



## Thing of beauty

Akihiro Kanai from AC Technology describes the development of a contemporary 30ft racing yacht, the K30W, designed to be competitive under IRC and in the HP30 class while also employing a sustainable building method, with wood used throughout as the primary building material.

The new wooden racer, launched in December 2021, is a development of ideas first explored with a 24ft wooden boat, W24, which we designed in 2012. The goal was to achieve the high performance of a modern racing yacht while taking advantage of the benefits offered by modern wood construction.

Based on the design of the all-carbon racer K36 Samurai, but with improved performance, K30W brought onboard Naoyuki Umeikawa of Wood Frailer as builder and Steve Koopman of SOK who worked with us on the K36 Samurai as structural engineer.

The impetus for this project was to create an even more extreme wooden racing yacht. The idea was that the new boat would be a result of lightweighting the deck and hull, and carefully use against current composite-built yachts under the IRC rating system.

The freedom and flexibility that IRC allows designers within a relatively simple framework is a great basis to be creative in the design of a wooden racing boat. The owner of W24, Yoshiaki Jimno, fully endorsed the new project.

When first starting out as a CFD researcher 30 years ago my first task was undertaking research on wave-making drag reduction. I have since used CFD as a tool in the development of America's Cup boats and countless other subsequent vessels of all types in the pursuit of performance.

These efforts have led to fuel efficiency improvements in commercial vessels, reducing carbon footprint and fuel consumption by designing new hull shapes, sometimes introducing sails as secondary propulsion. As a return to the old ways of sailing boats I had also been thinking about the possibility of wooden boats for the 21st century. The idea was to create a modern racing boat as the latest in the evolution of the sport.

Despite its wooden construction K30W employs the very latest

The K30W is at the sharp end of wood-savvy construction but it still offers a glimmer of optimism to those who bemoan the lack of opportunities for home-built offshore IRC designs in the fashion of the original IOR 14 and even 1/2 Tonners. The new boat should be racing in Europe by the end of this year, which will give a good gauge of performance in both IRC and HP30 class. Stiffness and sized rigging are in the agenda for the HP30 class. Stiffness requires E-glass design and similar to a much more expensive carbon build, its performance to date has proved 'more than sparkling'

panels. Two longitudinal webs run between the transom and main bulkhead, supporting both the cockpit and hull panels.

The substantial heeling and grounding loads induced by the deep, high-aspect keel fin are supported by extending the top of the keel fin to the underside of the cockpit sole. This avoids having to use large wooden laminations in the bilge to support the keel loads. The carbon fin is contained within a thin fibreglass trunk to maintain watertight integrity and a thicker integrat flange around the bottom of the trunk disperses the keel loads into the surrounding wood hull. The carbon fin is supported by a thick, multi-layered wood bulkhead.

The hull was cold-moulded with four layers of wood, including the first layer of planking, each epoxy-bonded with vacuum bagging. The inner and outer veneers, of red cedar and mahogany respectively, are oriented longitudinally to span the transverse frames and to provide a visually pleasing orientation for the clear final finish. The inner veneers of red cedar are oriented at +/-45° to provide shear and cross-grain strength. The frames, deck, cockpit and chamfer panels are all made of Baltic birch plywood.

The shroud chapelets are of typical carbon uni-strap construction lapping onto the hull sides. However, to accommodate the relatively low peel strength of wood grain the carbon uni-strap are interlaced within the planking veneers, doubling bonding area, and are extended further down the towsides than would be found on a more contemporary composite structure.

In regard to the global stiffness of a wooden hull compared to a carbon hull, the thickness of the carbon hull is multiple times thicker than the wood, but the wood thickness is multiple times thicker than the

combined outer and inner skins of a carbon boat. So the overall global bending stiffness is actually much higher than that of a conventional E-glass laminate design.

Umeikawa of Wood Frailer believes exploring using trees, which naturally create the structure of wood without any difficulty, is something we need more of in the age of carbon neutrality.

Since this period of building coincided with great advances in digital fabrication, new technologies such as 3D CAD, CNC router, laser cutter, 3D printer, 3D scanner and reverse engineering all enabled us to combine traditional wooden shipbuilding techniques with the latest digital technologies. For example, the frames of Baltic birch plywood were all CNC-cut and fabricated, ensuring accuracy and saving a significant amount of time in assembly.

The deck layout was designed to make the large cockpit ergonomically efficient, with the sliding hatch placed on the floor of the cockpit instead of on deck. The minimal small pit is located aft of the mast, and the forward vertical side of the cockpit is also the rear of the mast bulkhead, which contributes to a lighter weight and less deck area.

The boat maker, Tetsuya Sasaki, introduced the latest deck gear and control systems for the K30W, including the latest B&G Nemesis displays, Spinlock softiejo clutches, UNREEL revolution reels for spinnaker halyards and Brother system for sail sheets. Some custom parts for bushes and dogbones were developed from scratch by the team members.

The first sailing was in 20k of very cold northerly winds on Lake Biwa in the middle of Japan. The boat showed good balance, stiffness and a nice soft feeling steering through waves without any creaking sounds at all (in general I think that wooden boats have a very different way of absorbing vibrations in waves).

We expected to join the HP30 race at Cowes Week in the UK this year for the start of our K30W campaign, but had to postpone to next year due to the unstable international situation and other factors. But we look forward to the K30W soon competing alongside other high-performance boats in the IRC and HP30 fleets.

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