The unique Teknicraft design…

Much have been written about some of the special features of Teknicraft's unique design, but seldom has it been explained in more detail such that potential operators of these designs can have a better understanding of how it works.

The design as it is in its current state of development is a culmination of the blending of the main requirements; low resistance, good seakeeping, low maintenance and moderate cost.

The critical factor is the balance between low resistance in the medium and high speed range, and providing a soft ride when sea conditions deteriorate, without compromising service speed. Generally speaking the two requirements oppose each other. To have low resistance at high speed, a hull typically relies on good dynamic lift from low deadrise angles, flat planing surfaces, and strong deflecting chines. To ensure low vertical accelerations though, the hull needs to have a parabolic or similar curved shape, with flowing lines.

The clear area of the tunnel plays a major role in determining both resistance caused by the actions of the water inside the tunnel, and sea keeping which is affected by any green water reaching the upper areas of the tunnel.

The answer, according to Teknicraft's proven hull design, lies in the use of a asymmetrical hull shape with essentially vertical tunnel sides, combined with semi circular parabolic hull curvature, and most importantly, the employment of a hydrofoil support system. The hydrofoil is designed to provide just the right amount of lift, such that the catamaran demi-hulls are partly above the surface of the water, but not to the extent that seakeeping is compromised. The submerged part of the hull at service speed is essential to ensure high speed stability and soft ride.

Being mounted at approximately the level of the keel, ensures that the foil system is not vulnerable to damage from debris, nor grounding, thereby reducing maintenance of the foils to no more than normal maintenance of the hull, such as upkeep of anti-fouling paint.

When an asymmetrical hull encounters a following sea and the forefoot of one hull is more submerged than the other, a steering action would normally be expected which could cause a broaching tendency. To overcome this, Teknicraft has developed the bow area of the hull to be conventionally symmetrical. The bow, which affects directional stability in following seas and slower speeds, therefore ensures that tracking is maintained. At high speeds this part of the bow is above waterline, and does not cause any disadvantage to hull resistance.

The hydrofoil, which is none other than an underwater wing, works on the same principle as an aircraft wing. By moving the wing through the water, it creates a lifting force, which opposes the weight of the vessel and partly lifts the vessel out of the water. Teknicraft has mastered the design to always ensure that the lifting force and the displacement are always in balance at the cruising speed and design load.

However, in reality the load and the operating speed of some vessels often varies depending on different schedules. For instance, a passenger ferry may be transporting a full load of passengers from point A to B during a morning peak time run, and return for the next run with virtually no passengers. To keep the schedule frequent, the ferry may want to return at a much higher speed than the full load cruising speed. The lifting force generated by the hydrofoil is a function of its area, the angle of attack, and the square of the vessel's speed. It is therefore clear that an optimum foil for the fully laden condition would be quite different to the optimum foil for the light load, high-speed operation of the same vessel.

To be able to have a hydrofoil system that is optimum for a whole range of operating conditions, Teknicraft developed a system whereby the lifting force can be altered to suit any particular operating condition. In an effort to keep the system simple and reliable, Teknicraft opted to design the system such that the angle of attack can be varied. This enabled the lifting force to be varied without the complications which would be necessary to change the area of the foil. A simple hydraulic powered mechanism has been successfully incorporated into the design, coupled to a digital touchpad which enables the captain to dial in the foil angle suitable for a particular passenger load and sea condition. If the captain wishes to adjust it underway to optimise fuel consumption, it simply requires the angle to be altered on the keypad, whilst travelling at speed.

The hydrofoil also has a significant influence on the seakeeping and the wake/wash signature of the vessel.

Whilst the foil is operating in the submerged mode for which it is designed, the lifting force is practically constant at cruising speed, irrespective of depth below the surface. Therefore when the vessel encounters a wave, the constant lifting force ensures that the hull remains in the same vertical position, and the influence of the wave forces on the hull is significantly less than what it would be without a foil. The foil acts as a vertical damper, reducing vertical accelerations, which ensures enhanced seakeeping and a more comfortable ride for passengers and crew. As before, the adjustable foil enables the vessel to be operated with optimum foil lift, and therefore peak seakeeping performance at all times.

The wake/wash of the hull is to a large extent dependant on the volume of water being displaced by the vessel. It is therefore evident that the foil system, which is lifting the hull partly out of the water, has a significant affect on reducing the wake/wash of the vessel. At low speed or high load condition it is important to increase the lifting force to ensure the vessel is lifted out of the water sufficiently to reduce the wake/wash. This is being accomplished by using the adjustable foil. Increasing the angle of attack of the foil in this condition increases the lift coefficient. This in turn ensures that the foil generates a larger lifting force, reducing the wake/wash signature.

The Teknicraft foil is positioned, relative to the centre of gravity of the vessel, such that it lifts the vessel without altering the optimum trim angle of the vessel. It therefore does not depend on trim foils to ensure that the vessel is at optimum trim. However, the system does include a set of small stern foils of which the main function is to ensure stability in moderate to rough sea conditions, and to assist with trim angle correction in the 'hump' speed range.