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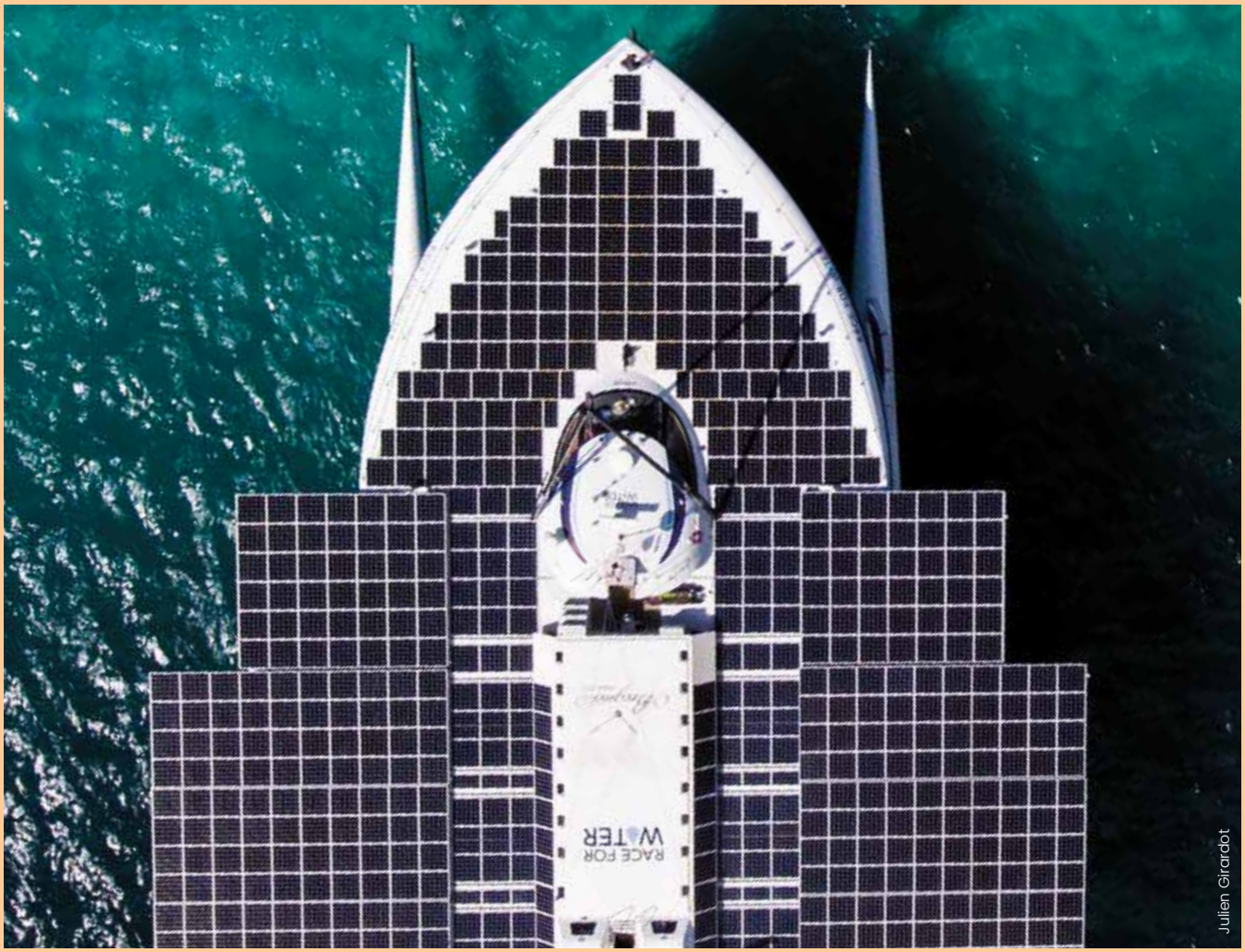
12/2020

The Superyacht Innovation Report



Julien Girardot

The Innovation Essays – by the industry's brightest thinkers

The cyber threat to superyachts, amid an imminent regulatory shift

The floating experiment that is the Race for Water voyage of philanthropy

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A RICH TAPESTRY OF CREATIVITY

It may be winter, but William Mathieson is basking in the warm glow of industry innovation ...

BY WILLIAM MATHIESON

I must say, a summer spent curating the views of a spectrum of experts for *The Superyacht Buyer Report* turned out to be so much more enjoyable than I'd expected. At the beginning of the process, I had thought it akin to herding cats: a logistical and administrative nightmare.

But, despite the practical challenges – over 400 personal emails sent in relation to columns submitted – I found the process to be wholly satisfying. And it was no more satisfying than when reviewing the finished product – surveying not only the stellar complement of names and companies assembled, but the broad spectrum of knowledge presented across a spectrum of sectors.

It got me thinking, "There can be no better topic to apply such a process to than 'innovation'". After all, the very concept of 'innovation' is somewhat abstract and open to a profound level of interpretation. For this reason, I thought it a perfect subject in which to roll out another compendium of guest essays.

So, with that idea in mind, I set about drawing up a shortlist of contributors. But, this time, I enlisted the help of my editorial team; after all, who am I alone to identify the industry's 'innovators'? So I granted everyone free rein to identify a list of the individuals they've defined as free thinkers, future thinkers, disruptors and, above all else, innovators.

The beauty of this process was that, inevitably, many of those identified were not manufacturers; indeed, the majority of our final contributors list are not OEMs, but instead come from a diverse spectrum of other sectors.

With the shortlist agreed, the next step was to form a brief. But, after much discussion, what we all agreed was that the more nebulous the brief, the more 'innovative' the response. So, in contravention of every line in the commissioning editor's rulebook, we kept the brief as open as possible, so open in fact that we simply invited these forward-thinking industry stakeholders to write around the subject of innovation.

I'm pleased to say, the result is as I'd hoped and expected. We have a rich tapestry of thought leadership on display, covering a plethora of subjects, systems and services.

What is encouraging for us all is that, given free rein to comment on the future, the pervading theme of many articles was 'sustainability'. Now, that may not come as a surprise, but it further reaffirms the sea change in industry thinking that has occurred over the past five years.

Even so, there are myriad other topics and facets of yachting discussed within this issue, and the cavalcade of content presented indicates that, at the end of a very tough year, the future remains bright. WM

Essays

Features

Industry innovations

The Superyacht Report

12/2020

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THE INNOVATION ESSAYS

BY RORY JACKSON

Innovation is not a clearly defined term. It's nebulous and means many things to many people and this very fact has formed the basis of The Innovation Essays. Rather than hampering some of the market's most imaginative and forward-thinking minds, we presented contributors with a purposefully vague and far-reaching brief. Quite simply, we wanted to find the most interesting and innovative developments that are on-going or planned for the superyacht market, with no limitations on subject, scope or timeframe. Therefore, we invited 32 of the superyacht market's brightest individuals, from all sectors of the industry, to provide their thoughts on the subject of innovation and the resulting content is as diverse as the market itself.

In recent years the superyacht industry has been characterised by a number of key developments. Chief among these developments has been a focus on sustainability and usage. Not only are superyachts now expected to travel more expansively than ever before, to increasingly dangerous locations, they are also expected to house more toys and activities than ever before, as well as doing all of the above in an increasingly sustainable manner. However, it would be wrong to limit innovation to a set of sustainable goals or performance targets. Perhaps the question of innovation is really about getting back to basics, ripping up the rule book and simply asking, what does the owner really want? There are a million ways to frame questions of innovation, but herein we tackle 32.

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Sarah Allan

Innovation and regulation go hand in hand

Sarah Allan, partner at Penningtons Manches Cooper, outlines how the development of regulations can sometimes be as innovative as the technology they govern.

While the concept of fully automated ships may seem far-fetched, the related technology could benefit the superyacht industry.

Technological innovation in superyachts often grabs the headlines, whether the fastest, tallest or lightest. Improvements in efficiency and sustainability are now higher on the agenda than ever before. *Black Pearl* and *Savannah* are both examples of yachts where their owners have paved the way with new greener technology. However, such technological development not only requires a combination of great science and design, but maritime regulation has to keep up too.

Superyachts as 'ships' have largely had to comply with international maritime regulations that have evolved around the commercial shipping industry. Technological innovation in superyacht construction has been tempered by compliance with Classification Society standards of construction and certification. The flag state where the yacht is registered enforces maritime regulations appropriately with the safety of ships and crew and pollution prevention at its core. Many superyachts must comply with such regulations due to their sheer size or because they will be operated commercially. However, owners of yachts used solely for private purposes often choose to build to class standards as failing to do so can impact on their ability to obtain insurance and the resale value of the asset.

While the reduction of emissions is high on the IMO's agenda, its focus has been on reducing sulphur content where many commercial vessels use heavy fuel oil. On 1 January 2020, the global upper limit on the sulphur content of ships' fuel oil was reduced to 0.5 per cent, which is mandatory for all ships operating outside certain designated Emission Control Areas, where the limit is already 0.1 per cent.

In the superyacht industry there is a clear desire by some owners to achieve zero carbon emissions using alternative forms of propulsion such as hydrogen fuel cells and lithium-ion battery banks. While this technology has been used before in different industries, its application in the maritime sector is still novel. It, therefore, presents different risks, where it has taken time for appropriate regulations to evolve. For instance, Marine Guidance Note 550 for Guidance for Safe Design, Installation and Operation of Lithium-ion Batteries was published by the MCA as recently as 2016.

In 2019, the Red Ensign Group's new Yacht Code came into force. The Code consolidates an updated version of the Large Yacht Code (LY3), and the latest version of the Passenger Yacht Code (PYC). As Jo Assael of Döhle Yachts explains, "The new Code makes use of industry best practice and international standards such as ISO, as well as following the IMO's overarching remit for increased 'Goal Based Standards' as a form of regulations. Most chapters now have a roadmap to achieving either 'Equivalent Arrangements' or 'Alternative Design and Arrangements' that throw the doors open to innovation and exploring novel ways to comply with regulations historically written for ships, and not yachts."

While the Code paves the way for technological innovation in the superyacht sector, the regulations inevitably lag behind. As Derek Munro of Divergent Yachting and owner's representative of *Black Pearl* explains, "It in fact falls to the designers, suppliers and shipyards to work closely with class to develop suitable regulations to enable such novel technology to be used. Inevitably, the trail blazer will have to invest additional time and expense in developing the regulations with class ensuring compliance."

Good examples of regulations which have come about as a result of such innovation are DNV GL's regulations "Carbon and PBO Rigging for Sailing Yachts" and "Design and Construction of Large Modern Yacht Rigs", which both came into force in December 2016. The award-winning yacht *Pink Gin*, launched in June 2017, is the world's largest all-carbon-fibre sloop built to these standards with the closest of cooperation and oversight by the classification society.

The concept of having Maritime Autonomous Surface Ships (MASS) that can operate independent of human interaction is another area of technological development that is a hot topic. There is an obvious tension between SOLAS, with minimum manning requirements and the obligation to keep a proper look out, and the desire to have a fully automated vessel operated by artificial intelligence. A future with autonomous vessels roaming across the world's oceans will also have to overcome issues around insurance, cyber-security and piracy.

While the concept of fully automated ships may seem far-fetched, the related technology could benefit the superyacht industry, allowing for the reduction in crew on board, changes to the design of the bridge or improving safety by reducing human error. Equally, given the complexity of some superyachts, advancements in technology will allow smaller crews to operate larger and more complex yachts efficiently. However, if developments in this area are to happen there needs to be close cooperation with the classification societies.

As alluded to, the development of maritime regulations has been slower to evolve because they require international approval through the IMO and we should not underestimate the importance of regulation where safety is a priority. However, we are now seeing a faster pace of change with pilot schemes being operated by different flag states testing new technology, and, for the first time, superyacht design is paving the way towards change.

What is clear is that to achieve change it is essential for designers and project managers to engage both class and flag state authorities at an early stage and to work with them by offering the solutions. This does require significant investment in time and resource but ultimately it results in a better and safer product. Insurers will also be more likely to lend their support, making the technology viable for wider use. SA

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Craig Barnett

Giant leaps

Purposely electing to operate in an environment of extreme pressure is not for the fainthearted, but at Triton Submarines, Craig Barnett finds it offers extraordinary results and rewards.

We believe the essential key to success in innovation lies in the team employed for the task in hand.

Pioneering at the forefront of an evolving sector such as human-occupied submersibles requires the capacity to innovate. The challenge for a small- or medium-size business is the efficient conversion of innovative ideas into practical solutions. Creativity is a prerequisite, but there is no substitute for the talent and expertise that are essential to transform revolutionary new ideas into capable and reliable products.

Another essential requirement for innovation is relevant and sometimes proprietary experience, which at Triton Submarines is measured not in years but centuries. Only when a team can repeatedly create and successfully deliver simple, reliable, efficient and safe submersibles is it possible to develop models which challenge conventional thinking but are grounded in practical and common-sense-based solutions.

With the Triton 36000/2 (named *Limiting Factor* or *LF*), we set numerous records for exploration in the most remote and least explored area of the ocean – the Hadal Zone, including successfully diving to the deepest point in each of the five oceans during the Five Deeps Expedition. Triton designed, engineered, manufactured and operated the first human-occupied craft in history capable of unrestricted access to the entirety of the world's oceans. It is not a stretch to compare the 'repetitive use' of this remarkable submersible with SpaceX's development of reusable rockets for space exploration.

Following initial discussion of innovative ideas, Triton follows a path of rigorous design, evaluation and exhaustive testing, with each stage closely monitored by a third-party classification society (DNV GL in the case of the Triton 36000/2). With submersibles being made up of thousands of components this is an arduous process, but with the end product, and its human occupants, operating in the most extreme and hostile environment on Earth, our margin for error is zero.

To illustrate the dedication required to undertake extraordinary innovation, we can use the pressure hull of the *Limiting Factor* (*LF*) as an example. This hollow sphere's task is to accommodate two people, plus all of the non-pressure-tolerant systems and components, on thousands of repeated dives to depths as great as 11,000m. From within the pressure hull, the occupants must be able to see their environment and have full control of all the exterior systems and equipment including propulsion, manipulator arm, navigation, cameras and communications.

Triton's principal designer, John Ramsay, imagined two Titanium hemispheres, which were clamped and bolted together rather than welded. As counterintuitive as it might have seemed at first, Ramsay's decision proved both innovative and inspired. When extreme pressure increases risk due to the inherent inconsistency (or discontinuity) of a welded fabrication, a clamped and bolted arrangement between the hemispheres allows for improved tolerances.

In-depth metallurgical analysis proved Grade 5 Titanium to be the best material for the project. Triton and DNV GL sent separate samples of the Titanium to specialist laboratories for metallurgical analysis and the results were compared. Satisfied in the material properties, the hemispheres were forged before precision machining was employed to produce what is essentially a 1,500mm-diameter hollow ball-bearing finished to within 99.93 per cent of perfect sphericity.

Following production was the testing phase, which involved flying the pressure hull to the Krylov State Research Center (KSRC) in St Petersburg, Russia to immerse it in the only test chamber in the world capable of simulating the crushing pressure at 'full ocean depth' plus a factor of safety equal to 14,000m or 45,000ft underwater! The 1,740mm inner diameter of the KSRC test chamber had at least partially driven the dimensions of the submersible, so when the sphere was gently lowered into the chamber there were just 30mm to spare on each side of it. Successfully passing these external pressure tests was a milestone moment in the project.

With just one of the components of the Triton 36000/2 ready for assembly, our attention moved to the thousands of other components and systems. Nobody said extraordinary innovation is easy! At Triton we believe the essential key to success in innovation lies in the team employed for the task in hand. It is through curating the most experienced collective of submersible experts on the planet – with almost 500 years' combined experience in the field - that we have the ability to significantly move the needle in our field.

The Triton 36000/2 project confirmed creativity, experience and intelligence are nothing without determination, dedication and, perhaps most importantly, courage.

We are deeply grateful to our clients who possess a spirit of adventure as well as the courage and passion to explore. It is only through their willingness to fund audacious projects that Triton can create revolutionary submersibles. The intellectual property developed for the *LF* submersible provided a springboard for many of the new models we have in development now. In order to occupy and maintain a position at the forefront of any sector, a company must be willing to undertake a tireless programme of progression and innovation. Triton is able to deliver submersibles with the reliability, quality and capabilities that we do because we are constantly being challenged by our clients to reach further.

At Triton we carefully consider every move but will always have the confidence in our ability to take giant leaps, which is the nature of innovation. After all, Henry Ford could have just trained faster horses. CB

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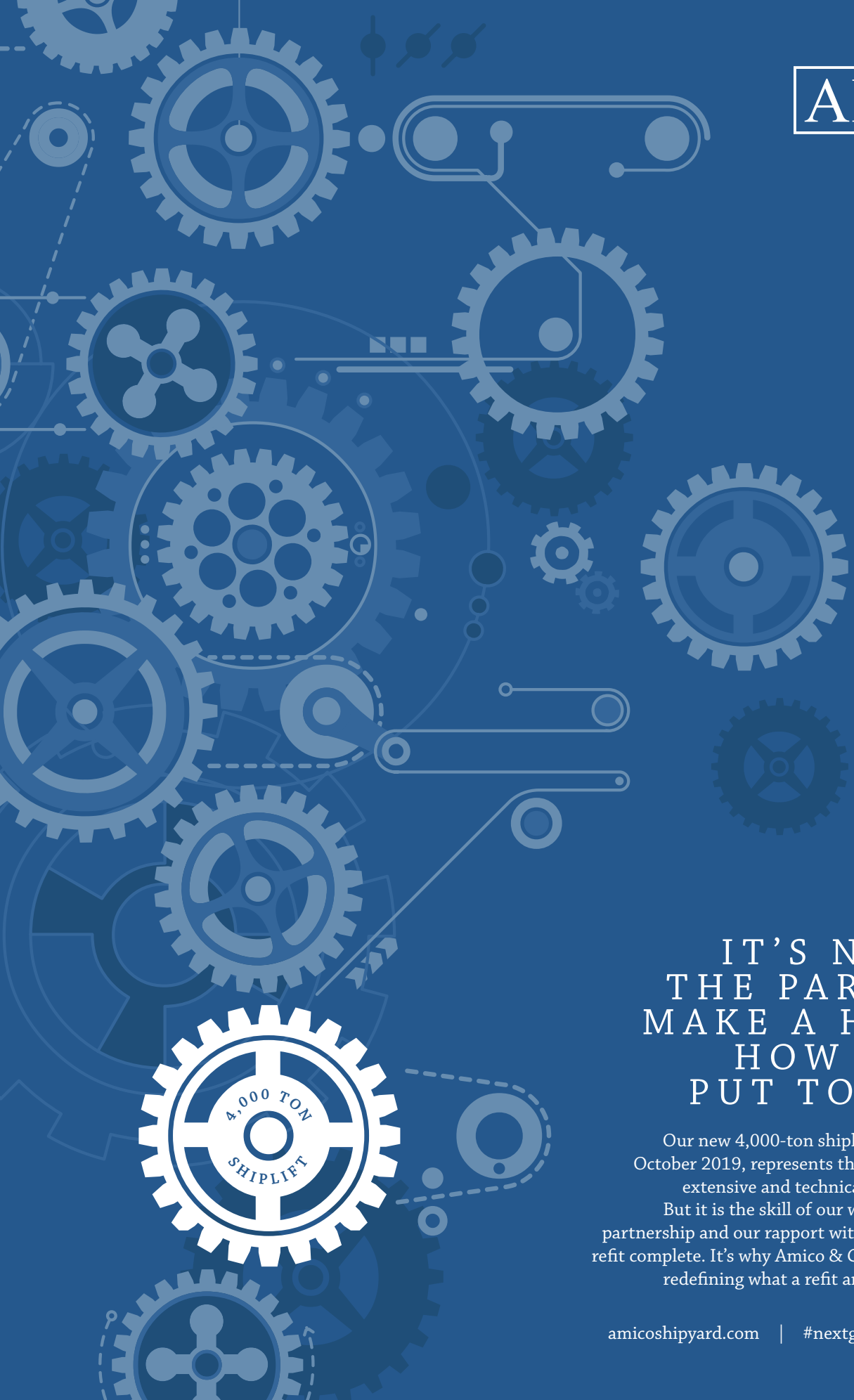

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Mike Blake

AI and yachting

Mike Blake, president of Palladium Technologies, on what the future of artificial intelligence will really look like.

