



## Inconspicuous qualities

Words: Lucie Maluck | Pictures: Robert Hack, Martin Roscher, Freddy Philips

demagnetization

**They lie hidden, often hundreds of meters below the surface of the water – but their effect is devastating. Today there are still well over 200,000 sea mines at the bottom of the Baltic Sea. They are left over from the Second World War and seriously limit commercial fishing and merchant shipping operations. If they are not spotted and a ship happens to pass over them, there will be no help for the vessel and its crew. That is why the Finnish Navy is aiming to commission three new minehunters in 2015 – costing a total of €250 million. MTU is supplying specially demagnetized engines both for propulsion and onboard power generation on the new ships.**



Some things are just there all around us, unnoticed and taken for granted. Like the air we breathe, for example. Or the sun, without whose light and warmth we could not survive. The Earth's magnetic field is another example. None of us is aware of it, but without the magnetic attraction of the poles, our world would be entirely different. Highly energized particles from the sun or outer space would very likely make life on Earth impossible if they were not trapped by the magnetic field thousands of kilometers above the planet. Whales, sharks and turtles use the magnetic field as a navigation aid. But it is also used by sea mines for more sinister purposes. They are fitted with magnetic sensors so that they can detect when ships that they are programmed to destroy are close by. The job of seeking out mines and rendering them harmless is the purpose of a minehunter. The Finnish Navy is currently in the process of commissioning three such new vessels. The 52-meter craft will each be powered by two 8-cylinder MTU Series 396 engines. In this type of application, the performance of the engines is a secondary

consideration because, when on minesweeping duty, the ships travel at no faster than five knots (9.3 kph). So that the minehunters can slip as silently as possible through the water, the engines have double resilient mountings. And their magnetic signature has all but been indistinguishably erased.

### **Accuracy and precision**

Building such engines is a highly complex process that takes several weeks. “We need well over a hundred hours for one engine,” said Albert Hagenlocher, test track manager at MTU. That is because the engine is not demagnetized all at once. Hagenlocher has to demagnetize every component individually. The crankshaft, the camshaft, the con rods, the turbocharger, the cylinder heads and even the bolts – 16,000 components for every engine. A lot of work by any standards. “But that is how we make sure that the magnetic signature of the components remains permanently weak,” he said, seemingly lost in his own thoughts as he placed a cylinder liner inside a demagnetizing coil.



### **Permanent and induced magnetic signatures**

At this point the magnetic signature is still very strong. A sea mine would immediately detect an engine with this component in it, and explode. To weaken the magnetic signature, the test track manager passes an electrical current with a special wave envelope through the coil. The wave envelope has a total of eight variables. The frequency and maximum strength of the current flowing through the coil are two of them. Setting exactly the right wave envelope is a very precise art. “You can’t teach this,” claimed Hagenlocher with a mischievous grin. He maintains it is much more a matter of experience, because every magnetic component has two different magnetic signatures – a permanent and an induced one. The permanent signature of the cylinder liner is something he can erase; but not the induced signature. That is determined by the Earth’s magnetic field, and it fluctuates constantly as well as varying between geographical regions.

The Finnish minehunters are initially to be used only in the Gulf of Finland. But even that geographical limitation is far too wide-ranging. A ship that has no magnetic signature when off the coast of Helsinki can be magnetically charged again when only 150 kilometers away off the coast of Turku, and thus be detectable by sea mines. So there are coil systems installed on board. They hide the ship’s magnetic signature by creating an opposing field that counterbalances the residual signature of the ship as a whole.



### **Measuring residual signature**

MTU determines the strength of the engine's residual signature on a purpose-built magnetic testing track. It is housed in a shed made entirely of wood and a special type of steel. With the aid of a probe 20 meters below ground and numerous coils in the shed, Albert Hagenlocher can simulate the magnetic field anywhere on the Earth with just a few mouse clicks. Then the engine – with its 16,000 demagnetized individual components now fully assembled – rolls along a track through the shed on a truck. On the three computer screens in front of him he can see the engine's residual signature represented in nanotesla accuracy. Hagenlocher laughs with satisfaction. The engine has only a very weak residual signature that will be easily counteracted by the onboard coil systems.

### **Quiet, inconspicuous and non-magnetic**

And that means the engine is ready for duty on the Finnish minehunter *Katanpää*. She is due to enter service in 2015 and start clearing mines from the coastal areas of the Finnish Baltic along with her sister ships, the *Vahterpää* and *Purunpää*. Commandant Heikki Vierelä is already preparing himself and his crew for the mission. To begin with, his new ship will only operate in the Baltic, though he intimates that international missions are envisaged in five to ten years' time. "Here in the Baltic Sea off the Finnish coast all the mines date from the Second World War. But in asymmetrical warfare, mines are a favored means of blockading port entrances, for example," he explained. Using special sensors on the ship, he and his crew locate the mines then defuse or detonate them. The MTU propulsion engines paired with Voith-Schneider propellers enable the crew to maneuver the vessel very precisely even in heavy seas and high winds because that combination allows the thrust to be infinitely varied without changing the engine speed. And with the help of the Callosum ship automation system, they can concentrate fully on the job in hand. The system controls and monitors not only the propulsion plant but also the MTU on-board power supply, the fire alarm system and the tank measuring system. "However, the most important requirement of the engines is that they are reliable," the Commandant adds. They too should simply be there, unnoticed and taken for granted. Quiet, inconspicuous and – above all – non-magnetic.



## “We’ve got a sauna on board”

Interview with Heikki Vierelä, Commandant of the „*Katanpää*”

### Why does the Finnish Navy need minehunters?

In the Gulf of Finland there are still thousands of mines left over from the Second World War. They put a serious limit on commercial fishing and merchant shipping operations. And apart from that, in asymmetrical warfare mines are a favored means of blockading port entrances, for example. Once we are thoroughly familiar with the ship, the *Katanpää* will also take part in international missions and clear mines in combat zones.

### How do you track down mines under the water?

We have sonar equipment on board that can locate mines under the sea by changes in the echo pattern. Some of the detection systems are permanently mounted on the ship, some are on self-propelled robots. The great advantage of the robots is that the ship and crew can stay back at a safe distance.

### And what happens to the mines?

That depends on how dangerous they are. Sometimes it is enough just to know their exact location so that we can mark them on sea charts. But if they pose any danger to other ships, fishing boats or divers, they have to be blown up.

### The *Katanpää* is powered by MTU engines. What are the important features of the engines from your point of view?

Quite clearly, a minimal magnetic and acoustic signature. Closely followed by reliability. The power is of secondary importance because the ship only travels at high speeds between deployment zones. When we are actually searching for mines, we use electric propulsion and only need one of the four MTU engines on board.

### The Finns are famous for their saunas. Do you have one of those on board?

Yes, we actually do have a sauna on board. It’s the same on all Finnish Navy vessels over a certain size. Saunas are part of Finnish culture and so are part of life on board a minehunter too. But it’s also there for safety reasons as well. Our divers have to defuse mines in the freezing waters of the Finnish

Gulf, so being able to warm up in the sauna is very important.

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