

ARCHIVED REPORT

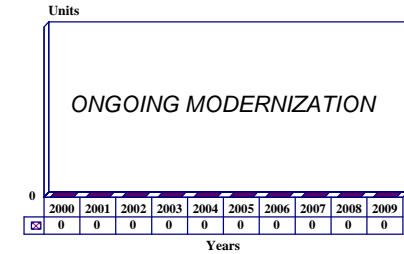
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Karel Doorman Class - Archived 8/2001

Outlook

- Modernization, upgrades to continue for a number of years
- Multipurpose capability strongest trump card of these ships
- Successor LCF (De Zeven Provinciën) now coming on stream

10 Year Unit Production Forecast
2000-2009



Orientation

Description. Multipurpose frigates for anti-submarine warfare (ASW), anti-surface warfare (ASuW) and anti-aircraft warfare (AAW) operations.

Sponsor

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(*systems integrator*)

Licensees. No production licenses have been granted.

Status. In service.

Total Produced. A total of eight ships have now been built by the De Schelde Group in Flushing, the **Pennant List**

<u>Number, Name</u>	<u>Builder</u>	<u>Launched</u>	<u>Commissioned</u>
F827 <i>Karel Doorman</i>	Schelde	4/1988	5/1991
F829 <i>Willem Van Der Zaan</i>	Schelde	1/1989	11/1991
F830 <i>Tjerk Hiddes</i>	Schelde	12/1989	6/1992
F831 <i>Van Amstel</i>	Schelde	5/1990	1/1993
F832 <i>Abraham Van Der Hulst</i>	Schelde	9/1991	12/1993
F833 <i>Van Nes</i>	Schelde	5/1992	7/1994
F834 <i>Van Galen</i>	Schelde	11/1992	12/1994
F828 <i>Van Spejk</i>	Schelde	3/1994	9/1995

Mission. The Multipurpose (M-Class) or Karel Doorman Class frigate was first deployed in the early 1990s as a replacement for the Wolf and Van-Speyk classes to conduct ocean patrol and escort duties in the North Sea and northeastern Atlantic Ocean. They are equipped for both anti-submarine and surface warfare roles. In addition they have both long- and short-range

Netherlands, and have been operational since 1996.

air defense systems. The ships have a helicopter deck which serves primarily to support anti-submarine helicopter operations.

Price Range. The cost of an export Karel Doorman class ship is estimated to have been US\$300 million each.

Technical Data

Specifications

	<u>Metric</u>	<u>US</u>
Dimensions		
<i>Length (Overall):</i>	122.3 m	400.9 ft
<i>Length (Waterline):</i>	114.2 m	374.7 ft
<i>Beam:</i>	14.4 m	47.2 ft
<i>Draft:</i>	4.3 m	14.1 ft
<i>Helicopter Deck:</i>	22 x 14 m	72 x 46 ft
Displacement		
<i>Standard:</i>	2,800 tonnes	
<i>Full Load:</i>	3,320 tonnes	
Performance		
<i>Speed (Maximum):</i>	55 km/h	30 knots
<i>Speed (Cruise):</i>	40 km/h	21 knots
<i>Range:</i>	9,250 km at 33 km/h	5,000 nm at 18 knots
<i>Endurance:</i>	30 days	
<i>Crew:</i>	16 officers, 138 enlisted (170 with helo)	

	<u>Type</u>	<u>Quantity</u>
Armament		
<i>Guns:</i>	76 mm L62 OTO Melara Mark 100	1
	Oerlikon 20 mm cannon	2
<i>CIWS:</i>	Signaal Goalkeeper 30 mm	1
<i>Missiles</i>		
<i>SSM:</i>	Boeing Harpoon Block 1C	2x4
<i>SAM:</i>	Raytheon/Hughes Sea Sparrow Mark 48	16
<i>Torpedo Tubes:</i>	Mk 32 Mod 9 324 mm	2x2
<i>Torpedoes:</i>	Mk 46 Mod 5	
<i>Helicopter:</i>	GKN Westland Lynx SH-14D	1

