

# ARCHIVED REPORT

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## MJ-332 Frankenthal Class – Archived 4/2011

### Outlook

- Turkish program finally completed in 2009, with *Anamur* photographed at sea and *Akca* reported commissioned
- No impending orders for MJ-332 class ships
- Any future construction of MCMVs likely to be of GRP-hulled vessels

### Orientation

**Description.** Fleet and coastal minehunters (MHC), with a secondary function of laying mines.

#### Sponsor

Federal Office for Military Technology and Procurement (Bundesamt für Wehrtechnik und Beschaffung – BWB)

Konrad-Adenauer-Ufer 2-6

Postfach 7360

D-56057 Koblenz

Germany

**Status.** In service.

**Total Produced.** Twelve (plus 10 SM-343 Hameln class preceding this series) have been produced for Germany. Five are in service with the Turkish Navy, with a sixth under construction.

#### Pennant List

<u>Number &amp; Name</u>	<u>Builder</u>	<u>Country</u>	<u>Launched</u>	<u>Commissioned</u>
M1058 <i>Fulda</i>	Abeking & Rasmussen	Germany	9/1997	6/1998
M1059 <i>Weilheim</i>	Lürssen Werft	Germany	2/1998	12/1998
M1061 <i>Rottweil</i>	Krögerwerft	Germany	3/1992	7/1993
M1062 <i>Sulzbach-Rosenberg</i>	Lürssen Werft	Germany	4/1995	1/1996
M1063 <i>Bad Bevensen</i>	Lürssen Werft	Germany	1/1993	12/1993
M1064 <i>Grömitz</i>	Krögerwerft	Germany	4/1993	8/1994
M1065 <i>Dillingen</i>	Abeking & Rasmussen	Germany	5/1994	4/1995
M1067 <i>Bad Rappenau</i>	Abeking & Rasmussen	Germany	6/1993	4/1994
M1068 <i>Datteln</i>	Lürssen Werft	Germany	1/1994	12/1994
M1069 <i>Homburg</i>	Krögerwerft	Germany	4/1994	9/1995
M265 <i>Alanya</i>	Abeking & Rasmussen	Turkey	3/2003	7/2005
M266 <i>Amasra</i>	Istanbul Naval Shipyard	Turkey	5/2004	7/2005
M267 <i>Ayvalik</i>	Istanbul Naval Shipyard	Turkey	7/2005	6/2007
M268 <i>Aycakoca</i>	Istanbul Naval Shipyard	Turkey	9/2006	9/2007

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<u>Number &amp; Name</u>	<u>Builder</u>	<u>Country</u>	<u>Launched</u>	<u>Commissioned</u>
M269 <i>Anamur</i>	Istanbul Naval Shipyard	Turkey	9/2007	9/2008
M270 <i>Akçay</i>	Istanbul Naval Shipyard	Turkey	9/2008	3/2009
M01 <i>Al Hasbah</i>	Abeking & Rasmussen	UAE	5/1992	3/1993
M02 <i>Al Murjan</i>	Lürssen Werft	UAE	2/1992	12/1992

**Mission.** The location, identification, and destruction of sea mines in coastal waters, as well as the laying of mines for harbor defense.

**Price Range.** The last two German ships of this class had a unit value of \$112.25 million (1995 dollars).

## Contractors

## Prime

<b>Abeking &amp; Rasmussen Shipyards</b>	<a href="http://www.abeking.com">http://www.abeking.com</a> , An Der Faehre 2, Lemwerder, 27805 Germany, Tel: + 49 421 673 30, Fax: + 49 421 673 3112, Email: <a href="mailto:info@abeking.com">info@abeking.com</a> , Prime
<b>Fr Lürssen Werft GmbH &amp; Co KG</b>	Zum Alten Spreicher 11, Bremen, Germany, Tel: + 49 04 21/66 040, Fax: + 49 04 21/66 044 43, Prime
<b>Krogerwerft GmbH &amp; Co KG</b>	PO Box 460, Rendsburg, 24754 Germany, Tel: + 49 4331 951 255, Fax: + 49 4331 951 145, Email: <a href="mailto:kahl@krogerwerft.de">kahl@krogerwerft.de</a> , Prime

