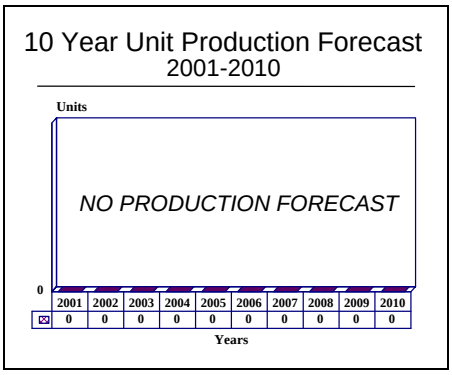
MHC-51 Osprey Class - Archived 5/2002

Outlook

- Procurement complete
- Probably represent last conventional MCMVs ordered by USN
- Attention now shifting to airborne, standoff and unmanned technologies
- Some attempts at exporting class made
- Future upgrades likely



Orientation

Description. Minehunter coastal (MHC), representing a modified version of the Italian Lerici class design.

Sponsor

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(shock & vibration analysis, simulation software)

Licensees. No production licenses have been granted for this class. Production of the Osprey class itself was based on the original Italian Lerici class design by Intermarine, with modifications.

Status. In operation. With the exception of the first-of-class, all ships are assigned to the Naval Reserve Force.

Total Produced. Twelve

Pennant List

Hull	Builder	Launch	Commissioning
MHC-51 *Osprey*	Intermarine USA	3/1991	11/1993
MHC-52 *Heron*	Intermarine USA	3/1992	8/1994
MHC-53 *Pelican*	Avondale Industries	2/1993	8/1995
MHC-54 *Robin*	Avondale Industries	9/1993	5/1996
MHC-55 *Oriole*	Intermarine USA	5/1993	9/1995
MHC-56 *Kingfisher*	Avondale Industries	6/1994	10/1996
MHC-57 *Cormorant*	Avondale Industries	10/1995	4/1997
MHC-58 *Black Hawk*	Intermarine USA	8/1994	4/1996
MHC-59 *Falcon*	Intermarine USA	6/1995	2/1996
MHC-60 *Cardinal*	Intermarine USA	3/1996	10/1997
MHC-61 *Raven*	Intermarine USA	9/1996	9/1998
MHC-62 *Shrike*	Intermarine USA	4/1997	5/1999

Mission. The mission of the MHC is reconnaissance, identification and neutralization of current and future threat mines on vital waterways in littoral regions and harbors worldwide.

Price Range. Based on contract value averaging with information from US program acquisition cost summaries, the unit cost spread out over the life of the series has been about US$145 million (in FY97 dollars).

Technical Data

Specifications

	Metric	US
Dimensions		
Length:	57.3 m	187 ft 10 in
Beam:	11 m	36 ft
Draft:	2.9 m	9 ft 10 in
Depth:	7.5 m	24.6 ft
Height:	21.3 m	70 ft
Displacement		
Full Load:	907.33 tonnes	893 tons
Performance		
Operating Speed:	18 km/h	10 kts
Top Speed:	28+ km/h	15+ kts
Range:	2,800 km at 22 km/h	1500 nm at 12 kts
Endurance:	15 days, depending on shore-based support	
Crew:	5 officers, 4 CPOs, 42 enlisted	
Multi-Purpose Crane:	2 tonne capacity	
Boat Handling Crane:	1 tonne capacity	
Compartments and Spaces:	110 ea. (total)	
Tanks:	24 ea.	

	Type	Quantity
Electronics		
Radar:	Raytheon SPS-64(V)9, I-band	1
Sonar:	SQQ-32 (high-definition, variable-depth)	1
Navigation Command System:	SYQ-13	1
Mine Countermeasures:	SLQ-53 Deep Sweep (since 1995)	1
	SLQ-48 ROV (with 1,070 m of cable)	1
Armament		
Gun:	0.50 caliber (12.7 mm) machine gun	2
Machinery		
Diesels:	Isotta-Fraschini ID 36 SS 8V-AM	2x800 shp
Propulsion:	Voith-Schneider cycloidal propellers	2
Hydraulic Motor:	N/A	1x180 shp
Thrusters:	Bowthruster	2
Generators:	Isotta-Fraschini ID 36	3x328 kW

Design Features. The Osprey class is a fiberglass monohulled coastal and harbor minehunter/sweeper used for locating mines with sonar and neutralizing them with a remotely controlled underwater vehicle in coastal, harbor and other shallow water areas. MHC-51s are the world's largest and the first major US Navy vessel to be constructed entirely of fiberglass-reinforced plastic (FRP). The basic design is derived from the Italian Lerici class mine countermeasures ships built by Intermarine SpA of La Spezia, Italy.

