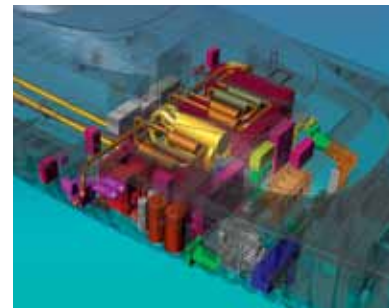


The absolute perfection that was required in this build was easier to attain with computer aided design – Redman Whiteley Dixon used Alias software, normally used by car designers, to calculate curves (below left) and Royal Huisman found it essential to use Rhino pre-engineering software for planning every last centimetre (right) so that as much as possible could be packed into limited spaces. Life-scaled plywood mock-ups were also constructed to refine the design and layout (above left), with the accommodation package being the first priority around which the systems and sailing elements were designed



Twizzle

THIS IS A BOAT THAT HAS ALMOST BEEN BUILT TWICE, WITH EVERY SYSTEM LABORATORY TESTED IN AN UNCOMPROMISING PURSUIT OF PERFECTION

The 57.49 metre performance flybridge ketch *Twizzle* will leave the Royal Huisman Shipyard in Vollenhove for launching on 8 July before a September delivery, marking the culmination of several years of research, engineering and construction. The launch ceremony will signify the completion of a project that has pushed the perceived limit of what is technically possible on board a sailing yacht, with freshly designed or refined systems and astonishing attention to detail and accuracy, where an intense scale of technology internally and externally has been incorporated without infringing the overall aesthetic appeal. A collaboration between Redman Whiteley Dixon, Dubois Naval Architects and Todhunter Earle, the design was driven by the owners and their crew based on previous yachts including the 47 metre Perini *Andromeda la Dea*. She is not only Royal Huisman's first flybridge yacht, but also a remarkable and unique vessel that has undoubtedly challenged the yard, representing one of the most complex and sophisticated builds ever attempted.

Only those fortunate enough to board *Twizzle* will fully appreciate

the technology and engineering under the surface, but the yacht's exterior displays a formidable and successful combination of structural design, styling and construction. In profile, the superstructure is striking for two reasons: the apparently seamless, wraparound glass at deck level and surrounding the internal bridge; and the sweeping, unsupported overhang incorporating the mizzen mast. For Arjo Spans, the yacht's project manager at Royal Huisman, this area required considerable strength to ensure basic structural stability, but it would also have to withstand the forces of the mainsheet located at the forward limit of the flying bridge and the tack fitting of the mizzen staysail. 'The superstructure is all glass and looks as though it's floating,' says Spans. 'There's not a lot of construction going through the coach roof and dividing these forces through proper construction was crucial.'

Unusually for a sailboat, the yacht's general arrangement was a starting point for the owners and Redman Whiteley Dixon were tasked with the exterior and interior styling with the flying bridge as the fundamental feature. 'The superstructure is the very core of the boat

with the accommodation package designed first and the systems and sailing elements second,' confirms Justin Redman. The design process made extensive use of 1:1 plywood mock-ups to refine the design and optimise the engineering required to ensure maximum space and comfort in the public areas and cabins – a technique the design team would recommend to anyone building a complex sailing yacht.

