



MOMENTUM

NEWS FROM CJR PROPULSION

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First choice

CJR Propulsion consolidates its position for precision commercial propulsion systems



CFD Spotlight

Analysing and optimising performance through CFD

Only the best will do

Securing long-term partnerships with the most prestigious marques,

Investing for growth

CJR Propulsion discusses its acquisition and investment programme

Message from the MD...

Each year, at about this time, I sit down and think about what CJR has achieved and the business’ most important moments from the last twelve months.



There are always plenty of fantastic developments to highlight but it seems like this time round, there’s been more than most. We’ve completed a major acquisition, made significant investments in new technology and driven consistent growth across all departments.

In this issue of Momentum, we’re talking about the most important projects to have benefitted from CJR’s advanced design and engineering capabilities and how, together with our Australian partner VEEM, we’ve been working with some of the most prestigious builders in the business, delivering fully optimised propeller and stern gear packages to the likes of Princess, Sunseeker and Gulf Craft, to name just a few.

We also look at how switching from jet propulsion to a shaft drive system can offer attractive efficiency gains and spotlight recent CFD consultancy work.

However, undoubtedly the most important development has been moving our investment strategy into a period of acquisition with the purchase of all assets relating to Oval Stainless and the subsequent creation of CJR Fabrication. Following the purchase, we set about investing in the business’ capabilities in order to be able to compete with the very best in the world. And, as you will read in the following pages, it has already started to pay dividends with a host of new orders and several new clients coming onboard.

There’s still a long way to go but we are beginning to establish CJR as the go to team for all quality propulsion and all on-board metalwork requirements.

With all this in mind, we invite you to take a look at what we’ve been up to and, if you attending the show, we hope to see you on the stand for a chat about CJR’s comprehensive design and manufacturing solutions or simply to discuss how we can make a positive difference to your next project.

Many thanks

Mark Russell
Managing Director

“We’ve completed a major acquisition, made significant investments in new technology and driven consistent growth across all departments”

Investing for growth



Following its recent acquisition of Poole-based fabricator, Oval Stainless, CJR Propulsion has now instigated a major investment programme within the business.

New equipment worth half a million pounds has already been commissioned and production has moved to a larger, purpose built facility in the local Poole area. The existing, highly experienced Oval Stainless team has also been retained and will join the CJR family as part of the newly established CJR Fabrication.

Discussing the acquisition, managing director for both businesses, Mark Russell, commented: “The purchase of the Oval Stainless business is an excellent strategic fit for CJR and provides significant cost synergies for our existing business. First on that list is the ability to bring production of high quality deck gear and stainless stern gear in house for the first time. The integration of all Oval’s assets instantly strengthens the value we can provide across the marine sector and recent investments in advanced manufacturing equipment has only further enhanced our offering, especially within the commercial and superyacht markets.”



The new equipment currently being installed includes an advanced 5 axis water jet from market leader Flow, an Armada CNC press brake – capable of producing stainless steel rudder blades for even the largest vessels – as well as new bending tools designed to automate complex tasks required

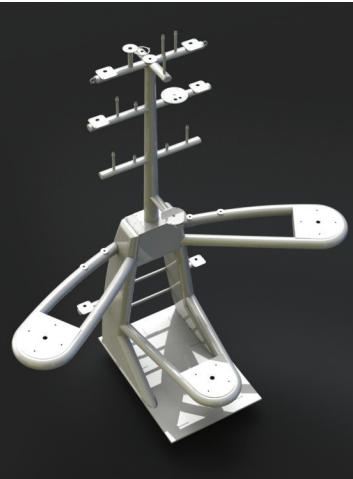
to produce aerofoils for highly efficient rudders, oval tubes and fuel tanks.

