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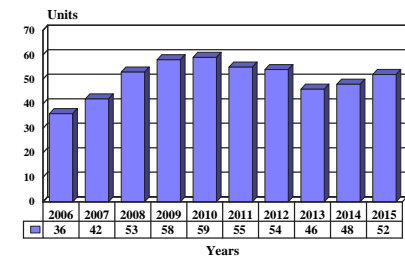
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SUT Torpedo - Archived 12/2007

Outlook

- SUT production has ceased
- More countries developing their own torpedo systems
- South Korea among countries developing lightweight and heavyweight torpedoes
- White Shark heavyweight torpedo entered production in 2000, followed by Blue Shark, a lightweight torpedo, around 2005-2006

10 Year Unit Production Forecast
2006 - 2015



Orientation

Description. Surface-ship and submarine-launched, wire-guided acoustic homing heavyweight torpedo with electric propulsion.

Sponsor. Bundesamt für Wehrtechnik und Beschaffung (BWB), Koblenz, Germany.

Status. Production of the SUT has ceased, but the torpedo remains in service. The White Shark is in series production and service with the South Korean Navy. The Blue Shark could enter series production next year (2006).

Total Produced. Approximately 503 SUT, 115 White Shark, and nine Blue Shark torpedoes had been produced through the end of 2005.

Application. The SUT torpedo is intended to destroy both surface and underwater targets.

Price Range. According to Atlas Elektronik, the unit cost of the SUT torpedo in October 1994 ranged between \$1.6 million and \$2 million, depending on quantity and conditions, for deliveries in 1997. South Korea, in reporting the development of its indigenous White Shark torpedo in the summer of 1998, quoted a price of \$1.52 million each for its SUTs.

Contractors

Prime

Atlas Elektronik GmbH

<http://www.atlas-elektronik.de>, Sebaldsbrücker Heerstrasse 235, Bremen, 28305 Germany, Tel: + 49 421 457 02, Fax: + 49 421 457 3699, Email: marketing@atlas.de, Prime

SUT Torpedo

NEX1 Future	http://www.nex1.co.kr , Prudential Tower 11F-12F, 838, Yoksam-dong, Gangnam-gu, Seoul, 135-983 Korea, Republic of (South), Tel: + 82 1644 2005, Fax: + 82 2 2033 0600, Prime
NOTE(S): South Korea's Agency for Defense Development (ADD) was the lead government agency involved in the development of both the White Shark and Blue Shark torpedoes.	

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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

Design Features. The SUT's body is made of aluminum or plastic. Three versions of the torpedo exist today, with slight differences in guidance programs and the amounts of data transferred by wire to the launch vessel. The torpedo has a large payload, which, in combination with its guidance systems, ensures the optimum placement of the explosive power. The torpedo also takes advantage of available over-the-horizon techniques, allowing it to target on sights at far greater distances than its predecessors.

The torpedo is specially built for passive homing, and thus is able to approach its target under a great variety of stealthy circumstances. The extent of the torpedo's

interactivity among its various sensor systems allows the weapon to effectively operate over the horizon as well (range permitting).

The wire guidance provides immunity from interference and exists as a two-way datalink between the weapon and its launch pad. The operation is practically wakeless, thanks to the electric motor, which also happens to be very quiet.

After the guide wire has been terminated, the torpedo continues operation as a highly intelligent, independent unit. The weapon's internal computer takes over the responsibility for target search, target loss, corrective actions, and other operations.

	<u>Metric</u> SUT	<u>Metric</u> White Shark	<u>U.S.</u> SUT	<u>U.S.</u> White Shark
Dimensions				
Length	6,150 mm	6,000 mm	242.31 in	236.4 in
Length, incl. guidance wire case	6,620 mm	N/A	260.6 in	N/A
Diameter	533 mm	483 mm	21.0 in	19.03 in
Weight	1,414 kg	1,000 kg	3,116 lb	2,200 lb
Weight, warhead	260 kg	370 kg	575 lb	814 lb
Performance				
Maximum depth	600+ m	N/A	2,000+ ft	N/A
Minimum depth	2 m	N/A	7 ft	N/A
Speed, maximum	35 kt	35 kt	35 kt	35 kt
Range, maximum	40+ km	30 km	25+ mi	19 mi
Sonar range				
Passive acquisition	4-6 km	N/A	2.5-3.7 mi	N/A
Active acquisition	3 km	N/A	1.9 mi	N/A

N/A = Not Available

Propulsion. The torpedo is electrically propelled and has three speed and range options. Torpedo attitude is controlled by a free gyro, acting directly on the control surfaces. The guide wire is a dual core type, allowing for two-way exchange of sonar data between weapon and launch platform. The SUT torpedo is a quiet weapon and is virtually wakeless.