The hull structure is based on continuous monocoque construction, laminated from special 140-mm-thick fiberglass skin. The hull has no transverse frames and has been designed with exceptionally low magnetic and acoustic signatures to protect against the sudden shock loading resulting from undersea detonations of the mines nearby during minehunting operations.

In designing and building the Osprey class, Intermarine USA contributed to Navy advanced composite materials studies in support of marine structural designs up to 240 feet (73 meters) in length. In the process, Intermarine USA developed a comprehensive capability to design and manufacture molds of complex shapes in a wide variety of materials. Proper mold design, preparation and demolding are obviously key in the quality of the laminate. Mold materials used in the construction of the Osprey class include steel, wood, foam and fiberglass.

The composite materials fabrication building at the shipyard encompasses an area of over 160,000 square feet and is equipped with six semi-automatic resin/glass impregnators on fully articulated bridge cranes. Materials storage areas and environmental controls have been specifically designed to meet all composite materials storage and manufacturing requirements. The facility is large enough to house six minehunters or molds, all undercover, simultaneously.

Overhead crane service can accommodate loads of up to 66 tons, while the building rail system is used to move complete ship hulls. Laminate structures with primary bonds in excess of 8 inches thick can be cut, joined and finished at the facility. Laser theodolites are used to obtain exact internal dimensions for bolting deck and bulkheads. Special matching processes have been developed to ensure the proper fit of maintenance access plates and equipment foundations.

The ship has two Isotta-Franschini ID 36 SS 8V AM diesel engines which provide 1,600 horsepower and drive two Voith Schneider cycloidal propellers. The non-magnetic diesel engines are similar to those used in the Navy's Avenger class mine countermeasures vessels. The three diesel generators are Isotta-Fraschini ID 36. The ship has a 180 horsepower bow-thruster motor. The machinery is acoustically isolated and suspended from the main deck in glass-reinforced plastic cradles. When an undersea explosion occurs, the isolated machinery remains unaffected.

The heart of the Osprey class is the Minehunter Integrated Combat System, which integrates the AN/SQQ-32 Variable Depth Sonar from the Submarine Signal Division of Raytheon and Thomson Sintra, and the SYQ-13 command system. The SQQ-32 is a variable depth shipborne minehunting sonar system for the detection and classification of mines.

The SYQ-13 navigation/command and control system is produced by Unisys Corporation. The system's high-resolution, color graphic militarized operator workstation consoles have been proven at sea aboard the Canadian Halifax class frigates. System software represents the next-generation capability when compared to the Unisys-supplied SYQ-12, which is operational on the old Navy MSO class minehunters.

Mine Warfare Systems aboard include the SLQ-48 Mine Neutralization System, the Modular Influence Minesweeping System (MIMS), and an SLQ-53 Towed Influence Sweep system. This system is installed in the Avenger class mine countermeasures vessels, too.

Both arrays are located in a hydrodynamically stable towed body, which can be locked in a hull-mounted position or deployed for variable-depth operations. The SLQ-48 is a mine neutralization system mounted on a remotely operated vehicle. A central well located in the forward part of the ship is used to deploy the SLQ-48. The system is tethered to the ship with an armored, electrical 1,070-meter-long tow cable. The SLQ-48 was developed by the Marine Systems Group of Alliant Techsystems which is now part of the Naval and Maritime Systems Division of Hughes Aircraft Co.

The system includes two operator and system control consoles consisting of AN/UYQ-31 operator data terminals equipped with bit-imagery memory displays and a side-scan processing unit. The consoles are identical and both can be configured for detection and classification operations.

Operational Characteristics. Coastal minehunters are the first US Navy ships designed with a primary mission of clearing harbor, coastal and ocean waters of acoustic, magnetic, contact and pressure mines. They enter suspected minefields using precise navigation and search for mines with a variable-depth sonar. The target mines are investigated with a remote-controlled underwater vessel which can also neutralize mines using explosives and other devices.

