Coen Meerbach

With the superyacht industry remaining buoyant, and shipyard order books full for several years, there are increasing opportunities for composite structures aboard these luxury craft.

Whilst full composite constructions remain more common in sailing superyachts than in motor yachts, even the traditional heartlands of steel and aluminum superyacht building in the Netherlands, Germany and Scandinavia are seeing increasing amounts of composites making their presence felt.

Whether composites are to be used for the construction of the entire yacht or for some of the components described below, there are still several important issues to consider when it comes to exploiting the full benefits of these lightweight materials.

Detailed design engineering, construction processes suitable for the design, finding a capable manufacturer, project management, production validation, and liaison with class organisations are just some of the challenges.

These are all key areas where an experienced composite engineering partner can add massive value to the project.

With maritime work in their very DNA, Solico’s engineering team has been proud to work with composite manufacturers, rig builders and shipyards on some of the world’s most stunning superyachts. In this review, we will look in more detail at some specific applications where composites really prove their worth on board (Fig. 1).

Radar and communications masts – the ultimate engineering puzzle.

A superyacht mast must support multiple sets of equipment (typically yachts carry dual installations for radar and communications to remove blind spots and provide system redundancy), complement the vessel’s exterior styling, and present natural frequencies that eliminate resonance in use. With some of these mast structures as large as 15 m from foot to tip, composites are, in many cases, the only viable solution.

Satisfying the designer’s aesthetic requirements and validating the mast’s structural performance are generally the first steps in the design process. Then, the more complex analysis of the structure’s vibrational modes begins. It is often the mast’s natural frequency modes, and how these might be excited by the interaction with the vessel’s propulsion at certain speeds, that poses a greater engineering challenge than the initial design.

By using carbon fiber pre-preg or semi-preg materials, Solico has been able to deliver weight savings of 30–50% vs similar aluminum mast structures, with advanced composites also allowing the fiber paths to follow the loads enabling more fluid and organic forms that may be difficult or impossible to form in metals.

As well as new builds and refit work, Solico’s experience can also be applied to coding and approval issues. In 2020, the company helped the captain of the 82 m Amels built Ilona with a major operational hold-up. When new regulations meant the yacht’s radar mast harness points couldn’t be used for cleaning and maintenance as they now required pre-installation testing, Solico was able to supply calculations and design data validating the system that had been installed in 2003 (Fig. 2).

“At Solico we often say the radar mast is the most complex composite structure on the vessel, where we may see different composite production techniques such as hand lamination, infusion and prepreg processes using both glass and carbon fiber reinforcements, all contributing to meet a bespoke set of structural, aesthetic and natural frequency requirements unique to each vessel.” Coen Meerbach – Maritime Business Unit Manager

Composite structures turn helidecks into swimming pools

As superyacht designers aim to maximize the use of space onboard, elegant solutions have been proposed that use movable
surfaces to create swimming pools when the vessel is at anchor or in port, with the pool floor acting as a helideck or even dance-floor in the raised position.

Solico has now engineered more than 10 of these structures, with each project bringing a unique set of engineering inputs. Pool size, shape, type of helicopter, and deck load ratings all have an impact on the design as well as mechanical details such as how the floor will integrate with the lifting system.

Interestingly, most of these sandwich composite structures are quite buoyant, so they need to be pulled down and locked in position to form the pool floor. Teak decking is often used to provide a seamless deck finish when a floor is raised, and a comfortable surface for bathing when the pool is in use.

Solico’s project scope typically involves full engineering of the composite structure, detailed design for production of the composite parts and any metallic interfaces with the lifting and lowering system. In addition, Solico provide the relevant class organisation with all calculations and testing to complete the rating and sign-off of the helideck.

Whenever a vessel needs a deck, door, hatch or panel to move, lift, slide or open, we’ve got a composite engineering solution to make it happen (Fig. 3).
Enhancing stability with lightweight superstructures and canopies

With their raised position on the vessel, the mass of superstructure parts and canopies has a significant contribution to a yacht’s stability. Therefore, lightweighting of a composite design, or a switch from metallics to composites for weight reduction is a common scenario in this area. In some cases, vessel weight rising above target during the build forces a switch to composite materials relatively late in the project.

Solico has engineered superstructure elements and canopies for some stunning superyachts as well as motor yachts, often having to react quickly, and propose rapid tooling concepts and production processes to accelerate programs as the vessel nears completion.

In 2019, the 52m Feadship built Broadwater arrived at Huisfit, Royal Huisman’s dedicated refit division, for a 4m waterline extension and a full refit. At the same time Solico’s engineers were set challenging weight reduction and stiffness targets for the yacht’s new 8m x 8m canopy and mast assembly.

Combining carbon fiber composites for stiffness and strength, with glass fiber used for specific areas requiring full radar transparency, Solico delivered on all counts. Fully detailed equipment mounting points and even certified harness positions meant builders Rondal could fast-track the build without any delays (Fig. 4).

Growing in parallel with the superyacht sector

Solico believes that industry will see a period of continued growth in the integration of composite structures into superyacht build programs over the next 5–10 years. As owners and designers look to add more features and equipment to their vessels and the market in general seeks to improve sustainability and reduce emissions, efficiently engineered lightweight composite structures deliver on all counts. With market leading expertise throughout the vessel, and their recent expansion of the maritime engineering team, Solico provides a complete superyacht engineering package.