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MEKO-200 - Archived 11/2008

Outlook

- Last MEKO-200 completed in September 2006, ending program construction
- Total of 25 ships for five navies built
- No additional MEKO-200 ships likely to be ordered; instead sales will concentrate on new-generation MEKO-A design
- This report will be archived next year

Orientation

Description. Multipurpose frigate design with variable payloads. This design uses standardized modules for weapons and electronics, and standardized interfaces and equipment.

Status. In service.

Total Produced. A total of 25 MEKO-200 ships had been built by the time construction ended in July 2006. In addition, five MEKO-360 and six MEKO-140 class ships have been built.

Sponsor

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Pennant List

Ship	Shipyard	Order Date	Launch Date	Commission Date
Turkey				
F240 *Yavuz*	Blohm +Voss	9/1983	11/1985	7/1987
F241 *Turgutreis*	Howaldtswerke	9/1983	2/1988	2/1988
F242 *Fatih*	Golcuk	9/1983	9/1988	7/1988
F243 *Yildrim*	Golcuk	9/1983	11/1989	7/1989
F244 *Barbaros*	Golcuk	1/1990	9/1993	3/1995
F245 *Orucreis*	Golcuk	1/1990	7/1994	5/1996
F246 *Salihreis*	Golcuk	12/1992	9/1997	12/1998
F247 *Kemalreis*	Golcuk	12/1992	7/1998	6/2000
Portugal				
F490 *Vasco da Gama*	Blohm + Voss	7/1986	6/1989	11/1990
F491 *Alvares Cabral*	Howaldtswerke	7/1986	6/1990	5/1991

MEKO-200

Ship	Shipyard	Order Date	Launch Date	Commission Date
F492 *Corte Real*	Howaldtswerke	7/1986	6/1990	11/1991
Greece				
F452 *Hydra* [(a)]	Blohm + Voss	2/1989	6/1991	11/1992
F453 *Spetsai*	Hellenic Shipyard	2/1989	12/1993	10/1996
F454 *Psara*	Hellenic Shipyard	2/1989	12/1994	4/1998
F455 *Salamis*	Hellenic Shipyard	2/1989	5/1997	1/1999
Australia				
F150 *Anzac*	Tenix	8/1989	9/1994	5/1996
F151 *Arunta*[(b)]	Tenix	8/1989	6/1996	12/1998
F152 *Warramunga*	Tenix	8/1989	5/1998	3/2001
F153 *Stuart*	Tenix	8/1989	4/1999	9/2002
F154 *Parramatta*	Tenix	8/1989	6/2000	10/2003
F155 *Ballarat*	Tenix	8/1989	5/2002	6/2004
F156 *Toowomba*	Tenix	8/1989	5/2003	10/2005
F157 *Perth*	Tenix	8/1989	3/2004	9/2006
New Zealand				
F77 *Te Kaha*	Tenix	9/1989	7/1995	7/1997
F111 *Te Mana*	Tenix	9/1989	5/1997	12/1999

[(a)] This ship's name is transliterated as both *Ydra* and *Hydra*.

[(b)] This ship was originally named HMAS *Arunta*, but the name was then changed to HMAS *Arrente* on the grounds that this better represented the pronunciation used by the Australian Aborigine population. However, the name was changed back to *Arunta* since the ship honors the World War II destroyer HMAS *Arunta*, which had a distinguished service record.

Mission. The MEKO-200 is a modular light frigate designed to provide export customers with maximum flexibility. According to the specified weapons fit, it is capable of anti-submarine, anti-surface, and anti-air warfare.

Price Range. The high degree of modularity of the ship's design makes cost assessment difficult. However, recent contract values have ranged between $240 million and $330 million. The most common appears to be around $320 million.

Contractors

Prime

Blohm + Voss GmbH	http://www.blohmvoss.com, Hermann-Blohm-Strasse 3, PO Box 10 07 20, Hamburg, 20457 Germany, Tel: + 49 40 3119 0, Fax: + 49 40 3119 3383, Email: info@blohmvoss.com, Prime
Golcuk Naval Shipyard	Golcuk, Izmit, Turkey, Tel: + 90 262 41234201, Fax: + 90 262 4124202, Licensee
Hellenic Shipyards SA	http://www.hellenic-shipyards.gr, 3, Palaska St, Skaramangas, 12462 Attica, Greece, Tel: + 30 210 5510000, Fax: + 30 210 5570700, Email: marketing@hsy.gr, Licensee
Tenix Pty Ltd	http://www.tenix.com, Level 12, 141 Walker St, North Sydney, 2060 NSW, Australia, Tel: + 61 2 9963 9600, Fax: + 61 2 9963 9690, Licensee

Subcontractor

BAE Systems Land & Armaments, Armament Systems Division	http://www.uniteddefense.com, 4800 E River Rd, Minneapolis, MN 55421-1498 United States, Tel: + 1 (763) 571-9201, Fax: + 1 (763) 572-9826 (Mk 45 5-Inch/54 Lightweight Gun)
Bainbridge International	8, Flanders Park, Hedge End, Southampton, SO30 2FZ Hampshire, United Kingdom (Flame Retardant Protection Systems)
Boeing Naval Systems	http://www.boeing.com/ids, PO Box 516, St Louis, MO 63166 United States (RGM-84 Harpoon)