Both the detection and classification arrays of the SQQ-32 are dynamically stabilized for enhanced performance. The detection array is electronically stabilized. The classification array is actively, mechanically stabilized for high-quality imaging in both shadow and echo modes. This stabilization counters the image smearing which occurs with unstabilized imaging sonars and gives the SQQ-32 performance characteristics unattainable in systems without this feature. Superior classification performance minimizes Mine Disposal System deployments.

Either display console can be configured for the classification or detection display function. Rapid towed body access and system-level Performance Monitoring/Fault Localization significantly reduce maintenance requirements. No manual adjustments are required systemwide. Built-in test capability detects system problems and alerts personnel on the operator's consoles.

Mine detection is carried out using multiple ping processing. The detection range is increased by using a lower operating frequency. The computer-aided detection techniques include marking of mine-like sonar contacts with track buckets for further detailed search. Classification of targets is carried out using higher frequency narrow beam acoustics to provide high-resolution echo and shadow imagery.

In the detection phase, the display presents a high-resolution view of the seabed together with evaluation data on mine-like objects or features on, near or tethered to the seabed. The data from two azimuthal search sectors are presented in B-scan format on the left hand side of the screen. The display shows computer-generated symbols to identify and highlight significant features and potential targets.

In the classification mode, the system presents visual data based on the physical appearance of the complementary echo and shadow images. Processor, power and control cabinets house two AN/UYK-44 computers together with dedicated detection and classification processors and a telemetry buffer. The system includes performance monitoring and fault localization software.

The command and control system includes a multi-thousand contact sonar database, two modes of sonar contact clustering, a color tactical display, enhanced operability, and hard copy and magnetic media mission record capabilities. It uses Kalman filtering and accommodates navigation sensor failure and a variety of navigator aids. The system uses 32-bit processing and performs contact re-classification and database editing. It adapts easily for growth and meets US MIL SPECs for shock, vibration and electromagnetic interference.

The Navy plans to purchase a new mechanical sweep, the SSDS, for the Osprey class. This is a derivative of the 37U-1 airborne minesweeper and will be capable of sweeping deeper than any current sweep system. The Canadian company Indal Technologies is building two prototypes of cable-handling systems for the SSDS under a C$3 million contract awarded in June 1992. The pallet-mounted system has a common hydraulic drive for its three drums: one carrying some 1,500 meters of cable, the other two carrying 600 meters each.

The standard mine-disposal system is the Mk 116 Mod 0 Mine Neutralization System (MNS) and includes two SLQ-48 remotely operated vehicles (ROVs). The MNS was designed to detect, locate, classify and neutralize moored and sea-bed mines. The SLQ-48 vehicle is equipped with two low-light-level television cameras and a high-resolution, long-range sonar. It also carries cable cutters and mine destruction charges. The vehicle is controlled, via a physical tether, from consoles mounted in the parent platform. The standard charge used against a mine is a Mk 57 bomblet. Propulsion comprises two 15 horsepower hydraulic thruster units.

Initial target detection is provided by the ship's onboard sonar, and this information is then used to navigate and track the ROV to the area of the target using its onboard acoustic tracking system. Vehicle sonar is used during the mid-course search and final homing phases. Display facilities include vehicle sonar, vehicle TV, deck TV, vehicle control and navigation, cutter and dropped charge and provision for monitoring system status.

The class carries modularized, interchangeable mine countermeasures equipment. This allows the ships to perform one mission at a time. Short conversion time makes it possible to accomplish needed changes during normal port returns.

Variants/Upgrades

Gaeta. The original design of the Lerici class was modified from the fifth ship onwards, with a hull 2.5 meters longer and a displacement of 77 tons more. These eight ships are usually referred as the Gaeta class to distinguish them from the original Lerici design. The last pair was ordered in September 1992.

Huon. The Australian version of the Gaeta class is known as the Huon class; a total of six will be built. Three have been launched thus far, the last expected to be in service by fall 2002. The first hull was built in Italy and transported to Australia for completion; the others are built entirely in Australia.

Lerici. The MHC-51 Osprey class is a derivative of the Italian Lerici class minehunters (a.k.a. Gaeta class in its current version), from which also evolved the Huon class for Australia and Swallow for South Korea.

For more details on those classes, please refer to a separate report on the Lerici class.

