Vessels highlighted
NH 1816
Arklow Bank

The vision of
Peter Zorge
Director Business Group Maritime at Econosto Nederland bv

Special
Ports & Maasvlakte 2
When the Dutch indemnity insurance company NH 1816 decided to sponsor the Royal Dutch Life Saving Association (KNRM) in 2009, there was no urgent need for a replacement vessel in the KNRM fleet. This created the opportunity to develop a new type of Search and Rescue (SAR) vessel, corresponding to the present-day needs of the association.

While the volunteers of KNRM are very satisfied with their current largest SAR vessels, the Arie Visser Class, there are undeniably points for improvement on this design, which for the past twenty years has braved every storm on the North Sea coast. The main goals for the new design were to reduce noise and vibrations, to reduce the fuel consumption and emissions and to improve the comfort and safety of those on board. For the development, a task force was set up with the following parties:

- KNRM, as a client with a wealth of real-life experience,
- De Vries Lentsch, the naval architects responsible for the Arie Visser Class of vessels,
- Damen Shipyards, international shipbuilding group with an interest to broaden their portfolio,
- TU Delft, renowned university and research institute with a strong emphasis on fast craft.

In the earliest stages, two concepts were developed: an enlarged and improved version of the Arie Visser Class and a new type, which integrated elements of the axe-bow principle developed jointly by Damen and TU Delft. A free-sailing model was built for each of these, along with a third model of the Arie Visser Class, which would remain a benchmark throughout the design. The three models were extensively tested in North Sea wave spectra, both at TU Delft (for bow and stern waves) and at MARIN, were the large wave basin allowed for testing with stern and bow quartering waves.

**Sea axe**

Research of Lex Keuning (TU Delft) indicated earlier that a ship’s speed in waves is mainly determined by what the crew considers acceptable for both their own limbs and the strength of the vessel. This appreciation of the crew is primarily guided by the strength and frequency of extreme vertical accelerations. For endured sailing, the crew will try to keep the acceleration at the helm seats around - or preferably below - 1 g. The research at TU Delft led earlier to the successful introduction of Damen’s sea-axe designs for crew suppliers, of which derivatives were built in the form of yacht support vessels and catamarans for wind farm maintenance. The dynamics of a much smaller SAR vessel in breaking waves are of course totally different, which justified a detailed study to verify the potential benefits.

**Vertical accelerations**

By minimising the difference in volume above the waterline and below the waterline, the sea-axe bow makes pitching motions in waves softer, as it avoids the sudden contact of a wider portion of the hull with the water. Certain aspects of the sea-axe design could not be applied on NH 1816, such as the deepest point at the bow, which would make beaching impossible. Nevertheless, the adapted sea-axe bow proved efficient; in head seas of an identical wave spectrum, vertical accelerations of 2 g at the bow have a probability of ten percent in the Arie Visser Class, while they only have a probability of three to four percent in the NH 1816.

The highest acceleration levels encountered are reduced by 50 percent (from 6 g to 3 g).

As a result, the crew will be able to maintain a higher speed, and reach a long-distance target in a shorter time. Or, when sailing at the same speed, the comfort of the crew will be significantly improved. An added benefit of the longer waterline length is the reduction in fuel consumption. While this would be ten to 25 percent lower at the same displacement as the Arie Visser Class, extra systems and functionalities have made NH 1816 about 4.5 tons heavier. Still the resistance curve up to 30 knots is practically identical to that of the Arie Visser. The extra weight only becomes a factor when sailing at 30 knots or above.

**Broaching**

Significant attention was given during the model tests to the avoidance of broaching.
Although the boat has enough power to outrun the waves and thus avoid surfing, which can initiate the sudden uncontrolled shift of heading called broaching, there are times when the speed cannot be controlled at will. Examples are failure of an engine or towing of another vessel. To ensure course stability and the proper balance between the lateral surface in the bow and that in the stern, NH 1816 is equipped with two fixed fins, made of carbon, in the stern. These can be retracted with a hydraulic system to avoid damage in shallow waters and reduce the turning circle when steering between breaking waves. The blades have been engineered in such a way that they will shear off in case of contact with an object (or the bottom) without damaging the boat’s hull. During model tests, NH 1816 proved less prone to broaching than the Arie Visser model when the fins are deployed.