EPCOTS	http://www.epcots.fr/anglais/index.html, 66 Impasse Branly, Zone Industrielle BP99, Toulon, 83079 France, Tel: + 33 498 080000, Fax: + 33 498 080008 (Sound Isolation)
Eurotorp	http://www.eurotorp.com, 399, route des Crêtes, BP 113, Sophia Antipolis, 06902 France, Tel: + 33 4 92 96 38 50, Fax: + 33 4 92 96 38 55, Email: et@eurotorp.com (Torpedoes)
Filtronic Components Ltd	Airedale House, Acorn Park, Shipley, BD17 7SW Bradford, United Kingdom (RF Components)
GE Transportation - Marine Engines	http://www.geae.com/, 1 Neumann Way S-156, Cincinnati, OH 45215 United States, Tel: + 1 (513) 552-5465, Fax: + 1 (513) 552-5005 (LM2500 Marine Gas Turbine)
Gresham Power Electronics Ltd	http://www.greshampower.com, Telford Rd, Salisbury, SP2 7PH Wiltshire, United Kingdom, Tel: + 44 01722 413060, Fax: + 44 01722 413034, Email: enquiries@greshampower.com (Power Handling Systems)
Industrial Acoustics Co Ltd	http://www.iacl.co.uk, IAC House, Moorside Rd, Winchester, SO23 7US Hants, United Kingdom, Tel: + 44 1962 873000, Fax: + 44 1962 873132 (Noise Control & Shock-Mounting System)
L-3 Communications - ELAC-Nautik GmbH	http://www.elac-nautik.de, Neufeldtstrasse, Kiel, 24118 Germany, Tel: + 49 431 883 0, Fax: + 49 431 883 496, Email: marketing@elac-nautik.com (Echosounders)
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)
Oerlikon Contraves AG	http://www.rheinmetall-detec.de, Birchstrasse 155, Zurich, 8050 Switzerland, Tel: + 41 44 316 2211, Fax: + 41 44 311 3154, Email: info@ocag.ch (Sea Zenith Close-In Weapons System)
Raytheon Co	http://www.raytheon.com, 870 Winter St, Waltham, MA 02451-1449 United States, Tel: + 1 (781) 522-3000, Fax: + 1 (781) 860-2520 (Mk 29 SeaSparrow Launcher)
Raytheon Integrated Defense Systems, Maritime Mission Systems	http://www.raytheon.com/businesses/rids, 1847 W Main Rd, Portsmouth, RI 02871-1087 United States, Tel: + 1 (401) 842-2200, Fax: + 1 (978) 246-8800 (SQS-56 Sonar)
SMAC	http://www.caoutchouc-elastomere-suspension.com/, 66 Impasse Branly, Zone Industrielle BP11966, Toulon, 83079 France, Tel: + 33 494 752488, Fax: + 33 494 4759499 (Rafting)
Saab Microwave Systems	http://www.saabgroup.com, Solhusgatan, Göteborg, 412 89 Sweden, Tel: + 46 31 794 9000, Fax: + 46 31 794 9002 (Sea Giraffe)
SaabTech, Head Office	http://www.saabtech.se, Nettovägen 6, Järfälla, 175 88 Sweden, Tel: + 46 8 580 840 00, Fax: + 46 8 580 322 44, Email: info@saabtech.se (Command & Control System)
Thales Nederland BV	http://www.thales-nederland.nl, Haaksbergerstraat 49, Hengelo, 7554 PA Netherlands, Tel: + 31 74 2488111, Fax: + 31 74 2425936, Email: info@nl.thalesgroup.com (DA 08)
Thales Underwater Systems, HQ	http://www.thales-naval.com, 525 Route Des Dolines, BP 157, Sophia Antipolis, 06903 France, Tel: + 33 4 92 96 30 00, Fax: + 33 4 92 96 39 50, Email: TUS@thales-underwater.com (TSM-2633)
Thordon Bearings	http://www.thordonbearings.com/, 3225 Mainway, Burlington, L7M 1A6 Ontario, Canada, Tel: + 1 (905) 335-1440, Fax: + 1 (905) 335-4033 (Bearings)

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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

MEKO-200

Technical Data

	Metric	U.S.
Dimensions		
Length		
ANZAC	118.0 m	387.1 ft
Hydra	117.0 m	383.9 ft
Portugal	115.9 m	380.3 ft
Turkey (Track 1)	110.5 m	362.5 ft
Turkey (Track 2)	116.9 m	383.5 ft
Beam		
ANZAC	14.8 m	48.6 ft
Hydra	14.8 m	48.6 ft
Portugal	14.8 m	48.6 ft
Turkey (Track 1)	14.2 m	46.6 ft
Turkey (Track 2)	14.8 m	48.6 ft
Draft		
ANZAC	4.3 m	14.3 ft
Hydra	4.1 m	13.5 ft
Portugal	4.1 m	13.5 ft
Turkey (Track 1)	4.1 m	13.5 ft
Turkey (Track 2)	4.3 m	14.3 ft
Displacement	Standard	Full Load
ANZAC	3,195 tonnes	3,495 tons
Hydra	2,800 tonnes	3,100 tons
Portugal	2,700 tonnes	3,300 tons
Turkey (Track 1)	2,500 tonnes	2,784 tons
Turkey (Track 2)	3,100 tonnes	3,350 tons
Performance		
Speed, Maximum		
ANZAC	50 kmph	27 kt
Hydra	57 kmph	31 kt
Portugal	59 kmph	32 kt
Turkey (Track 1)	50 kmph	27 kt
Turkey (Track 2)	59 kmph	32 kt
Range		
ANZAC	11,100 km at 33 kmph	6,000 nm at 18 kt
Hydra	7,600 km at 30 kmph	4,100 nm at 16 kt
Portugal	9,100 km at 33 kmph	4,900 nm at 18 kt
Turkey (Track 1)	7,600 km at 33 kmph	4,100 nm at 18 kt
Turkey (Track 2)	7,600 km at 33 kmph	4,100 nm at 18 kt
Crew		
ANZAC	22 Officers; 141 Enlisted	
Hydra	22 Officers; 151 Enlisted	
Portugal	23 Officers; 159 Enlisted	
Turkey (Track 1)	24 Officers; 156 Enlisted	
Turkey (Track 2)	24 Officers; 156 Enlisted	

