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Holtrop-Mennen founders reveal the secret of method's long-lasting success

In the naval architect world Holtrop-Mennen is a household name. As Jan Holtrop and Frits Mennen retire after more than 40 years at MARIN, Report asks them to reflect on their ground-breaking achievement.

1982

First simulator for Vessel Traffic Services worldwide

1983

"Australia II" with MARIN winged keel wins America's Cup

Courtesy STX Europe

The Holtrop-Mennen method has proved to be highly effective at the initial design stage to establish the still water performance and for estimating the required propulsive power. For some readers that may not be familiar with the Holtrop-Mennen method, the pair worked on developing a numerical description of ship resistance and propulsion, using basic hull dimensions. The total ship resistance is subdivided into components and each component has been evaluated by multiple regression analysis. Holtrop and Mennen examined almost a thousand model tests and a few hundred trial measurements from the MARIN database.

However, these two very modest men certainly did not set out to take the hydrodynamics world by storm. Jan went into the industry after finding that a mathematics degree was simply "too abstract". He then found his way to a shipyard and enjoying a more hands-on approach, this stimulated him to study Naval Architecture.
Perhaps Frits was more destined to work at MARIN. Frits used to while away his youth watching canal traffic and he always enjoyed making models of barges. Fortunately one of his teachers saw potential and suggested he go off and study for a maritime career.

True pioneers So both found themselves at MARIN in the early seventies and they were asked to go to the then new Depressurised Towing Tank and find a modern way to carry out data analysis with a focus on the extrapolation of model tests. Initially, the method was designed for internal purposes so MARIN could make more accurate predictions. "I knew something about the traditional power prediction methods but it was how to change these into modern extrapolation methods," says Frits.

"It really was a totally new area. Ships were rapidly becoming bigger and bigger and traditional methods of extrapolation were becoming more uncertain," adds Jan.

"Miracle method" A new "miracle method" was definitely needed, stresses Frits. After analysing all the components numerical formulations were developed from which scale-effects could be derived and by adding a few additional formulas, we could come up with a general power prediction method, Frits says.

Using the general extrapolation method of William Froude a percentage correction is to be made for correlation but for several classes of ships nobody knew accurately what that correction should be, says Jan.
A large negative correction was unthinkable but it was sometimes encountered in the correlation of model tests and in full-scale trials of the biggest ships. Under the component-based approach scale effect corrections could be made for the viscous resistance and the efficiency elements.
"It was much better to make a distinction between these components as it gives a more rational approach," adds Jan.
Of course, one thing that was crucial to the development of the Holtrop-Mennen method was having a very good database, points out Frits and that was just what he had access to at MARIN. A high quality database, with hundreds of model experiments and full-scale trials was vital, he says.
In the Depressurised Towing Tank with new test equipment in "unfriendly conditions" there was an urgent need to have adequate checks on the results, they add.