Over the past decade, CJR Propulsion has developed an enviable reputation for producing highly efficient propulsion systems, manufactured to the highest quality. According

to Russell, this is due, in no small part, to the company's continuous investment in the latest design and production technology, including advanced CFD software and robotic finishing tools, as he explains:

"In order to produce the finest products and become a highly valued and long-term partner to the most prestigious names in the industry, we have to be at the forefront of what's physically possible. We are always looking at what's coming to market, both from inside and outside the marine industry. And, if we feel a new piece of equipment will improve our offering or provide greater value for our customers, we want to be the first to have it.

"The same can be said for our workforce. Just like technology, we continually invest, train and nurture our team to ensure they share the business' values and have the knowledge they need. With the new fabrication business, there was already a wealth of experience and expertise internally so we are delighted that we've been able to



retain a number of coded welders, capable of meeting classification standards for the likes of ABS and Lloyds. We have also been able to attract former team members back to the business, with Michelle Davies, who left the company some time ago, joining CJR Fabrication as the new general manager of the Poole facility."

In the last five years CJR has made a conscious effort to diversify its offering and today boasts extensive

experience in a wide range of consultancy services, in addition to its advanced manufacturing capabilities. The inclusion of Oval's assets continues to build on this strategy and significantly extends the value of CJR to boat builders across the marine sector, becoming a one stop shop all precision engineering propulsion systems and fabricated metal work.

CJR Fabrication currently specialises in producing high quality aluminium and stainless steel products for a wide range of applications within the commercial and domestic arena, including oval and round tube, bespoke deck gear and stern gear, propellers, tanks and architectural equipment. Furthermore, CJR's investment has already begun to bear fruit, with CJR Fabrication's order book growing steadily in recent weeks. OEMs and boat builders have already placed multiple orders for stainless steel rudders, A & P brackets, as well as a several stern and rudder tubes - all of which will utilise the latest equipment to ensure the highest levels of accuracy, efficiency and performance.

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→ CASE STUDY: COLUMBUS 55M PROJECT OXYGEN

Derived from a highly advanced 55m-catamaran platform, Project Oxygen utilises a state-of-the-art Extreme Semi-SWATH (XSS) hull form, which was originally developed for demanding offshore personnel transfer applications by Southampton's BMT Nigel Gee.

True SWATH vessels demonstrate by far the lowest motions in rough seas, but at the expense of very high running costs in comparison to more fuel efficient, conventional catamaran hull forms. BMT Nigel Gee has previously developed a Semi-SWATH hull form, offering significantly lower motions than those of a conventional catamaran, yet with a minimal increase in

powering. The XSS goes one step further, effectively closing the gap between SWATH and Semi-SWATH technology.

Rob Sime, Senior Naval Architect at BMT Nigel Gee explained: "BMT's proven XSS hull form offers seakeeping performance approaching that of a traditional SWATH vessel, but with powering and fuel consumption levels comparable to catamarans of more conventional form. The XSS hull form has already been adopted for demanding applications in the energy industry but is equally suited to explorer applications where owners may not want their enjoyment to be interrupted by the prevailing sea conditions."

The hull form, however, is almost all that's left of her original design, with Project Oxygen set to be every inch the superyacht. Offering outstanding speed and seakeeping performance, combined with all the luxury you'd expect of a boat of this calibre, Project Oxygen has been equipped for all manner of pursuits, but

will operate primarily as a dive-explorer vessel. Not only will she carry extensive dive equipment, she will also include her own submarine, which can be launched from an innovative stern lift that also doubles as an adjustable swim platform.

The installed propulsion system will allow Project Oxygen to comfortably reach speeds of up to 24 knots, while her low draught will allow access to many shallow inshore locations. A complex ride control system, consisting of active T-foils and interceptors, will ensure a smooth ride, even in the most demanding offshore sea conditions. Fuel consumption has been further optimised across a wide operating speed range through her four MTU 2000 diesel engines and twin Servogear Ecoflow controllable pitch propellers, combined with an advanced stern gear package supplied by CJR Propulsion and CJR Fabrication, as Mark Russell concludes:

"This is a fantastic project to be involved with and demonstrates the value available by working with both the CJR businesses. In this instance, CJR Propulsion will be providing a set of low drag P-brackets and stern tubes in durable aluminium bronze, while the huge stainless steel rudders and rudder tubes will be fabricated by CJR Fabrication. This will effectively be the first project to benefit from both stainless and ali-bronze products being available from a single manufacturer, with nothing being sub-contracted or out outsourced and that's great for everyone involved.



