Walrus Class - Archived 4/98

Outlook

- Four units in service in the Netherlands
- No further construction planned; last commissioned 1994
- Export sales prospects sluggish
- Rivals include Germany's 209, 212; Sweden's A-19; Scorpene
- AIP would be essential for improving submersed endurance

Orientation

Description. Diesel-electric torpedo attack submarines tasked with ASW and patrol operations.

Sponsor
Ministerie van Defensie
Plein 4
NL-2511 CR The Hague
The Netherlands

Contractors
Rotterdamse Droogdok Mij (RDM)
PO Box 913
NL-3000AX Rotterdam
The Netherlands
Tel: +31 10 487 2861
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Licensee. No production licenses have been granted.

Status. In service.

Total Produced. Four submarines are in service.

Platform

Name	Builder	Ordered	Commissioned
S802 *Walrus*	Rotterdamse Droogdok	6/1978	6/1992
S803 *Zeeleeuw*	Rotterdamse Droogdok	12/1979	4/1990
S808 *Dolfijn*	Rotterdamse Droogdok	10/1984	1/1993
S810 *Bruinvis*	Rotterdamse Droogdok	8/1985	1/1994

Application. The Walrus class submarines were tasked with patrol, surveillance, ASW, and ASuW operations.

Price Range. The unit cost is between US$240 million and US$250 million.

Technical Data

Characteristics		
Speed (surface):	12 knots	
Speed (submerged):	21 knots	
Speed (snorkeling):	9 knots	
Design diving depth:	300 m	1,000 ft
Range:	10,000 nm @ 9 knots	
Endurance:	60 days	
Crew:	7 officers, 43 enlisted	

Dimensions	**Metric**	**US**
Length:	67.7 m	222.2 ft
Beam:	8.4 m	27.6 ft
Draft:	7.0 m	23 ft
Displacement, surface:		2,450 tons
Displacement, submerged:		2,800 tons

Armament	**Type**	**Quantity**
Torpedo tubes:	21 in	4
Torpedoes:	Mk.48 Mod 4	20

Electronics	**Type**	**Quantity**
Sonars:		
Hull mounted:	Octopus	1
Towed array:	Type 2026	1
Radar:	Signaal ZW.07	1
Command and Control:	SEWACO VIII	
Periscope:		
Search:	Barr & Stroud CK35	1
Attack:	Barr & Stroud CH85	1

Propulsion	**Type**	**Quantity**
Diesels:	SEMT Pielstick 12PA4V 200VG	3
Electric:	Holec double armature motor	1x5,340 shp
Batteries:	Lead acid	3x140 cell
Auxiliary diesels:	Type 304	2x980 kW
Propeller:	5 bladed (Fixed Pitch)	1

Design Features. A key feature in the Walrus class is the widespread use of condition monitoring systems, to allow adequate preventive maintenance and automation. HY-100 steel is used to provide a deep-diving capability. Other hull-strengthening/noise-reduction measures include a provision to mount all systems on specially designed shock absorbing rafts.

The command and control system is the Signaal SEWACO VIII. This system is centered on two SMR MU computers for handling sonar data and seven operator consoles, each with its own minicomputer. A plan position indicator gives the operator either a sonar or radar video display. Data for the terminals comes from the submarine's sonar, radar, periscopes, electronic support measures equipment and navigational equipment. Interchangeable screens present all data coming from these systems. There is a central data recording system for contact identification, track evaluation and mission data analysis. The computers contain a built-in memory library that compares sensor inputs against information it has stored. It can also perform TMA (target motion analysis), give a tactical and situational display, control torpedoes and missiles, record data and perform simulations for training.

The high levels of automation in the Walrus class feature most in the platform systems. An integrated monitoring and control system (IMCS) supplied by Van Rietschoten & Houwens performs four automatic functions. Controlled from the central control panel in the command center. These include the propulsion control system (controlling the revolutions of the main Holec double armature electric motor); the battery

charging system (controlling the three lead acid batteries); the diesel startstop system (handling the diesel engines during surface and snorting operations); and the trim control system, which has an integral microprocessor and recommends trim and/or weight corrections. The IMCS allows unmanned operation of the machinery space, and the steering computers provide full autopilot capability, including preprogrammed depth. The steering station is designed to allow one man steering and diving control, and an auto pilot can provide automatic course and depth control.

The main propulsion on the surface is three SEMT Pielstick PA4V diesels, developing a total of 6,910 shp. Underwater propulsion comes from a Holec double-armature electric motor developing 5,340 shp. The motor draws its power from three sets of lead acid batteries, each with 140 cells. The maximum surface and underwater speeds will be 13 knots and 20 knots respectively. The stern control planes are in X-shape, as opposed to the traditional cross-shape used by most other Western submarines.