## Subcontractor

<b>Atlas Elektronik GmbH</b>	<a href="http://www.atlas-elektronik.com">http://www.atlas-elektronik.com</a> , Sebaldsbrücker Heerstrasse 235, Bremen, 28309 Germany, Tel: + 49 421 457 02, Fax: + 49 421 457 3699, Email: <a href="mailto:communications@atlas-elektronik.com">communications@atlas-elektronik.com</a> (DSQS-11M)
<b>BAE Systems Land &amp; Armaments, BAE Systems Bofors</b>	<a href="http://www.baesystems.com/Businesses/LandArmaments/Divisions/BAESystemsAB/">http://www.baesystems.com/Businesses/LandArmaments/Divisions/BAESystemsAB/</a> , Karlskoga, 691 80 Sweden, Tel: + 46 586 733 000, Fax: + 46 586 850 30, Email: <a href="mailto:info.bofors@baesystems.se">info.bofors@baesystems.se</a> (40mm L70)
<b>Bainbridge International</b>	8, Flanders Park, Hedge End, Southampton, SO30 2FZ Hampshire, United Kingdom (Flame Retardant Protection Systems)
<b>Hagenuk Marinekommunikation GmbH</b>	<a href="http://www.eads.com/hmk">http://www.eads.com/hmk</a> , Hamburger Chaussee 25, Flintbek, 24220 Germany, Tel: + 49 4347 714 0, Fax: + 49 4347 714 110 (Radio Communications)
<b>L-3 Communications - ELAC-Nautik GmbH</b>	<a href="http://www.elac-nautik.de">http://www.elac-nautik.de</a> , Neufeldtstrasse, Kiel, 24118 Germany, Tel: + 49 431 883 0, Fax: + 49 431 883 496, Email: <a href="mailto:marketing@elac-nautik.com">marketing@elac-nautik.com</a> (Echosounders)
<b>MTU Friedrichshafen GmbH</b>	<a href="http://www.mtu-on-line.com">http://www.mtu-on-line.com</a> , Maybachplatz 1, Postfach 2040, Friedrichshafen, 88040 Germany, Tel: + 49 7541 90 0, Fax: + 49 7541 90 2724, Email: <a href="mailto:info@mtu-on-line.com">info@mtu-on-line.com</a> (Diesel Engine)
<b>Northrop Grumman LITEF GmbH</b>	<a href="http://www.northropgrumman.litef.com">http://www.northropgrumman.litef.com</a> , Loerracher Strasse 18, Freiburg, 79115 Germany, Tel: + 49 0761 4901 0, Fax: + 49 0761 4901 480 (Displays)
<b>Oto Melara SpA</b>	<a href="http://www.otomelara.it">http://www.otomelara.it</a> , Via Valdilocchi 15, La Spezia, 19136 Italy, Tel: + 39 0187 5811 11, Fax: + 39 0187 58266, Email: <a href="mailto:press-office@otomelara.it">press-office@otomelara.it</a> (30mm Cannon)
<b>Raytheon Anschütz GmbH, (Raytheon Marine GmbH)</b>	<a href="http://www.raytheonmarine.de">http://www.raytheonmarine.de</a> , Zeyestrasse 16-24, Keil, 24106 Germany, Tel: + 49 431 3019 0, Fax: + 49 431 3019 291, Email: <a href="mailto:info@raykiel.com">info@raykiel.com</a> (Data Processing)
<b>Rheinmetall Defence Electronics GmbH (RDE)</b>	<a href="http://www.rheinmetall-defence.com">http://www.rheinmetall-defence.com</a> , Brüggeweg 54, Bremen, 28309 Germany, Tel: + 49 421 457 01, Fax: + 49 421 457 2900 (Electronic Warfare Equipment)
<b>Rheinmetall Waffe Munition GmbH, Branch Mauser Oberndorf</b>	<a href="http://www.rheinmetall-defence.com">http://www.rheinmetall-defence.com</a> , Werkstrasse 2, Oberndorf am Neckar, 78727 Germany, Tel: + 49 7423 70 0, Fax: + 49 7423 70 670, Email: <a href="mailto:info-wm@rheinmetall-wm.com">info-wm@rheinmetall-wm.com</a> (MLG 27 Light Naval Gun System)