	<u>Type</u>	<u>Quantity</u>
Electronics		
<i>Radars</i>		
<i>Air/Surface Search:</i>	Signaal LW.08	1
<i>Target Acquisition:</i>	Signaal SMART-S	1
<i>Fire Control:</i>	Signaal STIR 1.8	2
<i>Navigation:</i>	Signaal Scout	1
	Racal-Decca 1226	1
<i>Sonars</i>		
<i>Low-Freq Hull:</i>	Signaal PHS-36 (active search, attack)	1
<i>Towed Array:</i>	Thomson-Sintra Anaconda DSBV-61	1
<i>Command & Control</i>		
<i>Command System:</i>	SEWACO VII-B	1
<i>Satellite Comms:</i>	WSC-6 twin antennas, Link 11	2
<i>Electronic Warfare</i>		
<i>ESM:</i>	ARGOSystems APECS-II	1
<i>ECM:</i>	ARGOSystems APECS-II	1
<i>Decoy Launchers:</i>	Mk 36 SRBOC	2
Machinery		
<i>Main Propulsion Configuration:</i>	CODOG	
<i>Gas Turbines:</i>	Rolls-Royce Spey SM1C	2x48,000 shp
<i>Diesels:</i>	Stork-Wärtsilä 12 SW280	2x8,000 shp
<i>Generators:</i>	Diesel	4x650 kW
		1x120 kW
<i>Propellers:</i>	Controllable pitch propellers	2

Design Features. The Karel Doormans are the smallest of the front-line blue water ASW escorts. They represent a considerable achievement in that their design team has managed to compress the ASW capability of the larger Kortenaer frigates into a ship some 15 percent smaller and substantially less expensive than comparable ships. Their manning levels are also reduced in comparison with earlier designs, reducing their through-life costs and thus making them at least in theory even more attractive to cash-starved navies.

Karel Doorman frigates have been built specifically to minimize external radar and infrared (IR) signatures, compared to previous-generation ships of this type.

The ship is also fitted with full automation and roll stabilization systems. The propulsion system is a CODOG (Combined Diesel or Gas Turbine) layout. Two Rolls-Royce Spey SM 1A gas turbines provide 38,000 horsepower for high-speed sprinting for the F827. The two diesels are Stork-Wärtsilä 12 SWD280s. These two diesels produce 9,790 horsepower for cruising speeds. Each ship has four 650 kW diesel-electric generators and one 120 kW auxiliary diesel generator.

The ship is equipped with two quadruple launchers for the Harpoon Block 1C anti-ship missile. The Harpoon missile, manufactured by Boeing (formerly McDonnell

Douglas), has an active radar seeker with inertial mid-course guidance, a 220 kilogram warhead and length of 4.5 meters. Maximum speed is Mach 0.85 with a range of 120 kilometers.

The Karel Doormans' vertical-launch surface-to-air missiles are similar to those of the Canadian Halifax and the Greek MEKO 200 class frigates. For short-range air defense, the ship has a Mk 48 vertical launch system for the Raytheon/Hughes Sea Sparrow (RIM-7M) missile, which has a length of 3.7 meters and a weight of 230 kilograms. The Sea Sparrow is carried in 16 external cells ranged along the port side of the hangar. Speed is Mach 2.5 and range is 14 kilometers. Sixteen missiles are carried.

The main gun of the ship is a 76 mm OTO Melara Mk 100, which is capable of firing 100 rounds per minute with a range of 16 kilometers in an anti-surface mode and 12 kilometers in anti-air mode.

The Signaal Goalkeeper close-in weapon system (CIWS) is fitted as well. Goalkeeper consists of a 30 mm seven-barrel gun with bulk loader which allows rapid reloading and provides a rate of fire of over 4,000 rounds per minute. Range is 200 meters to 3 kilometers. The system also includes tracking and search radar and a TV camera.

