German Submarines – Capabilities and Potential

by Captain Raimund Wallner

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The dual commissioning of U26 and U30, which were the last two of the U206 class submarines, was celebrated in March 1975. The U212A class submarines U31 and U32 were put into service in October 2005. These two milestones characterise a unique phenomenon.

For more than 30 years, no new submarine had been commissioned by the German Navy. However, in this period the German maritime defence industry succeeded in establishing itself as the world market leader for non-nuclear submarines. The demanding military requirements of the German Navy during the Cold War for the extreme operational conditions in the northern European border seas had internationally become a benchmark. They contributed decisively to the success of the German submarine industry with its export product U209. At the end of the 1980s, more than 100 submarines of German origin were roaming the world's oceans, and the number has been increasing ever since.

During the Falklands War, the only maritime war since 1945, an Argentine U209 class submarine, the *San Luis*, kept the British fleet under pressure for six weeks. More than 100 light-weight torpedoes were expended by the Battle Group of Admiral Sandy Woodward against real and supposed enemy contacts. The submarine launched four torpedo attacks against the carrier *Invincible* and its escorts, but these, however, were unsuccessful as well. As it turned out, faulty wiring between the fire control system and the torpedo tube set of the *San Luis* had spared the British the disaster of the sinking of their flagship. Nevertheless, a single enemy submarine with an inexperienced crew proved the 'force multiplier' effect, a characteristic in which submarines of German construction excel: the capability to contain forces through stealth.

The German submarine FGS U32 leaving Taranto (photo: Italian Navy)

The U212 Sets New Standards

As the 'bestseller' U209 would run out of steam one day, an alternative had to be available in due time. Just as the German Navy's U205/U206 had set the ground for the success of the U209, now again a new domestic construction project was required to ensure further success of the German submarine industry. But the Navy, too, badly needed a successor to the U206 A class when it reached the limits of its life cycle at the end of the millennium.

The fact that the new U212 class was from its beginnings an offspring of the Cold War becomes obvious from the Staff Target of December 1987. It states that the boat be employed flexibly and without limitations in all parts of the area of operations, with priority in the Baltic Sea. Above all, this involved the requirement for air independence and low signatures. The first of the 12 boats was planned to be handed over to the Navy in the mid-nineties, the last in 2005. Today, relative to these Cold War objectives, we are ten years behind schedule, have drastically reduced the quantity due to budget restrictions, and have increased the lifetime of the U206 A class accordingly.

The U212 components with the greatest development risk were the propulsion motor with permanent magnet excitation[1] and the solid electrolyte fuel cell module to ensure air independence. Since the early eighties, industry supported by government funding had been working on the development of a fuel cell feasible for submarine propulsion systems.

Since the approval of the Staff Target in 1987, the world has undergone fundamental changes: the security environment, the strategic situation of the reunified Germany, the mission and strength of the forces, the focus of armaments and the defence budget – nothing was as it used to be. In combination with the technological problems of the development, these framework conditions complicated the realisation of a demanding project like the U212. They required adaptive and corrective measures until finally the building contract for the first batch of an initial four units was signed in 1994.

Now the Baltic Sea was no longer quoted in the mission need document of May 1994; instead, 'the European maritime areas and the North Atlantic' were defined as the focus of

FGS U32 and her Italian sister INS Todaro *entering Taranto (photo: Italian Navy)*

the operational theatre. For this purpose, long-range and, in particular, low-frequency acoustic sensors in the form of towed and flank arrays were required to complement the broadband cylindrical array, and the weapon performance had to be improved with the heavy-weight torpedo DM 2 A4.

Nine fuel cell modules of 34kW each provide the boat with its most outstanding capability: submerged operation over several weeks with air-independent propulsion (AIP). This means snorting can be limited to those phases of a mission when a reduced threat by anti-submarine forces is anticipated. The submarine skipper no longer has to take risks of being detected with optical or electromagnetic sensors due to technical necessities. Only tactical reasons will force him to take the high risk of exposing hoistable masts. To reduce signatures, the proven non-magnetic design was maintained. The Diesel generator system and other noise sources were mounted under a noise capsule on a 'floating deck'. The oxygen is stored in liquid form in two tanks – the hydrogen in metal hydride containers – both outside the pressure hull. The fuel cell is not yet capable of providing enough performance for high speeds. Furthermore, the size of the oxygen tanks represents a limiting factor in terms of energy supply. A conventional submarine battery is therefore still necessary. U212 is a hybrid submarine.

