

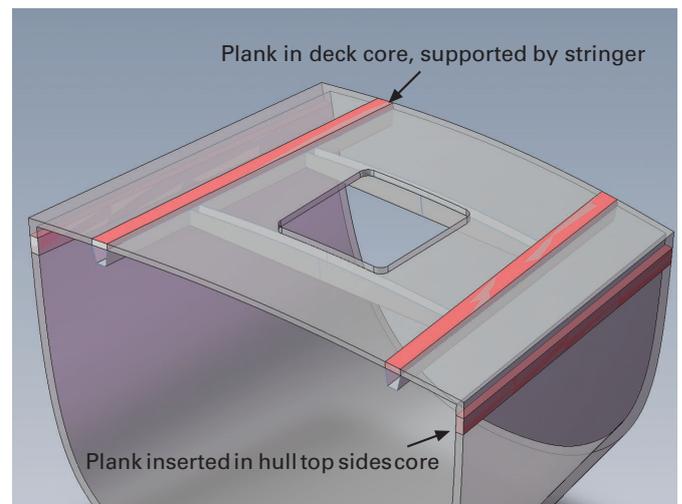
## UD PLANKS AND THEIR EFFECT ON DECK DESIGN

**Mast compression and tension in a sailing yacht's runners/backstay tend to bend the boat. This bending creates compression in the deck and tension in the hull bottom. Only measurable using specialist equipment, the bend is not apparent to the eye. Even though the bend is slight the forces in the hull and deck are very high and without the necessary support the structural integrity of the entire vessel is compromised.**

The installation of uni-directional (UD) planks helps to deal with the compression and tension that the boat is subjected to and provides a means by which to reduce the threat of buckling. The reason that the hull girder does not bend like a banana is because it has been specifically stiffened for these loads with reinforcing fibres aligned with the load direction. This is one of the main advantages of composites: the ability only to put stiffness/strength where needed.

On a small boat this is easier as the UD can be spread out, but as the boat gets bigger there is a notable increase in the compression load the deck is subject to. What then happens is the sandwich panel can't take the load intensity. The form of buckling can either be as a long wavelength "Euler" type or a short wavelength buckle. Euler type buckling can be prevented by adding supporting structure. However, with very high load intensities there is a point at which it is almost impossible to stop a short wavelength buckle and so there is a need to concentrate the UD into planks supported by the structure.

Increasing the vertical separation of the fore and aft bending material increases its effectiveness. This might make placing it on top of the coach-roof attractive but in order to work the fibre has to be continuous. However, coach-roofs are usually short and are often interrupted by the cockpit. UD planks then affect the deck layout as they need to be continuous and cannot be bolted or cut through. To do so would compromise its load bearing capacity. This means yacht designers are frequently constrained in this area as the planks are crucial to the fore and aft stiffness of the boat.



**Deck UD planks**

Having defined concentrated areas of reinforcement which need to be continuous smooth paths, these areas become no-go regions for hatches or deck fittings as they become king-pins: the key to providing stiffness and strength required. Consequently the side decks are used as the highest continuous path. If you look at the deck laminate drawing of a small boat (40-50ft) the tapes can be seen spread over the side decks.

This enables rig tension to be achieved without flexing as the forestay load increases when winding on the runners. Sometimes a concentrated plank with a beam under it is used to further increase its load bearing capacity.

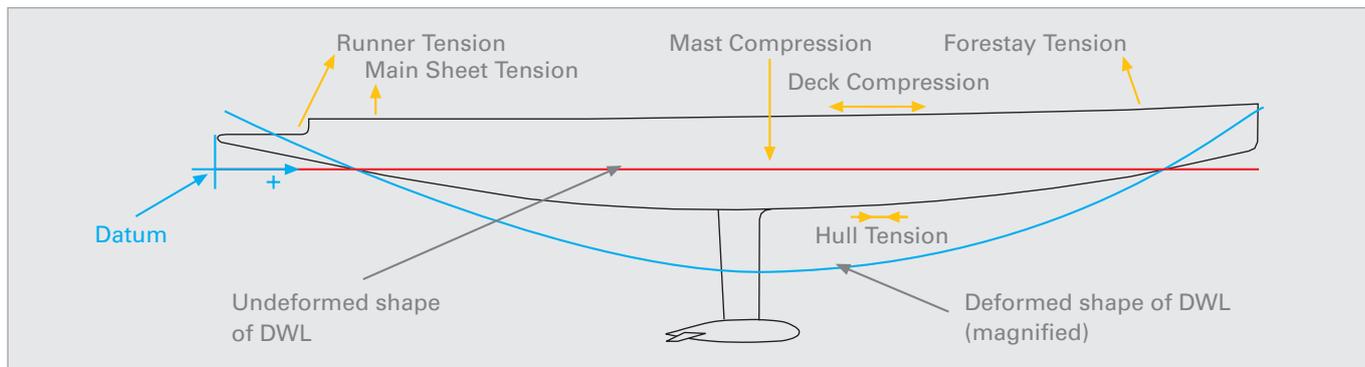
However as boats get bigger they tend to get sleeker, i.e. the length increases more than the depth and the rig loads increase at a greater rate. This means more fibre is required to stiffen the boat. On very large boats this may mean typically a 200mm wide strip of core is completely replaced with UD carbon. The reason SP-High Modulus, the marine business of Gurit, chose to put the UD in the corner is because the hull and deck joint are naturally stable, helping to stop the plank

and the deck buckling. The hull bottom is not so much of a problem as it is in tension and spreading the fibre results in added shell toughness.

The addition of UD planks to any boat building project is a necessity, not a luxury. It may limit the designer's plans and cause some consternation as the aesthetic appearance of

the boat may not wholly fit their vision. However without the support provided by the UD planks it would be difficult to make the boat structurally sound. Engineers will always do their best to accommodate a designer's wishes, but must always put these important design fundamentals first.

**For more information please e-mail [contact@gurit.com](mailto:contact@gurit.com)**



**Simplified fore and aft loading diagram**