Image courtesy of BMT Nigel Gee

Being commercial:

The financial reasons for switching back to shaftdrive

Over the past 20 years or more, jet propulsion systems have continued to grow in popularity and have now carved out a significant portion of both the recreational and commercial marine industry.



Claims of precise steering, excellent manoeuvrability, shallow draft and lower drag are all hard to deny but don't necessarily tell the whole story.

This was certainly the case for a recent CJR customer which operates 16 ferries within Spanish waters. The company initially approached CJR to investigate efficiency of its 60m Austal ferry – which had been fitted with water jets from new – as CJR commercial director, Belinda Russell, explains:

“When the operator approached our Spanish agents, Craft Management, they were becoming increasingly concerned about the levels of efficiency they were achieving from their Austal ferry. They asked us to perform a number of tests to identify if there was any reason why the ‘highly efficient’

water jets weren't living up to their reputation. We discovered the primary cause was a disparity between the vessel's operating speed and the original design speed. Effectively, the vessel's operating speed had been reduced from 35 knots to 28, meaning the jets weren't operating anywhere near the peak efficiency window and the result was unsustainable fuel consumption. It's something that isn't always highlighted with potential owners but move outside jet's optimum range and things get shaky pretty quickly.”

Another concern for the operator was the amount of time the vessel was spending in dry dock due to blocked inlets. A jet powered vessel's performance, and fuel efficiency, can be adversely affected by anything that

disrupts the smooth flow of water through the pump-jet. The ferry in question was working in relatively shallow water and the jets were disturbing mud and other small diameter debris that would then get into the jet intakes.

Following testing, teams from both CJR and Craft Management sat down with the client and discussed the available options. They ran through the results of the CFD analysis and explained how retrofitting the vessel would impact performance and efficiency, as well as reduce servicing costs. The result was a decision to extend the hull to accommodate the switch to a traditional prop-based, shaft drive system. To enable this to happen, the existing MTU 20 V 1163 engines, Reintjes gearboxes and KaMeWa water



jets were removed and replaced with four Mitsubishi S16R engines, four ZF gearboxes and four fixed pitch propellers and spade rudders.

“This certainly wasn't an easy project and the work required was extensive. It included the removal of the existing ride control T-Foils, relocation the auxiliary engines from aux engine room to main engine room and adding tunnel side thrusters into the ride control room of each hull. However, that said, the results have been fantastic and will easily pay dividends in the long run, especially for a ferry which is in almost constant use.”

Since the installation, the ferry has returned to active service, having lost almost ten per cent of her original weight. The hull lengthening process has cut resistance by 4.6 per cent and fuel consumption has also been notably reduced.

Following this success, CJR are now looking at the remaining ferries to identify if similar gains can be achieved by switching all 15 vessels to an fully-optimised shaft drive system.”

“Claims of precise steering, excellent manoeuvrability, shallow draft and lower drag are all hard to deny but don't necessarily tell the whole story. ”

First Choice...



CJR Propulsion consolidates its position as the go to supplier for precision commercial propulsion systems.

2013 saw CJR add several key commercial accounts and 2014 is continuing this trend, with a raft of new orders for multiple systems. The past twelve months has consolidated CJR’s position as the preferred choice for precision, high performance propulsion packages within the workboat and commercial marine market and since exhibiting at last year’s Seawork exhibition, CJR has secured orders worth in excess of two million Euros, following successful production partnerships with several leading workboat manufacturers.