Operational Characteristics. The Walrus class OTHW Integrated Torpedo/Harpoon Weapon system uses four 21 in torpedo tubes supplied by Vickers Shipbuilding and Engineering Ltd (VSEL) of the UK. The OTHW system includes the Mk.67 launcher system and an Mk.199 Turbine Ejection Pump (TEP) developed originally by the US Naval Undersea Systems Center. The Mk 67 water-launches Mk 48 rounds from the tubes at 4-5 g. Twenty torpedoes can be carried, with four in the tubes and 16 reloads. The primary torpedo will be the American Mk 48 Mod 4, which has a maximum speed of 55 knots and a maximum range of 50 kilometers (27 nautical miles). Although no sub-Harpoon missiles are held in the Royal Netherlands Navy (RNLN) inventory, provision has been made for these to be supplied from NATO warstocks should the need arise. The submarines are also able to carry mines as a two-for-one replacement for torpedoes.

The principal sonar onboard is the Thomson-CSF Octopus. This was developed as a collaborative effort between the British, French and Dutch navies. It comprises the Thomson Sintra ASM TSM-2233 Eledone hull-mounted, passive and active search and attack sonar suite using medium and low frequencies; the clip-on Marconi Underwater Systems Ltd (MUSL) Type 2026 passive very low-frequency towed array and the Thomson Sintra Fenelon passive ranging sonar.

The Eledone system includes a medium-range sonar, intercept sonar and hull-mounted flank arrays, providing the long-range sonar capability. The Fenelon intercept sonar is the only SEWACO VIII component with a dedicated stand-alone console. The Fenelon passive ranging sonar has been modified to improve the system's effectiveness. The Fenelon's three starboard hydrophones have been fitted with insulation material, isolating them from the submarine's self-noise and improving performance. This modification will be installed fleet-wide if trials results prove it effective. Other sensors, including the ARGO Systems AR-700 ESM fit and the Signaal ZW.07 surface search radar, have also been integrated into the DACCs.

Both Eledone and Type 2026 functions are integrated into the SEWACO Vlll's integrated information and display system GIPSY (Geintegreerd Informatie en Presentabe Systeem). This has seven monochrome Display And Computer Consoles (DACCs) supplied by Signaal. A large number of primary functions can be selected at any one of the seven DACCs in the Walrus command center. These include the long-range sonar and the Type 2026 plus the Eledone's flank array, medium-range sonar, passive ranging sonar (drawing in data from the Fenelon system), ESM, contact motion analysis, contact evaluation plot, tactical plot, weapon control and beaming frequency plot (BFP).

Other functions (including sound velocity profile, ray trace, ray path as well as the contact evaluation plot) can use a PC-based, but GIPSY and sonar-interfaced, workstation. This equipment, called ZWEMS (ZEefeeuwl Walrus Evaluation Measuring System) includes a number of acoustic propagation models and is fed with data about the acoustic conditions and the boat's sonar performance.

Variants/Upgrades

The second pair of Walrus class boats, the *KNlS Dolfijn* and the *KNlS Bruinvis* use the Brons-Werkspoor O-RUB 215X12 diesels, in place of the SEMT-Pielstick diesels. As a result, they have a surfaced speed of 13 kts and a submerged speed of 20 kts.

A derivative of the Walrus design was being offered to Canada. Designated Canwal, this included an increase in the number of torpedo tubes from four to six, the installation of air-independent propulsion (AIP) and the reinforcement of the sail structure to permit under-ice operation.

Program Review

Background. The Netherlands has designed and built its own submarines since before World War II, and this class follows the tradition of using indigenous designs. This class submarine was built as part of the Royal Netherlands Navy's (RNLN) 1972 fleet plan, which called for The Netherlands to maintain a six-submarine squadron. By 1975, it was apparent that the four Potvis class submarines, built from 1956-1965, would need replacement by 1985-1990. The Dutch considered ordering two more Zwaardvis class submarines, but new developments in submarine technology made them choose a new design. The RNLN used an indigenous design.

Initial project funding took place in 1975. The contract for *KNlS Walrus* was signed in June 1978. By December 1979, the *Walrus* was being built, and the contract had been signed for *Zeeleeuw*, the second boat. At this point problems intervened, delaying construction. While the new SEWACO VIII fire-control system had been tested, the new high-tensile steel for the hull had not. Construction was halted while the steel underwent further testing. New welding techniques required cutting the Walrus in two while changes were made to the engineering plant and 61 centimeters (2 feet) were added to the length. More delays occurred when the Dutch navy held talks with the United States Navy about the "lessons learned" from the losses of the submarines *USS Thresher* and *USS Scorpion*.

All the problems were corrected by 1983. The high-tensile steel gave the submarines a 300-foot greater dive than the Zwaardvis class, and the integrated command control system allowed the crew to be reduced by 17. These changes were incorporated into *KNlS Zeeleeuw* when its keel was laid in September 1981. The RNLN increased the number of submarines in late 1983. A Letter of Intent in January 1984 from the RNLN to RDM called for two more submarines, which were ordered in October 1984 and August 1985. The construction problems delayed launching of the *Walrus* until October 28, 1985. The keel for the third submarine, *Dolfijn*, was laid down in June 1986.

On August 14, 1986, fire broke out in the control room and galley of the *Walrus*. There were no fatalities, but the fire caused serious damage, delaying construction. An inquiry found that many electronic and electrical systems were severely damaged, but the hull was structurally sound. The total cost of the damage caused by the fire was assessed at 100 million guilders. Materials and parts intended for *Walrus* were transferred to the *Zeeleeuw*, which became the lead boat in the program.