Artificial intelligence (AI), which is the simulation of human intelligence, has become very prominent in the news, discussions and applications over the past five years. But the truth is that AI has been around for much longer, as I started developing AI applications back in 1987.

Today, we are surrounded in our daily lives with AI – in social media, online shopping, Google search engines, ridesharing, commercial flights (autopilots), banking and many more. Since it is difficult for most us to identify these implementations, and since we can't distinguish between AI and non-AI systems, there are four basic forms of AI and I will explain them as follows:

1. Reactive machines – good examples are IBM's Deep Blue, which beat the international chess grandmaster Garry Kasparov in the late 1990s.

2. Limited memory – machines that look into the past, such as parts of self-driving car software.

3. Theory of mind – these machines are more advanced and not only form representations of the world, but also entities in the world. It is this replication of how humans and creatures in the world have thoughts and emotions which affect their own behaviour.

4. Self awareness – this is the most advanced form of AI where these machines/systems develop a consciousness. Conscious beings are aware of themselves, know about their internal states and are able to predict feelings of others. The movies iRobot and Terminator are very good examples of this self awareness.

Why is there such excitement surrounding the first few levels of implementation of AI today? It is because we can use these AI systems/algorithms to handle massive amounts of data and learning, then developing patterns in this data, which we humans can't do as efficiently. They operate without breaks, and they continue to learn at a speed of the computers that they operate on, 24/7. Good examples can be found in the medical field. In radiology, AI has achieved the ability to detect cancer in mammograms at a 96.6 per cent specificity level, which is much greater than the average radiologist today. It continues to learn at breakneck speeds, continually getting better with its discovery of cancer.

Now, how do we translate these systems and examples to our world of yachting?

The examples that I am about to give may frighten, or even anger, some people who might feel that their own professions are at risk. But in reality I believe that this assistance will allow us to be freed up to perform tasks that we are much better at.

Navigation
This is an easy one as we move into self-learning autopilots, that are connected online with volumes of information about sea conditions, weather patterns, direct reporting from other ships and yachts, along with on-board navigation instrumentation. They can make much better decisions and never become distracted. This is happening today, in the shipping industry, in a limited fashion.

Cybersecurity
The only way to combat dynamically changing data attacks is to deploy sound and sophisticated AI appliances that morph their shields incautiously to protect the integrity of the yacht's systems, and the owner's data.

Security
We are using AI routines in our security systems to understand the patterns of the yacht's operation, identifying intrusions more quickly and immediately identifying the correct access to all areas of the yacht through facial recognition.

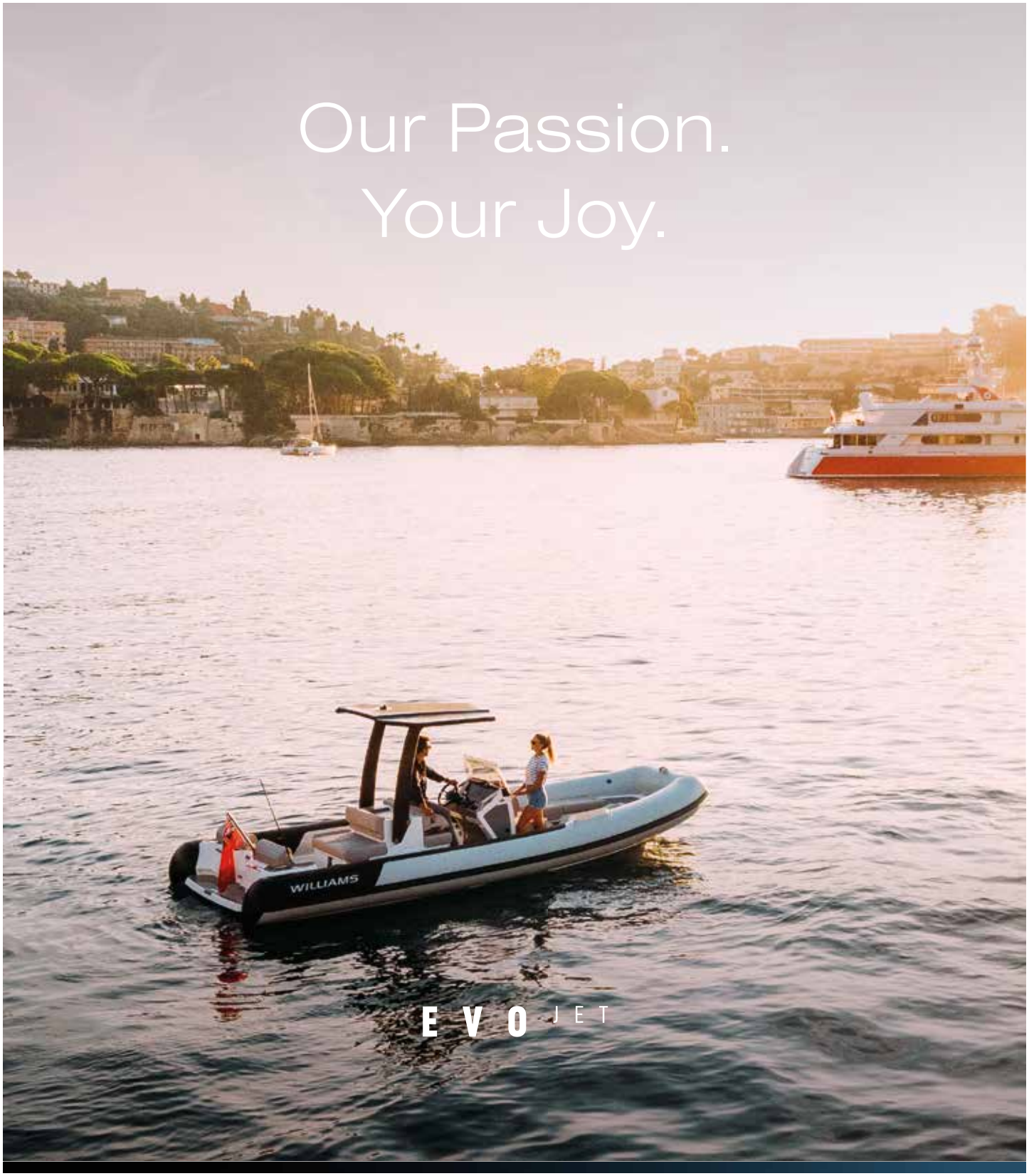
Alarm, monitoring and control (AMS)
Another area that benefits from the use of AI algorithms. These algorithms move the AMS from a reactionary system to a truly forward-watching and preventive system.

Owner/guest services
By implementing AI to learn the patterns of the owner and guests, these systems can then anticipate their needs. Simply knowing their system vitals such as blood pressure, heart rate, temperature would allow an AI-driven guest services system to react precisely and immediately. I envision that robotics will be deployed in the future to interact directly with the owner and guests. Consistency in this service would be a major benefit, along with the ability to be available at all hours of the day and night to the varying schedules of each individual.

Entertainment systems
These systems, in general, have the label of AV (audio visual). I have a design for a 'living yacht', where the yacht reacts dynamically to the individual and/or individuals in an area of the yacht. Using AI learning we can change the environment in the area of the yacht to provide the entertainment experience that is matched directly to the audience, including their current temperament and past histories of likes, which will provide the ultimate user experience.

Approaching AI with the right attitude is very important, and it might be best to consider it as a tool with which to make our lives better and easier. As individuals, we will not stop the implementation of AI in our daily lives. If we embrace it, we can help steer the direction that it is headed so that it benefits us. MB

I envision that robotics will be deployed in the future to interact directly with the owner and guests.



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Engel-Jan de Boer

Today's technology uptake driven by sustainability

Eco-efficiency is a key consideration in a sector where many new technologies are trialled, says Engel-Jan de Boer, Lloyd's Register yacht segment manager.

Wind power will play an important part in the sector's propulsion developments.

The superyacht industry is the Formula 1 of the shipping industry, where many of the latest technologies are trialled. It is a hugely fertile ground with owners wanting to participate in exciting new projects, which can then be upscaled to the commercial shipping world. For far too long, the industry has had an image of tycoons and villains owning and operating yachts for their own entertainment, but the opposite is evident in the projects we have been involved with recently in this sector.

Focus on eco-efficiency
In fact, the high-net-worth individuals who own these luxury superyachts are a fascinating bunch. They have sharp minds, a close attention to detail, and a desire to understand and pioneer new technologies whenever possible. Today, many of them are closely focused on eco-efficiency and sustainability.

A key differentiator of this sector is the fact that steady growth rarely falters and there are always plenty of new vessels at design, construction and commissioning stages. And LR's existing market share – 42 per cent of the 5,567 vessels of all sizes currently in service – means that the class society is well placed to track the latest technology developments and win more superyacht business.

It's worth noting that across the environmental considerations that are climbing the agendas of yacht owners, interest in wind is strengthening. More are now interested in sailing vessels, such as the three-masted 106.7m *Black Pearl*, delivered in 2018, while many are adopting hybrid power systems with batteries, including the recently delivered M/Y *Dreamboat* and M/Y *Bravo Eugenia.*

A trailblazer here was the 2012-built sailing vessel *Rainbow*, a J-Class vessel based on the lines of the original 1934 America's Cup winner, designed by William Starling Burgess. The LR-classed vessel has a classic interior true to the 1930s, but a modern hybrid propulsion and power system specially designed and engineered for the vessel.

Technology transfer
Solar power and other sources of energy are hot topics, including sails with solar panels, which reinforces the pressing need to keep abreast of the latest developments. We published *Rules and Regulations for Sail-Assisted Ships* last year and this July, we launched *Requirements for Wind Propulsion Systems*, a development from the experience and know-how LR has with sailing yachts now being extended and transferred to commercial ships.

A range of other sustainability features are now also found on owners' shopping lists. Cyber security, data analytics, glass constructions, 3D plan approval techniques and environmentally friendly solutions such as hydrogen and battery propulsion are among developments that are catching the eyes of more environmentally conscious and forward-looking owners.

Since many yachts are used both for their owners' pleasure and business, top-notch connectivity is essential, so the very latest communications technologies are to be found on these vessels. The availability and use of data are also changing the way we work with yachts and their owners in this sector. Systems and components are becoming more autonomous, allowing for remote condition monitoring and predictive maintenance.

This is already having an impact on the way class societies operate. Remote inspection techniques are often used now for smaller tasks such as verifying that a repair has been undertaken and completed and ensuring that minor damage has been rectified. The environmental footprint of construction, operation and maintenance has become, and will remain, a hot topic.

And the industry is developing a Yacht Environmental Transparency Index (YETI) to make owners even more aware of their environmental profile. The drive for owners to reduce their eco-footprint is good news for LR as it generates significant demand for our core classification and consultancy services.

Power of the wind
As to the future, wind power will play an important part in the sector's propulsion developments. These are also likely to have a bearing on wind propulsions in the commercial sector, an area which has great potential.

If slower steaming becomes the norm and global economies are less reliant on the 'just-in-time' principle, of which COVID-19 has demonstrated the dangers, rotor sails and ventifoils will probably become more common. There's doubt that there will be a push towards fully sail-operated vessels, but on some trade routes and liner services, these could be possible.

Actual propulsion systems using wind vary in configuration and we have been involved in a range of different technologies. Our rules and regulations apply to the rig insofar as this structure is used for propulsion purposes. The actual propulsion force may be generated by sails that are hoisted on the mast (a fore-and-aft rig, for example), rotation of the mast structure itself as in the Flettner rotor concept, or other ways of capturing wind force and transferring it to the hull. In a way, we are going back to our roots in 1760, when wind power was the only source of propulsion. E-JB

Hydrogeneration: crossing oceans without a drop of fossil fuel

Sailing a superyacht across the Atlantic without burning fossil fuel may seem inconceivable to some, but Baltic Yachts is using its developments in hydrogeneration technology to make it a real possibility for its clients.

The simple concept utilises an electric motor to harness energy created from spinning the propeller while sailing. The electric motor works as an alternator, using the energy created by the free spinning propeller to charge a battery bank which, in turn, supplies power to the sailing systems and services on board. This negates the need for a fossil fuel-run generator, significantly reducing fuel costs and the yacht's overall environmental footprint.

"Electric motors are increasingly featured on board sailing yachts to drive the propeller or to generate electricity while connected to the main engine, and if the boat is being propelled through the water by the wind in its sails, then we have the opportunity to generate electricity in a reverse capacity while sailing," explains Henry Hawkins, executive vice president at Baltic Yachts. "With hydrogeneration, it is entirely possible for a sailing yacht to sail across an ocean and generate all of its power needs as it goes."

The Baltic 142 *Canova* is Baltic's first project to feature a hybrid diesel-electric propulsion system designed for hydrogeneration while the yacht is sailing, enabling the use of all services without having to deploy a fossil-fuelled internal combustion engine. The 420kW permanent magnet electric propulsion unit aboard *Canova* is a fraction of the size of a diesel equivalent and is virtually vibration free and almost silent in operation, meaning increased comfort and significant weight and space savings through reduced insulation.

The average generating capability on *Canova*'s early trials averaged 27kW when sailing at 16 knots and an output of more than 35kW when sailing at around 20 knots. These and subsequent results have exceeded Baltic's expectations and it can now be said with confidence that *Canova* could cross an ocean in a moderate breeze, with all her electrical systems working, without using an internal combustion engine to drive a generator.

The latest developments in battery and electric motor technology has enabled the creation of Baltic's hydrogeneration system, and these are areas that are still rapidly evolving. As such, for prospective clients who wish to have a future-proofed sailing yacht design, hydrogeneration is a must. "We will see batteries and electric motors getting even smaller, more lightweight and more powerful," explains Kim Kolam, senior electrical engineer at Baltic Yachts. "In a few years' time, we might even be able to replace combustion engines with another technology that generates electricity."

Baltic is also working on developing a hydrogeneration product for refits, incorporating an individual hydrogeneration unit independent of the propulsion system to charge the existing battery bank. "For example, we could use an electric stern thruster that rotates fore and aft to generate power more efficiently than using the main propulsion drive," adds Hawkins. "This is likely going to be the next step for the technology."

While misconceptions exist about the complexity involved in hydrogeneration, Baltic's solution is made up of existing components and an integrated control system that is mostly automated – its operation is likened to the level of control needed for motor-sailing when adjusting pitch to optimise fuel consumption. The major benefits of improved comfort and reduced fuel costs and environmental impact also far outweigh a minimal loss of speed caused by the additional propeller drag. With *Canova* paving the way to a more sustainable future for sailing yachts, hydrogeneration is expected to become increasingly mainstream.

Daniele Bottino

Classification services: combining safety and innovation

A safety-focused mission can yield a technology dividend for superyacht owners, says Daniele Bottino, manager, regional business development, yacht sector lead at ABS.

Every yacht builder, owner and captain knows that classification is about safety. What they don't always know is that while the core mission remains preservation of life and property, classification is also about innovation.

Class responds to regulation with rules and guidance but it also supports the industry with technology and cutting edge services enabled by our unique role. The dozens of new superyachts delivered to ABS class over the last couple of years are testament to this approach; we have helped many yards and owners achieve not just safer but smarter sailing.

This is possible because many of the services we develop for the merchant marine sector can be scaled for superyachts and while some are some still emerging, others are becoming embedded.

Since first launching the service two years ago, ABS has seen demand for remote access to on-board systems surge as in-person visits became problematic. The advantages of this technology are obvious, in that they enable attendance remotely for an increasing number of survey types, which means we can continue to provide safety services at a distance.

The process has successfully streamlined business operations for vessel owners as well as equipment manufacturers globally. And while the pandemic has accelerated demand, the advantages are such that this was always destined to become a routine operation and we are well past the tipping point of market acceptance.

As ship owners demand greater understanding of the technologies they need to adopt to meet future regulatory constraints, they need to understand the impact on their fleet and if possible validate the technology before they specify it. The same principle applies to yacht owners as they look at how new technologies could be used on their vessels to positively contribute to today's pressing environmental challenges.

Modelling and simulation are not new technologies but are techniques that have become critical to the development of hi-tech systems. For example, a ship with a low carbon impact will require that all elements from the main engine upwards are connected so that we understand how they work together. Before the availability of simulation techniques, the process would have required testing, risk analysis and physical qualification of these components.

By simulating vessel systems we can model and measure a ship's contribution to carbon emissions and understand what is needed for mitigation, making it a key technology to drive the industry's digital and decarbonisation transformations.

Digitalisation and the tools used to collect, store and analyse the mass of data streaming from vessel systems will play a role in improving their integrity and performance with a new lifecycle approach that is more asset-specific, condition-driven and continuous.

These decisions are complex and require gathering information from multiple sources. An Original Equipment Manufacturer can provide information about its components but the decision about that asset is not made in a vacuum, it requires input on operations, chartering and crew to really determine the most effective decisions.

It's this challenge that drives the need for data fusion platforms, that takes various data sources via a foundational base to consolidate and standardise them to power business decisions.

From a class perspective, the aim is ultimately to replace calendar-driven surveys of hull and machinery systems and verification of compliance based on the actual condition of those components in accordance with specific survey requirements.

More and better information has operational dividends too, making weather forecasting more predictable, voyage planning easier and providing alerts to any potential high risk areas or those subject to specific regulations.

Visual inspections by properly trained and highly experienced surveyors have traditionally made up the majority of maintenance surveys, but the growing use of innovations like AI provides an opportunity to further augment human skills with computing power.

ABS is leading a project to apply AI and machine learning to an image-recognition tool designed to aid inspectors in reviewing data and making coating condition assessments. Work continues to make the tool more accurate for assessment of coatings and conversations with clients are ongoing to customise the tool for their particular applications using images specific to their assets and structures.

In their exploration form, superyachts are heading into ever more remote waters. To help them navigate safely, ABS provides dedicated solutions to help them understand and mitigate the risk, such as the ABS Polar Suite; an in-house software tool that inspects datasets such as seasonal sea ice and provides output in the form of easy to interpret charts of predicted ice conditions at the times and locations of the intended vessel operation.

All these tools and more are available to the industry as part and parcel of the class process. Safety remains the guiding principle; innovation is what we harness to deliver it.

Keith Chappell

10 steps to IMO compliance and beyond

Cyberprism's group technical director, Keith Chappell, outlines why prudent cyber risk management is an act of maturity, while avoiding a race to the bottom.

Having been a little disturbed by some of the questions posed to the panel at a recent cyber security online conference in relation to IMO 2021 compliance (MSC428(98)), I thought it worth writing something that helps vessel operators understand what is required. As a vendor of products and services this may appear strange, but we must recognise budgets are finite and in a sea of sales people selling the latest gadget or service it's important to understand that spend should only be made to address a risk and not because a sales person puts a compelling argument for their product.

I believe whether on board or ashore, Cyber Security and Information Assurance (CSIA) should be a process of continuous improvement and not a need to be compliant with any particular standard or regulation. Striving for compliance (with any standard or regulation) is simply joining the race to the bottom; IMO is no different and sets a relatively low bar that can be easily and cheaply surpassed.

Time is, though, running out; at the time of writing there are five months to meet the January deadline. However, it's not too late. The hardest part is making a start, especially if the finishing line is not visible yet. For simplicity we advocate a 10-step plan, effectively an on-ramp to CSIA, delivering IMO compliance along the way but continuing onwards, evolving and improving your organisation's CSIA posture.

Let's briefly remind ourselves of the IMO requirements (paraphrased below): -

- Cyber security measures must be adopted in the company's Health, Safety & Environment, Security & Equality/HSES&Q Policy Statement
- Risk assessments of all OT and IT systems on board and ashore
- Policy in place for the uses of removable data storage
- Policy and procedure in place regarding network communications and Wi-Fi for vessel crews
- Policy and procedure in place for monitoring and updating navigation and communication systems
- Policy in place regarding authorisation criteria for remote connections
- Inventory of all IT/OT systems
- Internet access policy in place outlining restrictions relating to operations currently being performed on board
- Contingency plans for emergency response developed and in place.