Also fitted are two Oerlikon 20 mm light cannons which fire at 800 rounds per minute to a range of 2 kilometers.

Two twin Mk 32 Mod 9 torpedo tubes are placed in two fixed mounts in the deckhouse. They are designed to fire Alliant Techsystems Mk 46 Mod 5 lightweight anti-submarine torpedoes.

The ship carries one GKN Westland Lynx SH-14D helicopter for anti-submarine warfare (ASW). The Lynx is armed with two Mk 46 homing torpedoes and dipping sonar and has been upgraded with FLIR Systems 2000HP FLIR (forward-looking infrared), GPS (global positioning system) and radar altimeter. All 20 Lynx helicopters of the RNIN are due to be replaced with NH 90 helicopters from 2003.

Most of the ships' electronics are manufactured by Signaal. These include a SMART-S three-dimensional target indication radar, a long-range LW-08 two-dimensional air search radar, which has a 94-nautical-mile range, and a Signaal Scout FMCW navigation radar, which has a 14-nautical-mile range and operates in the I-band. The other navigation radar is the Racal (Decca) 1226, with a 48-nautical-mile range. Fire control is provided by two STIR 1.8 radars.

The ship is fitted with Thomson Sintra's Anaconda DSBV 61 very-low-frequency, passive towed-array sonar, mounted on the hull at the bow. The Anaconda is a version of the French Navy's DSBV-61, which consists of a cable-mounted series of passive hydrophones. Signaal's PHS-36 active search-and-attack sonar is mounted on the hull at the front. This active sonar is a medium-frequency sonar operating at near the low-frequency end of the spectrum, with both FM and CW processing. It has excellent passive tracking capabilities.

Electronic warfare equipment is based around the ARGOSystems APECS-II integrated suite. This includes a masthead omni detector and scanner, two directional electronic support measures (ESM) arrays (fore and aft of the mast) and two jamming arrays: one on the forward starboard quarter, the other on the aft port quarter. These are supposed to give 360-degree coverage. The first four ships were to have received a Sphinx passive intercept system for ESM and a Ramses jammer for ECM, but the APECS-II system outperformed the older equipment to the extent that the ships carrying the original equipment were upgraded to the same standard.

Chaff and infrared decoys are the Sea Gnat munitions, fired from two Mk 36 SRBOC (Super Rapid Blooming Offboard Chaff) quad launchers by Lockheed Martin Hycor. The launchers' firing range is 4 kilometers.

The command and control system is Signaal's SEWACO VII-B. It integrates data from all the ship's sensors, provides the operator with an integrated threat and tactical situation presentation, and has an integrated communications capability. The system can automatically initiate and track all air and surface targets, evaluate the threat they pose and automatically designate targets to the ship's missiles and guns. A subsystem, the Signaal Multi-Weapon Control System (MWCS), controls the 76 mm gun and Sea Sparrow missile system.

Besides weapon control, SEWACO also integrates navigation systems, communications systems and automatic datalink. At the heart of the system are two VAX 4000-5000 mainframe computers. Subsystems are linked via a triple redundant Ethernet databus. For satellite communications, the ship is equipped with WSC-6 twin antennas and Link 11.

All ships have an Integrated Monitoring and Control System (IMCS). This system monitors all functions of the engineering and damage control system aboard the ships.

Operational Characteristics. The RNIN commonly operates in multinational, multforce peacekeeping and enforcement operations around the world. The Karel Doorman class frigates are designed and equipped to handle a variety of missions. They have supported counterdrug operations in the Caribbean with the US Navy and the UN operations in the Adriatic, and they regularly participate in NATO exercises. The three missions that the vessel can fulfill are anti-submarine warfare, anti-surface operations and air defense. These ships were designed to be interoperable with the Kortenaer class frigates.