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<b>Thales Underwater Systems Ltd</b>	<a href="http://www.thalesgroup.com/naval">http://www.thalesgroup.com/naval</a> , Ocean House - Troop Rd, Somerset, BA11 2TA Templcombe, United Kingdom, Tel: + 44 1963 370551, Fax: + 44 1963 372200 (Type 2093 Sonar)
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## Technical Data

	<u>Metric</u>	<u>U.S.</u>
<b>Dimensions</b>		
Length	54.4 m	178.5 ft
Beam	9.2 m	30.2 ft
Draft	2.6 m	8.2 ft
Height	4.85 m	15.9 ft
<b>Displacement</b>		
Standard		590 tons
Full load		650 tons
<b>Performance</b>		
Speed, maximum	33 km/h	18 kt
Speed, minehunting	11 km/h	6 kt (est)
Crew	5 officers, 32 enlisted	
<b>Armament</b>		
Guns	Bofors 40mm L70	1
Missiles – SAM	Stinger	2x 4
Mines	Seegrundmine 90	60
<b>Electronics</b>		
Radars	Raytheon SPS-64	1
ESM	FL-1800S	1
ECM	FL-1800S	1
Decoy launchers	Hot Dog/Silver Dog	2
COMINT	Telegon 6	1
Minehunting system	MWS80-4	1
Sonar	DSQS-11M	1
Minehunting vehicles	Penguin B3	2
<b>Machinery</b>		
Configuration	Diesel	
Diesels	MTU 16V396 TB84-DB51L	2x 5,550 shp
Auxiliaries	Diesel-engined electric generators	3
Propellers	Voith-Schneider CP	2

**Design Features.** The MJ-332 Frankenthal class minehunter is a further development of the SM-343 Hameln class built by the same contractor. The prominent raised foredeck characteristic of earlier minehunter designs has been lowered by one deck, reducing forward sail area and improving the handling characteristics of the ships. The ships are made of non-magnetic (austenitic) steel and are powered by two MTU 16V538 TB91 diesel engines, each producing

2,200 kW. Each engine drives a Voith-Schneider vertical cycloidal propeller. Each ship also has three diesel-engine-driven electric generators.

The ship has a limited armament suite consisting of one Bofors 40mm L70 mount capable of firing 330 rounds per minute. The ships carry two quadruple Stinger SAM launchers in armored tubs on the upper deck. Each ship also has two Hot Dog/Silver Dog infrared and chaff decoy launchers and the fully

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integrated FL-1800S electronic warfare system. This system is derived from the Octopus system installed on German fast attack craft and is a combination of the Cutlass B1 electronic support measures (ESM) system with an AEG threat library and the Scorpion jammer.

The electronics suite consists of an SPS-64 navigation radar and an Atlas MWS80-4 mine warfare system centered on the Atlas DSQS-11M sonar. The system comprises four main units: a high-performance minehunting sonar, the Atlas DSQS-11M; the Atlas Tactical Command and Documentation (TCD) equipment; the Atlas NBD precision navigation and tracking control system; and the Atlas AIS-11 active identification sonar, which is installed in the mine disposal vehicle. The Atlas MWS80-4 is interfaced to the control and monitoring systems in the ship's operations control center.