With this in mind let's discuss the first three steps to be taken:

Step 1
Ensure the business is brought into the process. CSIA must be led from the top. Don't have a technical conversation with the business seniors; the conversation must be pitched at the right level for this audience. The discussion should be around business risk. The business seniors should understand that the business already manages risk; CSIAis just another risk that needs managing and it may be possible to manage and evidence the management using systems already in place (the SMS for example).

The hardest conversation is usually around getting a workable understanding of acceptable risk. Often this is a more difficult conversation than securing an appropriate budget. The budget conversation can often be delayed until a better understanding of risk is made but understanding risk appetite and what level of residual risk may be acceptable is vital (this is not stipulated by the IMO and will vary by business activity and size).

Record the risk appetite in the cyber risk policy. It is also useful for the board to provide guidance as to the company's position on cyber risk, cyber risk inherited risk from suppliers and other third parties and any parameters in regard to acceptable levels of business interruption/inconvenience in the policy document. The document should also give consideration to the relative importance of gathering forensic evidence versus the urgency of return to normal operation of the vessel.

These conversations can be difficult and may be aided by securing a board-level briefing from a CSIA expert who can relate to the board.

Step 2
Take the time to plan a timeline that will help others understand the process and provide a ready means of demonstrating progress to business seniors (a basic KPI). Where possible, assign responsibilities and communication routes; time is short, and time spent in planning should help to avoid duplicated effort and communication misunderstandings.

Step 3
Agree and define the scope as early as possible, and ensure everybody understands it. Be it one vessel, all vessels or vessels and shore bases, don't get trapped thinking you will do a pilot on a single vessel, when the business seniors think you are addressing the whole fleet … it happens!

It's also worth considering that surveying multiple vessels, while time consuming and potentially daunting, will identify many risks that are not only common to multiple vessels, but have common risk calculations and remediation strategies.

Find time to ensure enough resource is available. Staging vessels one after another (where time allows) will allow knowledge gained from early surveys to be re-used on later vessels, and templates for asset and risk registers will mature and may be suitable for completion by others. Again, the plan is key, for large fleets addressing a vessel of each class early, then applying the knowledge as further surveys are undertaken does appear to be the most efficient approach. KC

Oliver Graffy

Using 3D laser scanners to create fit-for-purpose naval drawings

Naval architect and co-founder of Digital Dry Dock, Oliver Graffy explains how using 3D laser scanners to create accurate digital twins of marine assets can revolutionise the superyacht industry.

When we talk about yacht refits or any form of manufacturing within the yachting industry, our minds are drawn to time out of the water and time in the dry dock. Typically, it takes days to carry out the measuring process alone and, due to the absence of fit-for-purpose 'as-built' drawings, failure to measure accurately often leads to poorly estimated projects and costly re-work.

However, with the introduction of 3D laser scanners it is now possible to accurately measure the hull, superstructure exterior, interior and engineering systems in just a few hours.

This technology has already been put to widespread use in the building industry. It is even a legal requirement for government-owned buildings because of the time and cost savings it offers throughout the building's lifetime. So how does it work? And what value can its use bring to yacht owners?

How does it work?
The process begins with boarding the boat and gathering information. While it is an option to scan the entire vessel, nothing beats the knowledge of the owner, the captain or the crew in knowing where to start. From here, the laser scanning begins.

With the use of laser scanners, photogrammetry and scanning accessories, designed especially for yachts – such as the counterbalance rig which can be suspended over the side – almost any part of the boat above the waterline can be measured while it is still operational and in the water. This means that no matter what is being surveyed, whether a small engineering compartment or even an entire vessel, measurements can be taken while the boat is fully operational. Technology is currently being developed to enable inspections to be completed below the waterline too.

Once the initial scan has taken place, the data is uploaded and the scans are registered together to form the foundation of the digital twin – a point cloud. This three-dimensional data set can then be used to create drawings or models in either 2D or 3D and in any CAD format. Utilising these drawings and dimensional checks, findings are reported, comparisons are made to design drawings and there are checks for misalignment. Next, everything that has been found during the measurement process is depicted in a format which suits the client.

What does this mean?
This is a big move away from the unscientific and labour-intensive techniques being used to date. Traditionally, measurements are taken by hand in 2D and then translated into a 3D model.

If we take a look at 3D scanning's capacity to facilitate smarter fairing and finishing, the benefits become immediately clear.

Based on a 50m motoryacht hull, the mapping process can take hundreds of hours to complete. Factor in safety, over-orders and, often, an over-application of filler and it's time to consider stability and warranty issues too.

Scanning, however, requires one person and a fraction of the time. Plus, the elimination of a large part of the risk. Not only are scanners quicker and safer, but they are also astoundingly accurate. The technology used provides sub-two-millimetre accuracy at a 45m range and it's often possible to measure within a distance of 10 metres. This accuracy enables us to calculate the exact volume of product required, to the litre, as well as the distribution of filler. Plus, all of this can take place before the yacht reaches the dock.

What are the wider implications for the industry?
3D laser scanning and the resulting 'digital twins' have already been used in a number of other ways throughout the industry. For starters, they are having a huge impact on project timelines. Because drawings can be produced remotely and with such a quick turnaround, multiple processes are able to take place at once, compressing the project Gantt chart. For example, templates for joinery can be prepared remotely, while allowing crew or other trades access to the cabin. Furthermore, through the creation of accurate 'as-built' drawings, modifications can be manufactured in advance, cutting down the time in refit substantially.

We've also seen findings used to document insurance damage or help resolve warranty issues. However, it's not possible to go into details here due to client discretion and confidentiality.

Even racing has seen the benefits of digital modelling in this way, through the comparison and optimisation of hull shapes, plus rig, keel and rudder alignment.

This method is nothing short of revolutionising the superyacht industry in its ability to save time and money whilst providing a better set of drawings to work from. OG

Through the creation of accurate 'as-built' drawings, modifications can be manufactured in advance, cutting down the time in refit substantially.

C&N

Ahead of the curve

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The *original* yachting company

While some companies have reacted to change, others have been proactive in transforming the industry's digital landscape, as Camper & Nicholsons International Chief Innovation & Technology Officer Giovanni Alessi Anghini explains.

The global pandemic may have forced many companies within the superyacht industry to adapt their business models and increase the shift to digitalisation, but there are some early adopters who are already leading the way to the future.

Camper & Nicholsons International anticipated the industry's requirement to move with the technological times long before it became a necessity, investing in a dedicated, full-time, internal technology division, while others continued to outsource.

This has allowed the company to drive innovation in many areas of its offering, developing both internal and customer-centric technology solutions that are transforming the way superyachts are built, managed, chartered and purchased.

"This is part of a bigger plan, driven both by our shareholders and broad spectrum of in-house market experts", says Chief Innovation & Technology Officer Giovanni Alessi Anghini, who explains that his team utilises the vast array of industry insight available across Camper & Nicholsons' various divisions to maximise the functionality of these technological solutions.

"Technology will play a key role in developing services for different stakeholders … there are over 20 'products' under development within the C&N technical ecosystem. Instead of buying these solutions through third-party providers, we have decided to build them internally; we are, therefore, faster in developing solutions specific to the yachting industry, which is more unique than any I've ever seen."

Among these many solutions, there is one that has the power to transform the sale/purchase and charter processes across the market, with the development and subsequent launch of a company intelligence database.

While a company database has existed for over 15 years, over the past seven months a completely new infrastructure has been developed, resulting in an instantly accessible, real-time market information and analysis tool. Anghini's team has also incorporated marketing tools into the database so that client-centric reports and documents can be generated quickly and efficiently.

"We have designed an intuitive interface where users can browse through data stretching back over 20 years and undertake analysis utilising various metrics. So they can easily understand market performance very quickly."

Internally, this allows the client-facing team to have comprehensive market insights available at the touch of a screen, so that they are always providing the clients with the most detailed and accurate appraisal of the market landscape.

In the coming months the database will take on an exciting new facets, whereby brokers will be able to enter secure 'rooms' with clients, where sensitive information can be securely shared for the purposes of a potential transaction, without risk of dissemination. It is yet another example of the company's commitment to an unrivalled level of customer care.

"We are led by a CEO who strongly believes in technology and innovation. There is beginning to be an industry shift towards innovative products and services, and it is to our benefit that we have done it earlier and faster than most," Anghini concludes. "The key to the success of this process is not simply identifying a new product or solution, but the ability to make it a reality. And this is only possible because of our ability to work as one team. Innovation is disruptive by its very nature, and being able to manage delicate internal processes, as a group, is fundamental. Achieving this is what has made the process such a success."

MB92 GROUP

This challenging period has demonstrated that our greatest asset is our community. We wish to thank all our families, colleagues, working partners and clients for their trust and collaboration in enabling us to continue working.
We also wish to pay tribute to every single essential worker and health care professional for continuing to go above and beyond.

Thank you.

MB92 BARCELONA

MB92 LA CIOTAT

Aino Grapin

Giving innovation a focus

Aino Grapin, CEO of Winch Design, on why sustainability gives the concept of innovation a focus.

Three-dimensional sand can be sculpted and pressurised to create hard surfaces that mimic the natural form of raw stone, meaning no virgin materials are taken from the landscape.

Why do clients choose a particular designer? And why do they keep returning to the same designer? Some designers may count on innovation alone to win the favours of our demanding clients, but the world's most successful brands like Apple or Tesla, which exist at the intersection of luxury and technology, don't rely solely on innovation. How does this translate into the world of superyachts? In my experience at Winch Design, the main reason our clients repeatedly return is because they trust us and what we stand for. We listen to their dreams with intent and design with commitment and integrity that ultimately means clients feel a genuine connection with our designers and with their project. If our clients trust our ethos then it is only right that we speak with the same honesty regarding the ongoing sustainability crisis, the role that the superyacht industry must assume now.

If innovation in yachting needs a focus, it should be a sustainable one. We are tackling the challenge with the full creative force of the Winch Design team, but it is also essential to share each other's journeys, to be honest about which approaches work or don't work. So far, I can report back that the solutions lie not only in design breakthroughs, but also in organisational changes and broad engagement with an innovation ecosystem.

On a design level, our current projects allow us to work with technologies that excite both ourselves and our clients. They demonstrate that their wildest dreams can be compatible with a sustainable one. Re-inventing the wheel may be unnecessary but sustainability cannot be a tokenistic afterthought either. Through group-think innovation and by harnessing the skills of our partners, we can build on one another to create designs of real sustainable value. As demonstrated through the pioneering work of The Water Revolution Foundation, collaboration with the whole supply chain is vital to trigger a paradigm shift within the industry. We hope many more will join us in signing their Code of Conduct.

Sailing yachts are back to centre stage, thanks to their potential for sustainable innovation. For instance, we are developing a 100ft eco-concept with Royal Huisman, featuring extending solar panels that fan out like a butterfly's wings. The withdrawable systems maximise solar charging functions, resulting in unrivalled efficiency – even the sail is an opportunity for solar charging. The aim is to develop new technologies that harness the power of the wind and sea in the most efficient ways. Also on the Winch table are plans for an electric-drive mono hull sailing yacht and multi-mast 'DynaRig' concept. These projects take us back to our roots: the first Winch project in 1986 was a Swan 36ft, featuring interiors and deck spaces lovingly designed by Andrew.

In the motoryacht world, taking positive steps towards sustainable propulsion doesn't mean that we can rest on our laurels; progress is needed for interior design too. We have invested time into building an extensive database of sustainable materials. Innovative and beautiful materials such as palm leather, aloe vera surfaces and renewable rattan can take the place of leathers, rare wood marquetry and non-sustainable wall finishes. Three-dimensional sand can be sculpted and pressurised to create hard surfaces that mimic the natural form of raw stone, meaning no virgin materials are taken from the landscape. We are currently the first designers to be collaborating with The Water Revolution Foundation to design a concept interior for a new 60m yacht, where all materials are analysed and measured on their sustainability credentials.

How can we get real traction behind our wishes for innovation in sustainability from an organisational perspective? We have found that transparency is an essential pillar. By launching 'Life Worth Living - our roadmap to caring for people and the planet' we have openly shared our targets for the next five years and committed to publicly report back on our successes and, importantly, our shortcomings. Each team member at Winch is accountable for part of this plan. By transparently sharing our desire for innovation, we hope to encourage our partners to come forward with their own innovative ideas and clients with their desires for sustainable yachting, resulting in an innovation ecosystem. In other industries, companies rack up enormous R&D budgets in the hope that their innovation will find an audience. In custom yachts, we are fortunate to have clients who are patrons of innovation: they support us in creating the future of yachting.

In the words of Elon Musk: "When somebody has a breakthrough innovation, it is rarely one little thing. […] It's usually a whole bunch of things that collectively amount to a huge innovation." We can already see these sparks all around us and in our studio and we are excited for what's to come. AG

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(L-R) Alan Guy, Ralitsa Mihaylova and Dr Neil Nicolson

Recreational craft: preserving biodiversity and the asset

Alan Guy, director of technology, Ralitsa Mihaylova, head of special projects, and Dr Neil Nicolson, head of yacht consulting, at Safinah Group outline the imperative of employing an effective biofouling control strategy to protect assets and the environment.

Antifouling systems (AFS), whether a coating, a surface treatment or a device, are designed to protect the underwater hull from biofouling accumulation. Selecting and applying/installing the optimal system is key to achieving the best in-service performance results in terms of controlling biofouling. This not only protects the asset but also minimises the risk of transferring non-indigenous species and preserves marine biodiversity, an AFS function which is becoming significantly more important due to coordinated efforts to tackle biodiversity loss and an increased awareness regarding the gravity of the issue.

Selection and specifications
As awareness about the issues associated with biofouling grows, so do the attempts at solving them by increased levels of research and development of various AFS. Selecting the right AFS, whether a coating, treatment system, device or a combination of the above has never been more challenging as the market becomes more and more fragmented.

For the optimal solution to be identified, careful consideration needs to be given to a variety of vessel-specific factors affecting the suitability of potential AFS. The output of a methodical analysis of such factors is referred to as 'functional specification'.

Examples of such factors are typical operational profiles and associated environmental parameters, expected activity and speed patterns, freshwater exposure, refit/newbuild locations and AFS availability, substrate type, application/installation methods, biofouling management options and cleaning equipment availability at typical locations, etc.

The efficacy and performance of some systems may vary across areas of the underwater hull or may be affected by environmental parameters, such as temperature, water salinity and time spent in different ecological regions. This variability in AFS performance is a particularly important consideration for vessels, such as explorer yachts, that may be exposed to significantly different operational conditions over relatively short periods of time,

AFS installation and application
In terms of the underwater hull, once the optimal solution(s) have been identified, they need to be applied and/or installed in a manner ensuring that the systems' expected in-service performance will not be compromised.

Coatings are the predominant technology used to protect the underwater hull from biofouling. Surface preparation, mixing and adequate application are also integral to the process.

Niche areas present different types of challenges in terms of application and installation considerations compared to the rest of the underwater hull. The guidance on recreational craft provides a non-exhaustive list of typical niche areas including the following:

- Propellers, thrusters and/or propulsion units
- Rudder stocks and hinges
- Rope guards, stern tube seals and propeller shafts
- Apertures or free flooding spaces
- Areas prone to anti-fouling damage from groundings
- Outlets, inlets, cooling pipes and grates
- Anodes
- Anchors, anchor wells, chains and chain lockers.

Some of these areas, such as the entrances to inlet and outlet discharge pipes, bow and stern thrusters, rope cutters and rudder fixtures may be neglected or inadequately protected when applying AFS. Other areas, such as anodes, are typically not coated. The guidance for recreational craft suggests that to minimise biofouling accumulation in the area, (1) the anodes can be flush-fitted, (2) the gap between the anode and the hull can be caulked or filled with a rubber backing pad, or (3) the area of the hull is coated with an AFS suitable for low water flow.

There are alternative AFS that could also be considered.

Maintenance
The international shipping industry is being encouraged to adopt a risk-based approach to biofouling management, a trend that will likely affect the recreational sector as well. As a response, the industry is adapting by using the power of predictive analytics to assess the risk of translocating non-indigenous, potentially invasive, species through digital tools. AFS maintenance is an important part of biofouling management. It is not unusual for yachts to be idle, which typically leads to biofouling accumulation. In-water hull cleaning is one of the common remedies in such cases. There are potential water quality and biosecurity related issues with in-water hull cleaning equipment not capable of capturing debris, therefore local requirements may be in place in different regions. Apart from capture capability, another consideration related to in-water hull cleaning is the AFS suitability. Some cleaning strategies or equipment may not be suitable for all types of coatings, treatment systems or devices.

Frequent cleaning or scrubbing of the surfaces, especially with equipment that may not be recommended for the purpose, could lead to early AFS failures due to issues with coating thickness or integrity.

Marine growth prevention systems, such as chemical injections in internal seawater systems, and any other devices and treatment systems designed for controlling biofouling accumulation should be regularly monitored according to manufacturer's instructions.

Biofouling can have a detrimental effect not only on the operation of each vessel but also on the environment. Preserving marine biodiversity is crucial for achieving the UN Sustainability Development Goals and ensuring climate change resilience. The issue of translocating non-indigenous, potentially invasive, species via biofouling can be addressed through a coordinated effort on a global scale. Expert advice on developing an effective biofouling control strategy should be sought for best results. AG, RM & NN

Captain Jan Thordan Hansen

Innovation can build a bridge to digitalisation

Captain Jan Thordan Hansen, director, global business development, Sperry Marine, examines the perennial challenge between product development and technological advancement.

This new era requires that the supplier changes too ... so that the outcome is an improvement and not a further complication to an already complex business.

A truly innovative business is one that can anticipate its customer's desires while also providing for their needs. If that sounds like a contradiction then it only serves to illustrate the challenge that many businesses face in adapting to the era of rapid digitalisation.

Being able to marry these competing demands requires the ability to adapt a sometimes traditional business-to-business mindset to a market where the speed of technology adoption can outstrip product development cycles. For example, the evolution of superyacht bridge design has been driven by increasing requests from designers for systems that combine a very strong aesthetic quality with the Type Approval that provides high levels of safety and reliability. It is doubly true when the area of operation is not concerned with fuel savings or schedule keeping, but the regulated safety space on the bridge. The requirement for Type Approved, standards-based systems for navigation safety are a far cry from an app-based efficiency gain or drone-based spare parts delivery.

For a company that has navigation systems in its DNA, it has become a natural extension for us to think about what digitalisation can do for our customers; more and more of them are working to combine enhanced functionality with improved connectivity from bridge to shore.

Every superyacht bridge is bespoke; no two are the same. But superyachts are fully ocean-going vessels, so safety is the priority. A Type Approved bridge system must provide the look and feel that owners demand but also the redundancy and back-up the boat needs.

Sperry Marine's technology is trusted by navies and merchant shipping worldwide but there is little to match the demanding constraints on space and ventilation for a superyacht bridge which still meet the owner's requirements for slick appearance.

There are several elements to innovation on the bridge. The first will centre around gathering data to analyse system performance and better plan servicing and maintenance of the bridge components.

Digital updates for the electronic chart display are already happening but there is a need to improve the procedure for getting the data into the front of the bridge navigation system. Rather than rely on memory sticks for transfer, there should be an independently hosted back-of-bridge system with a secure connection to the front-of-bridge.

The data-on-demand model is quickly being replaced by real-time monitoring of vessel systems and customers are already exploring the benefits of a richer data stream that can enhance the safety and efficiency of bridge operations.

We also employ the same secure data stream to deploy software updates and patches directly into the bridge system whether the vessel is alongside or on voyage. That data can also be used to deliver more data from shore, such as weather updates, safe routing or berth availability.

These changes are already taking place but we think that customers, rather than vendors, should decide how and at what speed such tools – as well as more advanced ones - should be applied.

This new era requires that the supplier changes too; building a new skills base with people experienced in connectivity and data, so that the outcome is an improvement and not a further complication to an already complex business.