Fenders
Contrary to her predecessor, NH 1816 does not feature inflatable tubes, but a large foam-filled fender. More compact and positioned slightly higher, the fender will have less of a braking effect in uncoming waves, and the space on the side deck is significantly increased. There is also no risk of puncturing the tube. The bow is about 40 centimetres higher and entirely closed, resulting in more buoyancy in the bow, in spite of the lack of flare and overhang.

Composite deckhouse
Another important design goal was the reduction of noise onboard, which went from 53 dBA (A) to approximately 75 dBA. The largest contributor to this is the flexibly mounted composite deckhouse, built by North-Line in the Netherlands. It is joined to the aluminium hull (built in Poland) with adhesives and a rubber strip as vibration isolator. A bolted connection (built in Poland) with adhesives and a rubber strip as vibration isolator. A gate valve is partially closed to ensure that the exhaust flow has enough pressure to keep water out of the exhaust lines.

Manoeuvring tests were carried out with the models, and in these NH 1816 performed smaller turning circles than the Arie Visser Class when her fins were up, and larger when the fins are down. With hydraulic control from the wheelhouse, the choice between optimised course stability or optimised manoeuvrability will always be at the helmman’s fingertips.

Waterjets
Essential for manoeuvrability, shallow-water operations and the safe recovery of persons at

Engine redundancy
The engine room is divided in two separate compartments by a watertight bulkhead on centreline. Nevertheless, there is ample space around each of the engines for maintenance. Each main engine also has a completely individual fuel supply, with for each a small gravity tank automatically topped up by a fuel transfer pump. The watertight integrity of the vessel is exemplary. Even with two compartments flooded, the damaged stability criteria are met. The bottom can be damaged for 50 percent of the waterline length without catastrophic loss. The boat is also self-righting in the event of capsizing.

The electric system is also built to be redundantly and has two power sources. Each consists of a 230 VAC hydraulic generator, with hydraulic oil pressure generated in a PTO pump on the.

Engineer responsible for the project, John Nieboer, is keen to point out that a scientific approach - read number crunching and testing - is essential for a satisfactory result.

For the structural design, the rules from classification society Lloyd’s Register were only a minimal starting point. To put a number on the dynamic effects encountered when receiving a large boiling mass of whitewater head-on, damages on the current KNRM fleet were analysed. Damen’s engineers calculated how much pressure is needed to create certain indents found onboard the vessels and these were used as design pressures for the structure of NH 1816.

The new vessel will now be extensively tested over the next six months by KNRM’s experienced skippers in a variety of conditions. If the design proves to be as successful in the real world as the model testing indicates, it may well become the new benchmark for SAR vessels.

Bruno Bouckaert

Subcontractors and suppliers of equipment fitted on board the NH 1816 - VN 535501

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NH 1816 - VN 535501

AMW Marine, Bremen, Germany: Buckets, deck modules, crane, pontoon, winch

Coffin, Friesland: Command position, navigation, communication, galley

De Nooijer, Schiphol: Engine room, accommodation, machine room

Durco: VLS, separators, LPG modules, cargo modules, accommodation

Eex, Enschede: Lifeboats, firefighting equipment

Femtec, Eindhoven: ECO, position processors, computer systems, isolator

Fysergo, De Bilt: Communication

Genie, Westland: Crane, winch

Havland, Lemmer: Builder, dry dock, accommodation, engine room

Holland, Den Helder: Foam-filled D-fender

Innovations, Fender, Den Helder: Foam-filled D-fender

Knott, Terneuzen: Propellers, blades, generators, pumps

Krauss, Emden: APU, air conditioning

Kroon, Emden: VLT, PLC

Linde: Oxygen equipment

Lovol, Shanghai: Engines

Mitsubishi: Propellers

NH 1816 - VN 535501

Solico, Solingen: Warmth, isolation

T&D, Solingen: Propulsion

Tilia, Hamburg, Germany: Electrical system design and testing

Tug, Poland: Propulsion

Wageningen: Free sailing model scale testing

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MARIN, Rotterdam: Classification

De Keizer marine engineering, Eindhoven: FEM calculations aluminium hull

Zwartsluis: Hydraulic driven generators

Zaandam: Electrical system design and testing

Winel, Zaandam: Propulsion

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Aria Visser

Fysergo

Fyn Port

Femtec

De Keizer marine engineering

Zwartsluis

Fender Innovations

Eindhoven

Femtec

Zaandam

Rotterdam

MARIN

Hamburg

Tilse

Dordrecht

Harlingen

Wageningen

Tu-Delft

Solico

Servowatch

Northline

Knott

Wageningen

Winel

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Tilse

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