

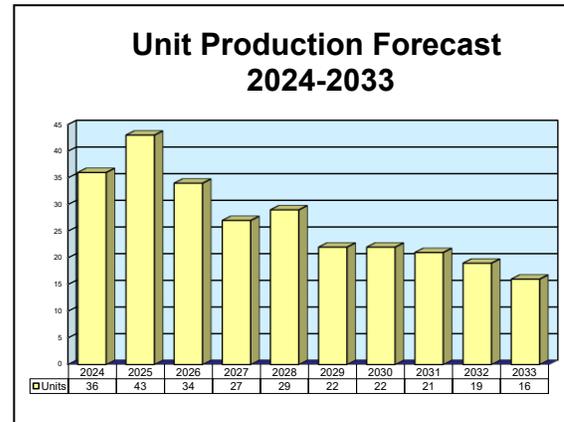
ARCHIVED REPORT

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Pluto/MIKI

Outlook

- Italian Navy MCMVs operate Pluto/MIKI and Kongsberg HUGIN AUVs
- Idrobotica seeking new client orders
- Italy looks to modernize MCM fleet and capabilities



Orientation

Description. Family of remotely operated vehicles.

Sponsor. Private development program.

Status. In production and service. The Pluto series is in use on board the Gaeta and Lerici class minehunters of the Italian Navy, as well as with 15 other navies and a number of commercial and scientific organizations.

Total Produced. Approximately 283 of the Pluto family of ROVs and 700 MIKI mine disposal vehicles have been built through the end of 2023. According to the manufacturer, 70 units of the original Pluto design

were in service in 1998 (the figure later rose to 80 units). Another 40+ units of the Pluto Plus version are in service with at least seven navies. In addition, more than 10 Pluto Gigas systems are in service.

Application. The Pluto family of remotely operated vehicles is used for sea mine disposal, underwater inspection, and scientific research.

Price Range. Estimated price of the latest Pluto version is from about \$500,000 to \$1 million, depending on the level of options.

Contractors

Prime

Idrobotica	http://www.idrobotica.com , Via Magazzini Generali, 13/A, Balerna, Switzerland, Tel: + 41 91 683 9284, Fax: + 41 91 683 9285, Email: info@idrobotica.com , Prime
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Contractors are invited to submit updated information to Editor, International Contractors, Forecast International, 75 Glen Road, Suite 302, Sandy Hook, CT 06482, USA; rich.pettibone@forecast1.com

Pluto/MIKI Archived FEB**Technical Data**

	<u>Metric</u> Basic Pluto	<u>U.S.</u> Basic Pluto
Dimensions		
Length	1,680 mm	66.1 in
Width	600 mm	23.6 in
Height	650 mm	25.6 in
Weight, dry	130 kg	285 lb
Weight, payload	45 kg	100 lb
Performance		
Service depth	300 m	1,000 ft
Speed, with battery	7.4 kmph	4 kt
Speed, with power cable	9.2 kmph	5 kt
Endurance (on batteries)	1-6 hr	1-6 hr

Propulsion. The thrusters are in the vehicle's top front and rear corners. The Pluto remotely operative vehicle (ROV) features five thrusters: two for forward and reverse movement, two for vertical and lateral shifts, and one for transversal motion.

Control & Guidance. Two joysticks are used to control the thrusters. The vehicle can maintain automatic depth control within 10 centimeters up or down.

A monitoring console is mounted on the mother ship, including a 9-inch display unit for information from the ROV. The information displayed on the screen includes the TV image, depth data, compass reading, head tilt angle, and elapsed time. It also features a sonar diagram.

All data can be video recorded. The display unit on Pluto Plus and Gigas is ergonomically designed.

Launcher Mode. The Pluto series UUVs are in use on board the Gaeta and Lerici class minehunters in the Italian Navy. The ROVs are launched via a dedicated hook and light crane.

Recovery. The Pluto is recovered via a dedicated hook and light crane attached to the mother ship.

Warhead. The Pluto can carry chain-cutting charges such as the Rheinmetall DM59, DM69, DM119, and DM129. Rheinmetall Defence offers the CM102 chain-cutting charge, and NDI provides the DAMDIC.



Pluto Plus

Source: NDI

Pluto/MIKI Archived FEB**Variants/Upgrades**

Idrobotica has developed the following: the basic Pluto design, the Pluto Plus, the Pluto Gigas, Plutino – MIKI, and BAT.