One such manufacturer is France’s ACCF. CJR met up with the business’ founder, Ronan Touly, to discuss working together and how CJR has become his first choice for commercial projects, he picks up the story below:

Some time ago we had been looking for a propulsion partner which shared our commitment to design and engineering excellence and had the capability, experience and understanding to create truly

exceptional systems.

CJR had very good references within the commercial market and its ability to offer truly bespoke solutions, using the latest technological tools, is exactly where we want to be as a business.

We found the whole team to be incredibly attentive, quick to respond and the final solution was precisely what we were after, with real data to support every decision and recommendation they made.

The first project we worked on with CJR was the new RORCAL 100L, which we launched on April 17th this year. She has been built using infused GRP with carbon stringers to increase longitudinal strength, weighs around 6500 kilos and has a top speed of 28 Knots – delivered from Volvo D9 engines and the complete propulsion package from CJR.

Following her launch, the customer commented on how happy they were with the vessel’s performance.

The propulsion package was highly efficient, faster and both quieter and less thirsty compared to previous models, which used a different supplier for the props and stern gear.

However, after just one month on the water the skipper hit a submerged object, while doing around 20 knots; he severely damaged the gearbox, prop shaft, propeller, tube, keel, rudder, part of the hull and part of the axial structure. Basically, everything needed to be fixed immediately so naturally we turned to CJR to help get the vessel back on the water in the quickest time possible.

Overall I find CJR to be a very dynamic business, with a strong focus on technology and producing highly-efficient and effective solutions. Finally, as we’ve recently discovered, they are also very good at delivering replacement parts on a very short timeframe! I now look forward to working together on our next project.



“CJR had very good references within the commercial market and its ability to offer truly bespoke solutions, using the latest technological tools, is exactly where we want to be as a business.”

Recent commercial projects:
1 x 60m Austal ferry
5 x 16m pilot boats for an Asian port authority
2 x 19m pilot boats for an Asian port authority
6 x (up to) 24m pilot boats for Baltic Workboats
4 x 19m pilot boats for French port authority
5 x 24m work boats for UAE port authority



Image courtesy of Princess Yachts

“Sunseeker, Princess, CRN and Gulf Craft, to name just a few, continually choose CJR for their propulsion systems...”

When only the best will do...

When it comes to securing long-term partnerships the industry’s most prestigious marques, the superyacht industry is understandably competitive.



It is only natural for builders of the finest recreational vessels to need every aspect of the boat to meet the highest quality standards, and perform accordingly. With this in mind, CJR’s continued dominance in this area is all the more noteworthy and helps justify the business’ investment strategy, where precision engineering, ultimate accuracy and total repeatability are central to its offering.

Sunseeker, Princess, CRN and Gulf Craft are amongst an impressive list of superyacht manufacturers which continually choose CJR for their propulsion systems and all remark that the reasons for doing so are firmly rooted in the quality of CJR’s products, driven through its design and manufacturing capabilities.

CJR is currently working on a number of highly exciting and unique projects, along with supplying complete propulsion systems for some of the most popular production boats on the market.



Image courtesy of Sunseeker

SUNSEEKER 155 YACHT

The tri-deck 155 is Sunseeker’s latest flagship model. Launched earlier this year, she is the largest and most advanced yacht Sunseeker have ever produced and features a complete set of CJR stern gear – one of the biggest CJR has ever manufactured. CJR managing director, Mark Russell, commented: “Accommodating up to 12 guests in total luxury, the 155 required a system which was exceptionally quiet, free from vibration, highly efficient and suited for long distance cruising and that is exactly what we delivered – an fantastic stern gear set up, for one of the world’s most extraordinary yachts.”

SUNSEEKER 86 YACHT

First launched in 2008, the Sunseeker 86 Yacht received a total overhaul this year, with a new model arriving later in the summer. Featuring a comprehensively updated hull form and offering an extended range of 1,500 nautical miles, the latest 86 has been described as ‘a seductive combination of style and elegance’. But, in order to achieve this impeccable standard, Sunseeker had to carefully review every detail - including the 86’s propulsion system. As a result, CJR was chosen to be the exclusive manufacturer of the entire package, including propellers and all related stern gear, for all future shaft driven 86 Yacht orders.

