



MASTering the art...

The “Best Mast” project aims to tackle the problems of mast design as current industry knowledge is often stretched beyond all previous experience.

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Traditionally, masts and the rigging of sailing yachts were designed and built using the experience of the mast builder, yacht designer and sailors, whilst taking safety factors into account. Limiting criteria were the buckling loads of the mast and the maximum tensions in the stays and design. But in addition, extreme weather, mast buckling, high tensile materials and aesthetics, all had to be taken into account.

Since the introduction of composites and modern design software, the requirements for rigging have been stretched beyond all of the industry’s traditional experience. Various tools for evaluation of designs are available but the knowledge of actual full-scale occurring loads is always a grey area.

In a bid to tackle such issues the “Best Mast” project was initiated by Nirvana Spars of the Netherlands, MARIN, MSC Gouda and TNO. The project’s aim was to develop a design load model and a software tool to facilitate a combination of the load model with modern FEM-based engineering software. The model should include loads in the mast and rigging by the combination of static pretension, quasi-static, wind-induced loads and dynamics, generated from wind variations and wave-induced ship motions.

Full-scale tests

MARIN’s role in the project comprised the determination and evaluation of the actual loads occurring in a full-scale sailing yacht, during its year-round operation. The Jongert-built sailing yacht Flying Magic was outfitted with extensive instrumentation during a refit in late 2002. More than 100 parameters were logged, varying from mast compression loads, mast bending moments and stay forces, to ship motions, accelerations and wind data. Sensors were integrated under decks and inside the mast in order to prevent visible cable penetrations and problems with wear under the constant weather and water loads.

The measurements continued into 2004 and included time in the Mediterranean, Atlantic and Caribbean. The behaviour of rig pretension and quasi-static loads under various wind angles was clearly identified from the measurements. “Best Mast” found the contribution of dynamic loads proved to be extremely significant. Their correlation with various motion components showed up from the long-term measurements taken. This made it possible to define a more general dynamic loading algorithm for the design stages.

Evaluation of this measured data is still ongoing at MARIN but the project is expected to be finalised in September this year.

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