All Pluto vehicles have been offered in five configurations:

- A battery-powered version equipped with a 6mm cable that is 500 meters long
- A battery-powered version with a 2,000-meter-long fiber-optic cable that is 3mm thick
- A remotely powered version that receives power from the mother ship through an 8mm cable that is 500 meters long
- A wireless link by means of a radio buoy towed by the vehicle
- An autonomous configuration, capable of preset missions, that has no link with the mother ship

Optional equipment for the original Pluto included a black-and-white, low-light television camera; a color TV or a still camera; search or scanning sonar; an acoustic pinger; a strobe flash; measuring instruments; and manipulators. The ROV featured 10 free radio channels for remote control and two four-digit telemetry channels for transmitting measurement data.

Idrobotica has also developed the MIKI, a disposable mine-clearance system. This system can be used in conjunction with the Pluto family of ROVs. The MIKI carries a 15-kilogram charge and has a maximum depth of 300 meters. This system's endurance is a little over one hour. The inert commercial version of MIKI is known as Plutino.

The BAT is a torpedo and ship sonar target. This system weighs 650 kilograms and can reach a speed of 18 knots. The BAT can operate at depths up to 300 meters.

Program Review

Background. Gaymarine developed Pluto with private funding, resulting in a lightweight ROV that is largely based on commercial technologies and devices used at oil facilities for inspections, etc. The concept quickly became popular in the global ROV market due to its low price and light weight, as well as its high degree of flexibility and reliability.

ROVs Improved to Meet Evolving Needs

The follow-on version of Pluto Plus was developed to provide better speed, range, and payload characteristics. A reusable fiber-optic cable was offered for the control cable. Another version, possibly known as the Pluto Pointer, enhanced the ROV's identification capability by carrying onboard sonars, an acoustic camera (for zero visibility operation), and a color TV camera. Physically, Pluto Plus and the subsequent models have been larger than the original ROV due to their enhanced capabilities and higher payloads.

Mine countermeasures operations in general are heavily affected by environmental conditions, and operations at night or during poor visibility are virtually impossible. Other factors limiting the effectiveness of MCM operations include heavy rain, wind, and strong sea states. Safe deployment and recovery of ROVs, their support ships, and mine-clearance divers are

compromised and severely limited in adverse weather conditions. Additionally, high-current areas near the deltas of rivers, straits connecting larger bodies of water, and muddy waters hamper clearance operations significantly. To overcome these conditions, the manufacturers of ROVs continue to improve the capabilities of their vehicles, particularly in high-current environments. Furthermore, the capability of ROVs to recognize and identify underwater objects is being continually improved.

Eventually, Idrobotica replaced the names of Gayrobot and Gaymarine.

New MCM Vessels. The Italian government contracted with Intermarine, a subsidiary of Immsi, in 2021 to perform preliminary studies for the Italian Navy's new minehunting vessel program. The Italian Navy had long mentioned a desire to acquire a new fleet of MCM vessels.

The Italian Navy may contract for construction of 12 new MCM vessels. Italy may build two versions:

- 8 Costiera class – Cacciamine Nuova Generazione-Costieri (CNG-C), also known as the New Generation Minehunter – Coastal. These vessels are for homeland security roles and will weigh around 800 tonnes at 57-60 meters long.

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- 4 d'Altura class – Cacciamine Nuova Generazione-Altura (CNG-A), also known as the New Generation Minehunter – Oceangoing. This vessel is for expeditionary roles and will weigh roughly 1,300 tonnes and be 75-80 meters in length.

These vessels will replace the Italian Navy's Lericci and Gaeta MCM classes. This program could cost EUR2.8 billion. Intermarine won a contract to develop these new MCM vessels. This contract includes the Calzoni Mini-Ranger USV and the Kongsberg HUGIN UUV.

Vehicle Models. The ROV series of Idrobotica is composed of the original Pluto design, an upgraded Pluto Plus model, and the latest model, the Pluto Gigas.

Pluto Plus. The Pluto Plus version features a floating, reusable fiber-optic umbilical cable that is 2,000 meters long. The vehicle itself features an improved hydrodynamic design with a semicircular transparent front end for improved observation capabilities.

Pluto Plus – Technical Data

Length	2,100 mm
Width	600 mm
Height	610 mm
Weight	315 kg
Weight, payload	100 kg
Service Depth	350 m
Endurance	10 hr

The Pluto Plus has a longer standoff range, and its speed is up to 6 to 7 knots. The operating endurance has been increased from two hours to 10, thanks to the doubling of battery power.

The hull's drag factor is minimized, improving operating efficiency.