Additional sensors for the U212's efficient mission accomplishment are modern periscopes, ESM, mine avoidance sonar, sonar intercept, own-noise measuring and passive sonar ranging. UHF-SatCom complements the conventional communications facilities.

In 1996, Italy joined the U212 programme via a Memorandum of Understanding and an Industrial Cooperation Agreement between the HDW and Fincantieri shipyards; the programme was then renamed U212 A. Within the scope of a corresponding construction contract, two nearly identical submarines were built in La Spezia.

The New Export Design U214

Just as the export submarine U209 with its evolutionary derivatives had once emerged from the German U205/U206 design, a completely novel design now – nearly 30 years later – arose on the basis of the U212. Boiled down to the handy formula U209 + U212 = U214, the development of an export submarine with a fuel cell propulsion system, the first in the world, started in 1996. In February 2000, the first building contract was signed with the Greek Navy, and the construction of the first-of-class started one year later in Kiel. The rest of the series, meanwhile extended to four boats, will be built in Greece. A contract on three U214 boats to be built exclusively in South Korea also followed in 2000, the contract on two Portuguese boats in 2004. Together with the work still to be done within the scope of the U209 contract for South Africa, this is the current workload of the German submarine industry.

The 1700-ton U214 design is as compact as all submarines of German origin. Featuring a superb cruising range and high combat power, this submarine possesses an excellent indiscretion rate, enabled by its relatively large main battery and the two high-performance Diesel engines. Two 120kW fuel cell modules provide AIP power. The characteristics of a relatively long one-decker, the ferromagnetic construction, the eight swim-out torpedo tubes and the bow diving planes show the affinity with the U209. The Permasyn motor, a high automation level, the reduced signature, the towed and flank array sonar systems and the torpedo defence system are features which the design has in common with the U212 A.

The Second Batch of the U212 A and the Potential for the Future

Throughout the five years since the start of the fight against terrorism, the German Navy has been continuously operating together with allied and coalition partners in remote theatres. Submarines are an integral and indispensable part of this maritime contribution to be able to cover the underwater portion of the overall spectrum of maritime warfare.

It is necessary to improve those strengths which have always distinguished the German Navy as a valuable alliance partner, particularly in littoral warfare; today, however, no longer just on our own doorstep but with the capacity for worldwide deployment. This requires the improvement of sustainability and robustness, including better precision and weapons with stand-off capability, also for land attack. In addition, the capability of Network Centric Warfare (NCW) is indispensable for interoperability with our own and allied forces of all Services.

When the four boats of the first batch of

the U212 A were designed at the beginning of the nineties and their operational doctrine was defined, NCW was a vision at best. Their capabilities to participate in such operations are therefore only limited. Thus, it is planned to retrofit them. The building contract for the second batch of the class U212 A boats with two more units is due to be signed in September 2006. The boats can then be commissioned from 2012 on. Besides the NCW capability, upgrades relative to the first batch include the integration of additional systems and technically improved components. In terms of their structural design, the boats of the second batch will be largely identical to those of the first batch. Only in the sail area will they be slightly elongated to accommodate an additional hoistable mast for SHF SatCom and to provide growth potential.

Additional improvements will include the capability of communication from the deep, a new command and weapons control system, replacement of the present flank array by a newly developed advanced version, replacement of one of the two periscopes by an optronic mast, integration of a swimmer lock-out chamber, and tropicalisation of the air conditioning system.

The strength of the submarine lies in its invisibility. The detection of a submarine's presence – let alone its identification or even its engagement – alone requires an enormous expenditure of anti-submarine warfare (ASW) assets in all three dimensions. Just a handful of navies are able to chase a submarine with such distinct stealth characteristics as the U212 A, and these navies are our allies or friends. The British failure in the fight against the *San Luis* during the Falklands War reflects the strength of the submarine as did the spectacular sinking of the Argentine cruiser Belgrano by the British submarine HMS *Conqueror*, which was enough to lock up the Argentine surface fleet in port for the rest of the war.

