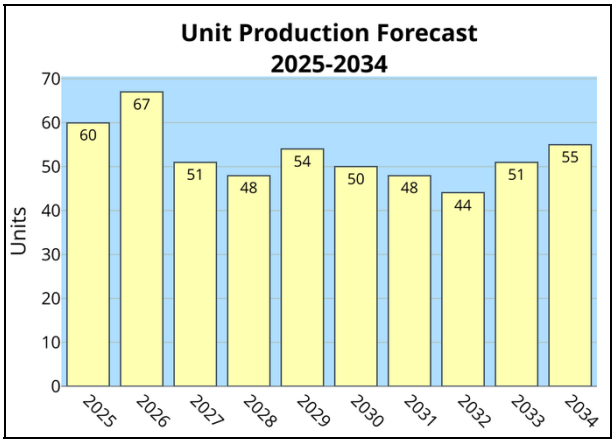
Naval Mine Disposal Charges

Outlook

- AUVs capable of deploying mine charges
- Resurgence of mine warfare in the Black Sea
- ROVs use expendable charges to clear naval mines
- Numerous companies build these disposal charges



Orientation

Description. Unmanned underwater vehicle.

Sponsor. The Danish Ministry of Defense, Naval Materiel Command, Copenhagen, Denmark, through the Royal Danish Navy, supported development of the Danish Mine Disposal Charge (DAMDIC).

Status. In production. The DAMDIC has been ordered by the Royal Danish Navy (RDN) and the Royal Australian Navy (RAN). This system is said to be operational on the RDN's Stanflex 300 ships.

Total Produced. Approximately 1,218 DAMDIC units and 2,818 other mine disposal charges were produced by the end of 2024. Some 100 units were ordered by the RDN for delivery in 1995.

Application. Small underwater vehicle for mine countermeasures intended to be deployed from an ROV, such as the Double Eagle.

Price Range. No specific information is available concerning the unit cost of the DAMDIC, although sources have said it could be in the $5,000 to $10,000 range.

Contractors

Prime

Centrum Techniki Morskiej (CTM) SA	https://www.ctm.gdynia.pl, ul. Dickmana 62, Gdynia, Poland, Tel: + 48 58 666 5318, Fax: + 48 58 666 5304, Email: ctm@ctm.gdynia.pl, Prime
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Nordic Defense Industries A/S	https://www.ndi.dk, Stenholm 9, Nørresundby, Denmark, Tel: + 45 98 17 1818, Fax: + 45 98 17 1858, Email: info@ndi.dk, Prime
Rheinmetall AG	https://www.rheinmetall.com/en, Rheinmetall Platz 1, Düsseldorf, Germany, Tel: + 49 211 473 01, Fax: + 49 211 473 4727, Email: info@rheinmetall-defence.com, Prime

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

Technical Data

	Metric DAMDIC	U.S. DAMDIC
Dimensions		
Length	82 cm	32.3 in
Diameter	25 cm	9.85 in
Weight, submerged	21 kg	46.2 lb
Weight, in the air	49 kg	107.8 lb
Performance		
Max depth	300 m	984 ft
Min depth	6 m	19.68 ft

Propulsion. The DAMDIC has no propulsion system.

Control & Guidance. The DAMDIC is controlled via a tether connected to the remotely operated vehicle (ROV). It is positioned alongside the target mine using a precalibrated hydrodynamic glide trajectory. The tether is used to detonate the onboard charge.

Launcher Mode. The DAMDIC is launched from an ROV.

Recovery. The DAMDIC is expendable and therefore not recovered. When it is decided that the DAMDIC will be recovered from the seabed, a mine diver is sent down to disarm the charge using a specially developed disarming tool.

Warhead. The main charge of the DAMDIC consists of 31 kilos of Composition B.

DAMDIC

Source: NDI

Variants/Upgrades

There are two variants of the DAMDIC: the DAMDIC Mk 1 (also known as a warshot), intended for operational deployment; and the DAMDIC Mk 1 T, designed for use in training programs.

Other mine disposal charges offered on this market include the CM101-CAP and CM104-CAP, both of which are in service with several navies. SEI, which had its headquarters in Ghedi (Brescia), Italy, once made these charges but has since been purchased by RWM Italia SpA, which is part of Rheinmetall Defence. SEI was part of the EPC (Explosifs et Produits Chimiques) Group, which had its headquarters in Paris, France. Rheinmetall Defence also produces a line of explosive cutters to deal with moored mines.

Other mine disposal charges are manufactured by ECA of France, providing the Remotely Controlled Ammunition (RECA), and CTM of Poland, offering the Toczek (whose production may have been suspended). Sweden's Saab Underwater Systems had been pushing the MDC 605, but it is no longer in production. Diehl of Germany once manufactured the DM801B1 mine disposal charge.