Special sonar sensors and an acoustic camera were introduced in the Plus version for navigation, search, obstacle avoidance, and identification purposes. Unlike those in the basic Pluto, which are mounted in a forward-mountable section, the sensors on Pluto Plus are all mounted in a single package featuring $\pm 100^\circ$ tilt and $\pm 80^\circ$ pan. The company's own Idrobotica SID identification sonar (or acoustic camera) is featured as standard.

To date, a reported 80 units have been sold to eight international navies.

Pluto Gigas. The latest version of Pluto, the Gigas, is larger and has been designed and developed specifically to operate in high-current environments and at depths from 600 to 1,000 meters. The Gigas has a longer operating range than the other two versions of the vehicle and can operate in poor visibility. About 90 percent of the components are said to be interchangeable with Pluto Plus, although the vehicle's

body is redesigned and constructed of carbon-fiber composites. A new propulsion system with double the power of Pluto Plus is featured, bringing the top speed to 7.5 knots. Two charges can be carried on board as payload.

Pluto Gigas – Technical Data

Length	3,320 mm
Width	610 mm
Height	780 mm
Weight	600 kg
Weight, payload	245 kg
Speed	7-8 kt
Operating Depth	350/600/1,000 m
Endurance	8-9 hr at 3 kt

The Gigas' electronically scanned sonar has a range of up to 200 meters, and its high resolution results in better search and navigation capability, complementing the Idrobotica SID. A Doppler log feature has been included to boost the navigation characteristics to operate in conjunction with a computer system, ensuring automatic, independent operation. In addition, the quality of the color TV camera has been upgraded.

The 2,000-meter-long, 3mm fiber-optic cable has a breaking strain of 350 kilograms, operating off a winch that is like that of the Pluto Plus but features an automatic constant pull of up to 120 kilograms.

The navies of Italy, South Korea, and the United Arab Emirates ordered this system. The Italian Navy is operating the Gigas on its Gaeta and Lericci class MCM vessels.

Pluto Pointer. This designation may have been used to refer to a version that had some of the features now seen on the Gigas while incorporating the main characteristics of the Plus. The Pointer is said to have three sonars, with one for long-range search, another for navigation, and a third for classification. It also includes a color television camera.

MultiPluto. The MultiPluto is a compact observation UUV designed for very deep ocean exploration. This UUV weighs 60 kilograms and can reach a depth of 4,000 meters.

Idrobotica unveiled this UUV in December 2015.

Nano. This is the latest UUV to be offered by Gayrobot.

Nano – Technical Data

Length	610 mm
Diameter	190 mm
Weight	< 20 kg
Speed, forward	> 4 kt
Endurance	1 hr

No orders for Nano have been reported.

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V-Fides. The V-Fides (Veicolo Subacqueo Filoguidabile) UUV project is part of the Whitehead Alenia Sistemi Subacquei effort to increase its share of the civil market. WASS (now Leonardo), in cooperation with Kayser Italia Srl (Livorno) and Scuola Superiore S. Anna (Pisa), designed this system. Specialists from Compolab (Livorno), CRM (Livorno), and Polo dei Sistemi Logistici of the University of Pisa support this team.

The UUV passed tests in a bathtub in 2014. Further evaluations were to follow. The UUV is suitable for the following missions:

- Seafloor exploration
- Environmental monitoring
- Monitoring of civil plants
- Certain robotic operations, such as cleaning, micro-coring, and water sample analysis

The UUV uses modular-based lithium-polymer battery cells.

V-Fides – Technical Data

Length	3.3 m
Height	2.4 m
Width	1.5 m
Weight, hull	180 kg
Weight, total	900 kg
Weight, payload	400 kg
Weight, max	1,500 kg
Speed, max	3 kt
Range	30 km
Depth	600 m
Endurance	4 hr

The vehicle is equipped with two main engines for propulsion (2 kW maximum power) and five engines for attitude control (total maximum consumption, 3.5 kW).

Funding

The Italian government is not providing specific funding details for the Pluto ROV or a successor program. Idrobotica designed this product with corporate funding; finished products are procured under the defense budget of each customer's navy.

The Italian Navy plans to acquire up to 12 new MCM vessels to replace the Lerici/Gaeta classes. These new vessels could operate two to four unmanned vehicles.

Italian Defense Budget Figures*

	<u>FY21</u>	<u>FY22</u>	<u>FY23</u>	<u>FY24</u> (projected)	<u>FY25</u> (projected)
Euros	16.8	18.3	20.2	19.5	19.7
U.S. dollars	20.1	19.3	21.7	21.1	21.2

*All values are in billions.