We are also aware that with greater connectivity and increased data transfer comes an increased security risk, which must be managed. Our approach is to build a cyber infrastructure which is capable of maintaining more than just an 'air gap' between the ship's network and the front-of-bridge navigation system, to provide a robust physical component of a layered cyber security strategy.

This approach to innovation could be viewed as small steps in the right direction but it is critical that the strategy actually provides tangible results, not innovations in search of a business model. By building a platform that can be used to deliver services as well as systems we will be able to make giant leaps too.

It also reflects the fact that - whenever possible - our service engineers are present on the boat; we see how customers use our products and hear first-hand about the improvements and enhancements they want to see. That gives us a unique perspective on how to create new services that meet these changing needs. History and heritage are not enough to protect any company from the challenges of digitalisation, but change need not be a threat to survival. Instead, it enables much closer dialogue on how we can support customer operations and deliver real digital value, rather than create disruption for its own sake. JTH

Marnix Hoekstra

Design of the times

Marnix Hoekstra, co-creative director at Vripack, believes true innovation comes from doing what we are already doing, only better.

Innovation is not necessarily the development of futuristic concepts, but rather the development of unique projects that perfectly reflect the requirements of the client in question.

The need to tell stories and create more choice within the superyacht market, as a means of attracting new clients, is a crucial element of yacht design. It transcends the boundaries of budget or time and frees the mind. For those who do not believe it until they see it, storytelling is a compelling method of transforming a 2D sketch into a tangible reality.

Many of our Vripack designs have journeyed to the ends of the Earth. They have placed the owner at the heart of the experience and breathed fire into the coldest of climates. Take 46m *Pioneer*, for example, a private expedition yacht with an incredible 11,000-mile range and robust cruising capabilities. She was the first yacht to circumnavigate North America and has tackled many high-latitude destinations, from Greenland to Alaska, and British Columbia to the Northwest Passage. She has two owners who share their time on board, which means the yacht never stands still. But it also highlights an alternative ownership model with real appeal, particularly in the current Covid climate.

Gayle Force is another example of a Vripack design – one of our legendary Doggersbank Offshore series – that has pushed the limits of what is expected from a compact yacht. Captain Scott Whittaker has some incredible tales to tell of when they spent weeks cruising around Patagonia in 2018 as part of their world tour. The owners typify the ambitious and visionary clients that Vripack's creative, holistic and collaborative approach attracts. And so, despite being in their 50s and 60s, the rough conditions, relentless winds and high seas only added to their excitement of being on board their robust 29m vessel.

It's hearing about these types of first-hand experiences that make future owners not only seriously consider having a yacht in the first place, but also to think hard about the type of yacht that they would like. Explorer yachts are really coming into their own because of the level of autonomy that they offer. Reports this year of owners spending weeks, if not months, on board their yachts in an isolated pocket of the world has given true meaning to the idea of escapism. And this need to feel safe, secure, and private is compounded by a desire to innovate, too. Inspiration leads to market growth if what you're putting out there as a designer has relevance.

Our yacht concept *Futura*, which we launched earlier this year, aimed to do just that. It's a concept that takes its design inspiration from nature itself. The crux of Futura is to create a 66m fossil-free yacht whose design captures wildlife's innate ability to freely propel through air and water because our enjoyment of yachting should not be to the detriment of the oceans. We believe yacht design should be in harmony with the world around us.

Of course, reducing yachting's impact on the world is not a new topic. The superstructure on *Futura*, with its egg-shape sliced onto a beautiful slender hull, is a concept that has been maturing in our minds for over a decade. Used with a biometric way of structuring, the result is lighter than traditional shipbuilding methods and something that is aesthetically beautiful, too. Capable of holding 100,000 litres of fuel, the yacht can run solely on 'blue diesel' if desired (a type of Finnish biofuel made from waste food, currently being used in the trucking industry). It also possesses revolutionary bio-based batteries made from salt, sand, water and plants. And the battery bank is 100 per cent biodegradable, charged by an enormous kite on an electric winch that can be released at the touch of a button (an innovative means of harvesting energy, formulated by Vripack in house).

The important thing to remember about innovation is that the market needs to be ready. If it's too advanced to comprehend, the industry won't be receptive. That is why we held back on developing *Futura* until a time when we felt it would truly resonate. This is true on an even smaller scale, too. Innovation is not necessarily the development of futuristic concepts, but rather the development of unique projects that perfectly reflect the requirements of the client in question. Inspiration is dependent on a client's 'readiness'.

There is a lot of pressure in the yachting industry to try to create the next big thing, to improve on the latest technology and create a new way of being. For me, it is not about repeatedly reinventing the wheel but doing what we already do, better. And this applies to our clients, too. Just the possibility of upgrading from a standard yacht to a hybrid explorer is revolutionary for some owners. It changes their outlook on where they travel, how they live, even how they bring up their children; it raises the bar for that family. And I think, from a design perspective, that is innovation. MH

Sander Jacobs

Polar expedition cruise vessels setting clean power generation example for superyachts

Superyacht operators no longer need to compromise comfort while being environmentally responsible, says Wabtec Corporation's Sander Jacobs.

About 91 per cent of the world's population now lives in locations where air pollution levels exceed air quality guidelines set by the World Health Organization. Air pollution is now the fifth highest health risk and cause of death, ranking just below smoking. More people die from air-pollution-related disease than from road traffic injuries or malaria each year. The harmful impact of air pollutants to human health, particularly NO_x, particulate matter and SOX have triggered emissions regulations in several industry sectors, including the marine sector.

Air pollutants in sea-going ships' exhaust gas are governed by increasingly more stringent standards defined in the International Maritime Organization's (IMO) Maritime Pollution Convention (MARPOL). US-flagged vessels operating in US waters or in the designated North American and US Caribbean Sea Environmental Control Areas (ECA) must comply with emissions limitations defined in the US Code of Federal Regulations (CFR), governed by the Environmental Protection Agency (EPA). IMO tier III NO_x emission limits have been in effect for all engines above 130kW that are installed on ships constructed on or after 1 January, 2016 and operating in the North American and US Caribbean ECAs, and for ships constructed on or after 1 January, 2021 and operating in the Baltic Sea ECA or the North Sea ECA. IMO tier II emission limits must be met by ships constructed on or after 1 January, 2011, when operating outside a designated NO_x ECA. Recreational ships with a length below 24m are excluded from tier III NO_x limits. For recreational ships with a length above 24m and below 500gt, the Tier III NO_x limits are scheduled to become in effect for ships constructed on or after 1 January, 2021. This date is approaching quickly.

A common methodology to meet IMO tier III and the more stringent EPA T4 NO_x limits is through reducing NO_x in the exhaust gas through a Selective Catalytic Reduction (SCR) after-treatment system. A reductant – usually a urea solution – is injected in the engine exhaust gas and funnelled through a mixing chamber to a reactor containing a catalyst that enables a series of chemical reactions converting the nitrogen oxides to yield nitrogen and water. A SCR after-treatment system typically includes the SCR reactor, dosing pumps, stainless-steel piping, a mixing chamber, and a stainless-steel urea storage tank. A complete SCR system takes up quite some space and adds significant weight to the ship: for example for a yacht with 2 x 2,500bkW engine power, the additional weight of the SCR equipment can easily total 10MT plus another 10–50 MT for the urea storage tank depending on the required range. The space taken up by the SCR system can easily total 15–20m3 plus 10–50 m3 for the urea tank.

For all ship types, but particularly for expedition cruise vessels and yachts, any additional space and weight taken up by machinery results in less space and weight available for passenger accommodation or entertainment options, thus compromising comfort and profitability. Other challenges with urea-based after-treatment systems include the complications with handling urea on board the ship and controlling ammonia slip as well as the urine-like odour. Moreover, urea may not be readily available in the remote pristine locations which these ships visit.

Fortunately, there is a solution that overcomes these challenges. Recently, several (expedition) cruise ship operators deployed an alternative solution to meet the most stringent emissions limits by utilising advanced exhaust gas recirculation (EGR) technology. Advanced EGR minimises the formation of NO_x during combustion, as opposed to reducing NO_x in the exhaust through a series of chemical reactions in an after-treatment system. This breakthrough engine technology assures compliance with EPA T4 and IMO III emission limits, without the need for a SCR after-treatment system. This in-cylinder emission reduction technology takes up significant less system weight and space compared to SCR technology, is less complex to install and easy to operate. Additional benefits include no visible smoke, even during load changes, and no need for a diesel particulate filter (DPF) to meet the 0.04g/kWh particulate matter emission limit specified by the US EPA.

Lindblad Expeditions' latest polar expedition cruise ships *National Geographic Endurance* (delivered in 2020) and *National Geographic Resolution* (under construction), and Phoenix's cruise ship *MS Amadea* (auxiliary power replacement) are among the list of ships that already chose this technology to ensure the most environmentally friendly propulsion without compromising comfort and profitability. This technology also provides yacht designers, builders and operators the ability to no longer compromise comfort while being environmentally responsible. This enables future generations to enjoy pristine locations for years to come. SJ

Recently, several (expedition) cruise ship operators deployed an alternative solution to meet the most stringent emissions limits by utilising advanced exhaust gas recirculation (EGR) technology.

Bram Jongepier

The two pillars

There are two profound paradigms that will shape our industry's future, says Bram Jongepier, Feadship, senior specialist, De Voogt Naval Architects.

Another process due to accelerate as the decade unfolds is the way the digital world is integrated within design and operations.

While much of our work currently in relation to innovation revolves around specific client requests for their Feadship, I'd like to use this opportunity to look into the future at two trends that will unavoidably affect all major builders: sustainability and digitalisation.

The development of the industry-wide measurement tool called YETI (Yacht Environmental Transparency Index) continues apace under the auspices of the Water Revolution Foundation. This tool will be sensitive enough within the next one or two years to discriminate between different options and stimulate owners to adopt more sustainable choices as they see rewards for their investment. A recognised rating system will indicate what constitutes a good yacht, in environmental terms, with a language understood and accepted across the industry.

Fuel flexibility is another big issue. Fossil fuels are on the way out and boats launched in five years' time need to be constructed to use whichever replacement is dominant within the proceeding decade. This could well be methanol, which can be supplied in quite a sustainable way and may allow us to design yachts with a much-reduced environmental impact. You need to get cracking now if you want to futureproof a 2025 yacht for methanol use in 2030. But until we know which fuel is the main player, we need to find ways to be flexible. The easiest option is implementing an electrical architecture so that, should highly efficient fuel cells running on methanol evolve, these fuel cells can replace the generators you're currently installing.

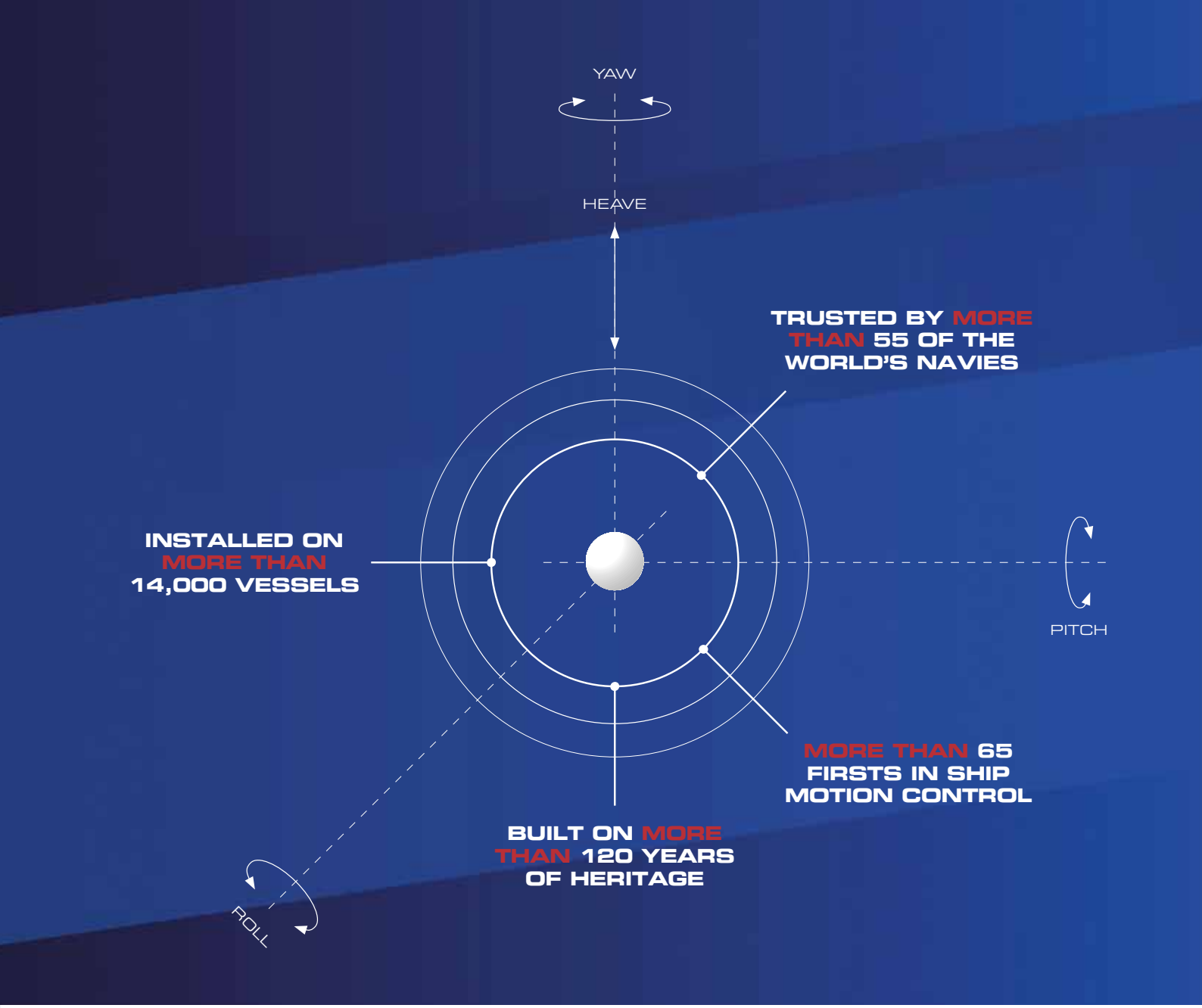
Forward thinking is also required in relation to materials. Feadship's lifecycle assessment studies have shown that the majority of eco-unfriendly impact is caused by a small number of materials, for instance steel and aluminium. Current contract specs assert that all materials must be new but I think this should be reworded as these structural materials will be available in recycled format soon and our industry needs to see if they are suitable for boats. For instance, while doubts still exist about the corrosion levels and mechanical properties of recycled aluminium, can this be compensated for by our coating materials and maintenance abilities? Can we allow a little less mechanical strength and a bit more weight if it results in a 90 per cent reduction in the impact of manufacturing all-new aluminium?

Sustainability also involves more than just installing an efficient engine on board; it revolves around creating efficient overall vessels that take into account all factors which influence each other and make up the whole. We are now looking beyond the efficiency of this 'system of systems' to operational profiles, and we see the same trend in, for instance, the offshore sector. This means not giving priority to a yacht performing optimally at full speed with a full quota of guests on the warmest day of the year in the hottest at-sea location, like Northern Australia. Look instead at the spread of operational conditions and optimise performance over that spread; in other words, take a lifecycle approach that defines the operational profile and design the yacht accordingly.

Another process due to accelerate as the decade unfolds is the way the digital world is integrated within design and operations. Current systems are like neighbours who rarely talk; we're developing systems that oversee all digital systems. We already have several boats in the Feadship fleet trialling structural monitoring – measuring the stresses a yacht faces as she goes through the waves and rests in the sun. This data provides feedback to us as designers and to the management company on the loads the boat encounters. Should a discussion arise about a vibration, we can examine the monitoring system and see that it is, for instance, caused by damage to the propellers showing up on the altered frequency profile. This kind of supervision and diagnosis allows us to increase support within our onshore operational assistance programme and give advice to owners/operators in areas such as planned maintenance.

These same systems also know which environment a boat is in. Radars see the actual wave pattern and the on-board system knows the yacht's response in terms of motion and can suggest, say, anchoring at a different orientation to increase comfort. In addition to this real-time advisory system we can also predict comfort levels and propose the best position to launch tenders or receive a helicopter. Add into the mix the Feadship weather forecast service that we've already developed, and boats can predict wave heights and direction in different locations. Uses range from knowing where best to sip martinis, to which route will save on fuel consumption.

Optimising power use in this way obviously brings us back to sustainability and makes the circle round. I don't think we'll see a fully autonomous superyacht anytime soon but some of the clear benefits of the autonomous shipping movement are already on board. BJ



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Gordon Kay

The future of sailing

Gordon Kay, owner of Infiniti Yachts, explains how delving into history can sometimes offer a glimpse into the future.

Not all innovation has to be a new invention. Sometimes revisiting an idea from almost 100 years ago and refining it can be very effective.

It is often said that the simplest ideas are often the best. As an industry, we tend to avoid simple in the quest for perceived technical innovation. The Infiniti Dynamic Stability Systems (DSS) technology is simple both in concept and execution for the owner, and this has been proven on the Baltic 142 *Canova*.

Interestingly, the decision to install the Infiniti DSS on this truly innovative yacht was met with widespread reservation, at best, and, at worst, derision across the industry. In the end, it is a numbers game, science rather than emotional response and the DSS had produced a heeling reduction of 30 per cent when sailing upwind and pitching reduction of over 40 per cent on *Canova*. The foil delivers a performance boost to the numbers that no other technology in the superyacht sector can deliver.

We had complete confidence in the process having developed the Infiniti DSS over 15 years ago and installing it in a wide variety of racing dinghies and performance yachts. We have learned when to trust 'the numbers' and when to rely on experience. For example, no computer will tell you that the yacht will be faster upwind when using DSS, but we know from experience that as soon as the sea state increases the VMG increases and this is the same for a superyacht as it is a racing yacht.

As adoption of this technology increases, so does the understanding of it in a wider circle of naval architects and the widening of this circle can only be a good thing for the industry at large. However, it does remain a complicated process and there are several examples of yachts that have attempted to either emulate the DSS technology or try alternatives with less than stellar results. Having led the way in foil development in a risk-averse manner, to the point where it is adopted by superyachts, the mantra remains the same. A well-balanced yacht is crucial, the foil where possible should not be there to hide the flaws in an inherently inadequate design. The core DNA of the yacht needs to be there before one can consider fitting a foil effectively to an existing design. Where Infiniti Yachts is unique is in developing yachts where the design is driven by the use of DSS and further gains are possible for the client as a result.

As an industry, we are blessed with owners and clients who are often very open to the idea of innovation, it is frequently the supply side which struggles to cope. Sail design and development is another area where there are significant development opportunities. Doyle Sails has developed the structured luff technology which transforms the loads seen on typical superyachts, reducing weight, cost and complexity and increasing performance. In like-for-like replacements loads have been reduced by as much as 40 per cent, in conjunction with improved flying shapes and subsequent performance gains.

It is much easier to commit to a new sail, as opposed to installing a DSS foil, but as the industry moves forward it is clear that combining the two technologies delivers gains which exceed the sum of the parts. At Infiniti Yachts we have repeatedly seen measured and proven gains working in conjunction with Doyle when developing yachts where we have installed DSS foils. Indeed, the entire structure of the Infiniti 52 has been designed around the Doyle Sails and a customised sail plan.

The loads seen when using structured luff and cableless sails result in a lighter structure, less labour hours and a more effective platform. All of these gains are particularly applicable to the superyacht world.

When developing the sail plan for the Baltic 142 *Canova*, we discussed with the owner the possibility of using a "Quad" sail, something most people are more familiar with when looking at photographs of the America's Cup J-Class Yachts racing in the 1930s. The thinking is simple; as yachts get longer, they get relatively narrower, so sheeting for reaching sails tends to be quite limited and the return of the sail is to all intents and purposes just drag. By effectively removing the return on the sail, or a large part of it, drag is reduced and the flying shape is significantly more effective.

