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Marco Giulio Barone

Underwater Technology at DRASS-Galeazzi Italy's Legacy in Commando Operations

For the first time, Italy's specialist in civil and military underwater systems allowed *MilTech* to explore in depth the world of insidious underwater vehicles such as Swimmer Delivery Vehicles (SDV), midgets, and mini submarines.

Technology Base

The historical starting point of DRASS-Galeazzi goes back to the 1920s, when the founder, Mr. Galeazzi, a pioneer in underwater operations, specialized in the construction of decompression chambers. In the military sector, the company is known for its *Maiali* (Pigs), underwater commando vehicles that allowed Italian frogmen to attack enemy harbours, like in the famous raid on Alexandria (Egypt) in 1941. Those years also represented a technology trigger for underwater technology. Sergio Cappelletti, DRASS' CEO, explains that *"the simplest object having to operate underwater must be adapted to sustain a 30-bar pressure, meaning that all thermodynamic laws are completely upset down. Our knowledge base is about modifying every object to fit into an underwater environment. We can do it thanks to a slow, century-long, stratification process of competences and skills"*.

As we visited an example of a large decompression module, all this became clear. Screens need special coverage, anti-smoke sensors need to be resettled (everything burns faster), and so forth. Every single piece must be re-engineered for underwater use. Some others need to be miniaturized or improved along with emerging technologies – touch screens, composite materials components, electronics. For this reason, DRASS was proud of showcasing numerous objects reworked for

underwater operations. Most hardware is common to civil and military underwater vehicles, some others are specific. The company has two inter-related lines of business, civil and military. The latest achievements have been the award of a contract by Marina Militare for the design and production of a navy-tailored submarine rescue module within its programme for a new submarine rescue vessel (known as SDO-SuRS, Special Diving Operations – Submarine Rescue System) and the production of the new D-ONE diving helmet. The latter is expected to be revolutionary equipment for submarines, allowing for greater safety and better performance than legacy equipment, yet at a reasonable price. Furthermore, DRASS pursues R&D of plenty of underwater solutions dedicated to submarine infrastructure, energy, and unmanned technology, with a special focus on underwater communications – a key enabler for the development of swarm tactics. For instance, DRASS is a major partner of Italian energy giant SAIPEM for all its underwater activities. DRASS' knowledge base is also exploited for military applications, including SVDs, midgets, and mini submarines. The company is middle sized, with some 220 employees (engineers, specialized workers, etc.) split in two production sites in Livorno (Italy) and Győröd (Romania).

DS-Class SVDs

The DS-class of SDVs is designed for transporting between two and eight combat divers and their equipment 40-50 nautical miles distance from a deployment base, a mothership, or a submarine. To standardise the offer, DRASS proposes the DS-4 and DS-8 as base configurations, for four and eight commandos respectively, or a mix of divers and payload (additional equipment or mines). The DS-4 is 7.7m long and weights 3.8t,

◁ *Mock-up of the DG-550 compact submarine, the larger model in the portfolio. Behind it, an example of the revolutionary D-ONE diving helmet. (All photos Marco Giulio Barone unless otherwise stated)*

including 500kg of gear container payload. The DS-8 weights 4t, including 1,000kg of gear container payload. Both SDVs have a 1.6m beam and are 1.7m high. The DS-class can operate on the surface up to Sea State 2 and submerged up to Sea State 3 and can bottom the seabed up to an operating depth of 50m (with 80m as maximum depth). Its batteries allow for a 6.5kt maximum speed underwater, with a 4.5kt cruise speed, and a 3.5kt speed on the surface.

Primary sensors include a 360° optronic system (CCTV, day/night optical sight, thermal imaging) and a forward-looking sonar (FLS). The main role of SDVs is infiltrating/exfiltrating commandos to/from enemy territory, but it can be used also for discrete coastal patrolling and intelligence.

DG-Class Midgets

The DG-Class of diesel-electric midgets is designed for green and brown water operations, including the attack of strategic targets (oil platforms, harbours, etc.), anti-ship and anti-submarine operations, discrete patrol or ISR missions, SDV and inflatable boat deployment, mine deployment, and sabotage missions of underwater cables through ROVs and/or AUVs. The point of reference for the company is the DG-160, a versatile 169t boat conceived as a ‘Swiss knife’ for small and medium sized navies. For major navies, the DG-160 might find a proficient, low-cost asset for training purposes (crews, ASW warships, aircraft). A scaled-down design optimized for special forces deployment, the DG-100, is also available. A prototype of the DG-160 is currently being built in Romania, while a testbed is available in Livorno for completing the development of an in-house, dedicated Combat Management System (CMS) and for evaluation and training purposes. The boat’s capabilities are designed around the company’s understanding of modern submarine warfare. The DG-160 is 35m long, with a 4m beam and a 6.5m height and has a crew of nine. Its propulsion is based on one permanent magnet generator (plus one backup generator) and four battery banks, allowing for 10kt maximum submerged speed, 5kt cruise speed, and 8.5kt surface speed. Maximum operational depth is around 100m. The overall autonomy is 2,000nm, with a 160nm range of action on batteries only. In green and brown waters, the DG-160 is a sufficient asset to put the enemy at



D-ONE diving helmets on the shelves of the Livorno factory, ready for sale.

risk, thus empowering the operating navy with some deterrence and sea denial capabilities. In effect, the boat can deploy two heavyweight torpedoes (plus two optionally mounted externally) and/or six mines in two sets of three. In the commando configurations, it can host six divers and six diver gears containers. As a company representative explains, “modern heavyweight torpedoes are more accurate than legacy systems, with a 25-30nm maximum range. One of them is more than sufficient to sink or heavily damage any warship. Having a midget waiting for you along the

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A hyperbaric chamber, a best-selling item, under construction at the DRASS factory in Livorno. The company possesses two factories, one in Italy and one in Romania.