Contracts/Orders & Options

In Jan 2020, BASARNAS, Indonesia's National Search and Rescue Agency, took delivery of its first MultiPluto UUV for deep inspection and SAR operations.

In 2014, Algeria placed an order with Intermarine shipyard for the mine countermeasure vessel *El Kasseh 1*. Negotiations had taken place over the previous year. The contract includes an option for a second vessel. Intermarine launched *El Kasseh 1* in April 2016. *El Kasseh 1* is a version of the Katanpaa class MCM vessel constructed for Finland.

In late 2009, Intermarine won a contract to upgrade the Italian Navy's eight Gaeta class minehunters. This contract was worth \$285.8 million (EUR199 million) and was to be completed by 2014. The Pluto Gigas ROV and MIKI (Plutino) mine disposal vehicle were to replace the SMIN Mk 2 system.

On Jun 17, 2009, the Columbia Group, Washington, DC, won a \$10,626,000 firm-fixed-price contract for Pluto Plus ROVs. The Columbia Group was to provide three Pluto Plus systems and associated technical support and training to the Egyptian Navy under the FMS program. Work was performed in Panama City, FL (51 percent) and Milan, Italy (49 percent) and was expected to be completed by Dec 2011. The Naval Sea Systems Command, Washington Navy Yard, DC, was the contracting activity. [Contract Number N00024-09-C-4214](#)

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Worldwide Distribution/Inventories

Finland's MCM 2010 program saw the acquisition of three Katanpaa class MCM vessels. Remotely operated vehicles included the Double Eagle and the REMUS (the Pluto was not selected). Finland had repeatedly delayed a decision on a minehunter for its navy. Finland said in 2022 a new MCM vessel contract could be worth EUR18 million to EUR20 million, with options adding another possible EUR15 million.

The navies of the Netherlands and Belgium plan to jointly purchase new mine countermeasures (MCM) vessels. Ministers of the two countries signed a Memorandum of Understanding in Brussels. In addition, the Netherlands and Belgium will jointly purchase a replacement for their M class frigates. The Netherlands will take the lead with the frigate program, while Belgium will head up the minehunter effort. The first collaborative MCMV, set for the Belgian Navy, launched in March 2023. A second MCMV, destined for the Royal Netherlands Navy, launched in October 2023 and is expected to be delivered in 2025.

Reports claim Italy provided MCM vessels to the **Algerian Navy** in 2016. On September 30, 2017, the Algerian Navy commissioned the new mine countermeasures vessel, called *El Kasseh 1* (501), into service. This vessel carries the Leonardo C2 system and the Pluto Plus UUV.

The United States is providing the **Egyptian Navy** with new ROVs under a 2009 contract with the Columbia Group. Egypt will receive three Pluto Plus ROVs. The Columbia Group develops and builds specialized manned and unmanned undersea vehicles for military customers around the world. Its Marine Engineering division is involved in design and development of the remote multitemission vehicle under contract to the U.S. Navy. The company is the exclusive U.S. licensee for building the Pluto series of mine neutralization ROVs developed by Idrobotica of Italy.

The **Indian Navy** wants to acquire new mine countermeasures vessels. South Korea offered six versions of the Lerici, called the Swallow class. India canceled this deal in January 2018, but the requirement remains. India published a Request For Information (RFI) in 2023 to procure 12 MCMVs.

The **South Korean Navy** again mentioned an interest in new MCM vessels in 2020. Seoul wants to replace its aging Ganggyeong class minehunters (the first entered service in December 1986). The new program is the Minesweeper Hunter 2 (MSH-II) or the MHC 2. This would be different from the program to produce Yang class minesweepers. This new vessel could use a locally designed UUV or one from a foreign supplier. The MSH-II program will utilize a combination of unmanned vehicle systems for mine countermeasures operations.

Italy is offering MCM vessels to **Taiwan**. The Taiwanese Navy wants six new MCM vessels equipped with UUVs and a mine disposal vehicle.

User Countries. Fifteen countries have purchased the Pluto. The following countries are confirmed users: **Algeria** (Pluto), **Canada** (two Plutos are used on each Bang Rachan class minehunter), **Egypt** (Pluto, possibly Pluto Plus, on Swiftships-type MHC – U.S. provided Pluto Plus under an order in 2009), **Finland** (Kuha class), **Greece** (on Adjutant/Erato class minehunters; these ships were converted from minesweepers), **Italy** (on the Lerici/Gaeta classes), **Nigeria** (on two Ohuè class vessels), **Norway** (Pluto Plus on the Oksøy class), **South Korea** (Pluto Plus on the Swallow class and Pluto Gigas on Yang class), **Spain** (Pluto on Guadalmedina class; Pluto Plus on the Segura class), **Taiwan** (on the Aggressive class), **Thailand** (Pluto Plus on Gaeta/Ladya class), and the **United Arab Emirates** (Pluto Gigas).