	Type	Quantity
Armament		
Guns (main)		
ANZAC	5 in L54 Mark 45	1
Hydra	5 in L54 Mark 45	1
Portugal	Giat 100mm	1
Turkey (Track 1)	5 in L54 Mark 45	1
Turkey (Track 2)	5 in L54 Mark 45	1

	Type	Quantity
Guns (CIWS)		
ANZAC	None	
Hydra	Phalanx Mark 15 CIWS	2
Portugal	Phalanx Mark 15 CIWS	1
Turkey (Track 1)	Sea Zenith CIWS	3
Turkey (Track 2)	Sea Zenith CIWS	3
Missiles (SSM)		
ANZAC	None	
Hydra	Harpoon	8
Portugal	Harpoon	8
Turkey (Track 1)	Harpoon	8
Turkey (Track 2)	Harpoon	8
Missiles (SAM)		
ANZAC	SeaSparrow	8
Hydra	SeaSparrow	16
Portugal	SeaSparrow	16
Turkey (Track 1)	Aspide	24
Turkey (Track 2)	Aspide	24
Torpedo Tubes		
ANZAC	None	
Hydra	324mm for Mark 46 mod 5	2x 3
Portugal	324mm for Mark 46 mod 5	2x 3
Turkey (Track 1)	324mm for Mark 46 mod 5	2x 3
Turkey (Track 2)	324mm for Mark 46 mod 5	2x 3
Aircraft		
ANZAC	S-70B2 Seahawk	1
Hydra	AB-212 or S-70B6 Seahawk	1
Portugal	Lynx	1
Turkey (Track 1)	AB-212 ASW/ASuW	1
Turkey (Track 2)	AB-212 ASW/ASuW	1
Electronics		
Air Search Radars		
ANZAC	SPS-49(V)8	1
Hydra	Thales DA.08	1
Portugal	Thales DA.08	1
Turkey (Track 1)	Thales DA.08	1
Turkey (Track 2)	Thales AWS-9	1
Target Indicating Radars		
ANZAC	Sea Giraffe HC150	1
Hydra	Thales MW.08	1
Portugal	Thales MW.08	1
Turkey (Track 1)	Thales AWS-6	1
Turkey (Track 2)	Thales AWS-6	1
Fire Control Radars		
ANZAC	Bofors 9LV200	1
Hydra	Thales STIR	2
Portugal	Thales STIR	2
Turkey (Track 1)	Thales STIR	2
	Thales WM-25	1
Turkey (Track 2)	Thales STIR	1
	Contraves TMX	1
Navigation Radars		
ANZAC	Atlas Electronik 8600	1
Hydra	Racal 2690 BT	1
Portugal	Type 1007	1
Turkey (Track 1)	Decca 1226	1
Turkey (Track 2)	Decca 1226	1

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	Type	Quantity
ESM		
ANZAC	Sceptre XL	1
Hydra	Argo AR-700	1
Portugal	Argo AR-700	1
Turkey (Track 1)	Rapids	1
Turkey (Track 2)	Cutlass	1
ECM		
ANZAC	None	
Hydra	Argo APECS-II	1
Portugal	Argo APECS-II	1
Turkey (Track 1)	Ramses	1
Turkey (Track 2)	Cygnus	1
Decoy Launchers		
ANZAC	SRBOC/Nulka	4
Hydra	SRBOC	4
Portugal	SRBOC	2
Turkey (Track 1)	SRBOC	2
Turkey (Track 2)	SRBOC	2
COMINT		
ANZAC	Telegon 10	1
Hydra	Telegon 10	1
Portugal	Telegon 10	1
Turkey (Track 1)	Telegon 10	1
Turkey (Track 2)	Telegon 10	1
Sonar		
ANZAC	Spherion B	1
Hydra	SQS-56	1
Portugal	SQS-510	1
Turkey (Track 1)	SQS-56	1
Turkey (Track 2)	SQS-56	1
Command System		
ANZAC	CelsiusTech 9LV453	1
Hydra	STACOS	1
Portugal	STACOS	1
Turkey (Track 1)	STACOS	1
Turkey (Track 2)	TACTICOS	1
Propulsion		
Diesels		
ANZAC	MTU 12V1163 TB83	2x 4,420 shp
Hydra	MTU 20V956 TB82	2x 5,210 shp
Portugal	MTU 12V1163 TB83	2x 4,420 shp
Turkey (Track 1)	MTU 20V1163 TB93	4x 8,825 shp
Turkey (Track 2)	MTU 20V1163 TB83	2x 5,890 shp
Gas Turbines		
ANZAC	GE LM2500	1x 30,172 shp
Hydra	GE LM2500	2x 30,000 shp
Portugal	GE LM2500	2x 27,500 shp
Turkey (Track 1)	None	
Turkey (Track 2)	GE LM2500	2x 30,000 shp

Design Features. One of the main features of the MEKO technology is compartment independence. This means that the watertight compartments are completely independent of each other with regard to the supply of electrical energy, ventilation, air conditioning, and firefighting facilities. Below the waterline, redundant power supply systems are arranged – each independent of the other – supplying power to the ship's systems by way of vertical distribution lines.