MHC(V). Originally, plans for future MCMV construction envisioned also building a stretched derivative of the Osprey class, the MHC(V), that would

have greater operating range. However, it was determined that minor internal rearrangements of the existing ships could extend their endurance from five to 15 days, so plans to build the enlarged version were eventually abandoned.

Swallow. The South Korean Swallow class is said to be designed independently by Kangdam Corp in Korea, but the ship is very similar to the Gaeta (Lerici) class. Six ships have been bought, with the last three ordered in 1990.

An improved version, with a slightly larger displacement of about 600 tons, has been designed indigenously as well, based on the same family. The design contract for that work began in December 1996. Up to seven of those may be ordered.

Program Review

Background. In the early 1980s, the US Navy began the development of a new mine countermeasures (MCM) force, which included two new classes of ships and minesweeping helicopters. The vital importance of a state-of-the-art mine countermeasures force was strongly underscored in the Persian Gulf during the eight years of the Iran-Iraq war, and in Operation Desert Shield/Desert Storm in 1990 and 1991.

The 12-ship MHC program and an earlier program to construct 14 Mine Countermeasures Ships (MCM) were initiated to replace mine sweepers (MSO) constructed in the 1950s, the MSH-1 Cardinal class minesweeper/ hunters. The Navy originally planned to acquire 17 MSH-1 class ships. On May 13, 1983, the Navy awarded four initial Phase I contracts for design of the lead MSH coastal minesweeper. The lead ship of the MSH-1 class was funded in the FY84 budget, with the lead construction contract to be awarded in August 1984.

Bell Aerospace's original entry for the design comprised a hybrid design sidewall craft, a cross between a surface effect ship and a conventional monohull design. The designers argued that this design had major shock resistance advantages. The hull was made of fiberglass-reinforced plastic with a rigid polyvinyl chloride foam base.

The competing Marinette's design was a licensed derivative of the Italian Intermarine Lerici class. It also used a fiberglass construction material and incorporated a Voith Schneider vertical axis propeller.

In November 1984, the Bell Aerospace design from the two competing suggestions was then selected, and the keel for the first ship was laid in February 1986. Shock tests on a portion of the ship's hull resulted in large stress cracks, while continued testing caused the fiberglass and polyvinyl foam base to peel away from the wood hull framework. The engines failed to meet Navy endurance standards during initial tests. As a result, the Navy canceled the MSH-1 program and construction of the first ship in July 1986.

The Navy began negotiations with Italy's Intermarine in July 1986. The plan was to build the first ship in Italy in order to expedite the program. Congress and the American shipbuilding industry objected on grounds that many American shipyards were closing due to a lack of business. The Navy was instructed to build the entire class in the US, but Intermarine could team with a US company to build the first ship. Thereafter, all other ships would have to be opened to competitive bidding. Congress also noted that the Navy version of the Lerici had been modified so greatly that it would almost be a new vessel.

In December 1986, Intermarine SpA formed a team with Hercules Inc to set up a joint venture Intermarine USA. This company then leased the Sayler Marine Corp ship repair facility in Savannah, Georgia. The Navy awarded Intermarine USA a US$20.9 million contract on May 26, 1987, for detail design and construction of the first MHC. The contract called for work to be completed by April 1991.

In mid-1988, reports suggested that the first ship was running substantially over budget, some accounts indicating a US$30 million overrun on the planned US$120 million cost of the first ship. There were also reports that the Intermarine yard in Savannah was incapable of handling the full construction of the ships. The Navy met with Intermarine and solved most of these problems in late FY88 and early FY89. Intermarine began assembling the first ship in May 1988.

The Navy requested US$194 million for two MHC-51 class ships in the FY89 budget. Congressional instructions were that one of these ships would have to be ordered from a second-source shipyard. The Request for Proposal (RfP) for second source construction of the MHC-51 class was issued in spring 1989, and a contract for a second source shipyard and construction of MHC-53, the second of the two FY89 ships, was issued in late FY89 or early FY90. An additional contract, issued on February 24, 1989, was for production of the SQQ-32 minehunting sonar.

At this time, there was speculation that defense budget reductions could result in the program being abandoned with only one ship being built. Despite these rumors, Avondale Industries Inc was awarded a US$62.4 million contract in late 1989 for construction of the MHC-53. In August 1990, another contract was awarded to Avondale for the fourth ship of the class. Subsequently, contracts for six additional ships were awarded: MHC-55 and MHC-57 were ordered on March 29, 1991, and MHC-58, MHC-59 and MHC-60 were awarded in April 1992. The final two ships of the class were ordered in April 1993.