CJR's experience and expertise in designing highly accurate production propulsion systems, along with its long-standing relationship with Sunseeker, made it the ideal choice for the 86, especially as it enabled Sunseeker to benefit from CJR's advanced CFD technology. From the trim line down, every aspect of the new 86 Yacht was carefully analysed, using one of the most powerful super computers in the industry, in order to accurately simulate the interaction between the hull and the water and to produce a propulsion system specifically optimised to the 86's hull form.

PRINCESS 35M

Following on from the global success of its flagship superyacht, the Princess 40M, the new 35M is a impressive semi-custom motor yacht, capable of cruising both at high and low speeds with an impressively long range and outstanding efficiency. As with the original 32M, propellers will be provided by VEEM, with the option to upgrade to VEEM's Interceptor technology, which uses a simple and durable plastic strip housed in a 'dove-tail' groove on the blade tip of the propeller. The strips allow the pitch of the propeller to be adjusted

quickly and accurately, without mechanically compromising the fully CNC contoured blade surface that is standard on all VEEM propellers.

The propeller and stern gear have both been through comprehensive CFD analysis, using the vessel's actual hull form to truly understand and optimise the propulsion system's position and performance.

The 35M will also benefit from a bespoke stainless steel staircase and mast, both of which have been designed and constructed by CJR Fabrication, utilising the latest technology installed since CJR took ownership of the business.



VEEM Propellers on the new CRN 132

CRN (HULL NO.132)

Back in 2011, CRN announced its new 'DO' line of superyachts, which stands for DislOpen (Displacement / Open). During the press conference in London, CRN Chairman and Chief Sales & Marketing Officer of the Ferretti Group, Lamberto Tacoli, announced that the company had already signed a contract for a new 73 metre motor yacht. Fast forward three years and CJR is putting the finishing touches to a complete set of VEEM propellers for the enviably impressive vessel, which according to Tacoli "will be a very special superyacht with several "James Bond" features.



Image courtesy of Gulf Craft

GULF CRAFT 'MAJESTY' 155

Due for launch in 2015 and featuring a complete propeller and stern gear system from CJR Propulsion, the impressive Majesty 155 is a breath-taking 47-metre vessel, built in composite by the prestigious Middle Eastern shipyard, Gulf Craft.

The luxury superyacht – the largest ever to be constructed in Gulf Craft's

31-year history – represents the UAE-based builder's acceptance within an elite group of global boat builders with the capability to create vessels of this size and complexity. In addition, it demonstrates the company's ambitions to tackle the most prestigious and complex projects available.

Commenting on the vessel, Gulf Craft chairman, Mohammed

Hussain Al Shaali, said: "The Middle East continues to lead demand in the global superyacht market. Moreover, Gulf Craft and its global supplier network highlights the regional marine industry's capability, sophistication and growing prominence on an international stage - with the Majesty 155 being one of the largest composite superyachts ever to be constructed in the Middle East."

CFD Stoplight: Analysing and optimising performance



When a leading Dutch yard discovered untimely cavitation on the V-bracket and propeller of its latest commercial vessel, CJR’s CFD department was called in to investigate.

CJR’s Simon Lewis, who holds a doctorate in engineering, specialising in computational fluid dynamics, talks us through the process and the difference it can make:

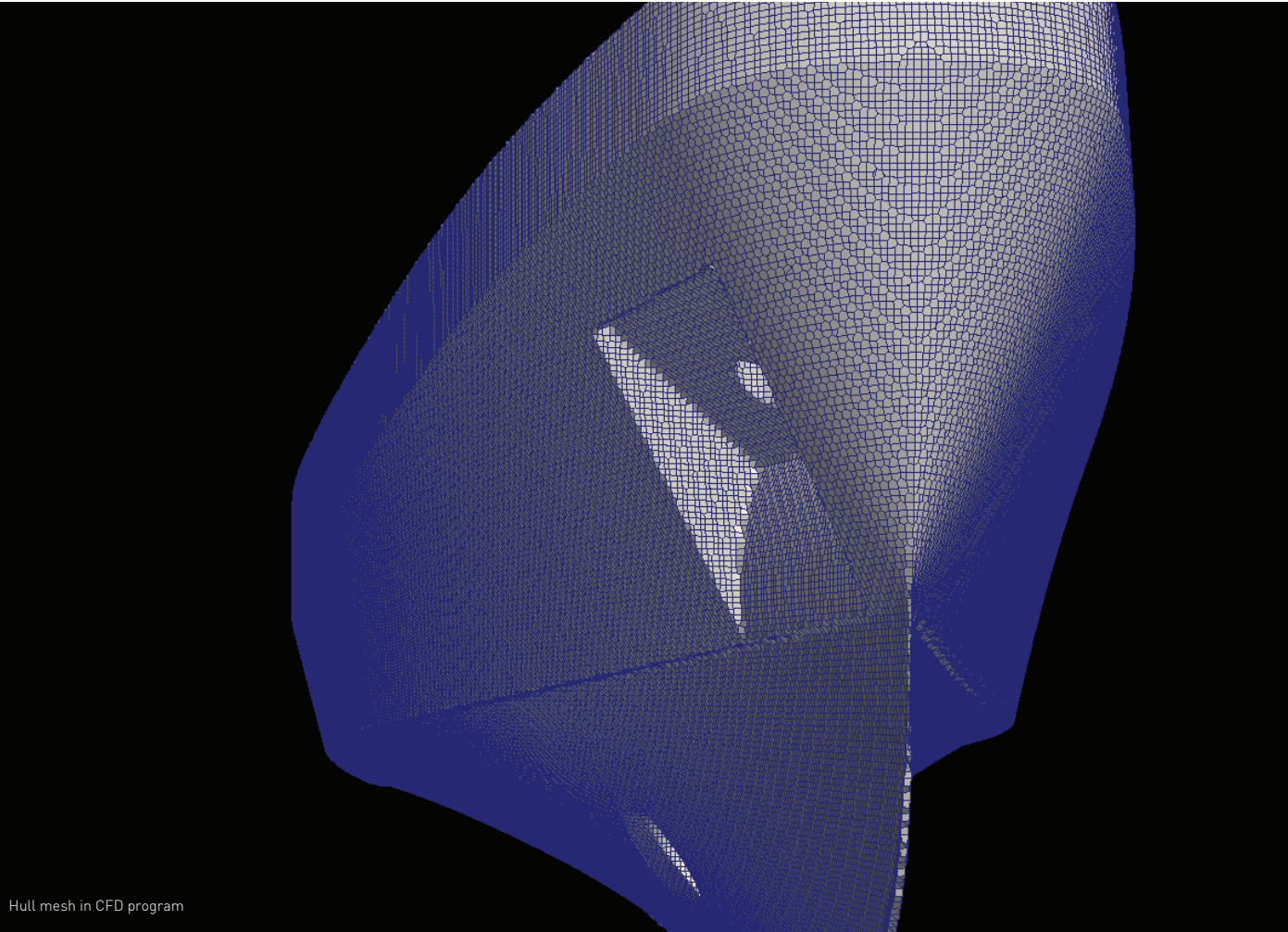
All the CFD work we conduct follows a similar path, and is geared toward optimising propeller design but this project required us to go a step further, looking at the V-bracket and rudder design as well. The process starts with a three dimensional CAD drawing of the hull, supplied by the yard. We then create a 3D computer mesh to represent an air and water environment for the CAD hull to sit in. We then introduce a set of boundary conditions comprising fluid parameters - including flow rate, pressure and turbulence. Changes in the flow conditions are calculated and used to gain insight into the area of interest, which in this case, was primarily the propeller flow and the

position of the V-bracket.