Dynamit Nobel Defence GmbH builds the MDC02 mine disposal charge.

James Fisher Marine Services in the United Kingdom uses the Barracuda mine disposal system. The system contains 1 kilogram of plastic explosives in its main charge. This system is different from the Barracuda that Raytheon is developing.

Raikka in Finland manufactures charges for use in explosive ordnance disposal.

Program Review

Background. The Danish Mine Disposal System (DAMDIS) was designed to neutralize sea mines through the sympathetic detonation of the Danish Mine Disposal Charge (DAMDIC) Mk 1. The development of this system was to meet a Royal Danish Navy need for an ROV-deployable mine disposal charge for use by some of its Flyvefisken-class Standard Flex 300 multirole patrol boats.

The Danish requirement called for a higher degree of safety than provided by any existing system. The requirement also included specific technical and operational demands. The following are some of the specific needs cited by the RDN:

- A mine disposal charge with no more power than necessary to dispose of the mine
- A system optimized for operation in waters with changing levels of temperature and salinity; e.g., the Baltic Sea
- A system with a low unit cost

The Danish Naval Materiel Command contracted with Nordic Defense Industries (NDI), the latter purchased by Saab in 2016, to develop the DAMDIC and the software for integration into the ROV's television subsystem.

Description. The Danish Mine Disposal System consists of the DAMDIC Mk 1 charge and a spool containing 1,000 meters of lightweight cable.

The explosive element of the charge is contained within a glass-fiber-reinforced polyester shell. Aft on the charge, the fuze mechanism is hidden under a black shield with fins designed to ensure that the DAMDIC follows a controlled glide trajectory when released from the ROV. Four short legs prevent the DAMDIC from rolling away from the intended target (especially should it be located on a slope).

The mine disposal charge does not contain any energy source that can activate the detonator, and its magnetic signature is said to be negligible. The fuze contains a pressure-activated arming mechanism, two independent locking mechanisms, and an independent transport safety device. The depth-based arming actuator requires a minimum depth of 6 meters underwater to overcome spring pressure, and the arming lock mechanism requires release of the charge from the ROV.

The charge can be fully armed only when it has been placed on the seabed and its cable attached to an energy source. The use of cable to detonate the charge provides a high degree of safety over acoustic signals, which are regarded by some as unreliable in coastal waters with large variations in salinity through the water column.

The DAMDIC is designed so that it will not adversely influence the speed or maneuverability of the ROV delivery platform.

Operation. Once a minefield is located, an ROV armed with the DAMDIC is deployed. The ROV carries the DAMDIC to the mine's location and then hovers over it at a height of about 2 meters. The ROV faces the current while the operator carries out a video survey. Using the camera's aiming reticule (bombsight), the operator selects a suitable place to drop the system's charge.

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A Mine Is a Terrible Thing That Waits

The charge is placed alongside the mine using a precalibrated hydrodynamic glide trajectory. By knowing the height above the seabed and the strength of the water current, an operator can predict the impact point relative to the target. The charge's fin array ensures a controlled trajectory.

As the charge falls, cable is slowly spooled out from the ROV. Once the charge is placed, the ROV slowly moves away, and the arming process begins. This process is controlled by the DAMDIC blasting machine (the detonating control unit) on board the mother ship, which transmits its commands over the cable connecting it to the charge. Once the command to detonate is given, the mine is destroyed through a sympathetic explosion.

Boxer MDC. The Boxer mine disposal charge is offered by Forcit Defence, a Finnish explosive and defense equipment company. The Boxer was field-tested in the Baltic Sea in October 2009. The firm unveiled the Boxer in September 2010. This system is designed for use by divers or with a remotely operated vehicle.

COBRA. The COBRA (Clip-On BX-90 Reloadable Assembly) is built by ECS Special Projects and converts an expendable Seafox MDV into a reusable ROV. The BX-90 is composed of a 90mm self-fill shaped charge, and an impact-initiated nail gun combined in a single unit. The BX-90 is designed for the disposal of floating/drifting, moored, and bottom naval mines.

The COBRA offers ROVs a standoff explosive ordnance disposal capability. This system is designed for use with the Seafox I and Seafox VSW.

Rheinmetall Disposal Charges. Rheinmetall Defence acquired the rights to disposal charges through the acquisition of SEI, an Italian firm. The company's products included the CM101-CAP and CM104-CAP.

The CM101-CAP and CM104-CAP are for use during countermining operations. These charges neutralize bottom sea mines by means of sympathetic detonation. They have a negligible magnetic signature and are in service with several navies.

The basic difference between the CM101-CAP and CM104-CAP is the quantity of explosive: 28 kilograms and 78 kilograms, respectively. The CM101 is called a lightweight disposal charge, while the CM104 is a heavyweight system. These disposal charges can be installed on a variety of ROVs and detonated after the ROV has retreated to a safe distance (up to 1,000 m for the CM104 and 2,000 m for the CM101).

