Seakeeping test for icebreaking trimaran

A series of seakeeping model tests was made for our Trimaran concept in August and October 2014.
These tests were made because the hull form and proportions of the icebreaking Trimaran differ significantly from all existing vessels.

Seakeeping tests of the Trimaran concept, motion in waves with H_s = 4.0m, T_p = 9.0s and φ = 45°

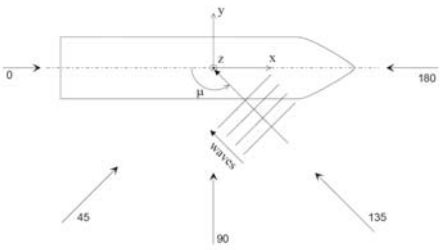
Seakeeping tests of the Trimaran concept, motion in waves with H_s = 4.0m, T_p = 9.0s and φ = 180°

Pictures on the left:
Seakeeping tests of the Trimaran concept, motions in waves with H_s = 4.0m, T_p = 9.0s and φ = 135°

The seakeeping tests of the icebreaking Trimaran were made in cooperation with the Technical Research Centre of Finland (VTT) in their test basin.
The test matrix was fairly comprehensive and included both regular and irregular waves and five different encounter angles (0°-180°) with zero vessel speed and various wave heights and frequencies. In addition, a 180° encounter angle was tested with velocity ahead. Tests with regular waves were conducted with a constant wave height of 1.0m and over a wide wave frequency range to obtain RAOs for different quantities. The motions and accelerations were tested in irregular waves using JONSWAP wave spectrum and significant wave heights of 2.0m and 4.0m to gain deeper understanding of the behaviour of the Trimaran concept and to measure maximum loads. The instrumentation included force measurements between the main hull and side hulls, accelerometers at different locations, relative motion sensors to measure the relative wave elevation, global movement measurement and slamming pressure sensors on the cross-deck.

Early results and observations

"The analysis of the test results is not wholly available yet but the observations made during the tests, and preliminary results, indicate that the Trimaran behaves rather well in waves, and no major problems were found. The roll angles and accelerations are very moderate despite the large GM. Even in 4.0m significant wave heights the side hulls stay in water and do not submerge excessively. Generally, the motions of the vessels were moderate in all tested conditions with zero speed. The largest accelerations and motions were measured in the bow of the vessel, while the stern had lower accelerations and smaller motions, which is favourable for using the large stern deck as a working deck. The clearance between cross-deck and water surface also seems sufficient, as only a very few, low energy contacts between cross-deck bottom and waves were observed," Structural Engineer Ville Valtonen explains.



The test matrix was fairly comprehensive and included both regular and irregular waves and five different encounter angles (0°-180°).

“Based on the early results and observations, the vessel can operate in 4.0m significant wave height without problems. With stern waves, the 4.0m significant wave height seems to be about the upper limit, but in beam or head waves, it seems that even more severe sea states would not cause any major issues. It has to be noted that larger waves tend to have longer periods, and are therefore less severe for a relatively small vessel, as the wavelength exceeds the vessel dimensions significantly, whereas waves with a length fairly similar to the vessel dimensions are likely to cause the most severe motions. Some examples of the vessel motions in waves are shown in the pictures above. The results of these tests will be used to further develop the hull form and vessel concept," Mr Valtonen says.