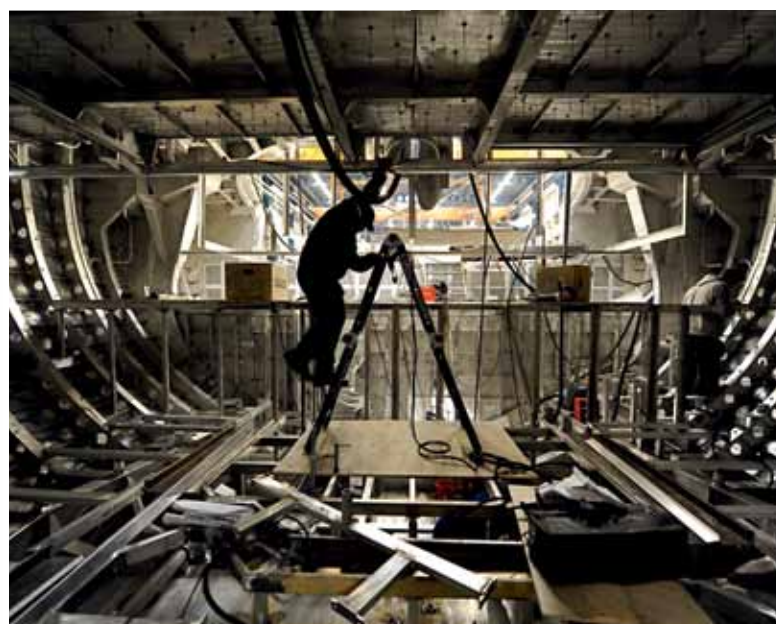
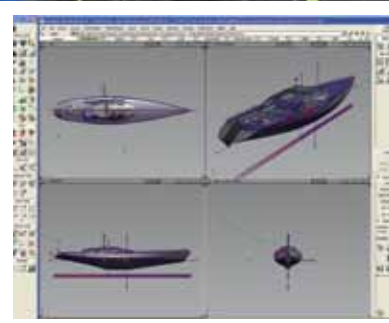
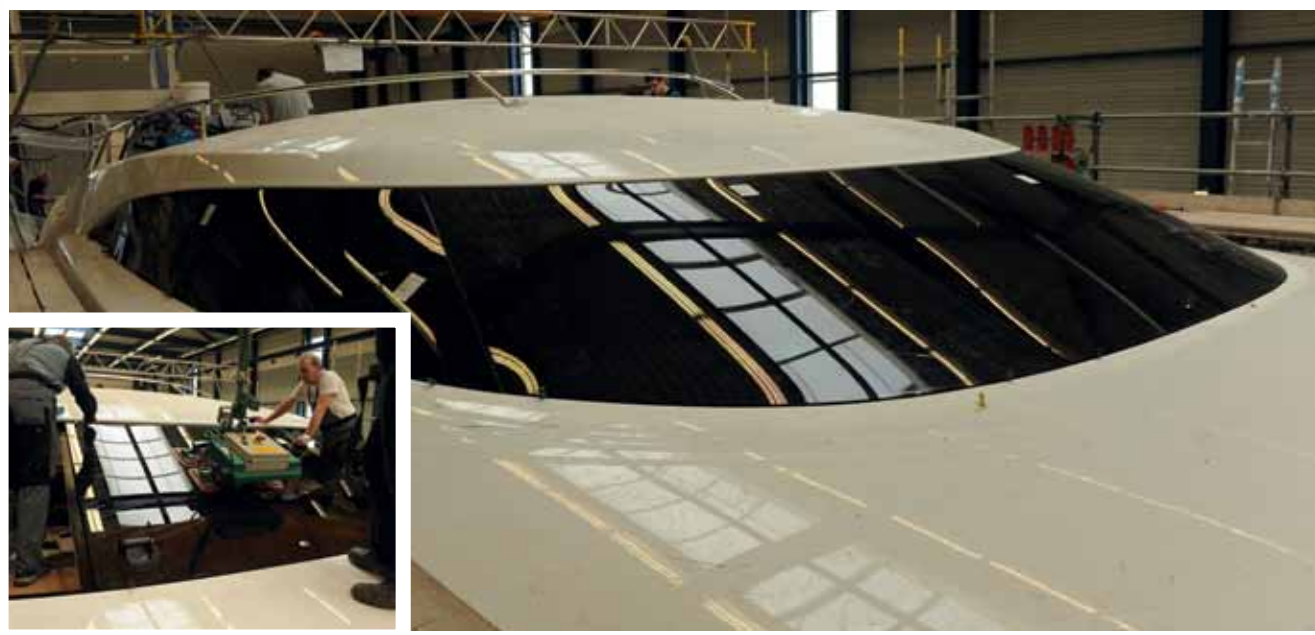
Redman and his team worked in partnership with Dubois on the naval architecture and structural design, with Dubois intricately refining the hull volume to 498GT – just under the 500GT classification limit. Uniquely, *Twizzle* is the only Dubois designed yacht where superstructure design and interior layout has been handled by another company. 'The integration of all the kit in the superstructure on the flying bridge and in the wheelhouse was major challenge,' admits Redman. The superstructure glass was a further design and styling breakthrough: 'I always wanted it to be a very flush design, rather like a pebble washed up on the beach, completely smooth with nothing sticking out and to make the glass come down to the deck involves a very complicated join to make something look so very simple.' The size of each panel and the rake on the screen is such that the supporting structure was extraordinarily well developed by Dubois and Royal Huisman. As a