We tested this in the wind tunnel at Auckland University with Richard Bouzaid of Doyle Sails almost 20 years ago and saw staggering results. Unfortunately, the sail is not 'legal' under racing rules, but it is highly efficient and having designed the geometry for North Sails Italy, *Canova* was fitted with this sail on launching. The sail has been an unparalleled success, with a far wider operating range than a conventional sail, with no positive in the leach it is simple to furl and, more importantly, leave aloft in all conditions.

Not all innovation has to be a new invention. Sometimes revisiting an idea from almost 100 years ago and refining it can be very effective. All of our data shows that this sail combination, in conjunction with the Infiniti DSS foil, is a winner in every regard and a pivotal development for the future of sailing. GK

Daniel Kerkhof

Creating a sustainable future for superyachts

Innovation is a loaded subject in the superyacht sector. On one hand, everyone involved is proud to claim that superyachts are the pinnacles of technology and innovation. But, on the other hand, it is clear that we could and should do more, especially when it comes to sustainability and control, explains Daniel Kerkhof, director of Crestron Marine.

All you will have to do is enter a room or deck for everything to switch to your preferences. And when you leave, the music and light will follow you, and turn off behind you.

Let's start with the positive news. Superyachts are cool. On board, you can always find the latest and the greatest technologies, from the technologies used to build the hull, the engines and electrotechnical installation, to the AV and control systems on board. The pace at which new innovations develop, and the pace at which new technologies are applied, is unique. With the level of bespoke design, and the unique positions of the superyacht owners, the superyachting industry is driving technological change and developing solutions for the challenges of the world of today; the industry is not only prepared for the future, we are shaping it.

The entertainment system on board is equipped for the more extreme expectations of users, especially now that mass gatherings will likely remain a thing of the past. The superyacht becomes even more of a getaway, with all the bells and whistles. For example, it is easy to transform the aft deck, with one push of a button, into a nightclub or a cinema offering the full immersive experience you would expect in a commercial movie theatre.

Internet of Things is no fad either and, in the future, we will even go further: hardware integrations will be replaced by a software model. Servers are already becoming multipurpose, comparable to the way the bridge is controlled now; a virtual, server-based control platform can run multiple control programs to control multiple areas of a superyacht over the network from a single centralised location. Crestron Virtual Control already offers the advantage of programming flexibility and the ability to easily add extra CPUs or memory, as needed. With hardware-based control, the programmer can decide which mobile devices and touch screens to put on which control system, to make sure that it isn't overtaxed when running several processes simultaneously. With the Virtual Control-server, the program slots can be divided virtually. The next step is a software-based digital signal processor, for audio signals, and a software-based decoder and encoder for audio and video transmission over a generic network infrastructure.

While the connectivity on board is still limited on bandwidth, it is just a matter of time until these bandwidths start growing dramatically. Enough to reliably integrate cloud-based voice control solutions into the superyachting space.

Another solution we see coming imminently is a cloud-based management platform for all equipment an owner or management company is looking after, over various locations or yachts. 'Cloud' always used to be the word to avoid when talking about superyacht implementations, but that is about to change. This will also impact the most important part of the installation for the owners and guest: the actual User Interface (UI). Right now, we are already taking a big step with the addition of HTML5 programming, which allows to replace the historical, more static UI with intuitive, fast and dynamic visuals that can easily run on your own device. This BYOD trend is also relevant now because of Covid-19, but I expect it to remain a requirement for the future. Our personal devices and iPads on board in the future will complement other, more frequently used control options of the future such as voice control and Bluetooth beacons.

Localisation will play a big role here. By being able to use a person's precise location, for instance through Bluetooth beaconing, the control system on board can be programmed to do exactly what you want, before you want it. Do you prefer blue lights on 67 per cent while the heating switches to 21°C and Spotify plays your favorite playlist? All you will have to do is enter a room or deck for everything to switch to your preferences. And when you leave, the music and light will follow you, and turn off behind you. At Crestron, we already have thorough experience with automated, integrated control. Now, we are gradually integrating our pinpoint beaconing technology into our products, because we are convinced that this, together with voice control, will play a much bigger part in the future.

Now, onto the part where we have a larger gap to close. Automation and integration of systems could make a difference on the sustainability of the superyacht industry. In offices and homes, it has been standard to turn off HVAC and lights when nobody is in the room. So why is the harbour filled with yachts where the lights all over the vessel are on for the whole evening, even though not all decks are in use? In truly smart spaces, different systems are integrated, resulting for instance, in the automatic closing of the blind and dimming of the lights when you turn on your TV. At Crestron, we have extensive experience with these types of integration in enterprise and residential applications, so we are looking forward to advancing them on board of superyachts too, especially since sustainability efforts will be a big part of the innovation of the future. DK

(L-R) Kim Kolam and Kenneth Nyfelt

Revolutionising on-board power

The quest to become less reliant on fossil fuels and reduce emissions will see the popularity of the combustion engine ebbing away, say Kim Kolam, senior electrical engineer, and Kenneth Nyfelt, sales director, at Baltic Yachts.

The reliability and running costs of the diesel engine have historically made it the power source of choice aboard yachts, not only for propulsion but also for driving charging systems. They were fitted exclusively to Baltic's numerous series production yachts and, even today, with other options available, it is taken for granted that a yacht will be fitted with a diesel internal combustion engine.

Despite enormous improvements in diesel engine power-to-weight ratios and reductions in emissions, the fact that they run on fossil fuel puts them at a disadvantage. The growing call to clean up and protect our environment and the acceleration of alternative power source technology will completely change how yachts are powered. Charging systems using more efficient batteries, solar power, electric propulsion, hydrogeneration and now fuel cell technology will all be part of the revolution.

Fitted with an electric propulsion motor and employing hydrogeneration to charge its battery bank, the Baltic 68 Café Racer, currently in build, will be the first yacht we have built without a conventional fossil-fuel-burning generator, although a small amount of gasoline vapour will be needed to fuel a micro-turbine designed to charge the on-board batteries and act as a range extender (REX). Micro-turbines are a fraction of the size and weight of diesels and have just one moving part, dramatically reducing maintenance costs. The technology requires a heat source to drive the turbine which, in turn, drives a generator, the fuel for which could be hydrogen, although, as described later in this article, storage is still an issue. The boat still relies on relatively large, heavy banks of Lithium-ion batteries.

So, how do we reduce the use of fossil fuels and find even more efficient ways of storing electricity? One solution could lie in the fuel cell used as a generator in conjunction with 3D-printed supercapacitors for storing electricity.

Fuel cells convert, typically, hydrogen and oxygen to generate electricity with the only by-products or emissions being water and heat. In the wider marine market, tests have been ongoing for the last 20 years, and there are larger motor vessels with fuel cell technology, but it's been mainly one-off projects. It's harder to fit on smaller yachts because of the space it requires. The 114kW hydrogen fuel cell currently being used in the Toyota Mirai electric car is the ideal size for 30-40m yachts and is being examined by the Baltic R&D team. On weight alone it's a winner, tipping the scales at just 150kg as opposed to 1,400kg for a 100kW diesel equivalent.

The big drawback of fuel cell technology for yachts is the lack of infrastructure needed to store and supply hydrogen. Carrying it in liquid form requires too much energy to cool it to -253°C and, in gas form, it has to be stored under pressure which is potentially dangerous because it is explosive. Inevitable leaks in the system would be a concern and accessing hydrogen in ports is also a major issue. Baltic is looking at ways of making hydrogen on board, but of course you may need diesel as fuel for the reformer, so finding a solution is definitely a work in progress.

Supercapacitors are also exciting. Using electrostatics rather than chemistry to store electricity, the advantages include almost instant charging and discharging. The latter could be particularly useful when, for instance, a large amount of electrical power is needed to drive a hydraulic pump during a sailing manoeuvre. Supercapacitors also don't use materials like lithium – lithium batteries are very flammable, whereas supercapacitors are not. The materials super capacitors are made of are also more environmentally friendly. Additionally, the ability to 3D print supercapacitors would reduce manufacturing costs and tolerances, making them extremely compact.

When supercapacitors are developed to a stage where they are lighter, smaller and cheaper than a normal lithium battery today, all the other challenges are minor and can be overcome with technology available today. Also, the self-discharge rate should not be higher than a modern lithium battery. The ideal supercapacitor is also completely non-organic, environmentally friendly and recyclable. They should also be safer than lithium batteries.

At Baltic we are always trying to 'future proof' our yachts as technology is constantly changing and evolving. Our dream is to have a combination of fuel cells and supercapacitors aboard yachts, which would eliminate emissions, reduce weight, save space and be cheaper. It's an exciting prospect, which Baltic Yachts is working on. KK & KN

Charging systems using more efficient batteries, solar power, electric propulsion, hydrogeneration and now fuel cell technology will all be part of the revolution.

Hayley Van Leeuwen

The key innovation trends have arrived, so how do you get on board?

Digitalisation is having a transformative effect on yacht operations and with it comes the ability to access and act on better data and information, writes Voyager Worldwide's Hayley Van Leeuwen.

Technology is set to simplify business processes, improve transparency, speed up transactions and reduce costs.

It is often said that the amount of progress equal to the entire 20th century's gains was achieved in the first 15 years of this century. Whether that is true or not, what is clear is that the rate of innovation today is faster than at any other time in history and will only increase as we move into the 2020s. The application of new solutions that take advantage of data, advanced analytics and other digital technologies has never been more important. Forward-thinking companies are already digitalising core business processes, integrating systems and experimenting with technologies such as blockchain and machine learning in order to be better prepared for the future.

The digital ecosystem is immensely complex; different stakeholders require different things but it generates an immense amount of valuable information that, still today, is mostly not being captured.

With the overwhelming amount of data that will become available as boats become more instrumented, interconnected and intelligent, faster and more powerful computers, advanced self-learning algorithms and analytics have the potential to create huge leaps forward in safety, efficiency and environmental performance.

In general terms, whatever can be automated should and will be automated to reduce the administrative burden, improve data quality and accuracy, improve decision-making, shorten response times and enable increasingly more efficient data sharing between maritime stakeholders. The difference in the future will be streamlined and automated services, where data delivery and collection are done automatically without the need for crew intervention.

This poses a challenge for yacht owners and operators; those that are able to make the technology investment or form alliances with partners are likely to reap the rewards in the form of significant competitive advantages: improved customer relationships, better access to finance and stronger overall business performance.

Instead of having to sift vast tracts of data, information should be a management tool that can be acted on. For example, at Voyager Worldwide, we have a 'data lake' of more than 1.9 billion data points and make over two million updates to that data every day. We use that data to make it easier for our customers to identify and rectify problems and, increasingly, to benchmark their performance.

Data on this scale creates counter-intuitive effects. Our superyacht navigation service was the first to encourage customers to spend less on charts and publications by helping crews to purchase them more accurately, using data analytics to show where there is over-spending and cost-savings can be made.

We can use data analytics to provide a highly intuitive view of each yacht's chart and publication holdings compared to the requirements of its Flag and other regulatory stakeholders. Captains and crew are able to immediately see any issues that may arise and resolve them quickly and efficiently, enhancing navigation safety and compliance.

By taking a leaf out of the disruptors' playbook we are able to change the pricing model and create a true partnership where we and our customers have a shared incentive to drive down the overall cost of navigation.

It's an example of how we can use data and analytic systems to make increasingly accurate predictions; historic sailing data can help us predict future navigation requirements with impressive levels of accuracy.

Perhaps more than anything, digital data and technology have the potential to help make new levels of transparency possible, putting the companies that embrace them in a strong position to achieve commercial advantage in a highly competitive market, retain long-term customers and access the finance they need to grow in future.

Some owners will want to use data more strategically to track and measure key performance indicators, benchmark against a wider fleet and identify opportunities to gain operational efficiencies that will enable them to demonstrate reduced environmental impact and improved performance.

Going forward, we envision a future where digital services and solutions provide captain and crew with an increasingly clear view of what's happening in their immediate environment, enabling issues to be identified and fixed faster, vessel performance to be improved and safety, environmental and compliance risks to be reduced. Technology is set to simplify business processes, improve transparency, speed up transactions and reduce costs.

Of course, none of us can really predict the future, but what is clear is the rate of technology change is speeding up dramatically with every year that passes. The key innovation trends are already here; the exciting part will be how we apply them over the next 10 years and beyond. HL

Colin Mason

In the eye of the beholder ...
While yacht painting has not changed dramatically in the past 40 years, what definitely has changed is the pace of the process and the quality expected, explains CCS technical manager Colin Mason.

All major paint suppliers sell their products with thorough and well-proven recommendations regarding application, in terms of climatic conditions, surface preparation and film thicknesses, etc.

All the painter has to do is follow the instructions. This was often the only line in old contracts: "All products shall be applied as per manufacturer's recommendations". Which is fine … the important point for any buyer is that this should (must?) be provable.

When suppliers sell material, this is made and tested under independently audited quality systems. You can even ask for a certificate of conformity for the batch you received that will list the test results. At every stage there are checks to ensure the manufacture is in specification.

This is ideal. Painting a yacht … over nine months … with 100 different pairs of hands … using multiple stages from sanding to application? By its very nature of having many more steps and much more processing, it requires a much more thorough QA/QC path to avoid any risks of defects, be that rework or rejection.

In an ideal contract, the buyer will be told what they will receive. They will also ideally know what controls will be put in place to ensure compliance. This is the basis of a paint inspection plan (PIP) or inspection and test plan (ITP).

This plan details the control steps and the pass/fail criteria for every stage as well as final topcoat appearance. This is signed off by the owner team, yard and applicator.

This prevents any discussion, for example, of what exactly 'North European yacht standard' is (a common phrase used in the not-so-distant past).

The technical requirements, for example surface preparation, film thicknesses, application and curing conditions, overcoating times etc. are defined by the supplier but there are also all the cosmetic aspects such as gloss, orange peel and fairness which, within reason, are defined and agreed between the seller (yard/painter) and the buyer. Now it shouldn't really matter who does the check, so long as the check is performed and signed off.

The process just entails lots of release-forms with appropriate results and signatures. Normally, these will be from the yard and the owner's representative (be that project manager or independent paint consultant.)

Just like every other paperwork process, this is ripe for digitisation to ensure nothing falls through the holes; with checks to ensure that every step is completed to satisfaction and that all the signatories are aware of any punch items that need reworking, and all within a traceable and transparent system.

The system should log all and any information you wish to add, be that daily climate conditions, dry film thickness (DFT) measurements, final orange peel and gloss readings etc. This way, all the relevant information and data for each step is accepted before proceeding. This way everyone knows they are on the right path. The builder/painter knows they are making successful progress and the owner's team can see that what they are getting is what they bought.

We are still seeing many examples of contracts having been signed with only limited acceptance criteria, let alone a thorough paint inspection plan. And if there is a paint inspection plan, the formalised recording and sharing of information is slack.

The biggest heartache is normally the tank coating.

While these may seem unimportant and are 'out of sight/out of mind', they are anything but. Especially if they go wrong and repair entail weeks in a dry-dock while someone cuts a hole into the underwater area so as to obtain access – the costs of repair are well into six figures per tank, excluding any loss of charter.

It is normal to see a build specification of product x at x micron DFT. The supplier's recommendations are often a document of 12-20 pages! Everything from the control of the initial metal work to the application of every coat (including stripe coats). There are even recommendations of the level of ventilation required so as to avoid any solvent entrapment or amine-blush – both of which will lead to rapid failure. It is all very well stating 'product will be applied as per manufacturer's recommendations', but the hard reality is that there is often little or no control on every stage of the tank coatings to prove this, let alone control it.

So, I am not talking about re-inventing the wheel or developing new concepts. I am only asking that all involved pay attention to the supplier's recommendations, follow these and prove that these have been followed. Only then will we not only be sure we reach our destination; the destination is one of happiness looking out over your aft deck to the sunset and not stuck in a drydock looking at your bank account getting smaller for something that could have easily been avoided. CM

Jenny Matthews

Innovation, sustainability and our social licence to operate

She of the Sea's founder, Jenny Matthews, explains how yachting can avoid the stick, enjoy the carrot and propel ourselves into the future.

A true sustainability commitment leads to innovation ... this innovation will determine your bottom line and the future trajectory of our industry.

Even before the global pandemic, the wider world has been exploring, studying and actioning how these factors are intrinsically connected. Together, all three are both cause and effect. Significant budgets and brainpower are being assigned to creating the perfect environment in which all three flourish. Industries across the board such as oil and gas, aviation, tech and even investment are turning their attention to reap the many benefits. Their focus? Adding stakeholder value through sustainability and innovation, while avoiding public ignominy by validating their social licence to operate.

The dance between innovation and sustainability, and its impact on the bottom line.

It could feel redundant to use this column to make the case for why innovation and sustainability not only matter, but are critical to the future of the industry. However, to ensure we are all singing off the same hymn sheet, let's do a quick run-down. For additional clarification, 'dustainability' refers to three central factors in measuring the sustainability and ethical impact of an organisation or industry: environmental, social and corporate governance, or ESG. As industry initiatives such as the Water Revolution Foundation and She of the Sea are highlighting, here's what we need to know.

a) There are incredible and critical benefits for all major stakeholders that come from weaving sustainability into our collective DNA.
b) Over the next few years, there will be two sides. Those that lead and those that get left behind. The only choice we each currently have right now is in which camp we will sit, based on the action or inaction of today.

So, what is the link between sustainability and innovation? We all want to innovate, and we cannot ignore the demand to be sustainable. More so, a true sustainability commitment leads to innovation. Finally, this innovation will determine your bottom line and the future trajectory of our industry.

The Carrot
Disrupt the status quo and engage new markets, attract premium talent, all while creating strong, authentic brands that reflect the values of our audience. What's not to love?

All result in solid revenue growth and bolster the bottom line. Perhaps more importantly this also means increasingly engaged owners wanting to invest their hard-earned millions.

We can attract the next generation of human capital required to innovate our way into the future by understanding their values. We can engage a whole new market of young, sustainably focused yacht owners by reflecting theirs. We can continue to exceed the expectations of the current owners and ensure their interests come first. We have all this to gain and more when we as an industry decide that sustainable practices are the way of our future.

The Stick
The cost of inaction is on the horizon. Not only in the form of penalties for ESG non-compliance, or loss of market share, but whether or not we can validate our social licence to operate. Until recently, yachting enjoyed somewhat of a cloak of invisibility to anyone outside its direct circle of major stakeholders. Now, however, the public eye turns with eager anticipation to see what really happens behind the closed doors of the 'one per cent'. As much as we might like to think we are, we are not an island, and the doors are no longer as closed as they once were. We are not immune to unpopular public opinion and neither are the owners of the vessels. A single viral post or tone-deaf Instagram pic can have catastrophic results. We live in a global climate where cancel culture is crippling companies and individuals who fail to understand the risks associated with inaction or indifference.

It is up to us now whether we, and the owners of tomorrow, think that being viewed as the bond villain, ocean-polluting epitome of the wealth divide is an acceptable risk they are willing to take. Whether or not this is accurate, we must accept that in our attempts to remain private, we have neglected to invest in the lens through which the wider world (and potential owners) will see us.

It is time for yachting to invest in its narrative, get our house collectively in order and make investing in a superyacht a risk-free, sustainable option for the owners .

Will we avoid upcoming penalties from inaction, move beyond compliance and embrace this challenge with passion and purpose? This is a call to action that all must answer. The future of our industry depends on it. JM

Remy Millott

Efficiency • Quality • Sustainability

Remy Millott, CEO of GYG plc, outlines the three pillars he believes will drive the coatings sector forwards.

Innovation takes time, with many months of research and development required from several parties to introduce a ground-breaking technology to market.

As we look to the future of the paint application industry, I believe the three words that comprise the title of this piece will be the main drivers behind the 'next big thing'. It often helps to revisit the past when looking for inspiration, and I am proud to say that Pinmar has played a key role in recent years in driving the adoption of the latest technologies and application methods within the industry.

Pinmar has painted hundreds of the world's finest yachts and is increasingly involved in fairing and finishing some of the largest and most impressive new-builds in the industry's leading yards. The size and complexity of new superyachts continues to increase; in 2010 the average length of a Pinmar project was 54 metres, today it is close to 80 metres. This presents new challenges for paint applicators, especially with respect to time and quality.