For the anti-submarine warfare role, the Karel Doorman class frigate uses the Mk 46 torpedos launched from either the helicopter or the ship. Each ship has one Lynx helicopter, which serves as a long-range anti-submarine platform, carrying two torpedoes. The torpedoes are capable of active/passive homing to a range of over nine kilometers and carry a 45 kilogram high-explosive warhead. Detection and targeting is done either through the helicopter sonar or through the use of the ship's separate search-and-attack sonars.

An Aerojet NIXIE (AN/SLQ-25) towed torpedo decoy is fitted, which has two towed units that emit acoustic signals from an onboard transmitter.

In anti-surface warfare operations, the primary weapons are the ship's cannon in rapid fire mode for medium-range engagements and the Harpoon anti-ship missile system for long-range engagements. Targeting is through the ship's own or the helicopter's radar

systems; the helicopter's secondary mission is to provide long-range targeting data for the Harpoons.

In anti-air role, the longer range weapon for the ship is the NATO Sea Sparrow vertical launch Point Defense Missile System (PDMS), which uses semi-active radar guidance for point defense against aircraft less than 8 nautical miles away. For medium ranges the ship's cannon can be used in rapid fire mode. Close-in engagements against low-flying aircraft and missiles are handled by the Goalkeeper super-rapid-fire gun. Surveillance, detection and targeting are performed by a range of radar systems on the ship.

The two 20 mm Oerlikons provide secondary air defense capability and are used as primary deterrents during peacetime patrol duties. ARGOSystems APECS II radar detection and jamming system provides the ECM/ESM capability. The automatic system can identify and jam up to 16 threats simultaneously. Detection range is 370 kilometers for ships and 93 kilometers for aircraft.

Air and surface search is provided by Signaal's SMART-S three-dimensional radar. This operates in the F-band (3-4 GHz). Maximum output is 145 kW, rotation rate is 27 rpm and range is 100 kilometers for a 2-meter-square target. Signaal's LW-08 two-dimensional long-range search radar is also fitted, which operates in the D-band and has a range of 230 kilometers.

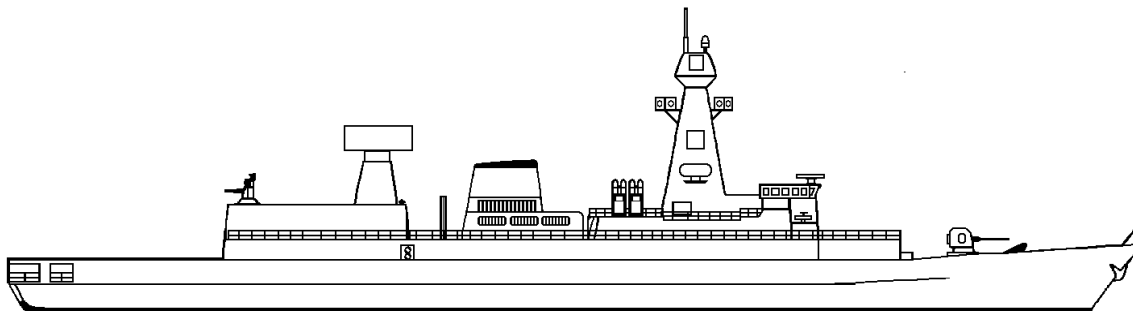
Two Signaal STIR tracking and illuminating radars provide fire control for the Sea Sparrow missile and 76

mm gun. STIR operates in I (8-10 GHz) and K (20-40 GHz) bands and has a range of 140 kilometers.

Signaal's IRSCAN infrared search-and-track system has been fitted to the Willem Van Der Zaan (F 829) for trials. It operates in long waveband infrared (8-12 micron) and can detect aircraft and supersonic missiles up to 20 kilometers and subsonic missiles to 12 kilometers. The system provides target detection and tracking for the Goalkeeper CIWS. Plans are to fit IRSCAN to all Royal Netherlands Navy (RNIN) vessels equipped with Goalkeeper.