The TCD has two consoles for the commanding officer and the minehunting control officer. The system is used to prepare, control, and document all phases of mine countermeasures operations.

The DSQS-11M is a high-definition, dual-frequency, hull-mounted minehunting sonar that provides computer-aided detection and classification of all types of targets, including ground mines, short tethered mines, and in-volume mines. The system provides three-dimensional target location and tracking of stationary and moving targets. The system uses side-scanning mode for route survey tasks. Low-frequency sonar is used for long-range detection and classification, and higher frequencies are used for high-resolution detection against high background clutter.

The ship's integrated navigation system, the Atlas NBD, uses data from the ship's sensor suite for navigation, vessel control, and speed measurement. The system is equipped with a Global Positioning System, inertial navigation, a Decca navigation aid, radiolocation, a gyroscope, an echo sounder, an anemometer, and the ship's radar. The Atlas NBD integrated navigation system downloads the data from the sensors and, using Kalman filtering routines, calculates the optimum values for position, course, longitudinal and latitudinal water speed, transverse ground speed, and the set, drift, and depth of water. The measurements are then distributed to the subsystems of the MWS80-4 and to other ships' systems. Track and weapons data are taken from a tactical database or entered directly into the system, and the NBD automatically steers the ship along the planned search route. The system can also be operated using a manual joystick.

**Operational Characteristics.** Minesweeping equipment includes Oropesa wire sweeps, acoustic and

magnetic loop sweeps, and two Penguin B3 minesweeping drones. The vehicles are stored in the ship's hangar. The vehicles are controlled via a recoverable 1,000-meter glass-fiber cable that carries television, sonar, and operational data to the platform ship. The vehicle carries two mine disposal charges, each weighing up to 125 kilograms, and is capable of disposing of a range of mines, including moored mines, which are dealt with by detonating the mine casing. The Penguin B3 is launched and recovered by an automated crane fitted with a motion restrictor. The Penguin can be safely launched and recovered even at high sea states.

When a target mine is detected on the ship's sonar, the Penguin remotely operated vehicle is launched and is automatically guided to the target. The vehicle is equipped with the AIS, a CCD low-light-level television camera, and searchlights.

The active identification sonar (AIS), Naval Designation DDSX-11, is capable of classifying and identifying targets irrespective of the turbidity of the water. The forward-looking sonar is installed in the nose of the Penguin and provides detailed high-resolution pictures of the target. The system has a variable range setting to adapt to the search, classification, and identification phases of the target engagement. The image data from the sonar are transmitted back to the display screen in the ship's control center to provide real-time display of the underwater scene. The frame repetition rate is the same as that of a cinematographic film.

The tactical command system is used for contact management. It presents the tactical and navigational data and controls the sonar and navigation equipment.

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## Variants/Upgrades

**SM-343 Hameln Class Minesweeper.** This is an earlier version of the MJ-332 class and is basically the same design. This class was designed in the mid-1980s, with a German consortium headed by STN winning the contract for production of 10 ships on January 3, 1985. The first of the Type 343s was launched on March 15, 1988, and the last on June 18, 1990. Originally designated a Fast Mine Warfare Vessel (Schnelles Minenkampfboot), the ship was reclassified in 1989 as a Fast Minesweeper (Schnelles Minensuchboot). It has the same hull and much of the same equipment as the MJ-332, and a similar superstructure.

The Hameln class differs from the Frankenthal in that it is a minesweeper rather than a minehunter. In its modernized form, it has handling facilities for Troika remote-control minesweeping drones and is equipped with two 40mm guns rather than one. These have a Thales WM-22 fire control radar. Also, the engines are different models: the SM-343 has two MTU 15V538 TB91 diesels, producing 6,140 horsepower.

**MA-2000 Program.** Phase 2 of the MA-2000 program was authorized in 1993. Plans were prepared for the modification of five MJ-332 and five SM-343 mine warfare ships with the new MA-2000 integrated standoff mine warfare system. This system provides drone control for two Seahorse sonars. Other features include buried-mine detection equipment having a synthetic aperture mode. Data are relayed to the mother ship for processing via a high-speed datalink. Mines are destroyed using a low-cost expendable unit.