result, the deckhouse windows are the largest glass panels ever produced by Yachtglass, involving oven heating and shaping on a scale the German company had never undertaken before.

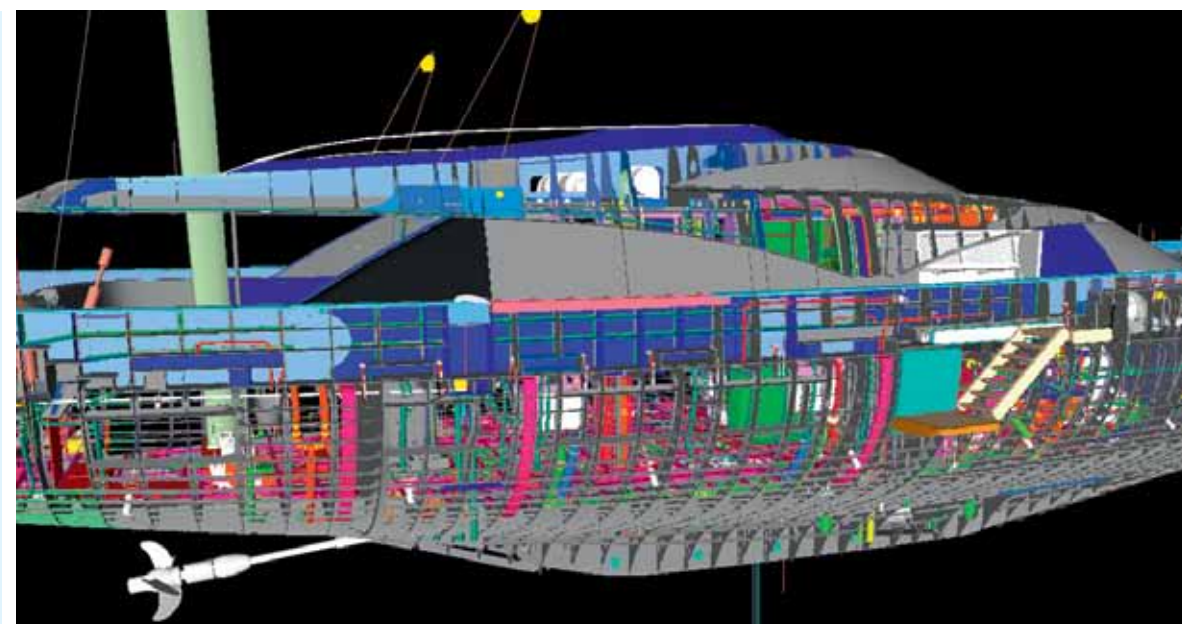
However, the styling and design of the glass windscreens entailed far more than pleasing visual appeal, ingenious structural support or groundbreaking manufacture techniques and Redman Whiteley Dixon used automotive technology: the Alias car surface fairing program. 'We can read reflections and see how light falls over certain surfaces way in advance of anything being built,' says Redman. 'You have to make sure that the light and the radius all work well and it doesn't bend or buckle as it goes all over the surfaces.' Glass tinting has also been applied making the panels dark externally, but totally clear when viewed from the yacht's interior. 'For such a simple form, it's really quite sophisticated,' he admits. 'I think Audi, historically, have simple forms, but they have been beautifully surfaced and it's a real art to achieve this.'