The Vesta transponder system, also by Signaal, aids in helicopter landing and identification. A transponder mounted on the helicopter emits a signal which can be identified by the ship's search radar.

Karel Doormans were intended for the blue water environment, and that is increasingly seen as a diminishing threat scenario. Instead, the littoral areas are the regions with the highest projected likelihood of crisis activity in the future. Hence, the ships built to counter such a defense doctrine must be fitted with very sophisticated radar and EW systems capable of operating in the high-clutter environment with rapid identification capability. The main threats for frigates in that environment are believed to be above surface, and the underwater threats (read: submarines) are of diesel-electric type that are more agile than their deep-water nuclear counterparts. The quality of water is different from the high seas, which means that the demands for the detection equipment are significantly different from those of the blue water environment.



LCF, Successor to Karel Doorman Class

Source: Royal Netherlands Navy

Variants/Upgrades

Originally, the Karel Doorman class ships were built in two distinct subgroups, the first four having the Sphinx/Ramses equipment and the SQR-18 in place of the Thomson-CSF Anaconda DSBV-61 towed array of the last four. Because of this, the second half of the series had a different version of the SEWACO command system, designated the SEWACO VIIB. By 1994, however, all ships had received the ARGO-Systems APECS-II as standard, and they now feature the Anaconda systems as well.

LCF (Air Defense Command Frigate). The Royal Netherlands Navy has released details of an air defense version of the Karel Doorman design, designated the LCF (Luchtverdedigings en Commando Fregat). These ships will be 134.4 meters (440 ft) long and displace 4,400 tons standard. They will have an electronics fit consisting of a Signaal SMART-L long-range 3D radar, a Signaal SMART-S target acquisition system, and two new phased-array fire control radars. In a preplanned product upgrade, they will be replaced by active phased-array radars when they become available. The ships will carry the Standard SM-2 Block 4 missile in Mk 41 VLS and a secondary missile armament of Evolved Sea Sparrows. Other weapons and sensors will

duplicate the Batch 2 Karel Doormans. Ship functions will be integrated via a SEWACO XI command system.

As detailed design of these ships has continued, they have evolved into an entirely new ship. RNIN has already placed two firm orders and possibly two more. The ship has also generated significant interest in the export market, and the United Arab Emirates (UAE) has already stated it will be among the navies procuring it.

MPLF (Multi-Purpose Light Frigate). This is a proposed scaled-down version of the basic Karel Doorman design, also presented by Schelde. The crew size was reduced to 120 and full load tonnage to 2,470 tons. The weapons fit was described as highly flexible in order to meet varying customer requirements.

Modernization. The installation of the SEWACO VII system was a gradual process, all ships now presumably featuring the SEWACO VII-B version. The APECS II electronic warfare system as well as the Anaconda DSBV-61 towed-array sonar were on all ships by the end of 1994.

A capability update for the whole series is planned for the year 2006.

Program Review

Background. In the late 1970s, the Royal Netherlands Navy (RNIN) began design studies on a replacement for the 950 ton Wolf class patrol corvettes. These were designed for coastal patrol and fishery protection. While these design studies were taking place, the Navy released its 1973 Fleet Plan which called for a force of 22 ASW frigates. However, the retirement of 10 old destroyers left the force well below this target.

To comply with the force levels mandated in the fleet plan, RNIN designers redesigned the new ships. The result was a frigate, slightly smaller than the Kortenaar class, with an anti-submarine warfare and ocean patrol mission. The designs were approved in 1983. The initial funding request later that year called for eight ships, and the first four ships were ordered in February 1984.