Our pioneering of the adoption of electrostatic paint spraying for superyachts, a technology initially developed within the automobile industry, is a case in point. Electrostatic application offers significant advantages over conventional paint spraying, not least being able to reduce the time required to top-coat larger superyachts as well as a 60 per cent improvement in paint-transfer efficiency, which massively reduces the environmental impact of overspray.

While the average length (and therefore the exterior surface area) of superyachts has increased significantly, the timescale of a typical refit period has not – on a pro rata basis. This requires paint applicators to cover a significantly larger paint area during the same number of weeks without compromising on quality. Electrostatic paint application has allowed us to do just that, matching the quality of a conventional approach and, in most cases, providing a better finish.

As with the introduction of any new technology or process, we have had to work hard with the paint manufacturers, equipment manufacturers, consultants and inspectors to reassure the market that this approach was the most effective. Today, over 90 per cent of Pinmar paint projects use the electrostatic application method as standard.

More recently, I am genuinely excited by the trial project we are completing in Germany, working with and understanding the benefits of the application of Awlgrip's remarkable new sprayable filler product (Awlfair SF) in partnership with AkzoNobel and Wrede Consulting.

Currently, our fairing process has an artisanal approach. It is very labour-intensive and based on highly-skilled individuals using techniques handed down from painter to painter. The process hasn't really been modernised in any significant way for a long time. We understand that we have to move with the times, and rather than waiting for others to take the lead, we have made it our mission to go out, invest and affect change.

The application of Awlfair SF is distinct compared to current methods in that it is applied using a pressurised airless spray rather than by hand. This technology allows for wet-on-wet applications enabling up to two filler applications per day without the need for sanding inbetween coats. Furthermore, the spray application ensures perfect mixing of the components, all but eliminates air pockets (which can cause cracks in the filler system), reduces multiple sanding periods and, in turn, reduces the number of painters required to fill and fair a yacht. This results in a reduction in schedule, improved aesthetics and a higher-quality end product overall.

We are nearing completion of our trial project using the Awlgrip SF filler system and the results have already demonstrated to us that this new technology will offer a step change in both the time and quality of fairing for large new-build projects.

So, what does the future hold? It is clear from these examples that innovation takes time, with many months of research and development required from several parties to introduce a ground-breaking technology to market. As with the electrostatic breakthrough, we continue to follow other application sectors, such as the automobile and aerospace markets, with interest, looking for innovative and game-changing solutions that could transfer to the marine industry.

But, with such a focus recently on sustainability and the environment (and rightly so), I do wonder if the next technological leap won't be driven by the yacht owners themselves.

With high-profile projects such as REV Ocean and OceanXplorer at the cutting edge of marine research and exploration, we have already seen a trickle-down effect, with recent new-builds utilising hybrid propulsion systems and sustainable materials, and I don't believe it will be long before environmentally conscious owners take more of an interest in eco-friendly paint solutions. As always, we want to be at the forefront of technology, and we will embrace any positive changes that this may bring to the application industry. RM

Scott Molloy

To boldly go ...
Scott Molloy, founder and managing director of Superyacht Electronics Academy, says that while true innovation can actually present initial challenges, it is worth persevering.

I predict within five years, UI panels will exist only as a back-up to emerging control methods. Why? Convenience.

When asked for my thoughts on superyacht innovation, I began with wondering what I considered that to be. And how much the industry actually innovates versus perception.

We regularly hear from companies offering things that claim to be different or new. Are they always innovating or is much of it hype? Most technology on yachts is not sector-driven, but follows existing lifestyle trends – for example, electronics consumerism and connectivity thirst.

Innovation is not sourcing the 'latest and greatest', or obtaining rare or expensive materials. In the luxury sector, the lines between innovation and 'wow factor' are blurred. Innovation has to be about solving a problem for the first time. Or improving on an existing solution in a way that brings additional benefits. Obviously, diverging from tried and tested solutions takes longer, costs more and brings more risk. Worse still, additional teething problems may negatively impact the on-board experience. So, to innovate can go completely against our primary objective.

One owner I worked for was a serial yacht builder who totally respected the processes of commissioning and 'running in' a new vessel. On his first trip, the crew had technical issues deploying a tender crane that stowed under the aft deck basketball court. As his guests stood observing, and unphased by the delay, he asked them to leave the crew to it. As he ushered them back inside, tales of how such issues were normal on a new boat ensued. This is the breed of yacht owner that makes it much easier to innovate. The breed of bold and adventurous yacht owner we need to commission more builds in the industry!

Recently, Crestron ran a live online panel discussion on the feasibility of a hydrogen-powered superyacht. While there were obvious and difficult hurdles, it would also require an adventurous owner to commission such a build. Or perhaps an owner with a desire to commission such a project based on environmental principles. Just because something is difficult, doesn't mean we shouldn't try.

Recent guest/owner surveys by The Superyacht Group indicated a strong dissatisfaction with their user interfaces for on-board systems. However, I believe that we are about to move away from the traditional user interface altogether. The current standard is a wireless touchpanel or iPad. Yet, believe it or not, universal push-button remote controls are still popular. Even in the luxury sector. Because aesthetics and the stigma of 'old-fashioned tech' aside, push-button control is more practical.

Once the user knows the button locations, unlike a touchpanel, they can operate it without taking their eyes off the task in hand. Consider the same problem when driving a new car. Our attention is diverted from driving, by trying to understand the touchpanel controls. This was much less of an issue before touchpanels appeared in cars. Don't worry, I'm not saying the future of user interfaces is button remotes! I am just highlighting how the touchpanel UI is far from ideal. I predict within five years, UI panels will exist only as a back-up to emerging control methods. Why? Convenience.

Common voice control solutions now give the ultimate convenience – not having to stop what you are doing. In comparison, consider the inconvenience in having to find your phone and navigate to an app setting for the same result. Convenience is a powerful weapon for the tech giants. They know we strive for it in our busy lives and are willing to pay for it. So, we can expect consumer trends to continue to move quickly towards more 'hands off' methods.

But, convenience comes at a cost. With voice control solutions from Google and Amazon, for example, the cost is further loss of your privacy. Voice control for yachts needs to be innovative in that it solves a couple of problems. One is that it guarantees complete privacy and security. The other, that it is served by the on-board yacht systems and is not cloud based. Although voice control might not work well every time, the user will typically patiently repeat a command. The user has not been inconvenienced. Oppositely, you can understand a faulty or confusing UI being frustrating. It has the user's complete focus.

As well as voice control, we will probably see advances in gesture control. Additionally, I imagine we will soon see a new class of discreet wearable tech allowing new methods of systems control. Even further ahead, what might be seen is the evolution of user interfaces. Might we be controlling our tech simply using the power of thought in the future? I think so. Although that sounds like science fiction, things generally are until they are made science fact. To quote Arthur C. Clarke: "Any sufficiently advanced technology is indistinguishable from magic."

In a rapidly changing world, I'm sure we'll see the superyacht sector come under intensifying scrutiny regarding ethical issues such as the environment and wealth distribution. Will there be an increasing pressure on owners to do the right thing, even if not naturally inclined to do so? And the same can be said for all parties in the sector from designers to shipyards, yacht management, and crew. This pressure is a good thing, and will help drive a new period of innovation. SM


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Craig Norris

Tackling microplastics pollution through superyachts and technology

Craig Norris, CEO of Victoria International Marina, presents a technology from Victoria-based Ocean Diagnostics that has the power to tackle one of humanity's most profound problems.

Oceans are our life blood. They feed us, regulate our climate and generate 50 per cent of the oxygen we breathe. They provide a playground for our recreation and are the foundation for much of the world's economy. More than three billion people rely on oceans to provide jobs and livelihood. By 2030, it is estimated that the ocean economy could be worth three trillion US$. As important as they are to human life, our oceans are under a severe threat from human activity, manifested in plastic pollution.

After its invention in the late 19th century, plastic production began to scale up in 1950. Since then, around 10 billion tons have been produced, of which more than seven billion tons have already become discarded as waste. It is estimated that between five and 14 million tons enter the ocean each year from coastal regions alone. Regardless of whether the plastic entering our oceans began as fibres from our clothing or are the result of fragmented pieces, the small plastic particles known as microplastics have the largest potential to damage our oceans, its inhabitants and ultimately humans.

Current technologies aimed to clean the ocean of plastic pollution fail in tackling the root cause of the problem. In Victoria's inner harbour, microplastics can turn up visibly as tiny pieces of Styrofoam sticking to pillars and fibreglass hulls, but in most cases, they are not even visible to the naked eye and go much deeper than the surface of the water.

What is the solution to such a complex, global problem? Stopping plastic entering the ocean is the most viable action to the problem. To achieve this, governments and environmental agencies need a significantly greater amount of data. As valiant as the efforts are by scientists and environmental foundations to generate this data, the sheer magnitude of the problem is overwhelming. One approach that can significantly increase the amount of data available is to engage superyacht owners to utilise their vessels as ocean sentinels, performing microplastic analysis as they circumnavigate the planet.

VIM have teamed up with Ocean Diagnostics, a Victoria-based microplastic-focused technology company, to do exactly this. As part of our new partnership, we have set out a three-phased project. The first phase will both test Ocean Diagnostics' technology and monitor long-term microplastic pollution in the harbour, while the second phase will form partnerships with a small number of forward-thinking, environmentally engaged superyacht owners to become part of an early adoption group. This exclusive group will participate in the development and testing of microplastic technology for superyachts. The final stage will open the technology on mass to superyachts, developing a global network of ocean sentinels to generate high-impact ocean data.

Victoria International Marina was developed under a strict set of values deeply rooted in the eco-conscious lifestyle the Pacific Northwest is known for. Strategically positioned at the beginning of the Pacific marina cruising corridor and inside passage, the marina serves the luxury-yacht community as both a kickoff point and a centre of knowledge and service when planning a West Coast cruising experience. So much of what this region has to offer is related directly to the supernatural beauty of its unadulterated coastline and the lifestyle that it supports.

Technology will play a powerful role in lessening our impact on the coastal and ocean environment and marinas like VIM can play an important role. Home to several world-leading technical organisations and their extensive support networks (for example giants Microsoft, Amazon and Boeing), the Pacific Northwest region is one of the world's largest tech centres and a natural place to develop and test ocean-conscious tech. Victoria International Marina sits dead centre in the region and is a hub for showcasing new tech to the greater marine business committee; after all, the largest market for new yachters are the same executives of the tech companies that invest and produce such tech. Being tech developers and investors they have a natural interest in seeing their passions mesh with their recreational time.

Having recently hosted the world's largest eco-fashion show (VIM Future Oceans, which was focused on awareness, solutions and support to the ocean plastic pandemic) the team at Ocean Diagnostics was a natural fit. The marina also works in partnership with local universities and colleges that run innovation and product development programmes, where government and private sector funding supports collaborative learning and development spaces that help bring new ideas to life. An example is a new moveable marina design that operates independent from shore and houses any number of amenities including helicopter landing space, accommodations, shared dining space, tender docking and provisions. The design is currently being worked on by Greg Marshall Naval Architects Ltd and Camosun College and promises to be a true employment of innovative marine technology.

Ocean Diagnostics develops revolutionary technology to advance microplastics research. Its technologies incorporate bespoke engineering with 3D printing, artificial intelligence, analytical chemistry and big data to enable discovery and diagnosis. "Such ground-breaking technologies will enable us to investigate new threats and depths otherwise inaccessible so we can make new discoveries on the health of our oceans," says Dr Dean Wenham, CEO and co-founder of Ocean Diagnostics. CN

Government and private sector funding supports collaborative learning and development spaces that help bring new ideas to life.









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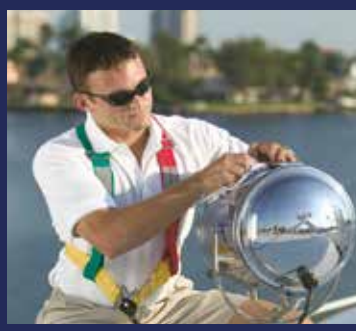

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Rob Papworth

Taboo or not taboo ...
While not wanting to tempt fate, for Rob Papworth of MB92 La Ciotat, there is a burning issue that requires discussion.

Fire. The only good thing about that word is that it forms the initials of the first names of my family, so when The Superyacht Group asked me to write an article about one of our new fire-prevention systems, my first reaction was to decline, preferring not to tempt fate. Accidents and insurance are the hottest and most taboo subjects in our industry at this time.

Health and safety has become an increasingly large part of our everyday focus. In MB92 La Ciotat we have increased our spending on both hard and soft HSE investments more than five times over the past three years; better equipment, training, processes and, most importantly, more and better people. Despite all this, like a large dark cloud, the threat seems strangely greater than ever.

As with many things in life, this increase in awareness is certainly partly due to much greater media scrutiny – where automatic search engines and social media mean that it is almost impossible to keep any major event quiet. Naturally, there is a very fine balance between protecting the reputation of your owner or shipyard, and the jobs they create, as a result of any incident, which is offset by the loudening murmurs for increased transparency to try to improve the lure of our industry as a whole.

Obviously, major incidents tend to be difficult to investigate as it often isn't until many months, if not years, later that the exact cause is known. These reports are then normally closely guarded secrets by the parties involved and despite calls for CAAI-type investigation panels these are unlikely to gain traction as the vessels we are dealing with are much less numerous certainly in terms of passenger numbers.

The problem with this secrecy is that when incidents happen, third-party shipyards will probably not even know that anything occurred, let alone the reason the incident happened. This means that each yacht or shipyard must conduct its own safety reviews, learning and investigations as this is not an area where a trial and error approach is tolerable! Add to this an increased focus on the environment and we can start to understand how health and safety has increasingly become a pre-occupation for many shipyards. Preventing the impact of pollution from fire extinguishing systems or pollution incidents is now right up there with preventing the incident itself and a balance between prevention is better than cure and preparing for all scenarios is always necessary.

This kind of blanket approach in MB92 La Ciotat has led us to install the largest high expansion foam extinguishing system in France, in an area where our superyachts do not even go! With 3,280m^2 of surface area to cover an automated system capable of extinguishing a fire in under five minutes without damaging the building, its contents or the surrounding environment has been installed. The result is a high expansion foam solution that fills the building up to eight metres high with de-oxygenated foam that suffocates all types of fire instantly. The volume of foam required to do this? 26,000m^3, which in superyacht terms is the equivalent of completely filling up two of the largest superyachts in the world! Thankfully the foam dissipates after just a few hours and, after a quick rinse, life can resume as normal.

In parallel to these kind of hard investments, we are also pushing for the latest technological solutions with mobile early warning and co-ordination systems on the drawing board to decrease reactivity time and allow for clear and concise instruction on a geolocational basis, which is extremely important on a large site such as La Ciotat. Individual daily mobile HSE sign-offs are now required to track flammable products or other high-risk scenarios, which, hopefully, will act as timely reminders to each individual working on board as well as providing key information on works and products in case of an incident. Other developments include multi-language signs and alerts.

The insurance industry is becoming more diligent and talks are already in process between the ICOMIA superyacht refit group and leading insurance figures to better formalise the review process of shipyards on a more frequent basis as, the current JH143 forms applicable to single projects are quite onerous to both parties – especially with many shipyards completing 50+ projects per year. Detailed analysis of procedures, structure, training, drills and basics such as the positions of hydrants, fire stations and other vessels can vary place to place within a yard, which makes for a very complex analysis. MB92 as a group has subjected itself to external auditing from a major surveying company, but an industry-wide system is obviously preferable to the insurers, in order to provide like-for-like risk analysis – to remove or optimise a vessel's shipyard insurance premium increase when entering a shipyard for major works.

It is a pre-occupation that is rippling across our industry, and will ultimately leave nobody untouched. But we all have a responsibility to join in with this drive for improvement, as waiting for an incident to happen before acting is the stuff of nightmares. RP

Preventing the impact of pollution from fire extinguishing systems or pollution incidents is now right up there with preventing the incident itself.

Martin Richter

Wind-assisted propulsion systems

Martin Richter, Ship Type Expert Yachts at DNV GL – Maritime, highlights the opportunity that an infinite resource presents.

The superyacht industry is becoming more environmentally aware and eager to explore new sustainable superyacht propulsion systems.

There has always been a 'them and us' mindset between yachtsmen who tend to fall into the sail or power categories, usually with strong views on what is a real yacht. While those in the first category may appreciate the idea of pushing through the sea without using any fuel but wind power, motoryacht enthusiasts equally love the fact that they can get from A to B in a straight line and at a predictable speed.

Wind has never been completely abandoned, but over a long period where oil prices have been low, systems that use the wind to aid propulsion have fallen by the wayside. However, as a result of new stringent regulations aiming to mitigate climate change, wind power as a source of energy seems to be becoming attractive again. Meanwhile, motoryachts are starting to move away from diesel engines as standard, with major builders looking at alternative fuels, including hydrogen, methanol, ammonia and batteries, just to name a few.

Although some of these emerging technologies are still in the early stages of development, numerous machinery propulsion solutions – from diesel and diesel-electric systems to liquefied natural gas, through to hybrid and all electric systems using batteries, as well as to some extent fuel cells and solar power – are already commercially available for owners wanting to improve the efficiency or comfort while also reducing the carbon footprint of their vessels.

Wind propulsion is sustainable by its very own nature. The physical principle is the same humans have used on sailing boats since time began. But what has changed is the efficiency of modern sails, the materials they are made of and their handling and control. Advanced aerodynamic science combined with computer technology has resulted in significant gains, such as doubling the amount of generated power per square metre of sail surface, as has already been demonstrated by some projects carried out in the commercial shipping field.

Examples of cutting-edge wind-assisted propulsion systems are rotor sails which take advantage of the 'Magnus effect': where the wind hitting a rotating cylinder from the side on board a moving ship creates a forward pull. Advanced implementations of the technology used on commercial vessels have enabled fuel savings ranging between 10 and 20 per cent. The technology is already mature and economically viable in areas with the right wind conditions.

Rigid wing sails, modelled on aeroplane wings, also offer a highly effective solution which can be operated automatically. But even though they have been used in racing for some time, notably in the America's Cup, they have not yet been implemented on commercial vessels.

Soft wing sails combine the aerodynamic advantage of rigid wing sails with the low weight and flexibility of modern textile sail materials, while also being able to be reefed and furled. DNV GL has worked together with VPLP Design and the French Engineering firm CNIM to develop a new wing sail and fully automated concept called 'OceanWings'. With the potential to reduce fuel consumption by 18 to 42 per cent, the design has been successfully tested on VPLP yachts, including the hydrogen fuel-cell co-powered catamaran Energy Observer launched in 2017. The technology is now commercially available for cargo ships as well.

Kite-assisted ship propulsion offers a cost-effective solution and is currently entering a new phase with more mature technology. Initial trials on commercial ships showed notable energy-savings, and technical advancements are attracting new attention among leading ship operators, for example K Line.

To support the advancements of innovative wind-assisted propulsion systems, we work together with owners, designers and builders to develop new concepts by supporting them with the assessment of savings and feasibility studies, including combining these with weather data. Building on our extensive knowledge and experience in this field, in 2019 we introduced a new DNV GL class notation called 'WAPS'. This works as an independent technical standard for the design and construction of wind assisted propulsion units, while also covering the procedural requirements associated with their installation.

With stricter IMO rules, and the media and public opinion pushing for less maritime pollution, while superyachts are veering towards more adventurous use, combining luxury with exploration to remote areas, there is change in the air. As a result, the superyacht industry is becoming more environmentally aware and eager to explore new sustainable superyacht propulsion systems, with zero emissions being the ultimate goal.

Although the development of some of these concepts is still in its early stages, superyacht owners and designers looking into more efficient and future-proof new builds now have the option to make the best use of both innovations in machinery and modern wind-assisted propulsion systems. MR

Helideck certification

Chris Wood, operations manager at Safeguard Helideck Certification, examines the challenges and rewards of their role as an Aviation Inspection Body (AIB) for Superyacht Aviation.