The CM101-CAP and CM104-CAP are also available in exercise and dummy versions suitable for training, simulation, and sea trials.

Technical Data

	CM101	CM104	CM107
Length	800 mm	970 mm	890 mm
Diameter	250 mm	350 mm	350 mm
Weight, in air	43 kg	100 kg	100 kg
Weight, charge	28 kg	78 kg	78 kg

The Italian Navy purchased the CM101-CAP and CM104-CAP for the clearing of seabed mines.

The CM107 is a new version that is available and in service.

Funding

No specific information is available concerning funding for the DAMDIC program. The Royal Danish Navy procured the DAMDIC to arm some of its Stanflex 300 class ships.

Contracts/Orders & Options

In Jan 2019, Naval Group won a five-year contract from the French Navy for maintenance and service of its minehunters. This contract, called "CMT 19," is part of the Tripartite minehunter (CMT) program involving Belgium, the Netherlands, and France. Naval Group built 10 minehunters for the French Navy in the 1980s.

In 1996, Australia became the first export customer for the DAMDIC. No figures were provided concerning the value of the contract, which involved the procurement of several hundred units.

Worldwide Distribution/Inventories

Nordic Defense Industries (now part of Saab) markets this system worldwide under the auspices of Naval Team Denmark, a government-supported defense industry export organization consisting of Danish and select overseas naval defense companies.

Several countries have expressed interest in the DAMDIC, including Brunei, Spain, Thailand, and the United Kingdom. The **Royal Australian Navy** bought the DAMDIC system for its new Huon class minehunters. The contract calls for the delivery of several hundred units to the RAN. The Royal Danish Navy and RAN use the DAMDIC on the Double Eagle ROV.

The **Spanish Navy** said in 2022 that it planned to issue a tender to acquire mine neutralization charges. This contract could be worth around EUR4 million.

In July 2024, Germany's Defence Minister said Germany, Denmark, Estonia, Finland, Norway, Latvia, Lithuania, Poland, and Sweden were seeking to jointly procure naval mines due to Russia's increasingly aggressive actions in the Baltic.

User Countries. The **Royal Danish Navy** was the first operator of the DAMDIC. Orders followed from **Australia**, **Finland** and **Norway**.

Forecast Rationale

During World War I, to combat German U-boats, the U.K. developed the North Sea Mine barrage, consisting of over 70,000 devices. In turn, Germany used large numbers of naval mines to deter Allied landings behind the Western front. In the course of the war, the combatants laid nearly 700,000 naval mines.

The Second World War saw the largest combat use of naval mines in history. Both sides deployed naval mines, with 600,000 to 1 million devices of all types laid through 1945. Despite efforts to clear these devices, extensive minefields remained in place after the war and are still a threat today.

Deployment of mines continues as countries attempt to defend and claim territory. For weaker navies, naval mines are a relatively inexpensive means of challenging stronger opponents.

A report from mid-2024 said U.S. military and allied forces had identified over 100 mines in the Black Sea since Russia's 2022 invasion of Ukraine. The conflict has led to a resurgence in mine warfare.

Iran has repeatedly threatened to close the Strait of Hormuz, in part through the large-scale use of naval mines. Russia has deployed naval mines in the Black Sea as part of its ongoing invasion of Ukraine.

Strategists believe China will employ mine warfare at strategic chokepoints in Indo-Pacific waters in a potential conflict with Taiwan. These mines are not sophisticated and are relatively inexpensive to produce, but difficult to detect and clear. Some naval officials are already talking about mines as the next IED threat.

As the years pass, the effectiveness of naval mines is increasing, making countering them more difficult. Mine disposal charges are a primary means of clearing naval mines, along with expendable mine disposal vehicles (MDVs). The DAMDIC, RECA, and CM series are just a few of the disposal charges available to meet this need.

These disposal charges, unlike expendable mine disposal vehicles, work in conjunction with a reusable undersea remotely operated vehicle. The ROV places the charge, which then explodes and detonates the targeted mine.

The proliferation of AUVs and advanced technology testing suggests navies will pursue equipping these platforms with disposal charges.

Production of mine disposal charges is proceeding. Our forecast encompasses production of all naval mine disposal charges. Potential customers are diverse and include Brunei, Pakistan, Thailand, and the U.K. Navies pursuing modernization of MCM ship fleets with autonomous MCM systems will need to procure charges as part of these efforts.

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Ten-Year Outlook

ESTIMATED CALENDAR YEAR UNIT PRODUCTION												
Designation or Program		High Confidence				Good Confidence			Speculative			
	Thru 2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	Total
MFR Varies												
Mine Disposal Charges												
	2,818	60	67	51	48	54	50	48	44	51	55	528
Total	2,818	60	67	51	48	54	50	48	44	51	55	528