The sonars of the remaining 10 ships are being modernized, and the ships fitted with improved Troika drone controls. The first ship to be modernized was the M1094 in 1998. The modernization of ship numbers 1090, 1092, 1093, and 1098 was completed by the end of 2000. This modernization improved the SDG-31 mechanical sweeps. The remaining ships will be converted to minehunters.

**HL-352.** The SM-343 Hameln class was converted and modernized under two separate contracts, each with a different task. Five of the ships (BMS *Ensdorf*, *Auerbach*, *Hameln*, *Pegnitz*, and *Siegburg*) were converted to minesweeper platforms and redesignated Type HL-352 (Hohlstab Lenkboot) vessels to improve their capability for sweeping and destruction missions. The ships received an MAS-90 mine avoidance sonar, a new Troika C<sup>2</sup> system for the operation of remotely controlled simulation drones, a DAISY PC-based workstation, and a number of Sea Fox mine disposal vehicles.

The drone control system on these ships was developed in cooperation with the Royal Netherlands Navy, resulting in a high degree of requirements commonality. The contract was awarded to STN Atlas, in partnership with Thales, DASA, and IBM as subcontractors.

**MJ-333.** The other five SM-343s (BMS *Kulmbach*, *Überherrn*, *Herten*, *Laboe*, and *Passau*) have been modernized to the same equipment standard as the MJ-332 class and redesignated the MJ-333 class. They were fitted with the STN Atlas MWS80-4 mine countermeasure combat system. Three of the ships already had the DSQS-11M sonar for minehunting, and the same would be added on the other two. Other systems fitted on these ships are the Sea Fox, the DAISY terminal, the TAKIS tactical command information system, and an NBD navigation suite.

**MJ-2000.** The MJ-2000 (Minenjagd-2000) modernization and conversion program described above concerned the role change of the SM-343s, and was intended to partly compensate for the pending decommissioning of the 12 wooden-hulled MS-331 Lindau class minehunters from the late 1950s and of the HL-351 Troika class remote-control minesweeper vessels.

The MJ-2000 program will later include development of a towed platform that will be equipped with several types of sonars, including buried mine detection sonars. The new Seawolf mine disposal vehicle will also be incorporated.

**Modular Multirole Mine Warfare Vessel.** Abeking & Rasmussen is developing a modular design for a mine warfare vessel based on the same hull as the MJ-332/MS-343, but with a number of different weapons, electronics, and warfare systems depending on customer specifications. The ship is intended to be suitable for a full range of mine warfare missions, as well as secondary roles such as patrol, survey, and pollution control. The key to being able to offer the same basic design for varying functions is the containerization of exchangeable elements that are loaded on the ship's aft deck area. This design has been offered for export to the United Arab Emirates naval forces.

**MHV 54-014 Alanya Class.** This is the Turkish version of the MJ-332 class. It is significantly larger than the German original, with a full load displacement of 715 tons as opposed to 650 tons for the German ships. The Alanya class has a top speed of only 14 knots (as opposed to 18 kt for the German ships), with a hunting speed of around 6 knots. The primary

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sensor is the Thales Underwater Systems Type 2093 in combination with Alenia Marconi's Nautis III-M combat management system. According to some reports, the ships' sonar systems, engines, and command and control systems will be produced locally.

The French PAP-104 Mk 5 was the remotely operated undersea vehicle of choice, with weaponry including an Oto Melara 30mm gun. The first ship was commissioned in 2004, with the last to be delivered in 2007.



