Full-scale ice trials with bronze propeller

In March 2016, two full-scale ice trials were performed in the Bay of Bothnia between Oulu and Kemi, where ice conditions are extremely hard during cold winters. The first trial was to perform ice trials for the Finnish Border Guard's offshore patrol vessel *Turva.* The second trial was to test the newly developed bronze propeller in heavy ice.

FNS Louhi was fitted with the bronze propeller. The level ice tests were performed in 60 to 85 cm thick level ice, both ahead and astern operation mode was used.

The bronze propeller for ice has been developed in cooperation with TEVO Oy and the Technical Research Center of Finland, VTT Oy. Although not as strong a material as stainless steel, bronze has some benefits compared to a stainless steel propeller: better corrosion resistance, easier to manufacture and maintain, not to mention cheaper. Bronze is a widely used marine propeller material in open water and TEVO Oy wanted to find out if it would be feasible to use also in ice-going vessels.

Bronze propeller test on *Louhi*

The bronze propeller was fitted on the Finnish Navy's multipurpose vessel *Louhi*. She is designed specially as an oil and chemical spill response vessel and is owned by the Finnish Environment Institute (SYKE), but manned by the Finnish Navy. *Louhi* is equipped with two azimuthing thrusters with stainless steel propellers, but for this test one propeller was changed to the bronze propeller.

The tests were performed in both ahead and astern direction in 60 and 85 cm thick level ice, 6 m thick ice ridges, and ice channels.

"The conditions for extreme ice conditions were excellent," says Kari Laukia, head for ship design and engineering. "We wanted to test the propellers in as heavy conditions as possible and succeeded in finding different conditions suitable for it."

"In addition to strength measurements, we also took underwater videos in order to see how the ice and propeller interaction took place. After the testing, *Louhi* returned back to drydock and the test propeller was remounted and sent to TEVO for inspection."

The conclusions based on the test results are that the bronze propeller can be suitable for vessels in 1A Super ice conditions. The testing conditions gave reliable results and input for the propeller design for 1A and 1A Super ice class vessels.

FNS *Louhi* was built by Uki Workboat Ltd. in 2011. She is a multi-purpose response vessel designed to operate in all Baltic Sea ice conditions and fitted with extensive mechanical oil spill response outfit, including equipment designed specifically for collecting spilled oil in ice conditions.

Only one quarter of the ice ridge is visible on the surface and three quarters of it is below the surface. If the visible ice ridge measures two metres, this means that there are six metres of ice under water.

Technical details:

Displacement	3,450 ton
Length	71.4 metres
Beam	14.5 metres

4 x Wärtsilä 9L20 diesel engines

2 x 2.7 MW Rolls-Royce Z-drive thrusters