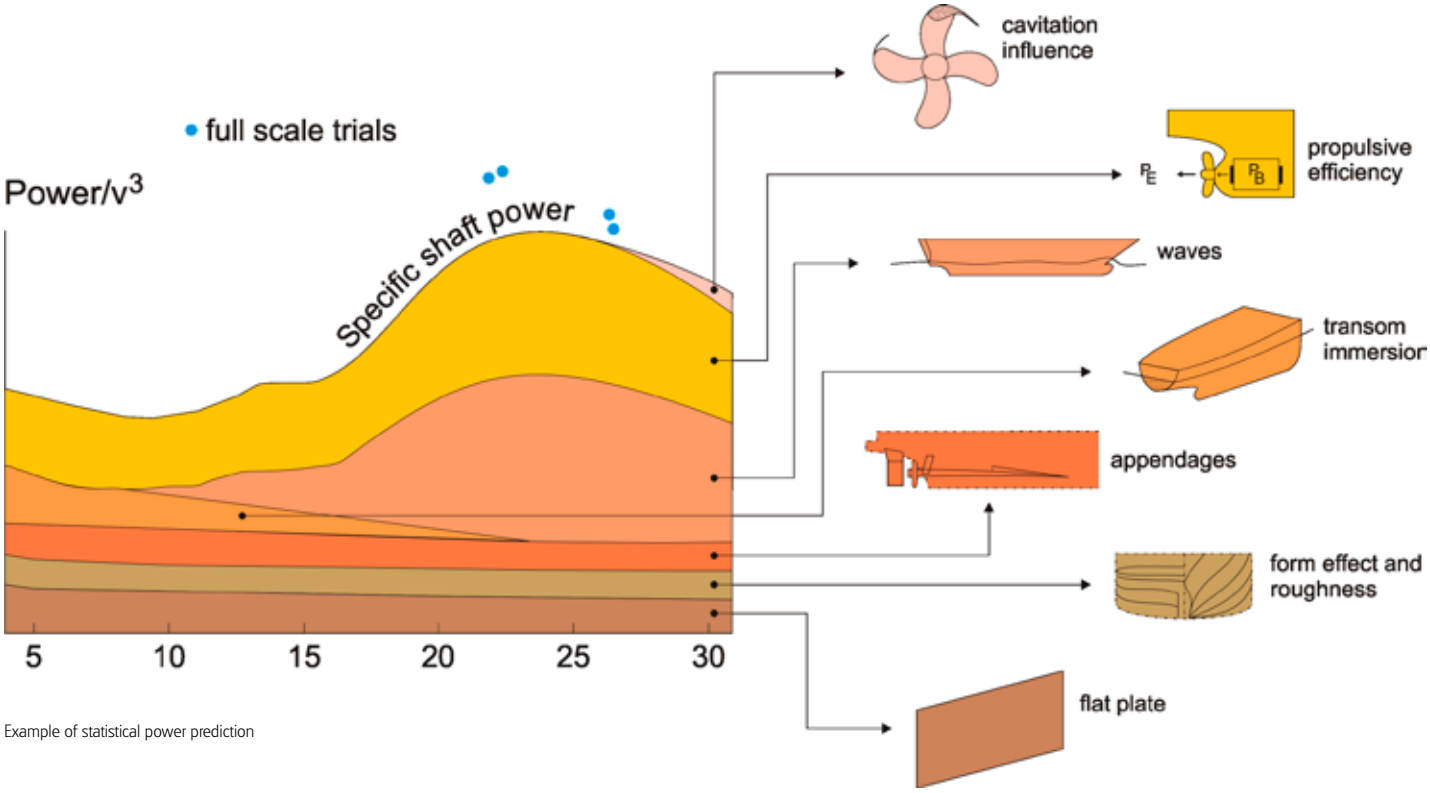
The two started with the system analysis and then reanalysed the model tests and the full-scale trials. The target was to have a component-wise prediction method that would show the difference between model and full-scale to serve the extrapolation of the model experiments, they explain.
The reaction was really quite a surprise, the two admit. After the method was first

1983

Start potential flow calculations for hull form optimization

1985

Model test of tow-out of Troll; concrete platform in 336 m water depth



Example of statistical power prediction

published, students worldwide got in touch. But things did not go quite so quickly in the naval architect world. There were some doubts, they add, as some naval architects still preferred the more traditional methods.

Certainly, one of the factors in its success was that the method emerged at virtually the same time as the computer found its way into the workplace. Computerisation changed things dramatically, Frits says. To make predictions for the resistance of a ship, many large graphs were needed. So it was always necessary to have a huge table! he laughs. "It would take about a day to find the performance of a ship but in the age of the computer just 10 minutes." The old method was very laborious and also literally you were relying on people's memory for correlation of comparable cases, he adds.

Available on Internet The Holtrop-Mennen method has been published several times and a PC program (DESP) was introduced by the end of the 1980s. DESP is also available on the Internet nowadays. Another important factor was that we decided to focus on a limited set of parameters, stresses Jan. "It is not necessary to have the complete ship form and all the details to make these calculations. We stuck with this simple approach and I think that is why the method is so widely used. Even now we only use about 15 parameters." The key to the method's success has also been its ability to be applied to virtually any ship type.

They both are certain that the method can go even further and could be used to explore extreme combinations of ship dimensions. For instance, the fuller coastal ship could be looked at or flat, wide, shallow-draught vessels. More data could be added to the propeller design part to improve the calculation for all kinds of nozzles, says Jan. "The method is still in development and a new generation can refine and extend our work."

Replaced by CFD? So as these two pioneers retire will their method also retire? The answer: a resounding "No"! CFD is substituting some parts of model testing but it is quite unlikely that it will replace this simple power prediction method soon, they stress.
It is extremely suitable for the initial design because of the limited number of parameters involved, stresses Jan. "You don't have to have all the ship's geometry details available." The method is also very successful with vessels with lots of appendages such as navy vessels, ferries etc. he adds. "A strong feature is that it can easily be checked against trial results of comparable ships or correlated with model tests on similar cases if you have enough data available. Once you have tested 9,000 models you should be able to predict the performance of number 9,001 with reasonable confidence!"

But of course, it could always be improved, Frits says. Frits has been involved in full-scale trial analysis for the last 35 years, spending many years interpreting and correlating full-scale data in a modern follow-up of earlier correlation studies by Franssen and De Jong. Sometimes he found systematic discrepancies, he says, so there is always room for improvement.
The Holtrop-Mennen method was very important for MARIN as well. Interest in the method meant that many new contacts were made all over the world. And as MARIN produces its 9,000th model (see in this Report), it can certainly be proud that the method is one of the most accurate tools the industry has.

1986

LIFSIM: time domain simulation of coupled 3 body motions

1986

SWOPS: first dynamic positioning for floating production