The two aft and two forward compartments are combined and equipped with one power distribution system (or Load Center, as Blohm + Voss designates it), each. All other compartments have their own Load Center, an independent fire pump, and an independent

ventilation system. The MEKO-200 frigate is fitted with a permanent air protection system (Constant Sealed System), which fulfills all internal climate requirements for a frontline NATO frigate. This system substantially increases survivability compared with previous naval vessels. The air conditioning system has been updated with the introduction of ventilation modules, designed and constructed by Norske-Kaeser, which replace conventional ventilation rooms.

Modularizing the air conditioning system demands early production of the ventilation modules. This aspect of construction usually starts some nine months before the first hull plates and profiles are cut. NBC (nuclear, biological, chemical) fans equipped with NBC protection units are installed in each compartment, increasing survivability. As the compartment bulkheads need not be penetrated by ventilation lines (a key feature of the MEKO design concept developed by Blohm + Voss), the bulkheads can be sealed off instantly simply by closing the doors. This greatly enhances the ability of damage control teams to prevent the spread of smoke and water into other compartments. The provision of independent ventilation also means that smoke can be extracted very effectively from the affected compartments.

The introduction of the vertical power distribution system feeding each individual Load Center serves to enhance the survivability of the MEKO-200 frigate, because electric power is distributed by the Load Centers via both main systems and subsystems. The Load Centers are equipped with a changeover for selectable feeding by one of the two main switchboards. A main distribution group, a weapons group, a lighting group, a 24 V group, and chargers for the external batteries are also incorporated in each Load Center.

The two main switchboards are fed directly from two brushless, synchronous alternators and are connected to each other by a cable laid amidships. One of the main switchboards is arranged in the forward damage control area and the other in the aft damage control area. They are thus separated from each other by several compartments. The Load Centers are fed by the main switchboards along separately laid halogen-free cables. The main cable tray is arranged horizontally on the fourth deck below the waterline. It runs directly upward from the bulkhead penetrations, which are fire-resistant and gastight and watertight, to the respective Load Center.

The conventional point-to-point wiring for the weapons and electronic systems has been replaced by the MICE/ DAIL (Multi-Interface Computer Equipment/Data Information Link) databus system developed by Blohm + Voss. Following the standardization of the mechanical interfaces for weapons and electronic systems by means of modules (containers and pallets), the introduction of the Blohm + Voss MICE/ DAIL databus completed the interface standardization (a MICE was incorporated into each subsystem).

Each MICE is provided with the interface adaptations and applications of the relevant subsystem. As a result, subsystem integration is not required, further reducing system integration costs. Each MICE is provided with a standardized Ethernet interface to the DAIL bus so that each MICE can communicate with the other. For easy monitoring of all databus activities, a network monitor console is mounted in the combat information center (CIC). With this network monitor, the operational availability of all weapons and electronic systems can be displayed, thereby facilitating central trouble-shooting.

Operational Characteristics. The MEKO-200 frigate may be continuously operated as a complete NBC citadel. Operation as partial citadel or, in extreme cases, a compartment citadel is also possible. The air conditioning, citadel pressure, and status of outer doors can all be monitored and/or controlled through the central naval automation system (NAUTOS). This system can be operated from each of the two Damage Control Section control areas and the damage control headquarters (DCHQ) in the machinery control room (MCR). Sea trials have shown that the constant sealed system ensures optimum internal climate conditions for the crew and the electronic equipment. Within about 15 seconds, the required overpressure of >5 mbar can be reached inside the citadel.

The central NAUTOS, developed by Siemens, is not restricted to monitoring the ship's service systems but can also be used for remote control and monitoring of the entire propulsion plant and all auxiliary machinery, valves, air conditioning, and main components of the electrical power system. The NAUTOS can be centrally controlled from the MCR, where an interfaced console with four workstations – each provided with two color monitors – is located. Each of these workstations allows full operation of the NAUTOS. With the NAUTOS, commands and signals are transmitted to the compartment system via a dual databus system and independent substations.

If central operation is not possible or the system fails, the redundant Damage Control Status Boards arranged in the forward and aft damage control areas may be used instead.

HMAS *Anzac*

Source: Royal Australian Navy

Variants/Upgrades

ANZAC Class. The combat systems suite on the Australian/New Zealand version of the ship is the 9LV 453 Mk 3 system manufactured by Bofors Electronics. The ships carry the Mk 41 VLS (vertical launch system) with the NATO SeaSparrow missile. They are outfitted with the Mk 45 5-inch L54 lightweight gun. The sonar is a Mulloka hull-mounted medium-frequency sonar.