CJR’s bespoke CFD software is then used to provide an in depth analysis of the flow around the hull. A number of different hull configurations were carried out, including a procedure to align the V-bracket struts with the flow in order to reduce the drag of the appendage, and minimise cavitation. This is an incredibly complex simulation, but the advanced software and CJR’s cluster computer is able to crunch the huge numbers involved very rapidly using parallel computing, so what would take weeks ten years ago, now takes less than a day. To give you an idea of the number of calculations that are needed, a simulation requires around 5000 iterations to reach convergence, with each iteration requiring a number of equations to be solved for each cell in a mesh containing over 10 million cells.

For this client, the hull in question was designed for a 24 metre fast response vessel, so the main aim of the project was to minimise drag, maximise performance efficiency while removing any unnecessary risk of cavitation from misaligned appendages. Using our CFD technology, we analysed hull resistance and propeller performance, as well as the flow around the hull, its original appendages and especially the flow around the V-bracket struts.

What we discovered was that although a lot of the optimization work was correct, the V-bracket was misaligned to the propeller flow and the result was unnecessary drag and premature cavitation. To rectify this we designed a new V-bracket which enabled the flow into the propeller to be a lot smoother. In turn, this created a new set of flow conditions which had implications on the propeller’s design. In particular,



Hull mesh in CFD program

“Through our CFD activities, CJR has developed a method for minimizing premature cavitation and related vibration...”

the pitch angle and camber distribution were impacted so the propeller design was also updated to work with the proposed shaft bracket design.

We then went a stage further and investigated the impact the new propulsion system design would have on the flow from the propeller into the rudder. Rudders are subjected to propeller induced velocities and flow angles that vary along the height of the rudder. Because of the flow angles from the prop, a suction pressure peak can form at or near the leading edge of the rudder, where cavitation is more likely to occur. Through our CFD activities, CJR has developed a method for minimizing premature cavitation and related vibration using a rudder design which is twisted so its profile is aligned with propeller flow angles along its entire span.

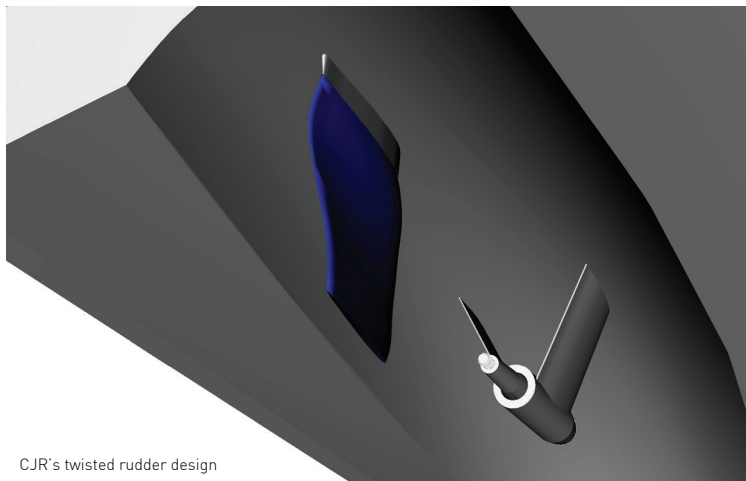
Combined, all the work took around six weeks to perform and resulted in around a two per cent reduction in resistance, as well as minimising the risk of cavitation erosion by creating a more uniform flow into the propeller and improving propulsive efficiency overall. We are also able to predict the pressure pulses on the hull caused

by the working propeller, and this is a very good indication of the noise and vibration felt onboard the vessel.

By smoothing the flow into the propeller, we predict a significant improvement in the noise and vibration during normal operation.

We are still awaiting trial data to validate the findings but we expect to see a small speed increase from the reduction in drag and a significant improvement in overall efficiency.

The client is delighted to have found such an effective solution and will be implementing the findings in their entirety for the next build, using CJR manufactured rudders and propellers.



CJR's twisted rudder design