

ARCHIVED REPORT

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F-125 Class

Outlook

- Production completed.
- Last ship of class commissioned in July 2022
- Major midlife upgrade will be essential to maintaining the viability of these ships
- This report will be archived in 2025

Orientation

Description. General-purpose surface combatant frigate with emphasis on land attack and command roles. Also known as Baden-Württemberg class frigate.

Sponsor. German Navy.

Status. In service.

Total Produced. Contract covers construction of four ships. Three in service. The fourth and final ship of the class was commissioned on July 13, 2022.

Pennant List

<u>Number & Name</u>	<u>Builder</u>	<u>Launch Date</u>	<u>Commission Date</u>
F-222 <i>Baden-Württemberg</i>	Howaldtswerke-Deutsche Werft GmbH	12/12/2013	6/17/2019
F-223 <i>Nordrhein-Westfalen</i>	Howaldtswerke-Deutsche Werft GmbH	4/16/2015	6/10/2020
F-224 <i>Sachsen-Anhalt</i>	Howaldtswerke-Deutsche Werft GmbH	3/4/2016	5/17/2021
F-225 <i>Rheinland-Pfalz</i>	Howaldtswerke-Deutsche Werft GmbH	5/24/2017	7/13/2022

Following significant problems, F-222 and F-223 were returned to their builder for remedial modifications. F-222 recommissioned in June 2019 after two years of remedial work.

Price Range. Based on the 2007 EUR2.0 billion (USD42.687 billion) contract for four ships, the unit price averaged \$671.75 million per ship in 2007, as reported in a ThyssenKrupp December 12, 2013, press release.

Application. These ships are tasked with providing support and command and control facilities for stabilization and peacekeeping operations.

F-125 Class**Contractors**

Prime

ThyssenKrupp Marine Systems GmbH	https://www.thyssenkrupp-marinesystems.com , Wertstrasse 112/114, Postfach 6309, Kiel, Germany, Tel: + 49 431 700 0, Fax: + 49 431 700 2312, Email: marinesystems@thyssenkrupp.com , Prime
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Subcontractors

Airbus Defence and Space	https://www.airbus.com , 88090 Immenstaad, Friedrichshafen, Germany, Tel: + 49 0 7545 8 01, (TRS-4D)
Eurotorp	https://www.eurotorp.com , 399 route des Cretes-Les Bouillides, BP 113, Sophia Antipolis, France, Tel: + 33 4 92 96 38 50, Fax: + 33 4 92 96 38 55, Email: et@eurotorp.com , (Torpedoes)
GE Marine	https://www.geaviation.com/marine/engines/military , 2901 E Lake Rd, Erie, PA 16531 United States, Tel: + 1 (630) 893-3344, (LM2500 Marine Gas Turbine)
Leonardo Defence Systems	https://www.leonardo.com , Via Valdilocchi 15, La Spezia, Italy, Tel: + 39 0187 5811 11, Fax: + 39 0187 58266, Email: pressoffice@leonardocompany.com , (127mm L54)
Rheinmetall Electronics GmbH	https://www.rheinmetall.com , Brüggeweg 54, Bremen, Germany, Tel: + 49 421 1080 0, Fax: + 49 421 1080 2900, Email: info-rde@rheinmetall.com , (Electronic Warfare Equipment)
Rheinmetall Waffe Munition GmbH	https://www.rheinmetall.com , Heinrich-Ehrhardt-Strasse 2, Unterlues, Germany, Tel: + 49 5827 80 02, Fax: + 49 5827 10 90, Email: info@rheinmetall-defence.com , (MLG 27 Light Naval Gun System)
Rolls-Royce Power Systems AG	https://www.mtu-solutions.com , Maybachplatz 1, Postfach 2040, Friedrichshafen, Germany, Tel: + 49 7541 90 91, Fax: + 49 7541 90 5000, Email: info@mtu-online.com , (Diesel Engine)

Contractors are invited to submit updated information to Editor, International Contractors, Forecast International, 75 Glen Road, Suite 302, Sandy Hook, CT 06482, USA; rich.pettibone@forecast1.com

Technical Data**Specifications**

	<u>Metric</u>	<u>U.S.</u>
Dimensions		
Length – Overall	149.0 m	488.8 ft
Beam – Overall	18.1 m	59.4 ft
Draft – Hull	5.0 m	16.4 ft
Displacement		
Full Load	7,100 tonnes	6,987 standard tons
Performance		
Speed	48.2 kmph	26 kt
Range	7,400 km at 33 kmph	4,000 nm at 18 kt
Crew	120, accommodation for 190	