'Further growth potential in the field of reconnaissance can be expected from unmanned underwater vehicles or even from unmanned aerial vehicles'

Combat against enemy surface and submarine forces is, and will remain, the primary task of German submarines. The new fibre-optically guided, highly agile DM 2 A4 has a combat range extending far beyond the horizon and has become a true 'stand-off weapon'. However, the torpedo is only suitable for engaging surface and submarine targets and always results in the highest level of escalation, i.e. the unit kill, the sinking of the enemy.

Anti-ship missiles, by contrast, are weapons normally facilitating mission kill. Six nations operating German export submarines are equipped with Subharpoon missiles, some with the land-attack capable Block II. Of course, the U212 A also has the potential for being equipped with this missile, or a similarly efficient one, for ground combat support from the sea.

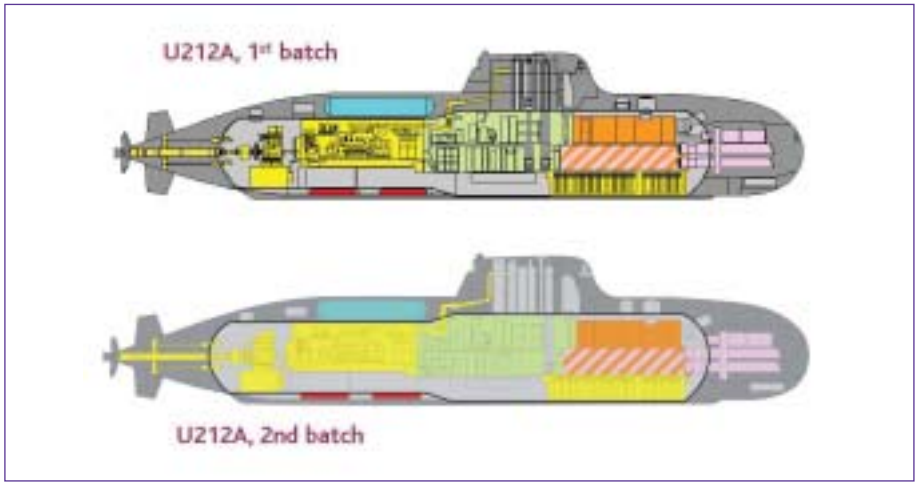
At present, the feasibility of IDAS[2] is being examined in an experimental study; this system could provide the U212 A with capabilities so far not available for submarines around the world. IDAS is a light wire-guided missile which can engage ASW helicopters as well as surface and close-to-shore land targets, including the targeting of moving land objects. Further weapon options for submarines, partially initiated by export customers, are being discussed in industry. This includes the integration of a 30mm machine gun called 'Muraena' mounted in a hoistable multi-purpose mast.

A second role increasingly gaining importance for submarines is that of covert reconnaissance and intelligence collection. In very shallow littoral waters, where German submarines can already exploit their full freedom of movement, bigger, and in particular nuclear-powered units, are not even capable of diving. A variety of sensors gives our compact submarine platforms enormous potential. A further growth potential in the field of reconnaissance can be expected from unmanned underwater vehicles or even from unmanned aerial vehicles,[3] which can all be deployed from the submarine. The same hoistable multi-purpose mast designed for the machine gun was recently used to build a demonstrator for the army's UAV Aladin as an alternative payload.

A third role in which German submarines have always excelled, and which becomes more and more important, is deploying special forces. While on the current boats frogmen have to swim out through the torpedo tubes, the second batch of the U212 A will allow them to use a four-man lock-out chamber and to carry along extensive equipment in pressure-tight containers.

To sum up, one may say that due to their characteristics of compactness, covertness, sustainability and high combat power, submarines made in Germany are already able to meet the majority of the demands which today's and future scenarios pose to underwater platforms. They do have their price, but they extend the maritime capability spectrum of the Bundeswehr in a unique way, and thus the military options in the hands of the political leaders, and it is no exaggeration to claim that the German Navy today disposes of nothing less than the best non-nuclear submarines in the world. ■

U212A 1st and 2nd batch compared (graphic from TKMS/HDW)



NOTES

1 Permasyn motor by Siemens, Erlangen
2 Interactive Defense and Attack System for Submarines
3 UUV, autonomous underwater vehicles (AUV), UAV