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F-124 Sachsen Class

Outlook

- No outstanding orders for this class
- German option on fourth ship has lapsed

Orientation

Description. Surface combatant optimized for air warfare and area air defense.

Sponsor. German Navy.

Status. In service.

Total Produced. Three ships completed.

Price Range. Based on the 1996 contract value, the unit price averages \$550 million.

Mission. These ships are tasked with area air defense, which means they provide protection for groups of ships against attack by aircraft and missiles.

Pennant List

<u>Number & Name</u>	<u>Builder</u>	<u>Launch Date</u>	<u>Commission Date</u>
F-219 <i>Sachsen</i>	Blohm + Voss, Hamburg	12/1/1999	11/4/2004
F-220 <i>Hamburg</i>	Howaldtswerke, Kiel	8/16/2002	12/13/2004
F-221 <i>Hessen</i>	Thyssen Nordseewerke, Emden	3/2003	12/15/2005

Contractors

Prime

Howaldtswerke-Deutsche Werft (HDW) GmbH	http://www.hdw.de , Wertstrasse 112/114, Postfach 6309, Kiel, 24124 Germany, Tel: + 49 431 700 0, Fax: + 49 431 700 2312, Email: info@hdw.de , Prime
TKMS Blohm + Voss Nordseewerke	http://www.thyssenkrupp-marinesystems.de , Zum Zungenkai, Emden, 26725 Germany, Tel: + 49 4921 85 0, Fax: + 49 4921 31 327, Email: info@tk-nswe.thyssenkrupp.com , Prime
ThyssenKrupp Marine Systems	http://www.thyssenkrupp-marinesystems.de , Hermann-Blohm-Strasse 3, PO Box 10 07 20, Hamburg, 20005 Germany, Tel: + 49 40 3119 1320, Fax: + 49 40 3119 3329, Prime

F-124 Sachsen Class

Subcontractor

Atlas Elektronik GmbH	http://www.atlas-elektronik.com , Sebaldsbrücker Heerstrasse 235, Bremen, 28309 Germany, Tel: + 49 421 457 02, Fax: + 49 421 457 3699, Email: communications@atlas-elektronik.com (DSQS-23)
Eurotorp	http://www.eurotorp.com , 525 Route des Dolines, Sophia Antipolis, 06903 France, Tel: + 33 4 92 96 38 50, Fax: + 33 4 92 96 38 55, Email: et@eurotorp.com (Torpedoes)
GE Transportation - Marine Engines	http://www.getransportation.com/na/en/marineengines.html , 1 Neumann Way S-156, Cincinnati, OH 45215 United States, Tel: + 1 (513) 552-5465, Fax: + 1 (513) 552-5005 (LM2500 Marine Gas Turbine)
MTU Friedrichshafen GmbH	http://www.mtu-on-line.com , Maybachplatz 1, Postfach 2040, Friedrichshafen, 88040 Germany, Tel: + 49 7541 90 0, Fax: + 49 7541 90 2724, Email: info@mtu-on-line.com (20V1163TB93 Diesel Engine)
Oto Melara SpA	http://www.otomelara.it , Via Valdicocchi 15, La Spezia, 19136 Italy, Tel: + 39 0187 5811 11, Fax: + 39 0187 58266, Email: press-office@otomelara.it (76mm L62 Super Rapid)
Raytheon Missile Systems	http://www.raytheon.com , 1151 E Hermans Rd, Tucson, AZ 85706 United States, Tel: + 1 (520) 794-3000, Fax: + 1 (520) 794-1315 (SM-2 Missiles)
Rheinmetall Waffe Munition GmbH, Branch Mauser Oberndorf	http://www.rheinmetall-defence.com , Werkstrasse 2, Oberndorf am Neckar, 78727 Germany, Tel: + 49 7423 70 0, Fax: + 49 7423 70 670, Email: info-wm@rheinmetall-wm.com (MLG 27 Light Naval Gun System)
Thales Nederland BV	http://www.thalesgroup.com/netherlands , Haaksbergerstraat 49, Hengelo, 7554 PA Netherlands, Tel: + 31 74 2488111, Fax: + 31 74 2425936, Email: info@nl.thalesgroup.com (Smart-L Radar; APAR)

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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