Control & Guidance. The SUT torpedo has an active/passive sonar system for terminal homing. The seeker/control system includes re-attack logic. The weapon can be programmed to carry out various types of search patterns when the guide wire either parts or becomes exhausted.

SUT Torpedo

Launcher Mode. The SUT heavyweight wire-guided torpedo is a dual-purpose weapon that can be launched off surface ships and submarines, and from shore positions. The primary deployment base is on board the Type 209 submarines. Others include the Oberon

submarines, as well as the Hajar Dewantara and PB-57 class surface ships.

Warhead. The SUT is equipped with impact and proximity fuzing.



White Shark

Source: ADD

Variants/Upgrades

The SUT heavyweight wire-guided torpedo is a dual-purpose weapon that can be launched off surface ships and submarines, and from shore positions. It is considered the most recent version of the Seal (DM2)/Seeschlange (DM1) family of torpedoes, its successor being the DM2A3/4 (Seehecht) line.

In common with German torpedo developments of the past three decades, the SUT torpedo is designed to operate effectively in both deep and shallow water and against surface and underwater targets. The German Navy operates extensively in shallow water with difficult sonar conditions, and these demanding requirements are reflected in the design of the SUT homing system.

The following versions of the SUT torpedo are being, or have been, developed: the Mod 0 – original

configuration of the SUT torpedo delivered to Indonesia and Greece; the Mod 1 – developed version of the SUT Mod 0 with modifications to meet specific user requirements, delivered to India and Chile; and the Mod 2 – further improved version of the SUT torpedo proposed to South Korea in 1987. This version includes an audio channel, which permits the relay of sonar data back to the launch platform, significantly boosting overall performance of the seeker head. The modification is also reported to allow the torpedo to act as a remote sensor for the submarine. Other enhancements are included, but the basic software remains unchanged.

Atlas Elektronik is also offering a Seahake upgrade package that will bring existing SUT torpedoes up to Seahake standard.

Program Review

Background. AEG Aktiengesellschaft Marinetechnik (later STN-Atlas Elektronik Underwater Technology and then Atlas Elektronik) developed the SUT (Surface and Underwater Target) torpedo in response to a requirement for a torpedo capable of anti-submarine and anti-surface ship warfare. AEG had produced all of the existing heavyweight torpedoes in the German inventory, including the Seal, Seeschlange, and SST-4.

Demand Pushes Development

Development of the Seal and the Seeschlange began in 1958, with (then) AEG-Telefunken sharing responsibility with the BWB, the German defense development and procurement agency. From the program's start, the prime concern was to develop a viable weapons system for the Type 205 and 206 submarines and the German FPBs then under consideration. The first operational boat of the class was commissioned into the German Navy in 1967.

Seal and Seeschlange are triple-speed, electrically powered torpedoes. Among the most advanced torpedoes in the world when introduced in the mid-1960s, they are still in service with the Type 205 and Type 206 classes, and the Seal torpedo is still used on some light surface ships. The Seeschlange has been decommissioned, and the Seal torpedoes converted into the DM2A3 Seehecht.

A high degree of equipment commonality exists between the two torpedoes, the prime difference being that Seeschlange is intended for the anti-submarine warfare mission, while Seal is designed primarily for use against surface vessels. Thus, Seeschlange's battery is only half the size of Seal's to make way for its three-dimensional or panoramic sonar. The current German designations for the torpedoes are DM1 for the Seeschlange, DM2 for the Seal, and DM2A3 for Seehecht.

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The Seal formed the basis of the SST-4 torpedo, an anti-surface vessel torpedo sold in the hundreds with export versions of the Type 209 submarine and FPBs. The Seal was then further developed for a new dual-purpose weapon, designated the SUT torpedo. This weapon was oriented specifically to the export market. According to reports published by U.S. naval intelligence, the German Navy requirement for a surface torpedo was to have been met by the NIXE program, which was canceled in 1972 due to changes in the requirements.