Italy equips its Gaeta-class minehunters with the MIKI mine disposal vehicle, the Pluto Plus, and Pluto Gigas ROV/AUV. Two other navies (including **Singapore**) have purchased this system. Italian Mine Warfare and Hydrographic Command (MARICODRAG) operates ten mine countermeasure vessels (MCMVs). MARICODRAG's final unmodernized Gaeta-class minehunter is scheduled to enter its mid-life update (MLU) by the end of 2023. This final ship will receive outfitting for the operation of a Kongsberg Maritime HUGIN AUV in addition to the Pluto MCM systems.

Pluto/MIKI Archived FEB**Forecast Rationale**

Mine warfare is experiencing a bit of a revival, at least in national security circles, as sea lines of communication (SLOC) continue to prove strategically crucial in modern geopolitics and future conflict. Naval mines remain a relatively inexpensive and effective mechanism for coastal nations to defend against superior naval forces.

Reports indicate hundreds of mines have been deployed in the Black Sea since the beginning of the 2022 Russian invasion of Ukraine. Further, reports also suggest Russia is behind the mining of those waterways to disrupt commercial shipping and tanker operations to pin blame on Ukraine for any incidents.

Some 30 countries are manufacturing naval mines and more than half regularly export these systems. There are over 250,000 naval mines in the inventories of 50 navies around the world. Some experts see this figure as a gross underestimate.

Despite this threat, investment in mine countermeasures has been insufficient for many years. Many of the world's navies continue to underfund their MCM forces, while acknowledging that they need to procure new systems. However, several European navies have funded studies or collaborated on programs in recent years to modernize and replace their MCM fleets and systems. Much of this modernization entails the inevitable but slow global transition from manned to unmanned offensive and defensive mining capabilities.

Idrobotica is a long-time provider of MCM systems. The company's Pluto ROV series is in service with a large number of military and civilian clients. The company may win additional client orders, but it is already looking beyond this system.

The Italian Navy is Pluto's most important customer. Off and on, Italy has considered acquiring a new MCM capability. Proposals include extensive upgrades of

existing vessels and the acquisition of all-new ships. For the near term, Italy upgraded its Gaeta class minehunters, replacing the SMIN Mk 2 with the Pluto Gigas ROV and the MIKI mine disposal vehicle. Italy is the first announced customer for the MIKI. The Italian Navy plans to acquire new MCM vessels from Intermarine. However, the new UUV for these vessels is the HUGIN built by Kongsberg.

Italy, in coordination with Intermarine and Leonardo, could field new MCMVs by 2028. The Italian Navy will continue to explore unmanned mine warfare capabilities with the future of its MCMVs but will also retain the legacy Pluto series of vehicles onboard its vessels. While we anticipate a gradual transition from the Pluto vehicles to more autonomous future systems, a timeframe is difficult to ascertain.

The naval mine threat will not disappear anytime in the near future. Naval mines remain very popular among navies, especially in the Middle East and Asia. The popularity of naval mines continues to fuel demand for countermeasures in the form of ROVs and mine disposal vehicles (MDVs), a situation that presents companies like Idrobotica with an opportunity to win new orders.

Idrobotica continues to manufacture underwater systems. Italy is the first customer for the MIKI mine disposal vehicle. The number of units involved in the deal is unknown. The Italian Navy may need 300 to 1,000 MIKI MDVs. Orders from other customers could help Italy stretch its MIKI procurement as well as support outyear production figures.

Overall procurement of the Pluto and MIKI systems for the Italian Navy will likely decline over the next several years. We expect procurement to support the maintenance of inventories before falling off in lieu of unmanned and autonomous underwater vehicles for next-generation MCMVS.

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Ten-Year Outlook

ESTIMATED CALENDAR YEAR UNIT PRODUCTION												
Designation or Program		High Confidence				Good Confidence			Speculative			
	Thru 2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	Total
Idrobotica												
MIKI												
	700	34	37	30	25	25	20	20	19	17	14	241
Pluto												
	283	2	6	4	2	4	2	2	2	2	2	28
Subtotal	983	36	43	34	27	29	22	22	21	19	16	269
Total	983	36	43	34	27	29	22	22	21	19	16	269