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	<u>Type</u>	<u>Quantity</u>
Armament		
Missiles		
SSM	Harpoon	2x 4
Close-In Defense	RIM-116 RAM launchers	2x 21 cells
Guns	Oto Melara 127mm L64	1
	Mauser MLG-27 27mm	2
	.50 machine guns	4-12
Torpedo Tubes	533mm	4
Torpedoes	DM2A4	
Helicopters	NH90	2
Electronics		
Combat Data Systems	EADS	
Weapons Control	Sirius IRST	
Radars		
Air Search	Thales SMART-L	1
Air Surface Search	Airbus Defence and Space TRS-4D	1
Surface Search	SPS-67; I-band	1
Navigation	Atlas 9600 I-band	2
Countermeasures		
ESM/ECM (integrated)	EADS FL-1800S	2
COMINT	EADS Maigret	1
Decoy Launchers	Rheinmetall MASS	6
IFF	Mk XII Mod 4	
Machinery		
Configuration	CODLAG	
Gas Turbine	GE 7 LM2500 PF/MLG	1x 26,820 shp
Diesels – Propulsion	MTU 20V1163	4x 3,875 shp
Electric Motors		2x 6,300 shp
Propellers	Five-bladed controllable-pitch; two shafts	2

Design Features. The F-125 design is a significant break from the basic MEKO 360 design that gave rise to the F-123 Brandenburg and F-124 Sachsen classes. It appears to be based on the later-generation MEKO-D class ships and, thus, has the same relationship to the F-123/F-124 family as the MEKO-A does to the original MEKO 200. The hull and superstructure have been reshaped and faceted to reduce radar cross-section. The superstructure incorporates two helicopter hangars, separated by a passageway intended to reduce the chance of fire spreading from one hangar to the other. The ship is designed to carry NH90 helicopters produced by the NH Industries consortium of Agusta (Leonardo), Eurocopter (now Airbus Helicopters), and the remnants of Fokker.

The F-125 is equipped with a combined diesel-electric and gas propulsion (CODLAG) system, comprising one gas turbine and four diesel generators that drive two electric motors. This powertrain drives two independent shafts equipped with five-bladed controllable-pitch propellers. The diesel engines are hooded and rafted for sound and vibration insulation. An integrated monitoring and control system (IMCS) monitors and

controls the propulsion, electrical systems, and ship operation, and provides damage limitation and control.

The helicopter-handling system from MBB Förder- und Hebesysteme uses laser-guided and computer-controlled manipulator arms to secure the helicopter after landing. The system allows a single operator with a portable computer panel to transfer the helicopter to a hangar without manual intervention. The helicopter flight deck is rated to accommodate a 15-ton-class helicopter.

The F-125 combat direction system uses a distributed real-time database and integrated communications network. It is based on the Advanced Naval Combat System used by the Finnish Navy's Hamina-class fast attack craft and includes a redundant databus and distributed data processing. The combat system is structured around eight separate warfare segments.

Air defense capability is restricted to two 21-round RIM-116 RAM launchers from Raytheon and RAM Systems GmbH. The RIM-116 is a fire-and-forget anti-air missile that provides short-range defense against incoming anti-ship missiles, including sea-skimming missiles.

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Anti-ship capability is provided by eight Boeing RGM-84 Harpoon missiles in two quadruple launchers amidships. These were to be replaced by an advanced version of the RBS15 missile at a later date. The F-125 is equipped with an Oto Melara 127mm gun and two Rheinmetall 27mm guns.

The radars on board the F-125 include a TRS-4D volume search radar, the Thales Radar Nederland SMART-L long-range surveillance and target indication radar, and navigation radar. The ship is equipped with a Thales Sirius IRST long-range infrared surveillance and tracking sensor. The ship's communications system includes UHF/SHF satellite communications, an Integrated Message Handling and Control System (IMUS), FOCON 32, and encryption / de-encryption units. Datalinking equipment includes a wide variety of separate protocols.

Operational Characteristics. The design requirements for the F-125 class stress the ships' deployability for long periods without need of major dockyard assistance. They are designed to go for a period of five years between major overhauls, and can be deployed for up to two years in one or more operational theaters without requiring a return to a home base for major maintenance. The F-125 is designed for

an operational availability of around 5,000 hours per year per ship, with the main machinery able to run 30,000 hours between overhauls.

Survivability in the face of battle damage or mechanical casualty is provided by the adoption of a redundant "two island" principle. This distributes key systems in at least two different isolated locations to ensure that a single hit cannot take out both installations. The superstructure is split into two larger pyramidal deckhouses, serving to manipulate radar image and provide redundant command facilities.