Space and weight are reserved for a close-in weapon system (CIWS), an additional octuple VLS, a second channel of fire for the VLS, a towed array sonar, offboard active electronic countermeasures (ECM), extended ESM frequency coverage, a Helo datalink, and satcom.

The ship has combined diesel or gas turbine (CODOG) propulsion with two MTU 12V1163 TB83 diesels and an LM2500 gas turbine. It has the Sperry Marine Mk 49 Mod 2 Ring Laser Gyro Navigation System, which is basically the same as the SINS used by the NATO forces. The ship also features the PA9154 Global Positioning System manufactured by GEC-Plessey.

Upgraded ANZAC Class. Evolved SeaSparrow missiles (ESSM) were incorporated in HMAS *Warramunga*, the first ship in the world to be so fitted (first missile launched January 21, 2003). Subsequent ships are similarly armed and the equipment has been retrofitted to the first two ships. Further anti-ship missile defense upgrades are being implemented under

Project Sea 1448. HMAS *Perth* will be the first of the class to be fitted with the 9LV Mk 3E combat management system, which will be retrofitted in the remainder of the class from 2006-2010. Also under consideration is either the installation of a CEA-FAR active phased-array multifunction radar or the replacement of the Sea Giraffe 2-D radar with a 3-D variant. The Nulka missile decoy is also being fitted. Contracts for the fitting of the Harpoon SSM were signed in 2002. MU-90 Impact torpedoes will replace Mk 46 torpedoes.

Barbaros Class (MEKO-200TN). This is the latest variation of the modified MEKO-200 form in Turkey. The first-of-class was delivered in September 1993. Ships number 1 and 3 of the series were built in Germany, while 2 and 4 came from Gölcük. They represent an improvement on the Yaluz class. The Barbaros ships have Mk 29 launchers fitted in the first two units, while the next two have Mk 41 VLS. These will be retrofitted on the first two.

Unlike the Yavuz class, these 3,350-tonne ships have CODOG propulsion for higher top speeds. The two diesels produce a total of 13,060 bhp while the two LM2500-30 boost gas turbines yield a total of 60,000 shp, resulting in a top speed of 32 knots.

The ships operate with a crew of 180, and are fitted with improved radars, including the AWS-9 air/surface search and AWS-6 air search units. They also feature a full command-and-fire control system, consisting of STIR-24 missile control and STIR-18 gun control, as well as the Cutlass B1 for intercept, the Scorpion B jammer, four SRBOC systems, and an SLQ-25 NIXIE. A DE 1160 hull sonar is also fitted. The ships also include a citadel for nuclear and biochemical warfare protection. An aft helicopter deck with hangar is fitted for aviation needs, housing an AB-212 helicopter.

The armament consists of eight Harpoon SSMs, one 8-cell SeaSparrow SAM (16 missiles, manual reload), one 5-inch L54 DP gun, four quadruple 25mm CIWS, and two triple 12.75-inch torpedo tubes.

Hydra Class. The 3,100-tonne Greek versions carry the Thales Radar Nederland MW-08 3-D air search radar, a DA-08 early warning radar, and two STIR-18 fire control radars. They are equipped with the hull-mounted SQS-56 (DE 1160) sonar system. Propulsion comes from a CODOG arrangement, using two MTU 20V956 TB82 diesels (10,400 bhp) and two GE LM2500-30 gas turbines (60,600 shp), driving two shafts at a cruising speed of 21 knots (diesels), with a capability of reaching top speeds of about 32 knots when assisted by gas turbines.

Electronic warfare equipment consists of the APECS-II intercept, four SRBOC systems, and an SLQ-25 NIXIE. The ships have an aft helicopter deck and hangar, operating an SH-60 helicopter. The armament consists of eight Harpoon SSMs, a VLS for 16 SeaSparrow SAMs, and a 5-inch L54 DP gun, as well as two 20mm Phalanx CIWS and two triple 12.75-inch torpedo tubes.

The first ship of the series was built in Germany, while the rest of the class has been built locally at the Hellenic Shipyard in Skaramangas.

Vasco da Gama Class. The Portuguese MEKO-200 ships are armed with one Giat 100mm (3.9-in) gun, which has a range of 6.6 nautical miles and a rate of fire adjustable up to 90 rpm. The ships have a minimum headroom weapons-handling system. The new handling system consists of a wire rope Minilift hoist, suspended on a trolley, which runs along overhead rails and turntable for transporting missiles, bombs, and torpedoes to and from the magazines. Close-in air defense is handled by the Phalanx Mk 15 CIWS. The ships carry a Dutch sensor suite, including the LW.08 two-dimensional air search radar and the ZW.08 surface search radar.

The fire control system is the WM 25 STIR gun and missile fire control radar. All three radars are manufactured by Thales Radar Nederland. A SEWACO (sensor, weapon, command) system provides for automatic collection, analysis display of all data from the ship's sensors, and integration with the different weapons systems. The Portuguese ships have the SQS-510, which is also an active, medium-frequency, keel-mounted system. The SQS-510 is manufactured by Computer Devices/Control Data of Canada.

The Vasco da Gama class ships have a CODOG propulsion system, consisting of two General Electric LM2500 gas turbines that produce 52,000 horsepower and a maximum speed of 32 knots, while two MTU 12V 1163 TB83 diesel engines produce 8,800 horsepower and a cruising speed of 20 knots.