SUT is the fourth member of the European family of quiet, electrically powered torpedoes developed during the 1970s. The others are the French F-17, the British Tigerfish, and the Italian A-184. SUT has a solid reputation as the leader in the market, based on the number of units delivered and the experience of the navies in sea trials and exercise firings of the weapon.

The SUT torpedo is a classic 1970s-design electric torpedo: very quiet and accurate, medium speed (35 kt), and with a long operating range.

Speed vs. Range Chart

	<u>Metric</u>	<u>U.S.</u>
Speed/Range	18 kt/28 km	18 kt/15.1 nm
Speed/Range	23 kt/40+ km	23 kt/21+ nm
Speed/Range	35 kt/15 km	35 kt/8 nm

The use of battery power was justified on the grounds of its superior quietness during the attack run, a requirement for passive-only attacks that is of major importance in surface target attacks and countermeasures operations.

With the rapid decrease in sound levels on submarines worldwide, however, such passive-only attacks have become far less practical. It is now generally accepted that the attack pattern adopted will have to involve at least a few active pings from the launch platform and the use of active guidance on the torpedo, alerting the target accordingly. The implication is that the torpedo will be engaging a submarine that is indulging in aggressive evasion maneuvers. As a result, about 50 percent higher speed is required from the torpedo relative to its target in order to stand a reasonable chance of success.

During the 1970s and 1980s, these considerations led the U.K. Royal Navy and the U.S. Navy to develop and produce internal combustion-powered torpedoes, which gained significant advantage in range and speed. However, this was achieved at a cost of higher noise levels and substantial penalties in terms of cost and size of the torpedo. The German Navy, in the meantime, made a decision to carry out a two-step modernization program of its Seal torpedoes. This program assumed a

timetable according to which, in Step 1, an upgrade of Seal to the Seehecht DM2A3 standard was to be carried out in the early 1990s, making it essentially a very advanced, dual-purpose, medium-speed (35 kt) torpedo. In Step 2, in the late 1990s, the DM2A3 weapons were to be upgraded to the DM2A4 level. The DM2A4, now in production, is a high-speed, dual-purpose torpedo with a remarkably extended operating range, as stated by the manufacturer.

White Shark. South Korea reportedly completed development of the White Shark (XK731) indigenous heavyweight torpedo in mid-1998. The Agency for Defense Development (ADD) Naval Center and LG Precision (now known as Nex1 Future) are involved in this program, although sources say this torpedo is based on NT-37 technology. The ADD Naval Center has a facility in Chinhae and its headquarters in Taejon.

White Shark – Technical Data

	<u>Metric</u>	<u>U.S.</u>
Length	6 m	19.68 ft
Diameter	483 mm	1.5 8 ft
Speed		35 kt
Weight, Total	1,100 kg	2,205 kg
Weight, Warhead	370 kg	816 kg
Range	30 km	18.6 mi

The White Shark uses an active sonar homing system. Unlike other conventional heavyweight torpedoes, the White Shark uses a “fire-and-forget” method rather than a wire-guided system.

The program cost Seoul “billions of won” over an eight-year period (1980-1988). The total amount spent on this program may have reached KRW80 billion. South Korean sources claim the torpedo’s price is only \$680,000 apiece, but in 1998 others placed this weapon’s cost at KRW950 million (\$722,000).

According to media reports, mass production of this torpedo is under way, and deliveries commenced around 2000. The South Korean Navy’s Type 209 submarines were to be armed with this torpedo starting in 2000, according to local media sources. Reports say the White Shark is carried on the last boat of the Jangbogo class submarines of the South Korean Navy. This torpedo will also be deployed on South Korea’s Type 214 class submarines.

The South Korean Ministry of Defense expects to earn income from the export of this torpedo.

Blue Shark. Besides this program, South Korea’s ADD is also working on a lightweight torpedo known as the Blue Shark (Cheongsangeo). Another name associated with this program is Grey Shark.