The contracting responsibility was shared between the two shipyards, without a lead/follow yard relationship. Both yards were given the same information and allowed to produce their own variations of the original design.

Although *Osprey* has undergone extensive DT&E since delivery, no OT&E has been conducted in a ship of the class. OPTEVFOR has completed OT&E of two of the ship's principal combat systems and found them to be operationally effective and operationally suitable. FOT&E of the AN/SLQ-48 MNS was completed in 1991 onboard USS *Sentry* (MCM-3), and OPEVAL of the AN/SQQ-32 (V) sonar was concluded in December 1993 onboard the USS *Avenger* (MCM-1).

In 1992, based on the Mine Warfare Plan, the US Navy reorganized its mine warfare forces, developing a unified mine warfare command structure. This placed all MCM groups under the charge of the Commander, Mine Warfare Command. The new structure was developed in response to lessons learned during the 1990-91 Persian Gulf War (Operation Desert Shield/ Desert Storm). The reorganization also placed all mine warfare assets under the operational control of a full-time flag officer. The goal was to provide for deployable mine countermeasures group commanders and forces to support forward-deployed battle groups and amphibious operations. The reorganization would collocate the mine warfare forces and establish a Mine Warfare Center of Excellence at a single site.

Under the reorganization, there would be two deployable mine countermeasures group commanders and staffs to support two concurrent, but geographically separated, major regional contingencies. Liaison officers from the mine countermeasures group commander's staffs would coordinate with theater commanders-in-chief. Operationally, they would embark on a mine countermeasures command-and-support ship. A national force would have a minimum of four MCM/MHC class ships, six to eight helicopters, and three explosive ordnance disposal detachments under the command of a Mine Countermeasures Group Commander. The Commander, Mine Warfare Command, could deploy in-theater with the group commanders and forces, if necessary.

USS *Osprey* (MHC-51) completed its Shock Trial in September 1995 at the Underwater Test Facility, Aberdeen Proving Ground, Maryland. This Shock Trial did not quite reach the planned test level of two-thirds design level keel shock factor. Five of six planned shots, each of increasing intensity, were conducted. The final planned shot at two-thirds design level shock factor was canceled because of the extent of cumulative structural damage incurred on the fifth and earlier shots.

Although the MHC-51 class ship is not under DOT&E LFT&E oversight, the MHC-51 Shock Trial is of special interest because it was the first US Navy Shock Trial on a hull constructed mostly of composite material. It provided an opportunity to study the shock response of a composite hull and assess the effectiveness of shock-isolated-cradle structures in protecting shipboard equipment. It was also the first Shock Trial at a land-based facility.

The MHC-51 Shock Trial, although largely successful, revealed certain weaknesses, notably in the MHC-51 glass reinforced plastic (GRP) hull structure's ability to withstand underwater shock. Critical structural repairs in MHC-51 have been completed, and other, less urgent repairs were scheduled to be completed during the summer of 1997. Hull watertight integrity was maintained throughout the Shock Trial. Shock isolation of cradle-mounted machinery proved to be effective. Other system weaknesses were observed, however, that require corrective actions. The Navy is addressing these weaknesses.

The MHC-51 Shock Trial, for the first time, made extensive use of finite element computer models to predict stress levels and motions of a GRP ship exposed to an underwater shock event. This experience has resulted in valuable improvements in modeling and simulation capabilities for the prediction of GRP ship hull responses to underwater shock. As a result of the Shock Trial, the Navy is also developing a GRP Repair Manual for use in inspecting and repairing damaged GRP hull structures.

OT&E activity during FY96 was limited to preparations for OT-IIIA, which was rescheduled for FY97 in order to accommodate Osprey's post-shock repair schedule.

The Navy has since analyzed Shock Trial results to full design level shock conditions in areas where problems occurred and is reportedly developing design improvements where appropriate and feasible.

The Navy's existing Mine Warfare Plan provides for a force level of 14 MCM-1 Avenger class mine

countermeasures ships, all in the active force. There will be 12 MHC-51 Osprey class coastal minehunters: one in the active force and the other 11 in the reserves. The last ship of the class was delivered to the Navy on January 11, 1999, and commissioned on May 31, 1999. This represented the effective end of the program.

