



The Axe Factor

Damen & Amels take a bow

By **Tork Buckley**

Plumb bows are found in both retro (such as Delphine) and ultra-modern designs (such as Wally sailing yachts). Plumb-ness of stem purely for style is often confused with a special-purpose bow that is part of the vessel's hydrodynamic design. Here we try to dispel the confusion and look in depth at the Damen axe bow featured on their Sea Axe vessel. We report on how it actually performed when I sea trialled the first unit to be delivered as an SSV. (SSV is an acronym The Yacht Report devised for the Superyacht Support Vessel. They are close relatives in many ways to an Offshore Supply Vessel, and it sounds so much more dignified than a 'toy carrier'.)

Axes and 'X's have become confused. The X bow was developed by the ship design division of Ulstein. It was developed in 2005 and had its first use on *Bourbon Orca* in 2006. There is little change below the waterline to a normal hull, but the bow rises up and slopes massively aft from where the forward end of the bow would be on a conventional Offshore Supply Vessel. The aim is similar to that of the Damen axe bow, with better efficiency (through lower hull resistance), better performance in a head sea, less slamming and higher maintained speed.

Feadship's *Predator* has a form of X bow, of which in issue 94 Chris van Hooren commented: "The keel is raked from 3.5 to 3.6 forward to 4.2 aft. Aft the hull is pretty conventional but forward we arrived at a particular hull form which is a little bit in the direction of an X bow." The X bow was also featured in the de Voogt X-Streams' design study – see issue 80. Some other designs have also been proposed with this

bow. Sabdes Design drew what looks like an X bow at 50 metres and also proposes a 72.5-metre for Icon Yachts; confusingly these are dubbed "Axebow". Arguably, unless following the Ulstein design, they are not true X bows, but as will become clear nor are they axe bows; their form is wholly different and the draft change is nothing like the TU Delft, Marin and Damen axe bow.

The Sea Axe was a logical evolution of the work Damen did in developing patrol craft that could maintain speed and comfort in bad weather.

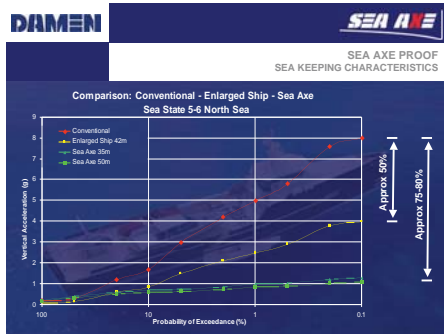
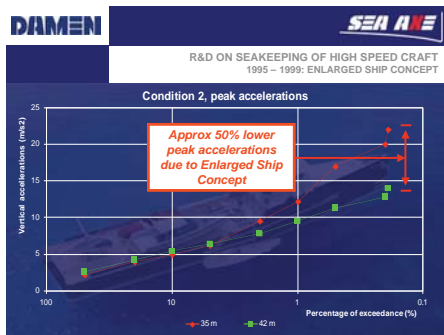
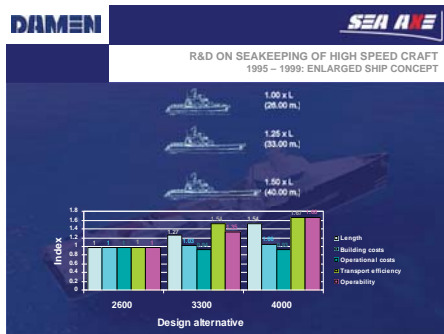
The Damen Shipyards Group is a family-owned Dutch company with 34 shipyards worldwide, 6,700 employees and around 1.4 billion euro annual turnover in 2009. It specialises in high-tech vessels and has become very successful with its standardisation philosophy. In 1991 Amels became part of the

Damen Shipyards Group so was not part of the initial Research and Development consortium. The Sea Axe Fast Yacht Support function is a logical product development from the Sea Axe's Fast Crew Supply role. Amels first identified the potential for sale into superyachting and then marketed the Sea Axe to superyacht clients.

Amels have been doing pretty well in that role. *Oberon* is the first of two 50-metre SSVs and in September, a walk-up visitor at the Monaco Yacht Show resulted in a contract for a larger 67 metres one at twice the displacement of the 50-metre.

There have always been a number of approaches to the SSV. I recall Peter Jago saying at a previous Project event (the former Global Superyacht Forum) that a support vessel should always be faster than the mother ship. This seems very sound; the toys get put away last and out first; if there is an interim passage at a higher speed than the yacht, then this is a must.

AXE BOW | AMELS' SEA AXE



Not all SSVs, though, have conformed to this logic. A number are former Offshore Supply Vessels or replications of Offshore Supply Vessels and are relatively slow. There have been fast designs: the late Björn Johansson proposed a very fast 50-metre multihull and BMT Nigel Gee discussed the economics of both fast and slow SSV designs in issue 108 on page 48 and in depth in a RINA paper (which was a synfo extra to issue 108). Another well-known yacht owner has a SSV in build in South Italy (we hope to report in detail on that later); it's known to be near completion and in sea trial phase.

The Sea Axe has a top speed of 25 knots and can make a Transat passage at 18 knots. *Oberon* is powered by four MTU 12V 400 M90s driving four fixed propellers. This is a special option, though, as CAT 3512 or 3516s are standard fit on the 5009 50-metre Sea Axe vessels. It was a logical evolution of the work Damen did in developing patrol craft that could maintain speed and comfort in bad weather.

Although in their Offshore Supply Vessel role they can and do carry cargo to a rig they are also crew boats designed to bring crew to and from rigs at high speeds in all weathers. The predecessor platform was the enlarged ship concept (top image) based on the theory that the longer and finer the hull the better the comfort, and higher the sustained speed.