Yavuz Class. Each of the Turkish ships of the first flight (weighing in at only 2,994 tonnes) has one 5-inch L54 Mk 45 gun, which has a range of 13 nautical miles and a firing rate of 20 rpm. For close-in air defense, the ships have Sea Guard CIWS, consisting of four 25mm Oerlikon Sea Zenith guns, the Plessey Dolphin tracking radar, and the Siemens Albis electro-optical sensor. The armament also includes eight Harpoon SSMs, one 8-cell SeaSparrow SAM (16 missiles, manual reload), and two triple 12.75-inch torpedo tubes.

The primary radar system for the Turkish ships is the AWS-9 air and surface search radar. It is backed up by a DA-08 air search radar. A BAE Systems Dolphin system, whose primary mission is to act as a tracking system for the Sea Guard CIWS, is also included, although it has a relatively limited surface search capability. To provide tracking and guidance for the NATO SeaSparrow Point Defense Missile System (PDMS) and the 5-inch gun, a STIR-24 is provided as a missile control radar and a WM-25 for fire control.

The Turkish ships have the Raytheon SQS-56/DE 1160 medium-frequency active keel-mounted sonar. These ships use diesel propulsion, and feature four MTU 20V 1163 TB93 diesel engines developing a total of 40,000 bhp. Two controllable pitch propellers on two shafts provide a maximum speed of about 28 knots. The ships have an aft helicopter deck, with a hangar housing one AB-212 helicopter to meet the aviation requirements.

The electronic warfare suite consists of Rapid/Ramses, including four SRBOC systems and an SLQ-25 NIXIE.

In addition to the MEKO-200, Blohm + Voss has designed a range of ships using the same basic principles. These include the following models:

MEKO-100. A small corvette intended as a coast guard vessel or, in other configurations, as a coastal surface combatant.

MEKO-140. A scaled-down version of the MEKO-200, intended for coastal surveillance and day running work but with a significant capability for longer deployment.

MEKO-360. A larger frigate or small destroyer.

MEKO-A Series. The latest variation of the MEKO theme, featuring both frigate and corvette designs. Introduced at the MECON '97 frigate conference in Hamburg, it is offered in three configuration baselines for the -200 level (an A version of the MEKO-100 series is offered as well):

- A-200 AAW (v)1, equipped with the full AAW system developed by Hughes, Thales, and DASA for the F-124. It incorporates the APAR active phased-array radar and SMART-L long-range-volume search radar.
- A-200 AAW (v)2, featuring the same Mk 41 VLS as well as the SM-2 and Evolved SeaSparrow Missile weapons systems, but fitted with SPY-1F and three Mk 99 fire control directors.
- A-200 AAW Multipurpose, which is fitted with a more conventional array of radars as well as two 7-ton helicopters instead of one 10-ton unit. This version also carries a towed-array sonar system.

Generally, the A Series has an exterior design with more stealth features, as it is intended to offer a lower radar cross-section (RCS) on the enemy radar. The MEKO-A class ships are a quite different design from the first-generation MEKO-200, and are the subject of a separate report in this tab.

Program Review

Background. The MEKO-200 frigate was designed by the West German shipbuilding firm Blohm + Voss with an eye toward the changing naval market of the 1970s. At that time, many NATO and Third World navies possessed former American and British destroyers and frigates that had been built during World War II and were approaching the end of their service lives.

Modular Design Introduced

Blohm + Voss realized that different customers would require different weapons or sensor systems and would have different preferences for powerplant configuration. Using conventional designs, each program would require a separate design effort, greatly increasing cost. If these costs were to be reduced to a level acceptable to the export market, a high degree of commonality would be required between the designs. Accordingly, the company designed a ship that could take different equipment in standardized modular containers that could be plugged in at certain points in the ship. This MEKO (MEhrzweck-KOmbination, or general purpose-combination) design takes advantage of Blohm + Voss' patented FE system (funktions-einheitssysteme, or function unit systems). The initial tests of the modularized container system took place in 1975, and by 1982 the first MEKO-360 frigate was operational.

Turkish Program. During the late 1970s, the Turkish Navy was considering various designs to replace its oldest World War II-era destroyers and frigates, but wanted a new design rather than another surplus ship. Turkey and Germany had strong trade ties for many years, and the Turks were very satisfied with both the Type 209 submarines and the former Koln class frigates they had received from the Germans.

After negotiations in 1982 and 1983, Turkey signed an agreement on September 7, 1983, for four MEKO-200

frigates. The order called for the first two ships to be built in Germany. In addition, Blohm + Voss and Thyssen Rheinstahl Technik agreed to help Turkey build the remaining two ships at the Gölcük Naval Shipyard in Turkey. The first keel was laid in May 1985, but fabrication of the first modules had already begun in September 1983. By November 1985, the first ship, *Yavuz*, had been launched and a second ship laid at the Howaldtswerke shipyard in Kiel. The third keel laying, to take place in Turkey, was postponed due to financial considerations and other priorities at the Gölcük Naval Shipyard. Fabrication of the initial modular units for the second and third ships began in early 1985.

Turkey's first frigate, the *Yavuz*, began sea trials in early 1987 and was commissioned in August 1987. The second ship, *Turgutreis*, was launched in late 1986 and began sea trials in July 1987. The keels for the two Turkish-built MEKO-200s were laid in June 1986, but construction was delayed by other priorities at Gölcük, and resumed in early 1987. The third ship, *Fatih*, was launched in April 1987. The fourth Turkish ship was commissioned in October 1989.