A normal year for the Safeguard Helideck Certification team would consist of visits to Europe, the Caribbean and places all over the world to conduct Helicopter Landing Area Certificates (HLACs) on board some of the world's most iconic superyachts. Normal business would be attending numerous events such as the Monaco Yacht Show or The Superyacht Forum to network and catch up with industry friends, but this has not been a normal year. Despite the disruption that Covid 19 has caused, the shipyards have continued to build and the requirement for yachts to have their helidecks certified has remained unchanged. We have been fortunate to remain busy and the scope of our work can be broadly split into two areas.

The certification process – design

Our role as an AIB is to ensure that aviation on board superyachts is taking place in the safest possible manner, but superyacht designs are constantly evolving, with many owners now specifying a requirement for multiple helidecks. The safety implications for this are considerable as the possibility of concurrent flying operations from the same vessel throws up numerous hazards that need to be carefully addressed. We therefore encourage early engagement of our team when a yacht is at the design stage, so that our expertise in deck loading, air-flow disruption and helideck location can be fully utilised. This allows for a smooth process in gaining the required helideck certifications for the completed yacht. A HLATC covering the design activities will remain valid for as long as the design remains unchanged. Any design changes would require a new HLATC to be issued.

It is also important to ensure the owner's needs and requirements have been met fully. This includes ensuring that the design team knows which helicopter the owner wants to operate on their yacht as the deck loading requirements for a H125 are significantly different from those of a H175. If this is not accounted for then changes may have to be made to the helicopter landing area/s and this in turn can impact the overall aesthetic of the yacht and delay the completion. We are well versed in working with multiple teams to ensure that such pitfalls can be avoided, the completion can be on time and aviation safety requirements are met.

The certification process – operational

We do our best to be as responsive as possible to our clients and will fly wherever we are required to provide a helideck assessment. We have great respect for the privacy of our clients and regularly work with a non-disclosure agreement in place. Once on board for a Helideck Certification Assessment, we look at the helideck itself to evaluate dimension, layout, obstructions, deck friction levels, landing area markings and structural considerations. We also review the fire detection and extinguishing arrangements, the emergency equipment, procedures and all documentation associated with helicopter operations on board. Once the criteria for the inspection have been satisfied then a Helicopter Landing Area Inspection Report (HLAIR) and a Helicopter Landing Area Certificate (HLAC) are generated and a thorough debrief given to the vessel's crew. A HLAC covering operations will be valid for 12 months, but it will cease to be valid if there is a change of ownership, the name of the vessel changes or if there are material changes to the helicopter landing area, aviation facilities or equipment without consultation and approval from an AIB.

As a team Safeguard Helideck Certification have over 60 years of experience operating helicopters on vessels at sea in the military. Our team comprises ex-military aircrew, flight deck officers, survival specialists, safety management specialists, engineers and naval architects. We live and breathe maritime aviation and strive to ensure that superyachts can enjoy their helicopter operations in the safest way possible.

James Roy

Innovation and changing perspectives

‘How do we give our clients a different lens to look through?’, asks Lateral Naval Architects managing director James Roy.

Perhaps the next ‘game-changer’ lies not in what answer we are going to apply to our existing question; the game-changer may lie in looking at the whole question from a different perspective.

I am often asked the question as to what technical ‘game-changing’ innovations are around the corner in the marine industry, be that in the superyacht, defence or commercial marine sectors. These questions tend to arise at the start of new projects, when the foundations of design intent are being laid, and how engineering will serve to deliver them.

We operate in a mature industry, where significant innovations have happened over a long period of time. Many have in fact come, gone and come back again. Some many times over, and with every cycle, are often even held up as ‘new’ innovations. It would be slightly arrogant to suppose that further significant advancements are not there to be innovated; however, the reality is that innovation is (in the main) incremental and progressive in nature.

I would suggest that asking such a question is to only see part of the answer. We live in a period where change is accelerating, both in a technical and social context. I for one enjoy, in my world of engineering, this pace of change; I enjoy that capitalism drives the search for a competitive edge, which in turn drives the advancement of knowledge and progress. There is a theory called the Technology Singularity, which suggests that eventually the pace of change will be so advanced that it will happen instantaneously.

Whether or not you believe in that being possible, we all experience that change (driven by innovation) finds its way to market at an increasingly faster rate. Consumer products that would typically have had several product generations on the same fundamental platform are now achieving market penetration at an accelerated rate, in turn driving a faster market response and a rapid need for the ‘next generation’ product.

However, there is a problem with comparing superyachts with the generalities of consumer products. We are building artisanal products (on a grand scale perhaps), mostly all unique prototypes, in a very niche market, with multiyear delivery timescales. Our throughput is tiny by comparison. The result of this is that progress will continue to be incremental. We should embrace that, because it will drive investment in a long-term view.

But is our industry responding to change in the right way? We seem to be selling pretty much the same product we were 10 years+ ago. Many are significantly better, in design, engineering, materials and quality terms, but in essence it’s the same. Are we limited by the incremental pace of innovation in our industry?

The seemingly frustrating technological limitations of the present should force us to reflect on our actual needs, and whether our perceived needs are based on real facts or ingrained paradigms. Change the question and perhaps we can answer it well with the technology we have today, and better serve the real needs of our customers, while advancing science and engineering and driving progress.

To give this some context, let’s look at some ingrained paradigms. Yachts have developed over many centuries; today, we have some broad labels we apply, principally motoryacht and sailing yacht. Our industry has certain narratives around each type of vessel; the customers who might buy them and what they might enjoy about them. Alongside this, we point to certain specifics and hold them up as the future, such as hydrogen and other alternative fuels for example.

Imagine now a world with no ingrained paradigms. A yacht is a yacht, if you want carbon neutral propulsion, then that technology exists in the wind. Go apply it. Don’t misread me, I am not promoting sailing yachts (although that is a passion), I am promoting adjusting our perspective. Perhaps the next ‘game-changer’ lies not in what answer we are going to apply to our existing question; the game-changer may lie in looking at the whole question from a different perspective.

The challenge here is making it compelling in the market, because it is unlikely to sit well with the majority who wear the spectacles of existing beliefs and perceptions. Taking this example, why can’t we make sail a compelling proposition to those who see a focus on zero emissions? The answer is not to sell them a sailing yacht. I’m not sure what the answer is, but it will lie in act of innovating.

Of course, this is a fairly ‘fluffy cloud’ example. In the real world our clients do have ingrained paradigms. They know what they want (largely) and while wanting to be unique they don’t want to be the wildcard. But it serves to highlight that not all innovation lies in new answers. It equally lies in new questions as well. JR

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Jasper Smith

A rising tide lifts all ships

Jasper Smith, chairman of the Arksen explorer company, outlines why the intangible elements of innovation are often as important as the products themselves.

Smart tech, extreme materials, automated manufacturing, machine learning – all these fantastic innovations are helping us to create better, more efficient and more consumer-friendly products.

But there's one element of progress that trumps them all.

Innovation does not only relate to hard-wired, tangible things. Innovation can be about process; the way we operate.

Throughout my career, I've always focused on taking a more collaborative approach to business structure. Early on, people said this was way out in leftfield. Now, more are aligning to this way of thinking.

Whatever advances we make, we'll never achieve the sum of our parts if we operate in isolation. The art of working together, rather than against, does not come naturally in business, but to achieve the essential movement towards a circular economy, we need to make this cultural shift.

So for me, the biggest innovation on the horizon is a change in the fundamental manner in which businesses co-exist.

Working together

I have a business background, in software development. The sector is hugely innovative, with some extremely bright minds pushing the boundaries of what's possible. It is also very competitive.

It may be a surprise, then, that collaboration is core to the industry. Individuals from rival companies regularly combine in large group 'Hackathons': a bringing together of minds to solve problems, innovate and advance technology for the greater collective good.

The sector is full of small, nimble companies often seeking out big opportunities. When one lands, collaboration is key to scaling up and down, depending on what is required.

It's not easy, but having a collaborative operational structure allows you to place trust in selecting the best partners. Being able to work with others to design out waste, cross-pollinate industries and maximise resource use is the only way we will achieve a more sustainable future.

And as our world becomes increasingly knowledgeable, it will be the individuals and businesses that enable collaboration to thrive that will be the winners.

Sharing economy

Collaboration is now an increasingly accepted part of society, as the 'sharing' and 'gig' economies continue to change the world.

Even in luxury yachting, the desire to own a vessel outright is shifting. Public conscience is such that a boat that spends most of its time sat in harbour is not just wasteful, it's borderline unacceptable.

In that area, the syndicate model offers huge benefits. It allows members to access fully serviced vessels in pristine condition at their allotted times, with the opportunity to exchange weeks and swap vessels for others anywhere in the world. What could be better?

A social philanthropy model goes one step further, where owners donate sea time to ocean research and conservation projects. Transforming what are often seen as opulent toys into a network of vessels that can further our understanding of the ocean is very powerful. Within the next few years I am not sure any other model could be justified.

We are now going past the need to 'own' everything. And that not only goes for consumer products, it goes for businesses too.

Collaboration between designers, suppliers, shipyards and end users offers many more engagement opportunities to help share resources for mutual benefit.

This will allow greater investment in technologies, systems and processes that promote rapid change (hybrid, hydrogen fuel cells, sustainable materials) and the design of products that embrace the principles of a circular economy.

Integrating a repair and replace approach, designing in a modular way to manage the advancement in technology and, crucially, establishing a route for materials once their value has ended in their existing use case can ensure the earth's resources are maximised.

Sustainable investing

Achieving this change on a large, global scale must start with capital and entrepreneurs, and core to this is ensuring all capital flows are linked to sustainable outcomes.

We will not get a second chance.

As Mark Carney said while governor of the Bank of England: "Climate disclosure must become comprehensive, climate risk management must be transformed, and sustainable investing must go mainstream."

Part of this new wave of collaboration will involve creating rules and regulations that can drive innovative investment.

For so long, capital has been without an agenda other than profit, and it's only been in the past seven years or so that we've been investing more with 'head and heart'.

By building collaboration into their commercial, operational and sustainability activities, companies will have a significant competitive advantage. That will drive investor returns, as in the future, these businesses will create value that an unsustainable company cannot achieve.

I am wholeheartedly aware of how the marine industry is traditional in approach and, as a result, slow to change. But I truly believe in the saying 'a rising tide lifts all ships'. JS

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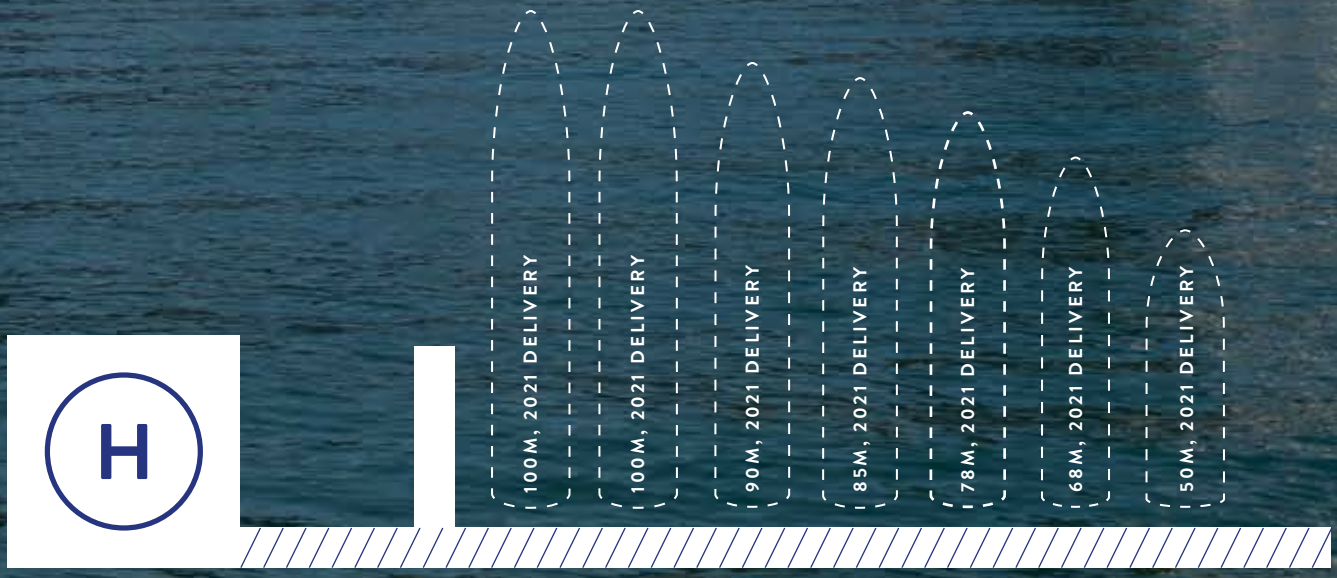

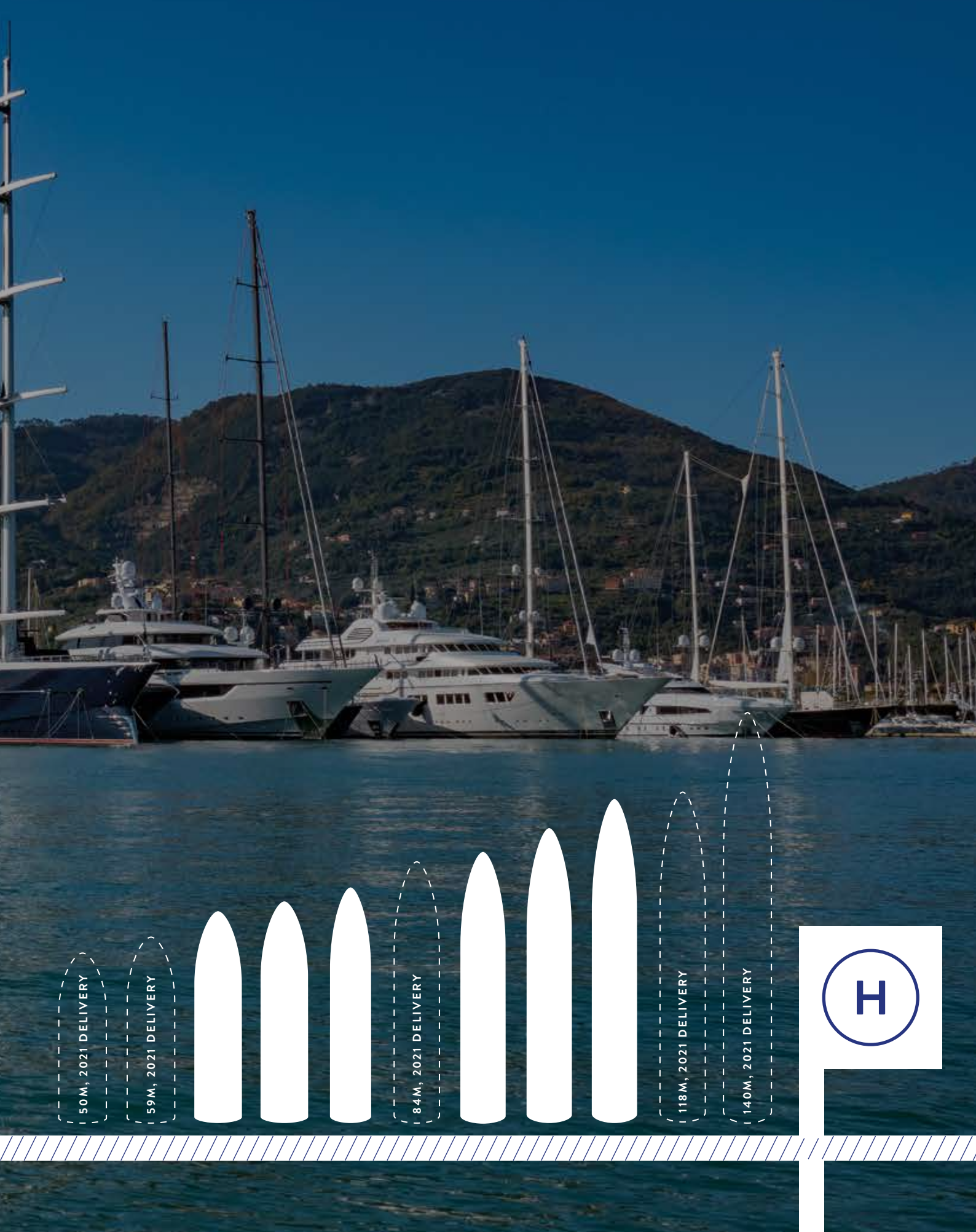
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Andrew Grant Super

A disruptive approach to superyacht expeditions

Andrew Grant Super, managing director of Berkeley Rand, says there is a clear need to innovate in the planning of passages and routes.

As part of an intensive research programme, assessing commercial opportunities in 'superyacht adventure travel', key issues were identified as being inadequately addressed within this fledgling sector – a sub-sector of both the more established superyacht service industry and bespoke luxury travel for UHNWIs.

While healthy revenues have been achieved in the recent past for yacht service-related companies, the superyacht travel adventure sector has seen woeful under-investment, with travel boutiques surviving contract to contract. And yet to place that much trust in a supplier taking captains and their guests on long-haul adventures, one requires deep navigational prowess, a well-established remote network of maritime logistical hubs and the financial stability to cover hundreds of suppliers and partners that are called into action for each expedition. In terms of transportation, only space exploration requires greater engineering logistics and financial bandwidth.

These days, superyacht 'adventures' or 'expeditions' involve travel between semi-remote to off-grid oceanic routes and locations. These journeys are becoming attractive alternatives, complementing the milk-runs that yacht captains are more accustomed to taking their guests on. In recent years, superyacht travel has included off-grid locations, from the Polar regions to Papa New Guinea, and semi-remote regions have included the Black Sea to the Norwegian Fjords.

According to the research, the majority of superyacht guests and owners have yet to see any significant marine biology or mammalogy activity. Nor have they ventured outside the Med or Caribbean on their yachts. Notably, one of the owner's children spent their time on Instagram 'liking' whale videos, unaware they were sailing over the largest oceanic migrational route in the South Pacific. Meanwhile, that sand-shelf the yacht just passed without interest happens to be nautically the most remote real estate for two thousand miles, appearing for only three months of the year.

UHNWIs now look for 'life-changing experiences' from their travel journeys, rather than passive sight-seeing. However, owners and their guests find the off-grid routes to be rather uneventful, often suggesting meeting up with the yacht upon arrival at the end destination, opting out of the best part of the journey.

So appears a new breed of superyacht expeditions in 2020, for the COVID era and beyond, where space-age immersive technology, theatrical experiential adventures combine with high-engineering feats supporting ocean-wide adventures for superyachting families. With BWA Yachting's progeny 'WetTech' venture, 'Berkeley Rand', who have introduced immersive experiential stagecraft for owner/users of superyachts, captains finally had a logistical partner to work with. Guests could live out their fantasies amongst captivating remote oceanic islands and waters.

The premise was to use 'experiential' stagecraft to bring alive the beauty and mystery of remote coastal archipelagos and their surrounding indigenous marine biology and marine mammalogy, to play-off from the remote islands experiential creations, timed to take off upon the arrival of the guests on the superyacht, one event after another, customised to each individual, carefully designed and planned together with the owners and guests. So uniquely designed, it's never been done before and won't ever happen again, there for the presence of the chosen few. The bandwidth of imagination to create and engineer these adventures knows no limit.

Combining a superyacht owner's interest in modern history and warfare, with thousands of miles of Pacific oceanic waters, one can apply augmented reality technology that brings to life a full-blown fleet of battleships duelling in real time in front of you as you stand on the deck, which now turns into its very own battleship with virtual gun placements to shoot down zero fighters above you, all in super high-definition visualisations. Beyond the battle of WWII's Midway playing out before the guests, one can take a submersible towards the very spots where the ships sank in battle, where you can relive the final moments and then view it as it is today, as a striking fluorescent artificial coral reef for the indigenous marine flora.

Immersive mobile pods are installed on superyachts that act as a centre for 'experiences' on board the yachts, playing out the local marine mammalogy chatter and gossip, where you can talk back through artificial intelligence natural language processing.