Each ship was to have two assigned crews. In order to maintain on-station time without returning to home ports, German doctrine aimed to operate the ships from a friendly foreign port and rotate ship crews. The F-125 frigate's 120-person crew creates a need for greater cross-training and implies a requirement for higher-quality recruits. MTU planned to enhance the training of F-125 engine room crews to permit wider assignment of responsibilities in maintaining the ship's propulsion system. The same philosophy was probably adopted for other areas of ship maintenance and operation. Accommodation is provided for additional personnel and for protection against asymmetric threats.

Variants/Upgrades

At the moment, there are no variants of this design.



F-125 Preliminary Design

Source: German Navy

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F225 Rheinland-Pfalz (F125 Class)

Source: Source: ThyssenKrupp Marine Systems

Program Review

Background. The F-125 class was launched in 1997 when the German Navy initiated the design of a successor to the F-122 Bremen class frigate. The construction program was originally to include eight F-125 class ships for the German Navy, four for the Netherlands Navy (as the Q class) to replace the Heemskerck-class air warfare ships, and three for Belgium to replace the Wielingen class corvettes. It was hoped that the ships would begin entering service in 2008.

These preliminary and somewhat tentative plans were quickly modified. The Royal Dutch Navy met its requirement by ordering a second pair of De Zeven Provinciën-class air warfare destroyers, while the Belgian Navy met its requirement by purchasing two ex-Dutch Karel Doorman class frigates. This left the German Navy to proceed with the F-125 program on its own.

Early comments from the German Navy suggested that the F-125 would be little more than a modified version of the F-124 Sachsen class. In 1997, Karl-Heinz Lippitz, director of the shipbuilding program at the Office of Military Technology, said that the F-125 would "retain as far as possible the new technologies introduced on the F-124 and exercise their growth potential." He

added that the new ships would integrate the SM2 Block IVA missiles and offer an area-wide theater ballistic missile defense capability. This concept was still central to German Navy plans in 1999, although the entry to service date had already slipped to 2010.

F-125 Emerges

In November 2002, Rear Adm. Thomas Kempf stated that planning was underway to produce the F-125 class frigates as a replacement for the F-122 Bremen class. The new ships would be general-purpose workhorses with the capability to control the operations of a task group. They would be supplemented by a new medium-size frigate significantly larger than the existing K-130 class corvettes.

In 2003, the design emphasis of the F-125 class started to change, with the previous air warfare orientation shifting to a land attack and command and control function. A sign of this change was a shift in nomenclature, whereby the F-125 ceased to be a frigate and instead was described as a "multimission combatant" with the suggestion that she might resemble a small LPD with a docking bay aft rather than a classic frigate. Emphasis at this point appeared to be on range and endurance rather than speed and firepower.

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By 2004, the new F-125 class had risen to the top of the German Navy's priority list, along with a second batch of U-212A class submarines. They had also regained the classification of frigate. The German Navy had allocated \$442.4 million for development of the class, whose design was to be completed by 2007. Construction, valued at \$2.83 billion, was to be completed by 2010. However, by this time it had already been accepted that the cost of the new ships would preclude replacing the F-122 class on a one-for-one basis and that, at best, four F-125 class ships would be procured.

The end of 2004 saw a concerted effort by German shipbuilders to persuade the German Navy to bring the construction of the F-125 class forward by two years in order to fill a looming gap in shipyard workload. It was apparent by this time that the old concept of the F-125 as a developed version of the F-124 had been abandoned and that the ship being designed was a new generation of warship. According to a German Defense Ministry spokesman, the new ship "wouldn't be a ship off the shelf, but completely new with new concepts and new definitions." He further stated, "We will look to the U.S. to see what they do on the Littoral Combat Ship or what the French do with their bilateral frigate program with Italy."

In parallel with the design evolution of this ship, the main armament was being reconsidered. The shift in emphasis in the design from air warfare to land attack meant that the original choice of an Oto Melara 76mm L62 was no longer appropriate, and a heavier gun was desirable. A highly regarded option was the 155mm MONARC program. MONARC, which stands for Modular Naval Artillery Concept, is a solution based on 155mm technology already fielded by the German Army Artillery Corps and in production for various European countries. Following preliminary work, the turret of a PzH 2000 was mounted on the foredeck of the new F-124 class frigate *Hamburg* in December 2002 in order to carry out a demonstration of the new concept. The demonstration showed that the PzH 2000 turret could be adapted to frigate-size ships at a reasonable cost while still maintaining its essential performance characteristics.

Despite the success of the MONARC demonstration, this option was not pursued, and the Oto Melara 127mm L64 was selected as the primary gun armament for the F-125 class. The primary reason for the rejection of MONARC was reported to be the inability of the design team to cope with some ammunition-handling problems in the dynamic conditions experienced at sea.