	<u>Metric</u>	<u>U.S.</u>
Dimensions		
Length – Overall	143 m	468.8 ft
Length – Water line	132.2 m	433.4 ft
Beam – Overall	17.4 m	57 ft
Beam – Water line	16.7 m	54.7 ft
Draft – Hull	5 m	16.4 ft
Draft – with Sonar Dome at Bow	7 m	22.9 ft
Displacement		
Full Load	5,600 tonnes	
Performance		
Speed	53 kmph	29 kt
Range	7,400 km at 33 kmph	4,000 nm at 18 kt
Crew	216 plus 39 officers	

F-124 Sachsen Class

	<u>Type</u>	<u>Quantity</u>
Armament		
Missiles		
SSM	Harpoon	2x 4
SAM Launchers	Mk 41 VLS	1x 32 cells
SAM Weapons	Standard SM-2 Block IIIA & Evolved SeaSparrow	
Close-In Defense	RAM launchers	2x 21 cells
Guns	Oto Melara 76mm L62	1
	Mauser 27mm	2
Torpedo Tubes	Mk 32 (324mm)	2x 3
Torpedoes	MU-90	
Helicopters	NH90	2
Electronics		
Combat Data Systems	SEWACO FD TACTICOS, Link 11/16	
Weapons Control	Sirius IRST	
Radars		
Air Search	Thales SMART-L	1
Air-Surface Search	Thales APAR	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	SRBOC	6
IFF	Mk XII Mod 4	
Sonars		
Bow mounted (med-freq)	Atlas DSQS-23	1
Towed array	LFASS	1
Machinery		
Configuration	CODAG	
Gas Turbine	GE 7 LM2500 PF/MLG	1x 23,500 kW
Diesels – Propulsion	MTU 20V1163	2x 7,400 kW
Diesels – Power Generation	MTU 12V396 TE54	4x 1,000 kW
Propellers	Five-bladed controllable-pitch; two shafts	2

Design Features. The F-124 design is a further development of the basic MEKO 360 design by way of the F-123 Brandenburg class. This heritage is shown by the hull construction of the F-124 class, in that it retains the three box girders and six double-skin bulkheads incorporated in the F-123 for increased survivability. High-strength D36 steel is used throughout the hull, superstructure, and mast modules. The ship is stated to be able to remain operable after sustaining impact from a 150-kilogram high-explosive warhead. The design exploits modular construction, employing units manufactured simultaneously at different sites and assembled on-slip to provide a more flexible delivery schedule.

In topside design, the main difference with the F-123 is the modification to accommodate the weapons/sensor suite associated with the anti-air warfare system of the F-124. Also, 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, Eurocopter, and the remnants of Fokker.

The F-124 is equipped with a combined diesel and gas propulsion system (CODAG), comprising one gas turbine and two diesel engines. This power train drives two independent shafts equipped with five-bladed controllable pitch propellers. The diesel engines are hooded and rafted for sound and vibration insulation. The ship's rudder is a semi-balanced, mid-oar-underslung system, which provides a turning circle of four ships' length at the 35° full rudder position.

The F-124 Combat Direction System is the Signaal SEWACO FD that uses a distributed real-time database and integrated communications network. It includes 17 multifunction consoles and processors, two large-screen tactical displays, 12 bus interface units, a COSMOS monitor, a redundant data bus, and distributed data

F-124 Sachsen Class

processing. The combat system is structured around eight separate warfare segments.

The F-124 is unusual in that it has a three-layer missile-based air defense system. The long-range area defense component is the Standard SM-2 Block IIIA, and the medium-range anti-air missiles are the Raytheon Evolved SeaSparrow Missile (ESSM). The ESSM and SM-2 are fired from the Mk 41 VLS 32-cell launcher forward of the superstructure. Point defense missile capability is provided by 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.

Anti-ship capability is provided by eight Boeing RGM-84 Harpoon missiles in two quadruple launchers amidships. The F-124 is equipped with an Oto Melara 76mm gun and two Rheinmetall 20mm guns.

ASW capability is provided by two triple Mk 32 torpedo launchers for close-in and self-defense work, and offensive power is delegated to the ship's helicopters using lightweight torpedoes.

The ship's electronic countermeasures suite includes an FL-1800 Series 2 integrated ESM system and deception/barrage jammers and six SRBOC chaff and flare decoy launchers.

The radars on board the F-124 include the SPS-67 surface surveillance radar manufactured by Northrop Grumman Norden Systems, the Thales Radar Nederland SMART-L long-range air and surface surveillance and target indication radar, and the Thales Active Phased Array Radar. APAR is a multifunction configuration operating in the E/F-band, providing target acquisition and designation for the SM-2s. The ship is equipped with a Thales Sirius IRST long-range infrared surveillance and tracking sensor. The bow sonar is the STN Atlas Elektronik DSQS-23 (the precise designation

is unclear; sources vary from DSQS-21B to DSQS-24M).

