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The first commercial application of the small scale, basic pod model installed in a ship model.

**MARIN engineers in cooperation with Eindhoven University of Technology have made a giant leap forward in the innovation of podded propulsor models. A new approach using a dedicated electric motor inside the pod, instead of a mechanical right angle drive was the result. This innovation greatly improves the accuracy and flexibility of model tests with pods. In addition, it facilitates the correct modelling of innovative, slender pod shapes. Report looks at this latest innovation from MARIN.**

# MARIN model pod innovation improves accuracy and flexibility

Until now, the usual approach to build pod models has been to use an external electric motor which drives a mechanical unit with bevel gears which transmits power to the propeller shaft. But there are several drawbacks to this method. Gears imply geometric restrictions which for certain pod shapes cause geometrical errors at model-scale. Gears also introduce vibrations which can disturb force and pressure measurement signals. Accurate pod unit force measurement, in combination with active steering is very complicated. Furthermore, the required angle between the propeller shaft and rotational axis cannot be modelled freely as it is always fixed to 90°.

## New questions

In addition, recent full-scale operational trouble with existing pods has raised many questions about the loads on pods. Particularly unsteady conditions are considered to be of importance when investigating the causes of early, unexpected mechanical failures. Research has generally been focused on steady state conditions, but investigating these new questions requires dynamic experiments. Existing tools to build pod models are not tailored for dynamic experiments. These new questions could only be answered by new tools. Therefore, a new direct drive pod model has been developed in cooperation with the "Design and Technology >

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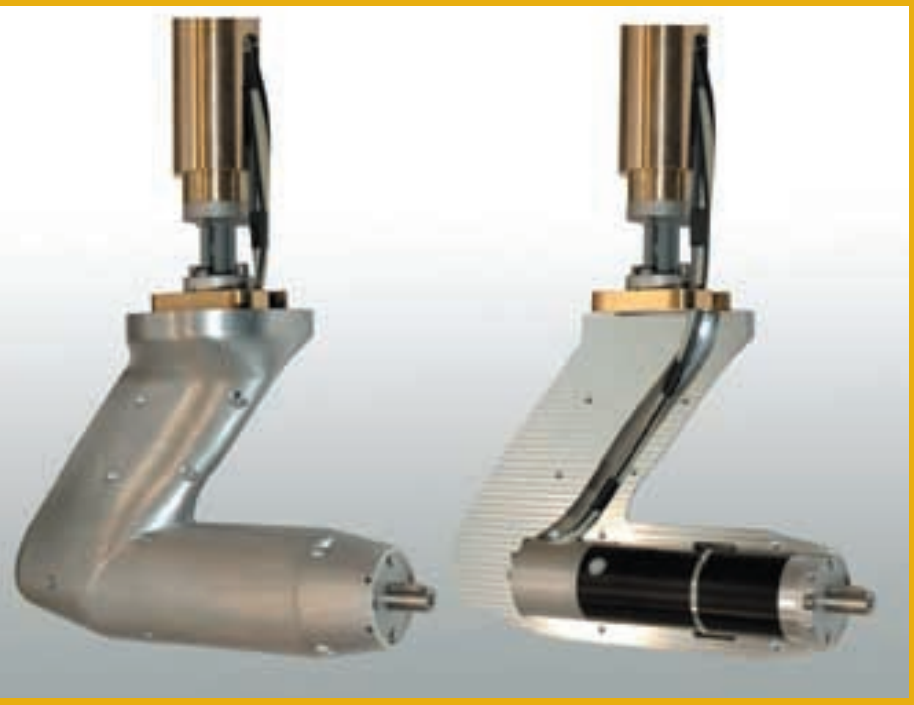
The small scale basic version of the new pod model.



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> of Instrumentation" group of Eindhoven University of Technology.

## New tools

To be able to serve the market for ongoing research on pods, two different pod model versions have been developed: a small-scale, basic version and a large-scale, more complex version. In both cases, the performance of the direct drive motor has been optimised for towing tank conditions.

The small-scale version is especially suited for manoeuvring and seakeeping experiments, where no detailed shaft measurements are needed. The large scale version is suited for propulsion studies where detailed dynamic measurements at the propeller shaft are needed. The small-scale, basic version provides sufficient power for pod gondola diameters ranging from 40 to 60 mm, while the large-scale, more complex version suits pod gondola diameters ranging from 70-120 mm. Both versions allow for dynamic measurements of the loads on the pod unit through a redesigned pod unit load sensor.

## New answers

This fresh approach opens new opportunities for model-scale research on pods. One of the main advantages is that reduced vibrations allow for better dynamic force measurements during steering. As yet, with the new set-up, data analysis is possible up to the first blade harmonic frequency. Improved filtering and correction methods may increase this frequency even further in the future. In addition, the disturbance of pressure pulse signals caused by vibrations of the drive system is minimised.

Through the elimination of the bevel gear transmission, the set-up has become much more flexible. Thus, innovative slender pod shapes with the strut connected to the rear end of the gondola can be modelled more accurately than before. The angle between the steering axis and propeller shaft can also be modelled correctly. Therefore, steering of the pod is improved and optimisation studies have become much easier.

## Expanding capabilities

In the near future, these new concepts will be further perfected and made ready for production. In May this year, the first prototype testing results are expected of a full six-component, propeller-shaft load sensor. With this new equipment, MARIN has extended and will keep extending its capabilities to serve the maritime market with even better predictions on the behaviour of podded propulsors.

## Proof of the pudding...

As Report went to press, data was being analysed from the first commercial project that has been carried out with the new pod models, in this case the small-scale, basic version. Seakeeping and manoeuvring tests with a ship model on a scale 1:20 have been performed. The vessel was equipped with slender compact pods which could be modelled well with the new pod model innovation. The large-scale, complex version will be applied in late 2006, in the new CRS project "Loads".