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Blue Shark – Technical Data

	<u>Metric</u>	<u>U.S.</u>
Length	2.7 m	8.86 ft
Diameter:	324 mm	
Speed	83+ km	45+ kt
Weight	280 kg	617 lb
Range	9 km	5.59 mi

Development of the Blue Shark torpedo began in 1995 but has been slowed by undisclosed technical problems. Eurotorp was reportedly contracted to provide technical assistance for the Blue Shark program, which may use the U.S.-built Mk 44 as its baseline.

South Africa's Institute of Maritime Technology (IMT) developed its A44 lightweight torpedo around a Mk 44 body fitted with a directed-energy warhead and a new homing system.

In July and September 2004, South Korea conducted a series of successful test firings of the Blue Shark torpedo. At that time, South Korea said it had spent KRW50 billion (\$43 million) to develop this torpedo. The torpedo may have a unit price of \$867,000 apiece.

Nex1 Future is the civilian contractor that will manufacture the Blue Shark. Low-rate production of the Blue Shark may have begun in 2005 with series manufacture starting this year (2006).

The Blue Shark is to be launched by the South Korean P-3C Orion maritime patrol aircraft, the Super Lynx anti-submarine warfare helicopter, and surface warships.

Significant News

Seoul-Jakarta Promote Ties in Arms Industries – South Korea and Indonesia are discussing ways to promote cooperation in the weapons industry. The two sides focused on South Korea's participation in Indonesia's military modernization program. Indonesia is interested in new submarines, basic trainer aircraft, and armored vehicles. (Korean Overseas Information Service, 8/06)

South Korea to Spend More on Defense – The South Korean government is ready to ramp up defense spending, as tensions rise around the Korean peninsula and Sea of Japan.

South Korean Defense Minister Yoon Kwang-ung said on July 10 that his government would spend KRW151 trillion (about \$150 billion) during the next five years to improve the state of the South Korean military. About 20 percent of the new spending will go to military research and development, Yoon said.

Other aspects of a new government plan include cutting 35,000 troops, mostly from the Army, from 2007 to 2011 to maintain a military force with 634,000 troops. The Defense Ministry also plans to buy new weapons systems, including surface-to-air missiles, mid-air fueling aircraft, large-sized transport ships and planes, and 3,000-ton submarines.

The plan is designed to allow South Korea to take over wartime operational control of its forces from the United States, which has essentially controlled deployment of its forces since the Korean War in the 1950s. (Xinhua, 7/06)

Cruise Missile to be Developed by South Korea – South Korea plans to develop a cruise missile. According to South Korean Defence Minister Yoon Kwang-ung, the nation is already working on cruise missile-related technology. Defense Minister Yoon gave no further details. South Korea is strengthening its missile capabilities. Defense Minister Yoon said South Korea has tested missiles about a dozen times over the past three years. He provided no specifics on the kinds of missiles tested. (Union.ie, 7/06)

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Funding

Development of the SUT torpedo and ongoing product improvement programs have all been funded by Atlas Elektronik.

SUT Torpedo

Contracts/Orders & Options

<u>Contractor</u>	<u>Award (\$ millions)</u>	<u>Date/Description</u>
STN-Atlas	76.8-86.4	1987 – South Korean Navy buys 48 Mod 2s for a reported unit price of \$1.6-1.8 million.
N/A	N/A	1988 – Taiwanese Navy order for 200 Mod 2s; supply source unverified.
STN-Atlas	86.4	1997 – Follow-up batch of Mod 2s to South Korea.

Timetable

<u>Year</u>	<u>Major Development</u>
1975	AEG begins to develop the SUT torpedo
1976	Trials begun
1977	Initial export negotiations
1980	SUT enters service
1981	Indonesia discusses production license
1986	Indonesia signs contract for licensed production
1987	South Korean order, with second batch for 1997 delivery
1988	Taiwanese order for 200 Mod 2s
1997	Follow-up batch of Mod 2s to South Korea

Worldwide Distribution/Inventories

In 1987, the **South Korean Navy** placed a contract with Atlas Elektronik for 48 SUT Mod 2 torpedoes to equip the first group of three Type 209-1400 submarines. South Korea began introducing those submarines into service in 1992-93. The fact that the submarines carry the SUT torpedo was only revealed during the commissioning of the first-of-class.