The ship's communication system includes UHF/SHF satellite communications, an Integrated Message Handling and Control System (IMUS), FOCON 32, and encryption/de-encryption units.

Operational Characteristics. An Integrated Monitoring and Control System (IMCS) monitors and controls the propulsion, electrical systems, and ship operation, and provides damage limitation and control.

The design requirements for the seagoing characteristics of the ship specify weapon engagement and helicopter operation capabilities up to Sea State 6, assuming that rudder roll stabilization increases the vessel's overall operational capability.

In diesel (AnDiMot) mode, one of the diesel engines is operated via two main gearboxes and one cross-connection gearbox. At peak performance, the diesel provides 7,400 kW at 1,350 rpm. The ship has an operating range of 4,000 nautical miles at a cruising speed of 18 knots in AnDiMot mode.

In gas turbine (GT) mode, the gas turbine produces 23,500 kW and 3,600 rpm, operating two main gearboxes and the cross-connection gearbox. In combined diesel and gas (CODAG) propulsion mode, both diesel engines and the gas turbine engine are operated. The maximum speed of the ship is about 29 knots.

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, which is handled by one man with a portable computer panel, allows the operator to transfer the helicopter to a hangar without manual intervention.

The helicopter flight deck is rated to accommodate a 15-ton class helicopter for fueling and torpedo loading.

Variants/Upgrades

155mm MONARC Program. MONARC, which stands for Modular Naval Artillery Concept (for naval gun fire), is a solution based on 155mm technology already fielded by the German Army Artillery Corps, and which is 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. As a result of the demonstration, it was shown that adapting

the PzH-2000 turret to frigate-sized ships was possible at a reasonable cost, while still maintaining the essential performance characteristics of the PzH 2000.

F-125. This will be the replacement for the F-122 frigates currently operated by the German Navy. The F-122s will begin to be retired in the first decade of the 21st century. This class is currently in the project definition phase, and is the subject of a separate report in this tab.

F-124 Sachsen Class



DMS Sachsen on Sea Trials

Source: German Navy

Program Review

Background. The F-124 owes its origins to the Trilateral Frigate Agreement signed by the Netherlands, Germany, and Spain. This agreement provided for the joint development of common systems that subsequently would be used in the national frigate programs adopted by each country. The trilateral cooperation was restricted to the combat systems, propulsion, and sensors installed on the ships in question, details of hull design being left to the discretion of the individual countries. The result was an extremely flexible and efficient form of partnership that economized on costs in developing common systems, yet allowed the individual navies to produce ships optimized for their unique requirements. Over the next few years, these arrangements were compared very favorably against the inflexible, highly centralized, and bureaucratic procedures adopted by the Anglo/Italian/French Project Horizon.

Modernizing the F-123

In 1991, the successor ship to the F-123 entered the initial system analysis and design studies phase of development. A requirement defined in 1992 called for a multipurpose frigate tasked primarily for anti-submarine warfare. However, by 1993, this frigate had

evolved into an area defense anti-air vessel in order to cover Task Force Protection. Total ship design began at this time, followed by development of command systems. The ship reached the project definition stage in 1997.

An order for three F-124s with an option for a fourth was issued in January 1996, but the actual contract award did not become official until June of that year. The keel for the first-of-class was laid on February 1, 1999, only 11 months after the first steel was cut on February 27, 1998. The ship was officially christened on December 1, 1999. She began her machinery trials in February 2001 after being floated out of dry-dock at the end of January. In July 2001, the first elements of the ship's APAR radar were installed prior to the start of weapons trials. The ship was handed over to the German Navy in March 2002. The *Sachsen* entered operational service in 2004. The second, *Hamburg*, was delivered in December 2004, and the third, *Hessen*, in 2005.

F-125 Emerges

In November 2002, Rear Adm. Thomas Kempf stated that planning was under way to produce the F-125 class

F-124 Sachsen Class

frigates as a replacement for the F-122 Bremen class. The new ships would be general-purpose workhorses that would have 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. Although the option for the fourth ship, the BMS *Thuringia*, had no specific expiration date, this shift of attention to the projected class of F-125 frigates caused any plans to build a fourth F-124 to be discarded.