The extent to which the F-125 represented a major change in German naval design priorities was reflected in a presentation by Rear Adm. Axel Schimpf in

July 2005. He stressed that the F-125 class was being deliberately designed for "stabilization operations" and "would need both lethal and non-lethal means for selective and precise interventions in order to control, de-escalate, or escalate a given situation." In his presentation, Admiral Schimpf also stated that the F-125 would not carry any sonar equipment and would be armed with point-defense air-warfare equipment only.

Construction Ordered

Construction of the F-125 class was approved in June 2007, with four ships being ordered for a total of \$3.1 billion, and the first ship to be delivered in 2016.

In early 2009, the formal program details indicated that a yearly production rate had been adopted, with the last ship scheduled for delivery in 2017. First metal on the new ships was cut in 2009, with the initial pair carrying on the established tradition of naming German frigates after provinces. By mid-2010, this schedule had changed slightly; the first pair of ships would be delayed for two years, and the last pair would be delivered in 2018. Assembly of the lead ship began in May 2011, with the keel laid in December 2011.

In late 2013, projected delivery of the last ship slipped from 2018 to 2019. News that a flame-retardant coating had peeled off the lead ship's hull structure followed. Repairing the damage required already-welded segments to be reopened. The repair costs amounted to some EUR100 million. The German government stated that shipbuilder Blohm + Voss and its partner, Lürssen Werft, should shoulder the additional costs. Coming at a time when ThyssenKrupp Marine Systems was experiencing major problems with the Swedish A-26 submarine, these additional problems were unwelcome.

In May 2017, the fourth and final ship in the F-125 series, *Rheinland-Pfalz*, was christened in Hamburg. This followed a month after Germany's second F-125 frigate class ship, *Nordrhein-Westfalen*, completed builder's trials. These demonstrated the ship's navigation characteristics and naval engineering functions. They also revealed serious issues with the ship's design that had major repercussions.

These problems included a persistent 1.3-degree list to starboard that prompted questions about the ship's stability. The frigate was also seriously overweight, a consideration that also had significant stability implications and limited its performance. The overweight condition was projected to increase the frigate's cost of operation by an unacceptable amount.

The most serious impact of the overweight issue, though, was that it more than eliminated the ship's design margin, placing a severe limitation on the German Navy's upgrade of a ship that was already

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regarded as being under-armed and under-equipped. To make matters worse, problems have been since been reported with the ship's command system that would impact its ability to operate in a contested environment. As a result, the German defense procurement agency BAAINBw refused to commission the first in the series, *Baden-Württemberg*. This is the first time in German naval history that the BAAINBw has refused to commission a ship. It has instead returned it to its builder for remedial action. This work was completed in June 2019 and the ship was finally commissioned.

The second ship followed in June 2020, and the third in May 2021. The fourth and final ship was commissioned in July 2022. The delays in commissioning from the originally published schedule indicated that construction of the F-125 class was probably affected by the COVID-19 pandemic as much as every other shipyard in the world.

In early 2024, it was announced that Germany extended its F-125 frigate support contract with thyssenkrupp Marine Systems and NVL Group to March 2029 for another five years to maintain operational readiness of the ships in class.

Funding

This program is funded by the German Ministry of Defense. A consortium called ARGE F-125 was formed in Germany to build the F-125.

Contracts/Orders & Options

No recent contracts identified.

Worldwide Distribution/Inventories

Germany. 4 ships of class

Forecast Rationale

The allegedly long list of problems experienced with the F-125 Baden-Württemberg class frigates drew a lot of attention from the naval community, but its equipment shortcomings and basic design errors (resulting in an inherent 1.3-degree list) are the least of its problems. The real issue was that the F-125 class represents a design solution that has become outdated by rapid developments in the international market and the march of events. This all suggests that the F-125 Baden-Württemberg class represents a dead end in naval design and will quickly become obsolescent unless it receives a major midlife upgrade.

Therein lies the problem. The F-125 Baden-Württemberg class are, in addition to their other issues, significantly overweight, eliminating the design margin put aside for future upgrades and modifications. The same design issues that demand a major midlife upgrade

also preclude it. In the final analysis, the German Navy procured an expensive fast transport that is dangerously limited in real capability. Its lack of conventional sonar deprives it of even a self-defense capability in the anti-submarine warfare environment. (Instead of a traditional sonar, the ships are equipped with a swimmer detection system.) Its air warfare ability is restricted to limited self-defense, and its surface warfare ability is average at best. In the face of world-class opposition, the ships will require escorts if their limited combat capability is not to prove a fatal weakness.

The deficiencies of the F-125 Baden-Württemberg class are such that no additional production of these unusual but expensive ships is likely. The four existing ships will remain in service but there appears to be no desire to order more. Thus, the forecast chart has been omitted.

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