



# More possibilities in model testing

With the latest improvements to our model testing facility, more complex testing options are now available both for our customers and our own research and development team.

Over the past two years, we have been developing a system for testing Dynamic Positioning (DP) in ice. In order to be able to do all the tests desired, some of the equipment in our model testing facility needed upgrading. All the necessary improvements are now completed, which has opened up new possibilities in model testing.

"The biggest mechanical change is that the propulsion motor for azimuth thrusters is now under water as it is in the real world," says development engineer Veikko Immonen, who is responsible for the technical development. This reduces the number of moving parts and enables a cleaner torque measurement from the motor, allowing for more accurate real-time power control.

"Another big change is that we now have fully controllable tunnel thrusters. Until now we've had no need of them in our testing, but for DP testing, they are essential – given that the real vessel has them, of course."

"On the technical side, we have opted for state-of-the-art vector control for the brushless permanent magnet electric motors. Additionally, the azimuth movements are now computer controlled by using a closed-loop stepper motor system," Immonen explains.



*New internals for azimuth thrusters*

# Modular principle

Each propulsion unit contains an independent microcomputer. They are all connected to a common CAN bus with the master controller module. All commands and measurement values are transmitted through the bus, which makes connecting multiple thrusters easy to do. This is good for DP vessels, as they can have many – for example drillships with six azimuth thrusters are already in operation.

“Previously, we had a limitation on how many thrusters we could put on a model. These limitations are now history, I suspect we'll physically run out of space on a model before the control system's limits are reached. If you can build it, we can test it,” Immonen assures.

A DP system needs good quality GPS and gyrocompass signals to operate. Since the required accuracy is measured in millimetres in model testing, using an actual GPS is not an option.

“We had to fake a GPS signal using data from our infrared camera positioning system. We also fake a gyrocompass using that same data. The actual DP software is exactly the same that runs on real vessels.”

## DP tests in ice

A DP system helps a ship to automatically keep its position. External forces such as wind, current and waves are counteracted with the thrusters and propellers. The problem arises when ice is present, because the forces involved are an order of magnitude higher, sudden and difficult to predict.

“The equipment in our model testing basin will be used to find the situations where DP does not perform well in ice.



A view of the DP control station.



A DP controlled model fending off ice floes coming its way

Our aim is then to find new algorithms or improve existing ones to enable the DP system to respond to ice forces in such a way that DP operation in ice is reliable,” Immonen outlines.

Sometimes a vessel does not need full DP certification, but the thruster configuration is such that it is difficult to control the vessel manually. The vessel can then have an autopilot system that is technically similar to a DP system but

without some of the strict requirements of DP. With our new equipment, we can test autopilot systems as well.

“All the improvements made for DP open the way for other advanced tests. This also enables new possibilities for multi-model testing,” Immonen adds.

### Meet Veikko Immonen

Veikko Immonen is tasked with technical development projects for the model testing facility. He is also involved in developing the ice simulator and the ice load monitoring system. Veikko has worked as Development Engineer at Aker Arctic since July 2014. His master's thesis for Aalto University concerned upgrading the model propulsion system for DP operation.

Veikko likes long bike rides and does not mind pedalling in cold weather or through snow. In summer, he likes to spend time on a certain island in the Saimaa Lake district.