The practical effect of the glass screen is an unrestricted view across the foredeck and two winches either side of the main mast are the only pieces of hardware on view. The absence of cowls or dorades on the foredeck is achieved by a series of eight ventilation ports installed in the bulwarks with a customised snorkel-and-ball system approved by

words: Oliver Dewar
photography: courtesy of Royal Huisman



The single piece of one-way glass used for the deckhouse windscreen (above) was the largest ever made by Yachtglass, and with the compound curves required, particularly complicated to produce. The ingenuity of the design extends to the invisible structural support, and even a consideration of the fall of light and reflections, which was worked out using automotive surface fairing technology, developed by Audi. Another highly developed design aspect was the join required to create the completely flush effect between deck and glass (far left) – its simple, smooth appearance belies the complicated design of the join necessary to create this



Lloyds to ensure complete watertight integrity when the boat is heeled. A further foredeck detail that is easy to miss due to the high level of craftsmanship in laying the teak is the inclusion of 18 customised Rondal hatches forward of the deckhouse including huge hatches for storage compartments housing two 6.3-metre Castoldi jet tenders and a C-quip knuckle crane. Most remarkable is the lack of visible hinges and the absence of margin planks between many of the hatches making the entire area a triumph for Rondal.

Dubois Naval Architects were asked to design the hull with a 3.8 metre minimum draught as the owners, experienced world cruisers, have been to many places where the water is too shallow for a conventional sailing yacht draught. As a result, Dubois designed a swing daggerboard that increases draught to 10 metres, which can be lowered even when the yacht is sailing at full speed so that it can efficiently be used while racing. *Twizzle* also has the highest sail area to wetted surface ratio of any yacht yet built, and the highest righting moment.

Clearly the most mechanically complex external area on *Twizzle* is

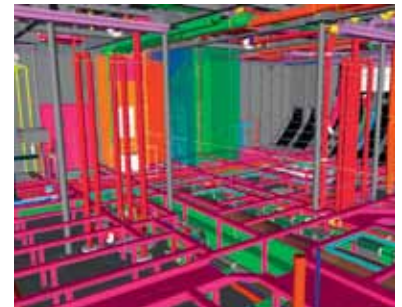
the stern platform which, once again, surpasses the usual expectations. Rather than a relatively simple platform that folds out on hinges to form a teak-clad bathing area, the transom slides down and then opens, revealing the stern bathing platform. Royal Huisman's system comprises two separate sections that can be raised or lowered above water level depending on the sea state and linked by adjustable, teak steps. The upper set of steps down from the main deck can be opened hydraulically to access a storage area for diving gear, a dinghy and a pair of kayaks and a carbon fibre C-quip swimming ladder can be deployed from the lower section of the platform. With the complicated manoeuvre and multiple functions of the stern platform, the System Integration Department at Royal Huisman devised a program to automate the entire sequence of movements from initial deployment to flushing the swimming ladder with fresh water after use. Impressively and intentionally, not a single hydraulic ram, cable or catch is visible and the entire structure is capable of mooring a tender despite these concealed hinge points above the waterline.

The communication, electronics and entertainment innovation on board *Twizzle* is also exceptional. The entertainment system is integrated by Harris Grant using Crestron and iTouch remotes, and guests can adjust the lighting, shutters, air-conditioning and television with a single handheld control. Moreover, guests can control their own iPods plugged into their cabin from anywhere in the yacht, and along with the usual DVD, Internet broadcast and satellite television streams there is an option to stream photographs from the day's cruising via a dedicated television channel. The yacht's alarm and monitoring system was designed by Royal Huisman and updated and customised as the 'Twizz-net' interface with extraordinary depth of information and detail available. In addition, *Twizzle* has an independent cellphone network, Alto Bridge. 'The primary application of Alto Bridge is when the network pick-up is bad,' explains the yacht's second engineer and IT officer, Izzy Pritchard. 'It's run via the V Sat unit. The boat effectively has its own cellphone network and your personal handset will show 'SY *Twizzle* Network' on the display. As soon as you set foot on the dock, it will switch back to your normal network.'