In January 1989, the Turkish Navy ordered two additional MEKO-200 frigates from the Gölcük Naval Dockyard. Most of the systems aboard these ships are the same as those aboard the first four ships, but the last pair has a SeaSparrow vertical launch system (VLS) for anti-to-air point defense. Construction of the last two Turkish ships was expected to begin in 1991; however, the contract was not awarded until January 1993, with commissioning in 1997.

Portuguese Program. While Turkey was beginning its MEKO-200 program, another nation was looking at the MEKO-200. Portugal had been considering replacing its frigate force since 1980. A plan to purchase two frigates from the U.S. Navy failed in 1982 due to a lack of funds. The Netherlands offered to build three Kortenaer class frigates in 1983, but this offer was rejected because of its high price, as was a follow-up offer to build three Karel Doorman class frigates. Portugal began negotiations with Blohm + Voss for the construction of three MEKO-200 class frigates in 1984, but these negotiations were hampered by Portugal's lack of necessary capital.

Portugal's NATO allies then agreed to help with the estimated $670 million program. In an agreement signed in November 1985, the U.S. agreed to pay about $250 million, while Germany and the Netherlands would pay $280 million and $30 million, respectively. Portugal would pay only $30 million, with the other $110 million coming from Britain, Canada, Italy, and Spain. In return for the Dutch support, Germany and Portugal agreed to have Signaal (now part of Thales) develop and install all the radars and fire control equipment. Following the funding agreement, Portugal ordered the three ships on July 25, 1986. The keel for the first Portuguese ship, *Vasco da Gama*, was laid in August 1988.

The Portuguese Navy's second and third frigates, *Alvares Cabral* and *Corte Real*, were laid down in February and August 1989, and the *Vasco da Gama* was launched in the summer of 1989. In 1991, the Portuguese naval program completed a major milestone with the commissioning of the first ship.

Greek Program. In 1986, the Hellenic Navy (Greece) began considering four frigate designs for a program to replace its World War II-era frigates. Greece wanted to build four to six frigates at the country's Skaramangas-Olympic shipyards, and began negotiating with Blohm + Voss for an offshore licensing agreement. Blohm + Voss' MEKO-200 design was competing against five other frigate designs: the Italian Lupo, the British Type 21, the Superior from Todd Shipyards Pacific, the Netherlands' Karel Doorman, and South Korea's Ulsan. This list was narrowed down to the MEKO-200 and the Karel Doorman designs by late 1987.

Greece ordered four MEKO-200s in April 1988. The order called for the first frigate to be built by Blohm + Voss in Germany, with the remaining three ships to be built at Hellenic Shipyards, Skaramangas, Greece. Construction of the first began in 1989, with commissioning in 1992. The last three were built between 1990 and 1997. Most of the weapons and electronics systems aboard the Greek ships were purchased from the United States under the Foreign Military Sales (FMS) program. The keel for the first Greek ship was laid in January 1991. Plans called for the last Greek ship to be launched in late 1996, but financial problems and technical difficulties seriously delayed construction.

Australian Program. Australia was planning a frigate replacement program in 1986 and 1987. The Australian requirement called for six to eight frigates to be built in Australia. In September 1987, the Royal Australian Navy narrowed its choices down to three finalists: the Type 23 from Yarrow Shipbuilders, the Karel Doorman from Royal Schelde Dockyards, and the MEKO-200 from Blohm + Voss. Three other navies – Ecuador, Tunisia, and Uruguay – also were considering the MEKO-200, but none of their plans were as advanced as those of Australia or Greece.

In mid-1988, the Royal Australian Navy narrowed its choices down to the MEKO-200 and the Karel Doorman designs. On August 14, 1989, Australia ordered eight

MEKO-200s to be built in Australia by AMECON, 25 percent owned by Blohm + Voss. Later in 1989, the contract was modified to include two MEKO-200s for New Zealand with an option for two additional ships. The Australian ships were to replace the River class frigates and provide a second-line patrol and maritime policing capability.

New Zealand did not exercise its option for two more ANZACs that came due in November 1997, leaving the New Zealand Navy with only two of these new frigates. The older Leander class frigates had been withdrawn from service, leaving the New Zealand Navy with inadequate resources for the country's self-defense needs. This was subsequently rectified by the purchase of an integrated maritime patrol and coastal protection fleet under the designation Project Protector.

During 1998, excess wear of the LM2500 turbine's blades on the Australian ships was discovered. This was a relatively straightforward problem that could be addressed with a realignment of the turbine and replacement of some blades. However, it was the first outrider of a series of problems with the ANZAC class. A suggestion that the sonar be replaced by a larger and more effective type was rejected on the grounds that the bow section of the ANZAC lacked the required volume. More seriously, the ANZAC project had always envisioned using the inherent flexibility of the MEKO design to accommodate a later upgrade that would address some of the equipment fit and other weaknesses in the original standard. However, as part of an Australian defense review, it was decided to bring this upgrade forward, in part to fill a growing deficiency in the Australian Navy's air warfare capability.