Funding

Milestone II for the MHC program was in FY87 and authorized the lead ship, USS *Osprey* (MHC-51). Milestone IIIA (LRIP) was approved in FY89 for MHC-52 and MHC-53, and full-rate production was approved at Milestone IIIB in FY90. The *Osprey* was delivered to the Navy in FY93.

Funding in FY90 amounted to US$249.8 million for two units. This was followed in FY91 by US$200.6 for an additional pair of hulls, while the FY92 budget provided US$349.9 million for three ships. The program was concluded in FY93 with authorization of US$246.2 million for the final pair of ships.

Mine warfare in general is becoming a growing priority for the US Navy's future strategy, and the capability of the existing minehunters will also be maintained and upgraded in the future in order to provide an organic minehunting capability for the Navy. Funding for the upgrade and modernization activity will be included in the Department of the Navy section of the US Defense Budgets, under the relevant line items.

Recent Contracts

Contractor	Award ($ millions)	Date/Description
Intermarine USA	118.4	April 1993 – Construction of MHC-61 and 62, including technical manuals. (N00024-92-C-220)
Intermarine USA	N/A	November 1993 – Engineering and planning services for post-shakedown availability.
General Systems Solutions	6	September 1995 – Modification to previously awarded contract no. N00024-95-C6373 for A/N37U-1 moored mine clearing sets to be deployed from MH-53 helicopters and MHC-51 minehunters.

Timetable

Month	Year	Major Development
Early	1980s	Navy conducts design studies for future minesweeper
May	1983	Phase I design contracts awarded
Nov	1983	Phase II design contracts awarded
Jul	1986	Navy begins negotiations with Intermarine
Dec	1986	Intermarine forms consortium with Hercules Inc
May	1987	Intermarine USA receives contract for MHC-1
May	1988	First keel laid down by Intermarine USA
Oct	1989	Avondale Industries selected to be second source with MHC-53 award
	1991	Originally scheduled completion date for first ship
Aug	1993	First ship actually completed
Nov	1993	USS *Osprey* commissioned
Sep	1995	USS *Osprey* shock tests completed
Late	1997	Structural repairs completed, less urgent repairs performed
Jan	1998	USS *Shrike* delivered to the Navy, completing the series
May	1999	Commissioning of USS *Shrike*
Feb	2000	Planned OWLD for USS *Shrike*
Sep	2000	First two MHC 51 class minehunters to be homeported in Bahrain

Month	Year	Major Development
Thru	2009	Continued upgrading and modernization of systems onboard expected

Worldwide Distribution

US (This program is for the US Navy only, which has 12 of these ships. All exports of this design family to other countries have taken place from the original manufacturer in Italy).

Forecast Rationale

Although mine warfare was originally a child of the US Civil War, the US Navy has never been a particularly prominent player in the mine countermeasures field. The US Navy has used mines against its enemies to devastating effect but its stress on deep water, highly mobile operations have de-emphasized the significance of defensive mine warfare. Such activities have historically been limited to clearing mines out of the way of amphibious landings. Periodically, the US Navy gets a wake-up call when it suffers a loss due to well-placed minefields interdicting a planned operation and there follows a quick build-up of mine countermeasures capability. Such gains are rarely long-lived; the Navy traditionally reverts to its preferred posture on defensive mine warfare issues.

This appears to be the position at the moment. Having built two classes of mine warfare ships using largely imported technology, the US Navy seems to have come to the conclusion that technology development has left this particular type of ship behind. The Navy has now set its sights on future technologies that can be used by deployed warships, submarines and aircraft to neutralize minefields, eliminating the need to enter fields and manually dispose of the mines. This standoff technology does not demand the use of expensive signature-suppressed mine warfare ships.

It therefore seems improbable that any additional MCMVs of this, or indeed any equivalent, class will be built. However, the US Navy MCMV fleet is relatively new and represents a useful asset for those circumstances where standoff mine warfare technology is inappropriate. This means that funds are expected to remain available for system upgrades and modernization for many years to come. No new purchases of hulls are foreseen. Although there have been some halfhearted attempts to export this class, these have not met with any interest, and any export sales of this design will be from Italy, through the original constructor of the Lerici class, Intermarine.

Ten-Year Outlook

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

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