With the complexity of the communications and navigation equipment on board, the yacht's owner made the foresighted decision to thoroughly test every system pre-installation: a decision that involved constructing a unique 'laboratory' at Royal Huisman. 'We basically assembled the electronics twice,' confirms Steve Jaconer, the owner's project manager from Yacht Project Management. 'All the systems were built in the lab, interfaced, tested and de-bugged,' he continues. 'Every speaker and television was tested and the radars and antennas were installed on the roof of the building. Even the yacht's CCTV system was put together in the lab.' Indeed, the yacht's masthead colour camera from FLIR, which also functions as a night vision camera, is controlled by the radar system and can switch quickly between four separate targets. It is unlikely that any other superyacht owner has requested this degree of rigorous testing and although the operation was timeconsuming and expensive, the benefits are clear. 'The testing completely proved the functionality of all the systems,' adds Jaconer. 'With all the interfaces and protocols tested beforehand, it also means that any post-launch work is kept to a minimum.'



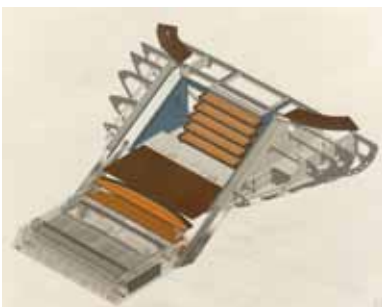
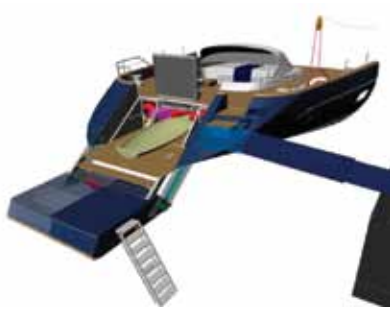
A 'laboratory' (left) of all of *Twizzle's* communications and entertainment systems was set up at Royal Huisman to build, thoroughly test and de-bug all systems before they were installed on the yacht, from the radars and antennas installed on top of the shipyard's roof (above) down to every speaker and television. Also customised for *Twizzle* by Royal Huisman is the alarm and monitoring system with its Twizz-net interface (left), which provides an extraordinary depth of information and detail. The yacht also has its own cellphone network, which kicks in when you board the yacht, registering on your handset as 'SY *Twizzle* Network'



While the communications are impressive, the bridge and flying bridge helmstations are completely clear of mechanical gauges, buttons and control levers, relying on active glass touch panels and widescreen displays from Radio Holland and Marine Technologies (MT) for all monitoring, navigation and communications data via the Integrated Bridge System. The flying bridge has sail control panels and screens giving full conning pages for both motor and sail, as well as a race page. Unlike many flying bridge yachts, the internal bridge on *Twizzle* is separated from the main deck saloon, raised to a half deck between the saloon and flying bridge: an arrangement that provides privacy for guests on the main deck, and through a phenomenal use of available space, an electronics storage area roughly one metre high, but easily accessible, has been included between the guest area and bridge, packed with communications, entertainment and navigation PLCs and housing the lithium battery emergency power supply, all in a chilled, temperature controlled environment. Unusually, the bridge has no wheel – or even a helmsman's chair – and the only manual controls visible are a trackball and two joysticks. However, with the use of the yacht's Dynamic Positioning System (DPS) from MT the inclusion of a wheel on the bridge would be little more than window dressing. Developed in Norway for conning rig supply ships and manoeuvring oil and gas platforms, the DPS enables *Twizzle* to hold an exact geographical position with the yacht's Wärtsilä variable pitch propeller working in unison with the two fore and aft Hundested thrusters and the rudder. The applications for a private yacht are substantial if mooring to a buoy, moving into a restricted, stern-to berth or docking side-to a quay when a gentle nudge of a joystick will inch the boat into position.

Meanwhile, on the flying bridge, two wheels are fitted behind a low windscreen directly below the mainsail with a clear view of the headsail luffs. On a large sailing yacht, the distance between the rudder and wheel is such that fly-by-wire steering systems are used and work efficiently, although any true, direct sensation of load on the rudder or handling under sail is absent. To recreate the feel of a direct mechanical steering system, Royal Huisman designed a customised rudder feedback system that measures forces on the rudder stock and converts these directional loads into corresponding forces on the wheel via an electronic actuator. The result is an accurate replication of direct steering, a feature that will enhance the pleasure and performance of helming whether cruising or racing. This rudder feedback system combined with load cells fitted in the masts monitoring load levels and trending, calculating the maximum load and flexing in the rig, will ensure that *Twizzle* can be sailed or raced at full potential.