Upgrade Program Scaled Back

A series of studies designated the Warfighting Improvement Program (WIP) were initiated to bring about this upgrade. Unfortunately, these all showed that the projected improvements would be very costly in proportion to the gains in capability achieved. The most satisfactory upgrade (from a capability point of view) would involve cutting the ships in half and adding a plug amidships to gain extra hull volume. This was economically impractical, and the Warfighting Improvement Program was canceled in December 1999. It was replaced by a series of more limited but more economically feasible proposals.

During the discussions over the WIP, it was stated that the ANZAC class had also suffered problems related to cracking in parts of the hull structure. As a result, repairs to bilge keel cracks were made to HMAS *Anzac*, HMAS *Arunta*, and HMAS *Warramunga*, while design changes were implemented for ships in build. These faults, which, in fairness, are not unusual in a new class of ship, pointed to the growing obsolescence of the original MEKO design.

End of the Line. The MEKO consortium suffered two setbacks during 1994. The first was the failure of the projected UAE variant of the MEKO-200 to be shortlisted for the UAE eight-ship light frigate program. This is the type of requirement for which the MEKO-200 would normally be considered an ideal solution. The MEKO-200 also failed to be shortlisted for the Austral-Malaysian OPV project, for which it was offered in a lightly armed form. The latter program was a long shot at best. No orders have been received since 1994.

The basic problem was that the original MEKO-200 design was now becoming overloaded, and a radical rethink was necessary. The result was the new MEKO-A family. These are an entirely new and greatly improved descendent of the first-generation MEKO-200 design, with more stealth characteristics in order to reduce the ships' appearance on enemy radar screens.

Most market attention has now been diverted to the new A series ships. The MEKO-A family is becoming a serious competitor on the market and has virtually displaced the older design from serious competitions. It is therefore unlikely that the MEKO-200 family will see any additional sales.

Significant News

EuroTorp Wins Australian Torpedo Contract – The Australian Defence Force (ADF) will acquire production quantities of the MU90/IMPACT lightweight anti-submarine torpedoes following the signing of the Phase 3 Alliance Agreement with the French and Italian consortium, EuroTorp, and the Australian-based Thales Underwater Systems Pty Ltd. Project Djimindi replaces the ADF's current stock of lightweight anti-submarine torpedoes with the new-generation MU90/IMPACT Lightweight Torpedo. The MU90/IMPACT Lightweight Torpedo, developed by EuroTorp, will counter current and future submarine threats. It is effective in both shallow and deep

water, regardless of the countermeasures deployed. The MU90/IMPACT will be integrated into the combat systems of the FFG and ANZAC class frigates, and eventually the Orion AP-3C maritime patrol aircraft and the Seahawk and Seasprite helicopters. (Eurotorp, 9/05)

Funding

Each program is being funded by the respective country's ministry of defense.

Timetable

Month	Year	Major Development
	1969	Blohm + Voss begins designing modular warship system
	1975	First sea trials of containerized modular weapon system
	1979	Blohm + Voss designs modular frigates
Apr	1983	Turkish Navy orders four MEKO-200 frigates
May	1985	First keel laid at Blohm + Voss
Jul	1986	Portugal orders three MEKO-200 frigates
Aug	1987	First MEKO-200 (*Yavuz*) commissioned
May	1988	Greece orders four MEKO-200s
Jul-Aug	1989	Australia orders eight frigates (ANZAC)
Jan	1990	Turkey orders two new MEKO-200s (Barbaros class)
Dec	1990	Keel laid for the first Greek frigate
Jan	1991	First Portuguese frigate commissioned
Dec	1992	Second pair of Barbaros authorized in Turkey
Oct	1996	Second of Greek MEKO-200s (F453 *Spetsai*) delivered
Dec	1998	Greece's third (last), Turkey's seventh ship commissioned
	2000	Turkey's eighth ship handed over
	2006	Last Australian MEKO delivered

Worldwide Distribution/Inventories

Australia	8 in service
Greece	4 in service
New Zealand	2 in service
Portugal	3 in service
Turkey	8 in service

Forecast Rationale

For the first time in almost three decades, no ships of the MEKO-200 design are under construction anywhere in the world. The MEKO family has been a standard feature of the *Warships* Forecast almost since Forecast International first started publishing this service. Because no further ships of this class are scheduled for construction, this report will be archived next year. However, the MEKO concept will not vanish from this product, since the next-generation MEKO-A class frigates are already proving a successful product and will be carrying on the reputation of the design family.

The commissioning of HMAS *Perth* means that a total of 25 MEKO-200 frigates will have been delivered to five countries. In addition, five MEKO-360 class destroyers and six MEKO-140 class corvettes have been

built, bringing the total of ships built to 36 for seven countries. This was not the end of the MEKO consortium's contribution to the naval design art. The seven German ships of the F-123 and F-124 classes essentially represent an interpretation of the MEKO-360 design. In the early days of those classes, both were listed in the *Warships* Forecast as being MEKO-360s until the evolution of the design led them to being treated as separate classes. This means that the final legacy of the first generation of MEKO designs is 43 ships serving the navies of eight countries.

The German Frigate Consortium has shifted its marketing attention to the new and improved MEKO-A class design, and that design family is covered in a separate report in this tab. In all likelihood, the MEKO-A designs will carry the basic concept on into a fourth, and probably fifth, decade of production. After the initial doubts over the concept, the MEKO family has now become one of the most successful naval designs of the post-World War II era.

Ten-Year Outlook

Because construction has been completed, this report contains no forecast chart.

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