



Dangerous Legacy

Off the coasts of the North Sea and the Baltic there are still 1.6 million tonnes of unexploded ordnance.

It's 10th January 2017, at the construction site of the offshore wind farm Gode Wind 2 in the German North Sea. A security vessel discovers a sea mine in the outer area of the wind farm. The Central Command for Maritime Emergencies is informed; the mine must be blown up. A team of experts from the bomb disposal team flown out that afternoon by marine helicopter decides against a detonation at sea due to the difficult weather conditions. The multi-purpose ship Mellum takes the German tethered mine in tow and takes it to the planned explosion site at the Watt mud flats off Horumersiel. The explosive power of the mine from WWII is between 150 and 250 kg. The detonation is carried out the following

day. Animals must be scared away and the detonation area extensively evacuated. Taking part in total: four ships, a helicopter, bomb disposal experts and the German police.

1.6 million tonnes of munitions

This may have been the first ordnance find in 2017, but it won't be the only one for sure. According to the expert group "Munitions at Sea", alone in the German North Sea and Baltic there are still an unfathomable 1.6 million tonnes of munitions. Loaded onto a goods train this would be 3,000 km long. But the finds are more or less random; in 2016 the central reporting centre for ordnance at sea received a total of 264 notifications of ordnance finds, while 2015 saw 218.

There are two main reasons why the number of finds is actually rising. Firstly, a federal and state working group has been looking at the subject since 2011, with find data being gathered and made public. Secondly, the areas of sea have also been being used for the expansion of offshore wind power since the German energy transition. Many of these areas were not only mined during the war, but also intentionally used as ordnance dumps afterwards. The annual report of the expert group for 2016 thus includes a total of 61 ordnance finds as a result of offshore activities, including one Russian tethered mine, German grenades, American bombs and a British ground mine.

"Our work begins even before the first find with research in historical records about the future construction site," explains Melanie Abbondanzieri. She is a Project Manager in the development department at Heinrich Hirdes EOD Services GmbH. In this way it can be clarified in advance to what extent the offshore site was along the flight path of an aerial attack on a big city, for example, which often means such a site is particularly affected.

Following this, the construction site is scanned using the corresponding technology. "One of the biggest challenges is making really precise finds," says Dieter Guldin, COO at SeaTerra. A ship tows the required sensors 150 m behind it, in order to find magnetic anomalies. "At 40 metre water depths, plus wind and waves, you can get into the range of centimetres, depending

on the technology used," says Guldin. But not every anomaly comes from ordnance: "96 percent of what we find is simply junk." To determine without doubt what it is, multi-sensor platforms are also used depending on the water depth, which can analyse the object using various methods. If these also do not deliver clear results, then ordnance divers are sent in.

"Once it is clear what we are dealing with, there are various options," explains Abbondanzieri. Can the ordnance be recovered or taken to another contaminated area? Must the find be blown up on site or can it be left where it is under certain circumstances? "Especially when cables are being laid, taking a different route can be an alternative."

But a lot of the time the find must be recovered or blown up. At the construction site of the Veja Mate wind farm alone, 95 km off Borkum, this was true for two incendiary bombs, two explosive bombs, a ground mine and two training bombs. "Whenever a live fuse is in place we have to detonate," explains Guldin.

Fully automated munitions search

Looking for ordnance is thus complex and expensive. You have to assume three to four million euros for a medium-sized wind farm, according to Guldin. In order to reduce costs in this area too, and to relieve divers of this dangerous work, the RoBEMM research project has been under way since the end of 2015. The aim of the three year project is to develop

a prototype machine which can fully automatically disassemble ordnance on the seabed and then dispose of it in an environmentally friendly way. "We are still at the concept phase," says Abbondanzieri. The company Heinrich Hirdes EOD Services is the leading party in the consortium consisting of companies and research bodies. The system to be developed, made up of a platform with a processing unit, should in the future be able to do everything automatically which today can sometimes only be carried out by a dangerous diving mission. This sounds simple but is actually complicated, for the system must be capable of clearly identifying the various ordnance and making it safe. "We do not have the documentation for some of the dumping grounds," says Abbondanzieri. These are sometimes in various archives of the wartime "attackers" and not all countries have made such information available.

However, even a fully automated system cannot prevent the need for blowing up unexploded ordnance at sea – with consequences for the maritime environment. Heavy metals and suspended solids pollute the sea, and each detonation is at the same time dangerous for aquatic mammals such as porpoises, which use their hearing for orientation. In order to protect them a bubble curtain is used, similar to when ramming foundations. "Noise levels are thus reduced by up to 96 %," says Cay Grunau, Head of Hydrotechnik Lübeck. However, when detonating, approx. 20 % more air must be used than when ramming. He

bemoans that as opposed to ramming, there are no clear guidelines for detonations: "For ramming there is an upper threshold by the BMUB (Environment Ministry) of 160 dB at a distance 750 m from the sound source." There are no such boundary values for detonations and thus no regulations on the nature of the bubble curtain. "We have carried out tests with the navy and developed our own standards here," says Grunau.

And there is even more – and fundamental – criticism. The problem of ordnance in the sea was talked down for decades, criticises marine biologist and environmental assessor Stefan Nehring. In 2003 he looked at anthropogenic pollution of the North Sea on behalf of the states of Lower Saxony and Schleswig-Holstein. "During this, I came across irregularities concerning statements on ordnance contamination, looked for old documentation on ordnance dumping at the Federal Archive in Koblenz, and got a result." Since then he has regularly published work on the subject of ordnance finds. So far there is still no adequate knowledge about what ordnance lies exactly where, and what condition it is in. "Nautical maps are still not up to date on the ordnance sites," complains Nehring. In the 1990s, details were even specifically deleted in order to play down the problem. He demands – so far unsuccessfully – the systematic identification of ordnance hotspots and a clean-up of these. Until then the finds will have to remain a matter of chance.

Katharina Wolf