Technology demonstrator of hyperbaric chamber, used by the company on exhibitions to showcase its comprehensive capabilities in underwater technology.



◁ Technology demonstrator of hyperbaric chamber, used by the company on exhibitions to showcase its comprehensive capabilities in underwater technology.

coast or next to the harbour put a serious threat to any navy". Furthermore, DRASS possesses an exclusive patent-pending mine-laying mechanism to rapidly and accurately deploy mines from small submarines without changing the trim of the boat. Nowadays, miniaturization and the company's capabilities to adapt virtually any hardware to fit inside a midget makes DG-160 a more flexible asset than legacy systems. In fact, the boat comes with a comprehensive command, surveillance, and communication equipment configuration including, among others, passive and obstacle avoidance sonars, optronic periscope, HF and UHF/VHF antennas, underwater communication system, INS, and echo sounder. The possibility of featuring a Radar Warning Receiver (RWR) and a complete Electronic Support Measures (ESM) suite with direction finding functions also shows the potential of such a small asset for SIGINT tasks, as envisaged by specialized company Elettronica during the XII Regional Seapower Symposium held in Venice in 2019.

In DRASS' view, advantages brought by the DG-class of midgets include also affordable price, easy maintenance, and low life-cycle



◁ An example of the DG-160 under construction in Romania. (Photo: DRASS)



Rear view of the full-scale testbed of the DG-160 midget submarine in Livorno.



A DS-8 SDV under construction in Romania.
(Photo: DRASS)

costs. As far as pricing is concerned, the DG-160 is offered at roughly at one fifth/one sixth of a latest-generation diesel-electric submarine – and is thus affordable for small navies operating in shallow waters. Midgets can be stored off water, in specific hangars conceived for easy maintenance and, consequently, prolonged service life, while safeguarding strategic information about how many boats are at sea at any given time. The DG-160 can also be disassembled and relocated by truck or train.

The Compact Submarine Concept

DRASS' technology base, along with innovations developed for the DG-160 SDV, can be easily exploited for bigger boats, such as the DG-550 compact submarine project or bigger designs currently under study. The DG-550 would be 40m long, with a 4.5m beam and a 7.8m height, with a complement of eleven. Its propulsion would be based on one permanent magnet generator (plus one backup generator) and six battery banks, allowing for 16kt maximum submerged speed, 5kt cruise speed, and 9kt surface speed. Maximum operational depth is 250m. The overall expected autonomy is 4,000nm, with a 260nm range of action on batteries only. The DG-550 is proficient in shallow waters, but could operate in blue waters as well. Deterrence and sea denial capabilities would be closer to a traditional SSK, thus with a price tag only 25-30% higher than a DG-160. Operational capabilities would be linearly superior in all aspects. Hence, the boat would deploy four heavyweight torpedoes (plus two optionally mounted externally) and/or eight mines in two sets of four, or a mix of torpedoes and ROVs/AUVs. In commando configurations, it is designed to host up to twelve divers and one large SDV or a large equipment container. Unlike midgets, DG-550 would require traditional docking, but operational and life-cycle costs would remain largely below larger boats, thus enabling navies with modest budget to possess a high-value asset.

Concluding Remarks

Since its foundation, DRASS has unceasingly represented a point of reference for underwater technology. In the military sector, however, the company has experienced highs and lows due to the peculiar sector it operates in, characterized by secrecy and often politically sensitive. Today, the renaissance of its capability in designing and producing covert state-of-the art underwater systems come at just the right time

– as the demand for this kind of systems grows worldwide, especially in the Middle East and Africa. East Asia has great potential as well, but the company would need a strong commercial partner to promote (and later support) its products in that theatre. DRASS recently had an intellectual property quarrel with Indian shipyard MDL, which would have copied the company's designs for its midgets.

Geopolitics are warming up worldwide, and energy crises mean states possessing maritime resources will need to protect them by credibly enforcing their Exclusive Economic Zone. In this, as Cappelletti highlights, "nothing is more threatening than underwater attack capabilities, which in some contexts are a true game changer in the balance of forces amongst strategic competitors". According to insights **MilTech** was able to gather, talks are ongoing with several navies for the DS-8 and DG-160 models, while the DG-550 has registered vivid interest amongst potential clients in the MENA region.



Exclusive photo of the interior of a DS-160. DRASS is working on a proprietary CMS for midgets and small submarines that provides the client with operational independence from other suppliers.