The premise was that extending the LOA is relatively cheap and in fact (second image) it was found that over four aspects of effective cost were reduced. Extending from 26 to 33m cost a mere 3% more (6% to 40m), but returned transport efficiency of 54% and 67% along with greater comfort. Those extensions were, it seems, a bit extreme for many, but the modest extension of 35 to 42 metres produced a reduction of vertical peak accelerations by up to 50%.

The evaluation of that figure is based on the percentage of chance of exceeding a given vertical acceleration as shown in the graph scales (third image).

In 2000, Lex Keuning, assistant professor at Delft University of Technology, started to look at a different approach for improving seeking characteristics of high speed craft. The result would be the Sea Axe first built in 2006. In the period of 2003-2006 Delft University, Damen, the Royal Netherlands Navy, US Coast Guard and Marin Wageningen carried out an extensive research program to determine the merits of the Axe Bow Concept. Three high-speed hull forms were tested both at Delft University and Marin Wageningen: the enlarged ship (as a base model for the research project), a wave piercer (somewhat like the later developed X-bow) and the Axe Bow

A complex formula (see Synfo extras) defines the Axe Bow, but in simple terms it has a higher bow, less change of water line beam, finer entry, less (actually no) flare and a deeper bow, deeper than any other part of the vessel; it resembles an axe in profile hence the name. Also three unusual short chine-like parts on the bow (see page 52) are a vital part of the design's function. In addition, the greater the LOA of Sea Axe the more effective all this is.

Why the hull works is well illustrated by the difference in sound and pain if you slam the flat of your hand hard on water or do the same with the edge. The comparison with conventional enlarged and Sea Axe forms is shown here (bottom image), which shows the difference of a conventional hull enlarged ship at a reduction of 75 to 80% with vertical peak accelerations that was achieved in sea state 5 in the North Sea.

Clearly this is not a concept; to date 20 have been delivered, with currently 17 in build. The roles are

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diverse; the majority are Offshore Supply Vessel/crew boats. Military and para military versions are available along with those for SAR, pilot duties etc, plus of course one SSV delivered, one in build and one under contract. Damen has the exclusive licence on the Axe Bow patents, which are owned by Delft University of Technology.

So much for the theory and numbers: does it work? It clearly does; "I do not believe that any other ship of this limited size and weight can come close to this sustained speed for such a long time in these conditions." That was the endurance sea trial captain on four hours steaming at 29 knots, Beaufort 7 with significant wave heights of 2.5 metres in very confused seas on a 35-metre Sea Axe.

I was invited by Amels to attend a sea trial just prior to handover of *Oberon* – the first of the SSV pair. The yard gleefully wished for really bad weather so I would experience first hand how it performed. The sea trial started in the Maas River and we zipped off towards the Hook of Holland, with a Damen patrol boat on the cargo deck to give some idea of a typical payload. Weather was fair with some wind, but as we approached the Hook the vessel could show off its heavy (weather) mettle. At the entrance shallow banks, riverine flow and a sharp depth change conspired to produce really nasty, short, sharp waves. These we passed very well with minimal to zero slamming.

Though there was – as might be expected – large pitching movement speed, it was effectively soft at both ends so transition from pitch down to up and visa versa was painless, even if the amount of pitch made keeping on one's feet a bit hard. There was no discomfort expect perhaps for those prone to seasickness. However, compared with most yacht hulls or even conventional ones in the same conditions, it was very comfortable.

Certainly the lack of slamming endorsed Damen's claims and it was quite evident that neither hull nor machinery was taking any harm. Speed was reduced only slightly from 25 knots with a solid 20 knots of forward way easily maintained. It was a fairly wet ride but after all flaring bows are there to keep a yacht dry. This workboat incurs no harm from taking water over and indeed above the bridge. In line with its offshore role the bridge offers a full 360 degrees view: a total joy for masters compared with any yacht.

In fact in Offshore Supply Vessel use there is also an aft facing chair for coming stern-to rigs etc, and offloading whatever is on its 225m²/250 tons cargo deck. These chairs are part of the overall bridge package that Alphasatron affords total control from in a seated position – a legacy of the need to manoeuvre and unload cargo to one metre accuracy alongside a rigid structure in massive waves.

The aft chair has been removed on *Oberon* and the area will be modified after handover to owner seating. Unusually *Oberon* is being handed over part finished – or at least cosmetically so.

I found *Oberon* just right for its purpose. Though I agree the steel deck would benefit from decking such as Bolidt, yacht quality fairing and finish seem both unnecessary and add to the work load on crew whose job is carrying, handling and servicing toys – not polishing



and washing down. Victor Caminada for Amels surveyed captains and owners about this and interestingly – surprisingly – most wanted an SSV to full yacht finish.

Yacht finish or not the Sea Axe is an interesting and aggressive looking vessel that would be a fine addition to a superyacht owner's fleet. *Oberon* will go fast and stay fast through horrible conditions; the ideal SSV characteristic – despite a rash of slower designs and speed rules.

The other visitors on the sea trial were all non-superyacht; predominantly from a fairly new operational sector – offshore wind farm servicing and construction. They were suitably impressed. Windmills usually break when it's bad weather so this may be a new growth sector for the design. There has to be a downside as there is to all designs. One is the narrow beam (9.7 metres on the 50-metre) and the fine bow's effect on crew accommodations. This may be easily dealt with by simply and cheaply adding length.

For a Helo pad to achieve regulatory compliance, deck extensions athwartships would likely be required. One look at the Helo deck on an Ulstein X bow (below) shows how function supersedes form and cosmetics. However, both these are easily engineered and on the 67-metre Sea Axe SSV a certified Helo pad is incorporated on the aft ship. This could of course be achieved