Despite the fire, construction of the other submarines proceeded according to plan. The *Zeeleeuw* was launched in June 1987. The RNLN also announced in early 1987 that, because of the Walrus fire, three submarines built in the 1950s/60s, the *KNlS Potvis*, *KNlS Tonijn* and *KNlS Zeehond*, would be kept in service longer than planned. It was also announced that two more Walrus class submarines would be ordered in the early 1990s.

The *Zeeleeuw* began sea trials in October 1988. By the end of that year, all the *Walrus* systems that were damaged by the fire had been replaced, and construction was proceeding, as was Dolfijn's. In April 1988, the keel for *Bruinvis*, the fourth and last submarine, was laid. In late 1988, The Netherlands decided not to order a third pair of Walrus class submarines after all, but rather design a new class, Moray, for construction in the mid-1990s.

The *Zeeleeuw* sea trials proceeded with very few difficulties through mid-1989. The automated systems concepts reportedly met all expectations. The submarine was commissioned on April 25, 1990. The *Walrus* started sea trials in late 1990. These are very comprehensive, to ensure that there are no aftereffects from the August 1986 fire. The *Walrus* was commissioned in June 1992. The *Dolfijn* was launched on April 25, 1990, the same date the *Zeeleeuw* was commissioned, and began its sea trials in 1991, commissioning on January 29, 1993. The *Bruinvis*, last of the four Walrus, was launched on April 26, 1992, and commissioned in July, 1994.

In 1991, the Taiwanese government approached RDM with a request for six submarines, either of the Moray or Walrus designs. This was initially approved by The Netherlands government, but approval was rescinded under pressure from the Chinese. The process was repeated in 1992 with approval first being granted, then rescinded under Chinese pressure.

This class is still being offered on the export market, but there are no reported sales. Reports circulated in 1993 suggested that the Dutch government would achieve major defense economies by sacrificing the submarine capability of the RNLN. This would involve placing the four Walrus class boats in reserve while the older submarines would be sold.

This proposal was regarded as unacceptable and a compromise by which the active submarine fleet was

reduced to four boats adopted. This saw the two submarines of the Zwaardvis class removed from service during 1994 and 1995 and put up for sale. Several potential buyers emerged for these boats, but none appeared to have pursued the matter beyond the point of initial inquiries.

Meanwhile, the public sentiment in the Netherlands has turned decidedly against any major investments in the defense sector. Since the last Walrus was taken into service in 1994, there are no plans to replace the program with another any time soon.

Funding

This program was funded by the Ministerie van Defensie for the Royal Netherlands Navy.

Recent Contracts

No contractual information has been made public.

Timetable

	1975	The Netherlands Defense Ministry initiated project definition
	1978	Design studies completed
	1978	First submarine of the class ordered
October	1979	*Walrus* keel laid
Dec	1979	*Zeeleeuw* ordered
October	1984	Third submarine ordered
August	1985	Fourth submarine ordered
July	1988	Plans to order two additional submarines canceled
	1994	Last Walrus commissioned

Worldwide Distribution

The Netherlands (Four submarines in service).

Forecast Rationale

The Walrus class is one of the most advanced non-nuclear submarine designs in Western service, and it offers a high degree of system automation. It is very similar in design and installed systems to the British Upholder class, but offers a greater reported range. It carries a slightly greater number of torpedoes than that design, but has two fewer torpedo tubes. The use of the **X** plane conformation for the tail control surfaces will provide somewhat superior handling characteristics. With these capabilities, it should have been a strong contender for a substantial number of export sales. The design, however, has failed to meet these expectations, partly due to its protracted development period.

The United Kingdom, France and Germany all have strong marketing programs to push their submarines on the international market. The Germans in particular have built up a strong record of overseas sales. The Swedish Type 471 design has many of the same capabilities as the Walrus, and it can carry more weapons. The Australian order for six Type 471s has created greater international interest in this design, which could lead to more sales. The Netherlands itself is promoting another export submarine design family, the Moray design. This is a simpler, less expensive design than the Walrus class and can be regarded as a non-NATO export hull, while the Walrus class is more suited to other NATO countries.

The adoption of an AIP system to extend the diving endurance is essential for a top-rank non-nuclear submarine. Germany (Type 212), Sweden (A-19) and the UK (Type 2495) are all developing such types. If the Walrus is to maintain any export credibility, provision will have to be made for the installation of AIP as well. This is reported to have been made, with regard to the proposed Canadian acquisition of diesel-electric submarines. RDM has suggested that the US

Navy purchase two such submarines to replace the now discarded Barbel class boats as ASW training targets at the AUTEC range. This, however, is a highly unlikely scenario.

Overall, there seems to be little market for the Walrus design. Most available export orders will be absorbed by the new generation of German submarine designs, the Swedish submarines, and the new Franco-Spanish Scorpene. This being the case, there is little hope that this class will see sales on the export market. No further construction will be undertaken once the present four submarines are completed.

Ten-Year Outlook

No production is forecast.

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