Export Opportunities

During early 2003, the Royal Australian Navy started to move rapidly ahead with its new Air Warfare Destroyer program that was intended to provide a modern fleet air-defense ship. Three advance candidates were studied to fill this requirement: the U.S. Navy's DDG-51 Arleigh Burke, the Spanish F-100 Alvaro de Bazan class, and the F-124 Sachsen class. In addition, two air warfare combat systems, the U.S. AEGIS and the system used on the *Sachsen*, were evaluated. By mid-2004, it was decided that AEGIS was best suited to Australian requirements, and this equipment was then specified as a baseline for the Air Warfare Destroyer.

Since the F-124 class would require an almost complete redesign to accommodate the AEGIS system, this decision precluded the selection of the F-124 design for the Air Warfare destroyer. This reduced the competitors for the contract to the F-100 or to the DDG-51, with the former being the leading candidate. Finally, the F-100 class was selected and its Australian variant is now known as the Hobart class.

The loss of the Australian contract was partially balanced by the announcement of a new requirement from Greece for a class of up to six missile frigates to replace the aging U.S.-supplied Charles F Adams class destroyers and the oldest of the Elli class frigates procured from the Netherlands. As might be expected, there was substantial competition for this requirement, with the leading contenders reported to be the De Zeven Provinciën class, the FREMM class, the F-124 Sachsen class, and the F-100 Alvaro de Bazan class. In January 2009, the Greek government announced that this competition had been won by the FREMM class frigates. This appears to have eliminated any future market for the Sachsen class.

Funding

This program is funded by the German Ministry of Defense. A consortium called ARGE F-124 was formed in Germany to build the F-124. It consists of Blohm + Voss GmbH as the leading shipyard, Howaldtswerke-Deutsche Werft AG, and Thyssen Nordseewerke GmbH. Each yard of the consortium team built one ship, with Blohm + Voss being responsible for the lead ship, the DMS *Sachsen*.

Contracts/Orders & Options

<u>Contractor</u>	<u>Award (\$ millions)</u>	<u>Date/Description</u>
GE Marine Engines	N/A	Mar 3, 1999 – Three GE LM2500 gas turbines for the first three ships.
INRI UK Ltd	0.5	Jun 12, 1999 – C ⁴ I software for the STN combat management system.

Timetable

<u>Month</u>	<u>Year</u>	<u>Major Development</u>
Nov	1990	German-Dutch memo on naval ship cooperation between the two navies
	1991	F-124 in initial system analysis, design studies phase
	1992	Definition, design, and development of ASW, AAW systems
	1993	Total ship design phase
Oct	1993	MoU signed by B+V, Schelde, Bazan
	1994	Development of command systems
Jun	1995	ARGE F-124 submits technical and commercial proposal for approval
Jan	1996	Three ships ordered, with an option for a fourth
Apr	1996	Design, construction, and delivery contract signed by BWB, ARGE F-124
Jun	1996	Contract approved by German Parliament
	1997	Total ship project definition stage

F-124 Sachsen Class

<u>Month</u>	<u>Year</u>	<u>Major Development</u>
Feb	1998	First steel cut for first-of-class
Feb	1999	Keel laid, first two modular sections of FOC joined
Nov	1999	Launch of FOC (<i>Sachsen</i>)
Q2	1999	Bids due in for 76mm Oto Melara guns from interested suppliers
	2000	Second ship laid down
Jan	2001	Machinery trials started
Jul	2001	Third ship laid down
Aug	2002	<i>Hamburg</i> launched
Mar	2003	<i>Hessen</i> launched
Nov	2004	<i>Sachsen</i> commissioned
Dec	2004	<i>Hamburg</i> commissioned
Dec	2005	<i>Hessen</i> commissioned

Worldwide Distribution/Inventories

Germany. Three ships in service.

Forecast Rationale

There is now no outstanding market for the F-124 Sachsen class frigates. Attempts to find export customers for the design have failed while German Navy emphasis on the new F-125 has eliminated any prospect of additional F-124 class ships being ordered.

The only German Navy activity for this class will be to upgrade the ships, with priority given to providing them with an anti-ballistic missile capability. It is likely that

future upgrades will be applied to the ship's sensors and command system to fully exploit the range of operational options provided by this very capable class.

Although additional construction at this time seems very unlikely, we will maintain this report for another year in case an unexpected export opportunity opens up. However, this appears very unlikely, and the probability is that this report will be archived in the near future.

Ten-Year Outlook

Since no additional construction is pending, a forecast chart is inappropriate at this time.

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