MJ-332 Class Minehunter *Rottweil*

Source: German Navy



FGS *Gromitz* after Running Aground

Source: German Navy

## MJ-332 Frankenthal Class

## Program Review

**Background.** Germany has one of the largest NATO mine countermeasures forces, but most of its ships were built in the late 1950s and early 1960s. By the early 1980s, many of these ships needed to be replaced. The German Navy began design studies for two new classes of mine warfare vessel in 1982. Two separate programs were envisioned, a small coastal minehunter and a larger and more capable multipurpose mine countermeasures and minelaying vessel.

### *Design Work Started*

In 1983, AEG-Telefunken and Messerschmitt-Bolkow-Blohm/Fokker Werft received project definition contracts calling on the two firms to work with three shipyards: Lürssen/Burmeister Werft, Krögerwerft, and Abeking & Rasmussen. Project definition studies were conducted through 1984, resulting in the MJ-332 and SM-343 programs.

In February 1985, the operational requirement for the MJ-332 series was approved. In June 1987, a decision was made to maximize commonality between the MJ-332 and the SM-343 in order to reduce life-cycle costs. Consequently, the MJ-332 became a specialized version of the SM-343, with reduced armament and electronics oriented toward minehunting rather than minesweeping. Effectively, the MJ-332 and SM-343 designs constitute a common pool from which hulls can be drawn for modernization and upgrade programs. Cross-modernization and equipment upgrades have blurred the distinction between these classes to the point where the division between the two types (which was always artificial) has become moot.

### *MJ-332 Ordered*

In September 1988, an order was placed for 10 ships of the MJ-332 class. The order was split as follows: four to Lürssen, three to Abeking & Rasmussen, and three to Krögerwerft. The first ship of the class, the BMS *Frankenthal*, was delivered in December 1992.

The SM-343/MJ-332 design has been offered in most of the recent competitions for mine warfare vessels, including in Saudi Arabia, Australia, Turkey, Spain, and Indonesia.

Turkey announced in the spring of 1999 that it would buy six minehunters for its Navy, based on the

MJ-332 Frankenthal design. Bids for this contract also came from Bazan, DCN, and Intermarine of Italy (i.e., presumably offering the Segura, Eridan, and Gaeta classes, or derivatives thereof, respectively). The vessels' primary mission will be to clear the strategically central Bosphorus Strait for shipping during crises.

The first ship was built in Germany by a consortium of Lürssen and Abeking & Rasmussen. The other five are being built locally in Turkey, at either the Taskizak Shipyard or the Pendik Naval Shipyard, near Istanbul. They are being constructed from non-magnetic steel, like their German counterparts, implying that a technology transfer may be part of the deal. These ships carry the British-designed Type 2093 sonar and Nautis mine warfare system. The first was delivered in 2005 with the program running around three years later. The last pair of ships was delayed longer with the M269 *Anamur* being photographed at sea in mid-2009. The last ship in the class, the M270 *Akca*, was reported to have been commissioned in 2009.

At one time, the construction of a second group of 10 ships for the German Navy was proposed, with construction to start in 1995. These would have included Troika drone control facilities. This plan was later delayed indefinitely, and in 1995 it was announced that only two more new ships would be ordered (BMS *Fulda* and *Weilheim*).

### *German Modernization*

Instead of buying more ships, the German Navy decided to convert and modernize its existing MJ-332 and SM-343 platforms to better match current and future minehunting and minesweeping requirements. In the summer of 1998 it was announced that all 10 SM-343s would be converted under two separate contracts. Under this program, the class was split into two groups. One group, the MJ-333 class, was made functionally identical to the MJ-332 Frankenthal class. Members of the other group, the HL-352 class, were modified to act as Troika drone control ships. This program proceeded swiftly and was completed by 2001. Additional modification programs include installation of the MJ-2000 minehunting system on the MJ-332 and MJ-333 classes.

## Funding

The program was funded by the BWB.