This resulted in the misleading impression that the first batch of SUT torpedoes had been delivered in a very short time. A convincing explanation, at first, was that the contract was for refurbished and modernized SUT torpedoes as an interim measure, pending delivery of the more advanced DM2A4 torpedo. This is now known to be incorrect. The torpedoes supplied to the South Korean Navy were newly built weapons as specified in the 1987 contract. Atlas Elektronik consequently was negotiating for the supply of a second batch of SUT torpedoes to South Korea.

In 1981, a license was granted to **Indonesia** to manufacture German torpedoes. The weapon in question is reported to be the SUT. The licensed production program, accomplished at the Indonesian Navy Arsenal, continues for both the domestic requirement and a moderate export requirement. The U.S. Naval Institute's *Guide to World Naval Weapons* and its *Combat Fleets of the World* have both reported that Indonesia supplied license-built SUT torpedoes to Taiwan. The Japanese naval magazine, *Ships of the World*, has supported these reports.

User Countries. The following user list consists of best estimates of customer inventories, based on the numbers of platforms in service, the average load-out per submarine, and an allowance for war stock storage on shore: **Chile** (95 SUT Mod 1); **Colombia** (56); **Ecuador** (56); **Greece** (112 SUT Mod 0); **India** (95 SUT Mod 1); **Indonesia** (37 SUT Mod 0, plus possibly about 50 more built under license); **Pakistan** (number unknown; quoted by some sources as also having SUTs but not confirmed by all); **South Korea** (48 + 48 SUT Mod 2); and **Taiwan** (reported to have an inventory of 200).

Forecast Rationale

The development of lightweight and heavyweight torpedoes is not high on the list of priorities for most nations. These torpedoes are readily available for international sources and are usually part of a larger package involving the procurement of diesel-electric submarines.

SUT Torpedo

South Korea Wants its Own Torpedoes

Nevertheless, some nations have decided to design their own torpedoes. Among these nations is South Korea. South Korea has developed light and heavyweight torpedoes, and production of both may now be under way.

The first torpedo developed by South Korea was the White Shark. This heavyweight torpedo entered production in 2000 and is in service with the South Korean Navy. Production of the White Shark could continue throughout the forecast period, and it may actually secure its one or two export clients. There is a chance that Indonesia could acquire the White Shark as part of a deal involving the procurement of ex-South Korean Navy diesel electric submarines.

The White Shark was followed by the Blue Shark, a lightweight torpedo designed for use by surface warships and anti-submarine warfare aircraft and helicopters. South Korea has long been reluctant to release details on this project, which had been under way since 1995. Therefore, it came as no surprise that

the Blue Shark may enter series production sooner than once anticipated.

South Korean officials said preproduction could begin in 2005, with manufacturing of the series to follow this year (2006). Previously, the Blue Shark was not expected to enter production until 2008. There are still concerns that the program's "unspecified" technical problems could cause further delays, in the area of perhaps one to two years, but no hard information is available to confirm this speculation.

SUT Production Ceased

As for the SUT, no further production of this torpedo is anticipated. The SUT enjoyed a fair level of success on the international torpedo market, but Atlas Elektronik has shifted its marketing focus to the new DM2A4. There is a possibility that production of the SUT is continuing outside Germany as part of a foreign licensing agreement, but no specific information is available. Latin America and Asia are believed to offer some potential in this area. However, no licensed production agreements have been signed and none are known to be pending.

Ten-Year Outlook

ESTIMATED CALENDAR YEAR PRODUCTION

Missile	(Engine)	thru 05	High Confidence Level				Good Confidence Level				Speculative		Total 06-15
			06	07	08	09	10	11	12	13	14	15	
ATLAS ELEKTRONIK													
SUT	UNSPECIFIED	503	0	0	0	0	0	0	0	0	0	0	0
Subtotal - ATLAS ELEKTRONIK		503	0	0	0	0	0	0	0	0	0	0	0
NEX1													
BLUE SHARK	UNSPECIFIED	9	14	20	27	32	33	35	34	31	33	37	296
WHITE SHARK	UNSPECIFIED	115	22	22	26	26	26	20	20	15	15	15	207
Subtotal - NEX1		124	36	42	53	58	59	55	54	46	48	52	503
Total Production		627	36	42	53	58	59	55	54	46	48	52	503