Unsurprisingly – considering the huge volume of impressive and diverse technology on board – the yacht's engineers are unable to pinpoint a personal favourite. Val Zahov and Chris Clamp are chief engineers on *Twizzle* and have been based in a private office at Royal Huisman since Day 1 of the project. 'The exhaust system for the generators is particularly good,' concedes Zahov after much thought. 'Instead of mufflers, they use soot burners. It's a development of Royal Huisman which we are very happy with.' Each of the three Northern Lights generators onboard has a soot filter: a compact unit approximately the same shape and size as a domestic immersion water heater. Within each soot-burning cylinder there are two identical chambers with filters. When one filter is filled with soot, the reserve chamber and filter comes on line while soot in the dirty



Another highly complicated piece of design engineering on *Twizzle* is her stern bathing platform, which does not deploy a normal hinge arrangement and was created without visible hydraulic hoses or rams. It is height-adjustable, and the steps can be raised hydraulically to access or stow the dinghy in the stern garage



chamber is burnt off thus replenishing the filter. Extensive tests were made pre-installation and it was found that a white linen handkerchief remained spotless when held in front of the generator exhaust outlets. For Zahov and his team, ease of servicing these compact units is also vital. 'The system uses mesh filters that are extremely strong and you can simply take them out and pressure wash the units,' he explains.

However, the engineering team on *Twizzle* are unanimous on one point. 'Huisman's use of CAD modelling has been a saviour,' believes Pritchard. This Computer Aided Design software used in conjunction with Rhino and Shipconstructor programs creates 2D and 3D design and drafting images and has become an essential tool. AutoCAD was applied to every area of the boat ensuring that space in each zone was completely optimised, making certain – for example – that all the equipment fitted without pinch points for the crew and without door opening restrictions in the confined areas of the engine room. At the hull construction stage, sheets of Alustar aluminium would arrive at Royal Huisman and through AutoCAD, precise cutting, shaping and cataloguing was possible. 'It saves walking onto the boat, taking a measurement and then going back to the workshop,' says Pritchard. 'Some of the cavities in the boat run air ducting, electronics, fire fighting equipment and all types of services and you just wonder how on earth they got it all to fit.' Zahov agrees: 'This is probably one of the strongest and most important skills. To get everything to fit and utilise the space to the maximum is something that no one can do as well as Huisman,' he believes. 'There isn't a single air-gap on *Twizzle* unless it is dedicated to storage,' adds Zahov. This achievement

is doubly impressive on a sailing yacht: 'Considering the shape of the hull, I'm amazed at how much space we have on the boat,' he continues. 'Those motor yacht builders ... they don't know how easy they have it!' Arjo Spans from Royal Huisman concurs with the yacht's engineers. 'If you look at the size of the hull and the scale of the interior, every bit of space has been used to make the interior as spacious as possible,' he explains. 'This can put a major pressure on the engineering department as their space gets really limited. All the wiring and plumbing has to run through these spaces and using 3D drawings and computer programs combined with expertise allows us to build a boat of such complexity.'

The Royal Huisman Shipyard and the neighbouring Rondal facility is a self-contained, 30,000 square metre, yacht-building citadel where raw materials of steel, aluminium, carbon, titanium and timber arrive at one entrance and pass through a network of store rooms, cutting sheds, testing areas, welding shops, humidity controlled joinery shops and ventilated painting halls before the various components meet in one of the yard's three, enclosed shipbuilding halls. This supremely organised and well-planned yard is staffed by a workforce drawn from the local region who will invariably remain with Huisman for most of their working lives, developing skills and an immense stock of experience. It also becomes clear by merely walking through the surgically clean yard that Huisman is a very good atmosphere to work in. A final testament to the yard is the fact that the majority on the non-Huisman team involved with *Twizzle* believe that a yacht with her level of customisation and complexity could not have been built anywhere else.