The keel of the first ship, then named KNS *Groningen*, was laid in February 1985. The second group of four ships was ordered in late April 1986, and RNIN stated it would order four more if and when funds became available. The second keel was laid November 1985, while the third keel followed in October 1986. In March 1987, the Dutch announced that the name of the

first ship was being changed to KNS *Karel Doorman* to honor a Dutch admiral. RNIN also said that the Karel Doorman program would be held to eight ships due to budget cuts. The fourth keel was laid down in March 1988. The KNS *Karel Doorman* was launched in April 1988.

Koninklijke Maatschappij de Schelde was proceeding with the construction of the class. Two more keels were laid in 1990. The RNIN is continuing to procure long-lead materials for the remainder of the ships. The first two ships of the class were both scheduled to be commissioned in 1990, but due to delays they were commissioned in 1991. The remaining pair of ships from the first batch were commissioned in mid-1992 and early 1993. The second group did not enter service until mid-1995/96 as a result of problems with the delivery of their new subsystems, the Anaconda towed array being particularly late.

Between 1987 and the present, the Netherlands has made a concerted effort to find export customers for the Karel Doorman design. It was proposed for the Australian ANZAC frigate requirement, in competition with a derivative of the British Type 23 and the German

MEKO-200, and was offered to Greece and Turkey, in both cases in competition with the MEKO-200. In all these cases it was beaten by the MEKO design. Another significant prospect was Indonesia, where the Karel Doorman, the US FF-21, the French Lafayette, the Yarrow 83 meter design, and the MEKO-200 were offered as a solution to the FSG-90 requirement.

At one point it was believed that this requirement, for 23 ships, had been superseded by the Indonesian purchase of the old East German Navy, but in May 1993 it was announced that the Karel Doorman and the MEKO-200 had been shortlisted for the FSG-90 requirement. No further word has been received on this requirement.

In March 1993, the Royal Netherlands Navy released details of its proposed air defense version of the Karel Doorman class, intended to replace the old destroyers *KNS Tromp* and *KNS de Ruyter*. The new air defense ships, now known as the LCF or the De Zeven Provinciën class, will be 134.4 meters long and displace 4,400 tons standard. They will have an electronics fit consisting of a Signaal SMART-L long-range 3D radar, a Signaal SMART-S target acquisition system and two new phased-array fire control radars. These radars will be replaced in a preplanned product upgrade by active phased-array radars when they become available in about 2005.

The ships will carry a 48-cell Mk 41 VLS equipped with 32 Standard SM-2 Block 4 missiles, 32 Evolved Sea Sparrow in quad-packs (using eight cells) and eight Harpoons. Other weapons and sensors will duplicate the Batch 2 Karel Doormans. Ship functions will be integrated via a SEWACO XI command system.

This design is being developed in partnership with the Germans and Canadians. In each case, the air defense combat direction subsystem is being developed as an independent block to be included with national hulls and command systems. In Canada, this envisions the use of the Halifax class hull and SHINPADS command system, in Germany, the MEKO-360 hull and SATIR command system. Following the detailed design phase, the LCF evolved into a new design with little in common with the Karel Doorman class.

In January 1994, the Royal Schelde yard released details of the MPLF derivative of the basic Karel

Doorman class. This is a downsized version intended for the export market. The prime export candidate was seen as being the UAE with its requirement for eight frigates. The MPLF bid for this contract was one of five shortlisted but is reported to have been suddenly and inexplicably dropped. Later, the bid was re-oriented around the full-sized Karel Doorman class design and the Royal Schelde design was reinstated in the competition.

In early 1996, reports began to emerge from the UAE that the Dutch proposal for the UAE contract had been accepted. The Dutch bid was accepted but was fundamentally different from the proposal previously on offer. Instead of purchasing the Karel Doorman class ships with two RNIN vessels being loaned to the UAE as an interim training measure, the contract was for the outright purchase of two older Kortenaer class frigates. This interim stage will be followed by the construction of between two and six LCF class ships in batches of two.