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## Contracts/Orders &amp; Options

<u>Contractor</u>	<u>Award (\$ millions)</u>	<u>Date/Description</u>
STN-Atlas Elektronik	190.0	Oct 16, 1995 – Order for two more ships of the Type 332 series (M1058 and M1059); one built at Abeking & Rasmussen, the other at Lürssen shipyard.
STN-Atlas Elektronik	103.6	Dec 1997 – Conversion of five SM-343 minesweepers to minehunter/sweeper platforms (new designation HL-352).
Peenewerft Wolgast, STN-Atlas	66.2	Jan 1998 – Upgrade of five minesweepers to advanced minehunters (MJ-333).
Abeking & Rasmussen/Lürssen Werft	550.0	Jul 30, 1999 – Turkish Navy order for six minesweepers based on MJ-332, with the first to be built in Germany and the remaining in Turkey.
Alenia Marconi		Feb 2001 – Turkish Navy order for six Nautis 3 command systems to equip the Alanya class minehunters.

## Timetable

<u>Month</u>	<u>Year</u>	<u>Major Development</u>
	1982	German Navy begins definition studies for new minelayer/sweeper
Jan	1985	Messerschmitt-Bolkow-Blohm/Fokker Werft designated program manager
Feb	1985	Operational requirement specified for MJ-332 series
Sep	1988	Ten ships ordered
Dec	1992	First ship delivered
Oct	1995	Last two ships ordered for the Germany Navy
3Q	1997	Invitations to Tender issued for MJ-2000 upgrade systems for both 332 and 343
Oct	1997	German Navy merges 4th and 6th Minesweeping Squadrons (Wilhelmshaven)
	1998	Upgrade of five SM-343s to advanced minehunters (MJ-333) and conversion of five dedicated minesweepers to multimission minesweeper platforms
Dec	1998	M-1059 Weilheim commissioned
Spring	1999	Turkey announces selection of German minehunter for its navy
Jul	1999	Turkey signs contract for six Type 332 derivatives
Dec	1999	STN Atlas delivers training system MJ-333 to the German Navy
	2001	German upgrade program completed
	2004	First Turkish ship commissioned
	2009	All six Turkish ships to be fully operational

## Worldwide Distribution/Inventories

<b>Germany</b>	10 MJ-332 Frankenthal, five MJ-333, and five HL-352 minehunters are in service.
<b>Turkey</b>	Five ships are in service and one is under construction for the Turkish Navy. Some unconfirmed reports suggest that options for two additional ships exist.
<b>UAE</b>	The German minehunters FGS <i>Weiden</i> and FGS <i>Frankenthal</i> were sold to the UAE on June 30, 2006.

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## Forecast Rationale

With the Turkish program apparently ended, it looks as if the construction career of the MJ-332 mine countermeasures ship has also ended. Although the dying days of the Turkish A class minehunter program were shrouded in doubt, the second-to-last member of the class was finally photographed at sea, taking part in a NATO exercise, in August 2009. The last of the class was reported to have been commissioned in April 2009 and was believed to have entered full-operational service by the end of the year. With these two ships, construction of magnetic steel-hulled mine countermeasures vessels has ended.

Although the German MJ-332 class was regarded as an aberration from the international trend toward GRP construction for minehunters, it would be wrong to suggest that its design was anything other than very successful. The unfortunate grounding of the German

minehunter *Gromitz* in January 2007 confirmed the durability and structural integrity of this design. The *Gromitz* was able to return to Germany under her own power (indicating that the machinery and shafts had escaped damage or demounting). It would appear that the combination of a shock-hardened hull and a reinforced keel prevented serious damage. Given the severity of the grounding, it is probable that a GRP minehunter would have been written off and one of the older wooden-hulled minehunters would certainly have been a total loss.

Given this great level of structural integrity, the MJ-332 class will undoubtedly serve for many years and will see extensive modernization and refitting. However, it is sad to note that the only reasonable projection for the MJ-332 class is that no new orders will be forthcoming.

## Ten-Year Outlook

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Since no additional construction is outstanding and there are no contracts pending for this class, no forecast is included.

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