Despite their obvious virtues, the Karel Doorman class ships have not achieved any success on the export market, although they have received substantial support from the Netherlands government. They have repeatedly reached the shortlist but have always failed at the final hurdle. This is because they have consistently been opposed by the MEKO-200 design which combines very similar sensors and command systems with an even more flexible layout, permitting virtually any armament configuration desired by the customer.

Karel Doorman represented a very innovative design. Nevertheless, even though the platform itself is still very usable, offering a high degree of agility, its electronic fit is, frankly, slightly out of pace with anticipated threats.

The new De Zeven Provinciën (LCF) class takes a different approach in its systems selection, and even though it is substantially larger, its capabilities are a good combination of seakeeping qualities mixed with the latest in sensors technology. Karel Doorman, on the other hand, is a very good platform for a navy that is moving in the same direction as the Netherlands, but whose responsibilities involve perhaps fewer open-sea operations in the tempestuous North Atlantic.

Funding

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

Recent Contracts

<u>Contractor</u>	<u>Award (\$ millions)</u>	<u>Date/Description</u>
BAeSEMA	1.0	<i>October 1993</i> – The Royal Netherlands Navy (RNIN) contract for acoustic support package covering environmental data and sonar performance predictions.
Rolls-Royce	16.5	<i>March 1996</i> – RNIN order for four Spey SM-1C gas turbines to equip LCF class destroyers.
Thomson-Marconi Sonar	N/A	<i>October 1996</i> – RNIN order for a training simulator for the Thomson Sintra ASM Anaconda (DSBV-61) tactical towed array sonar system. Delivery date: March 1998.

Timetable

<u>Month</u>	<u>Year</u>	<u>Major Development</u>
	1978	The Netherlands initiates design studies for new frigate/corvette
	1983	Final frigate design approved
Feb	1984	First four ships ordered (Declaration of Intent)
Feb	1985	KNS <i>Karel Doorman</i> laid down
Jun	1985	Contract for the first ships signed
Apr	1986	Second set of four ships ordered
Jan	1988	KNS <i>Karel Doorman</i> launched
Oct	1990	KNS <i>Karel Doorman</i> begins sea trials
May	1991	KNS <i>Karel Doorman</i> commissioned
Sep	1995	Last ship commissioned
	1995	Dutch order for first two LCFs
Mar	1996	Go-ahead for LCF order confirmed; UAE expressing interest in LCF
	1997	Dutch order for second pair of LCFs

Worldwide Distribution

The Netherlands (8)

Forecast Rationale

The market for Karel Doormans lies in upgrading and modernizing the equipment on the existing eight ships until the RNIN makes the decision to retire them. Until such time, any export sales of the Karel Doormans will come from taking out units in the RNIN fleet as the LCF/De Zeven Provinciën is being introduced. In fact, these ships should still be fairly attractive, despite their age, for a number of navies wanting to expand their capabilities by taking something solid from a reputable navy.

Even so, the Karel Doormans will remain in service for a number of years even after the new ships come on, the upgrades most evidently concerning the ships' sensors and command and control systems. This strategy is tied in with the RNIN plan to maintain two modular task groups that have different levels of readiness.

The new capabilities will be achieved through mid-life modernization and upgrade in combination with new procurement of other systems. In 1997, the Karel Doorman class was designated to receive SCOUT low-probability-of-intercept radars and lightweight armor plating for covering the Mk 48 vertical launch canisters for added stealth. In 1998, for instance, plans were announced to buy four active towed-array sonar systems, with sea trials beginning before the end of the year. The strongest candidate was STN-Atlas, because of its sale to LCF shortly before that. It is assumed that this update was carried out, although no reports to that effect have emerged in public.

The new De Zeven Provinciën class (LCF) is dealt as a ship class of its own and discussed under a separate report elsewhere in this Tab.

Ten-Year Outlook

No new production is projected – only modernization and upgrade activity of the onboard systems will continue throughout the forecasting period; the forecast chart has therefore been omitted.

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