Making the yacht go-invisible, stealth mode around you, through technology that allows you to see down to 300m below your feet and the decks, as you experience the enormity of the migrational sperm whales, you can see all around you, while submersibles are super-charged with technology that allows you to zoom in or out on the 3,000-mile route the local marine traffic has taken to reach you and then for you to track and sail with them as part of their pod.

On land, the adventures are no less impressive. Here one can recreate the hunger games or avatar for real, on desert islands amongst the tropical forestation, using augmented reality glasses where monsters and machines pop up out of nowhere. More remotely, we use experiential creations to engineer pop-up molecular gastronomic feasts with famed Michelin-star world-top-five restaurants on that sand shelf you passed by on your previous shift. Broadway musicals recreated with 10,000 dancing drone-lights creating skyscraper-height bubbles around the yacht, or go-chic and on-fleek with floating designer fashion shows or bringing a Grammy-award-winning team to write and perform songs with the prodigal daughter on board, while we gaze through specially adapted night vision goggles at the stars above and spin the planets and watch them dance with a touch of our hands.

This technology already exists and experiential stagecraft has been around 30 years or more. For some reason it skipped the yachting industry, until now. Exploration never looked so beautiful. AGS

Bill Tripp

The Water Revolution column

For Bill Tripp, innovation can be found across every inch of a vessel.

WATER REVOLUTION FOUNDATION

As a naval architect and designer, I have the necessity to react to a client's wishes, but also the means to lead decisions. Greatly improving our sustainability credentials has become a key part of our future success, as many of our clients want a light footprint. The means for significant improvement already exist and disruptive change is coming.

Drag reduction
I am a strong proponent of reducing drag to significantly lower fuel consumption. A well-designed hull shape of a large yacht can save a gigawatt of power in comparison to one of equal displacement and gross tonnage that is inefficiently designed.

Reducing the gap between what energy is needed and what is available is key to the successful use of alternative energy propulsion systems.

Hybrids
Innovation can come from smaller boats, where design and build cycles are quicker. We are currently building a 45ft sailboat with a DC pancake generator that turns the normal diesel into a parallel hybrid system. The batteries can be charged either by plugging in at the slip, hydro-generating while sailing or via the pancake generator. Without running the engine, the boat will be able to use all its sailing and cruising amenities and either hydro-generate or plug back in at the end of the weekend, while maintaining a conventional powering range for flat calms on long trips. The cockpit bimini will be made from solar cloth and charge the batteries from flat in a day. All these innovations are significant and scalable to larger yachts.

Similar hybrid systems can work on motoryachts to charge batteries and run systems via the use of excess diesel engine capacity when the engine is underloaded.

Current battery energy density is at best one hundreth of diesel, which leads to volume and weight problems. Graphene-lithium batteries are on their way, and scientists predict that they will be 50 per cent more powerful (energy density) at half the weight (specific density). Twice the power for the volume and four times the power for the weight. This development will give yachts a longer range under all-electric power and/or cover a more significant portion of the house load.

Materials
We recently completed a study on the carbon emissions impact of material choices on a 75m displacement superyacht. The results surprised us. The lighter aluminium yacht would need to travel 500,000nm to compensate for the increased amount of carbon released producing an aluminum vs. steel hull (estimated at 330t of CO). However, if the aluminium comes from a plant fired by hydropower instead of coal, then an aluminum hull is 40t of CO_2 greener than steel and 300t greener over 500,000nm. Looking at the entire lifecycle is therefore crucial to finding sustainable solutions.

Our industry needs to use more recyclable and sustainable materials. Tripp Design is leading a project to roto-mould sailing dinghies out of a bio plastic. This plastic is cellulose-based and biodegradable. Similar bio resins are being made, and when combined with natural fibre reinforcements on future projects 0 we see many uses for such materials both in the interior and exterior of yachts.

Bottom paint
One of our clients, *Aquijo*, an 86m sailing yacht which has just gone around the world, is undergoing her five-year refit and applying a new kind of bottom paint. It is a non-toxic paint that goes on with such a high level of gloss that no growth can stick, and what little does cling when docked for longer periods will come off completely when the boat hits 10 knots. This is revolutionary and means that we are not spraying toxins onto the bottom, the slipways or into the air, and, most importantly, we are not exposing pristine environments to dissolving toxins. This paint has a much longer lifespan and while advantageous economically, the true win is that we are no longer poisoning the sea.

Disruptive changes
Foiling was common in the '60s on ferry boats, only to be replaced, eventually, by non-foiling catamarans. Its resurgence has started in small sailing boats and is slowly shifting to smaller power boats and dramatically dropping the power required. Superyachts are starting to benefit from semi-foiling technology and less drag means less carbon footprint.

Hydrogen is still over the horizon for most yachts, but it will become a reality. The energy density is attractive, the safe storage is being addressed and the byproduct is water. It can be used to power engines or stored as fuel cells. Aircraft (and airports) may be first to widely adapt, and when they do, the attention and scale will bring fantastic change.

Summary
We need to push for innovation and embrace what is already available, Water Revolution's Database of Sustainable Solutions is aimed to facilitate exactly that. After all, we are bound to a world that is singular in its beauty and lifegiving resources. We are 150 years into a society that has learned to tame nature and started to change it. With change comes responsibility – we flaunt nature's rules at our peril. For the long-term health of our industry and planet, we must innovate and reduce the impact that running a yacht has on our environment. When building boats, we can adapt technology to many ends, and one of those ends must be to exist more in harmony with the oceans and our atmosphere, for it is exactly in this intersection where boats live. BT

John Venables

Let's face it, innovation is hard

But it is also essential, says John Venables, president & CEO of Naiad Dynamics. "In the words of the late American humorist Will Rogers, 'Even if you're on the right track, you'll get run over if you just sit there'."

From my vantage point, serving three separate and distinct marine markets, the yacht market is a special case. Consider ships that are built to serve a commercial purpose, such as ferries, crew supply vessels and all manner of essentially profit-based seagoing vessels. With operating costs central to their function, they have a clear incentive to drive innovation. Every aspect of a commercial ship's design is focused on improving the economics, that is, improving *return on investment*. Whether improving fuel efficiency or passenger comfort leading to increased ridership, on-board concessions or gambling revenues, it is all about ROI.

Similarly, military ships' sole focus on *performance* to best achieve the intended mission serves to inspire new and creative ways to enhance mission-critical operability. With lives at stake, the military wants, and undoubtedly deserves, the best. Military ship designs, along with all military shipboard systems, are optimised to best fulfil the ship's mission - its purpose.

Clarity of purpose has a tendency to 'pull' innovation. When a problem or unsatisfactory compromise arises, while trying to satisfy the profit-making objective of a commercial ship, or the mission of a combatant, it forces hard thinking and consideration of new possibilities – essentially innovative solutions. By comparison, conceiving new creative approaches and then 'pushing' them as improvements, often to a sceptical audience, is harder still. Such is typically the case in the yacht market.

In contrast to an emphasis on ROI or mission-performance, luxury yachts represent significant discretionary expenditures centered around the hard-to-quantify goal of enjoyment of the sea. Efficiency? Yes. Comfort? Yes. Quiet and convenience? Yes, and Yes. Yet how much of each, and at what cost? Not so clearly defined, these metrics are highly variable among shipyards, budgets and owners' preferences. Striking a perfect balance to satisfy all parties—paramount among them, the owner—has been an elusive quest many readers can attest to pursuing.

More than other ship markets, there is also the issue of the yacht as an investment. An owner who takes a chance on a new and innovative approach risks not only the trials and tribulations of being a first adopter of new technology, but also potentially hampering resale if his choice is not well embraced by future buyers. Industry awards and yacht club bragging rights aside, there is little tangible incentive for yacht owners to take bold chances on new innovations. Consequently, it is remarkable when new ideas break through established barriers, and naval architects, shipyards, suppliers and owners all align to embrace and invest in new technology.

As sponsor and chairman of the International Superyacht Society's annual Technology Award, fostering innovation is near my heart. One approach to reducing the risk of innovation is via technology transfer from other industries, such as aerospace, and from the commercial and military marine sectors. The Superyacht Forum nurtures innovation in yachting, which is why at TSF 2006 I presented to the predominately yacht-focused audience a range of mono and multi-hull forms with proven motion control solutions we had applied in other ship sectors. The hope was to inspire yacht designers and naval architects to consider advanced hull forms, while reassuring them that a wide array of well-proven systems exist to reduce motion and enhance seakeeping. Since then, some progress has been made, including these notable yacht examples with active ride control, to name a few:

• M/Y *Silver Cloud*, a 41m Small Waterplane Area Twin Hull (SWATH) yacht. Successful in the commercial ship market and equipped with multi-axis ride control systems, adapting a SWATH hull form and its systems to a yacht, while considered a breakthrough and innovative, was relatively low risk.

• M/Y *White Rabbit*, at 84m the world's largest trimaran yacht. From a motion control standpoint this yacht featured four 11.3m² active spanning foils simultaneously controlling pitch, roll and heave. Interestingly, it is a larger version of the same owner's breakthrough 61m trimaran, which was the first of its kind and also a One2Three Naval Architects design.

• M/Y *Spectre*, a 69m monohull. Conventional wisdom would suggest that monohull yachts are simply roll stabilised, but this naval architect, Mulder Design, aligned with the shipyard and owner to allow this yacht to feature a ride control system to simultaneously control pitch, roll and vertical acceleration.

Especially with the recent fascination with America's Cup foiling catamarans, it appears many designers and architects have been inspired to consider multihulls and utilise actively controlled foils such as ours to reduce resistance and enhance seakeeping. Moreover, recent foiling powerboat designs, especially in yacht tender size ranges, have captured the imagination.

Innovation may be hard, but it is alive and well. We continue to welcome this creativity, technology transfer and adaptive innovation to the yacht market. JV

When a problem or unsatisfactory compromise arises, it forces hard thinking and consideration of new possibilities – essentially innovative solutions.

Marc Verburg

Greener yachts and shipping: a look over the horizon

Marc Verburg, Fleet Operations Manager – Yachts, IRI Netherlands (B.V.), on a shifting regulatory landscape and the growing environmentalist imperative.

New short-term decarbonisation measures were developed by the International Maritime Organization (IMO) at its Intersessional Working Group on Reduction of Greenhouse Gas (GHG) Emissions in October 2020. These measures aim to reduce shipping's carbon intensity, a focus of the Initial IMO Strategy on reducing GHG emissions from ships.

Most attention is being paid to large merchant ships in the continued development of energy efficiency regulations, such as the Energy Efficiency Design Index (EEDI), because they account for a significant proportion of energy consumed. While not included in the EEDI framework, it is clear the yachts of the future will be much more fuel efficient and probably powered by new fuel types or technologies. This is due to the aspiration of all industry stakeholders – from the owners through to the managers, builders, designers and financiers – to build and run less energy intensive yachts and because yachts may be subject to future measures under the International Convention for the Prevention of Pollution from Ships (MARPOL) Annex VI.

Initiatives such as the Yacht Club of Monaco and Credit Suisse's Superyacht Eco Association (SEA) Index, which was launched in September 2020, is testimony to this aspiration. Based on the IMO's EEDI methodology, but amended for superyachts, the SEA Index focuses on the levels of carbon dioxide emissions and allows for an assessment as to how a particular yacht is meeting environmental objectives compared to its peers.

The Republic of the Marshall Islands (RMI) Registry is responsible for one of the world's largest commercial fleets. At the end of October 2020, 4,802 ships were flying the RMI flag. Of these, 624 were yachts, including some of the industry's largest and most innovative. International Registries, Inc. and its affiliates (IRI), which provide administrative and technical support to the RMI Maritime and Corporate Registries, has invested heavily in its resources including its technical, marine safety, and regulatory experts to support the diversity of vessels registered in the RMI. IRI provides 24/7 support and advice to the designers, builders, owners, managers, and crew whose ships are under the RMI flag. The dedicated yacht and regulatory teams help ensure that the latest IMO requirements are practically applied in a manner consistent with yachting operations.

Therefore, the RMI IMO delegation, which is active in negotiating and developing new regulations in the key sub-committees and working groups, is able to competently address and bring to the discussion the needs of large commercial vessels and yachts. The yachting industry is very much part of the IMO regulatory framework and will inevitably be impacted by the environmental regulations coming down the track for commercial shipping. Crucially, it is not enough to be instrumental in the development of the regulations. They must be implemented as intended, but in a pragmatic way.

What is coming up at the IMO? Key regulatory milestones that also may have an impact on yachts include:

Baltic Sea and North Sea emission control areas (ECAS)
Marine diesel engines installed on vessels constructed on or after 1 January 2021 will be required to meet the most stringent weighted NOx emission limits specified under MARPOL Annex VI (Tier III) when operating in the Baltic and North Seas. This is in addition to the previously designated sulphur oxide (SOx) ECAs.

Fuel oil sampling and testing protocols
Amendments on fuel oil sampling and testing were approved at the 75th session of the IMO Marine Environment Protection Committee (MEPC) to further address the consistent implementation of the 0.5 per cent fuel oil sulphur content standard. The amendments now recognise fuel oil "in-use" and "on-board" sampling for verifying compliance with regulatory limits. Entry into force will occur on 1 April 2022.

Safety-related aspects associated with the use of fuel oil
Another product of the work on consistent implementation of the 0.5 per cent fuel oil sulphur content standard relates to potential safety concerns associated with the use of new fuel blends. The IMO Maritime Safety Committee (MSC) is developing mandatory measures to enhance ship safety when using fuel oil. Flashpoint has been prioritised as a critical parameter, but other fuel oil safety parameters will also be addressed.

In the meantime, interim recommendations (Resolution MSC.465(101)) encourage Member States to notify the IMO of confirmed instances where fuel oil was delivered exceeding the minimum flashpoint requirements of the International Convention for the Safety of Life at Sea (SOLAS). In addition, amendments to mandate reporting and establish verification protocols for fuel oil safety related parameters are under development. These SOLAS amendments are intended to complement the MARPOL Annex VI requirements on fuel oil quality. MV

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Joshua Wallick

Tempo

In March 2020, DLBA Naval Architects unveiled the 58m AI-powered superyacht concept *Tempo*. As Joshua Wallick explains, *Tempo* is not about autonomy for autonomy's sake, but rather the things that autonomy enables.

Technologies
One of the key pillars of *Tempo* –and the subject of this article – is how the Industrial Internet of Things (IIoT) is powering mechanical and electrical system health monitoring and automation, and what that yields for owners. The sea is a harsh mistress, and superyachts are complex systems prone to failures in the best of conditions. Some of these failures are repeatable, common occurrences (for example loss of compression in a diesel engine) while others are rare or even unique. Some failures are identified by obvious signals from a sensor while other failures are complex and can only be understood by synthesising indirect sensor observations. In the past, the wide variety of possible failures necessitated human crew be available to intervene and correct casualty conditions.

When people talk about 'autonomy' or 'expert systems' or 'AI', they are talking about algorithms. Algorithms, combined with the large-scale machine-to-machine (M2M) communication, allow *Tempo* to automatically handle faults during operation and in some cases to prevent those faults from ever occurring in the first place. The heart of *Tempo*'s improved engineering reliability is an enhanced, three-stage Condition Based Maintenance+ (CBM+) capability that utilises a combination of rules-based machine learning and model-based reasoning.

Rules-based machine learning
Rules-based machine learning (ML) enhances traditional failure trend analysis. With machine learning, the autonomous 'engineer' can rapidly process thousands of data points to identify early warning signs of system failure and respond in real time. Additionally, this technology includes learning algorithms that make it possible for the controller to create its own rules over time as it identifies correlations between temperature, vibration, pressure and other sensor inputs that presage failure modes in ways never conceived of by human operators.

Model-based reasoning
Reliance on rules-based ML alone is a poor start for a new vessel type – large data sets needed to train the AI just is not available upon first commission. That is why *Tempo* also incorporates model-based reasoning (MBR). Unlike other forms of fault detection and management, MBR does not depend upon large data sets and hundreds of hours of run time. Yet, because of MBR, *Tempo* can anticipate and manage novel failure modes not previously experienced, not identified during design and even not directly observed by instrumented devices.

MBR uses first-principles models of the interconnected mechanical and electrical systems – a digital twin of the on-board systems – to predict sensor responses to nominal systems commands or, when performing diagnosis, to test hypotheses. When expected sensor responses do not match nominal values, MBR looks to identify the most probable failure scenarios in which the expected responses for that scenario most closely match the actual measured values. Within the MBR solution, the reasoning executive keeps track of candidate solutions for both fault diagnosis and/or fault handling, generates new hypothesised solutions, simulates the follow-on effects of any hypothesised intervention and continually checks whether the currently selected strategy satisfies fault-handling goals. Because MBR used first-principle models to game-out multiple competing/cascading scenarios in real-time it is able to go 'off script' and respond to novel/emergent situations in a way that a straight-stick ML solution could not.

Benefits to owners
Autonomous prognosis
The first benefit to *Tempo*'s owners that promotes increased operational availability is CBM+ prognosis. This is the ability of the system to autonomously predict component, assembly and/or system failures. This has the effect of:

- Extending the remaining useful life of installed systems by pro-actively scheduling needed maintenance while at the same time eliminating early or unnecessary maintenance activities
- Informing autonomous mitigation of impending faults, allowing the autonomous mitigation to devise and implement machinery and/or electrical configurations that minimise the use of failure prone components
- Improving the awareness of human operators/bridge watch standers by informing them of impending faults.

Autonomous diagnosis
The second stage of *Tempo*'s CBM+ solution is autonomous diagnosis. This is the ability to use real-time health diagnosis to detect existing faults. Together, prognosis and diagnosis produce *Tempo*'s CBM+ situational awareness of its own internal world model. CBM+'s situational awareness is used by the MBR reasoning executive to identify the impact of current and future failures on key ship systems, and to anticipate the consequences and benefits of possible automated interventions.

Autonomous mitigation
Once the root cause of failure has been identified and analysed, CBM+'s third stage, autonomous mitigation, recommends (or, if permitted, executes) the autonomous mitigation measures that reconstitute degraded performance. This may involve reconfiguring the propulsion system, engaging redundant systems, utilising bypass configurations, or simply minimising the use of vulnerable sub-systems.

Novel maintenance strategies
Because 'autonomous' doesn't mean unmanned, our *Tempo* project includes a careful examination of how human-machine teaming between owners, reduced crew complements, and on- and off-board systems can combine to promote safety, efficiency and reliability. Self-adaptive health monitoring solutions like our CBM+ will certainly reduce the need for underway crew to manage repairs. Coupled with *Tempo*-organic robotic inspection remotes, on-board additive manufacturing capability, shore-based casualty control centres and fly-away campaign maintenance teams; these AI- and data-driven CBM+ technologies all contribute to a significantly increased availability of the yacht to its owners – which, after all, is what it's all about. JW

Peter Wilson
Photo: Onne van der Wal 2017

Sailing with zero emissions

Peter Wilson, co-founder of MCM, on the company's quest for yachting's holy grail.

Through innovation and clear thinking we can ... solve problems with a higher level of thinking than that which created them.

In the words of Albert Einstein, "The problems that exist in the world today cannot be solved by the level of thinking that created them." So, what are the 'problems' within the superyacht industry? For this exercise, let's supplant the word problem for challenge. One could ask how we promote sustainability in the yachts that we build.

The word sustainability, along with environmentally or ecologically friendly, was rarely, if ever, used when we started MCM over three decades ago. However, back then, yachts were simply more sustainable by dint of the fact that they were generally smaller, with less 'sophistication'. Typically, we didn't need enormous engines and generators thumping away all day long. Those were simpler times when going sailing was to leave it all behind. As expectations grew through the vision of the clients, coupled with the innovation and creativity of designers and shipyards, what was once deemed impossible became possible – along with attendant complexities.

Today there is a trend, again promoted by our clients, whereby they are steadfast in their mandate to protect the very environment that draws them to the sea in the first place. They want to enjoy pristine anchorages. They don't wish to sail through seas of the subtropical five gyres. They want to live harmoniously with marine life in their environment. Then we must rise to the occasion.

As a case in point, we are currently developing a yacht for such clients. Their clear mandate is to create a large sailing superyacht that has zero emissions. A bold mission. To achieve this, they have assembled a design, research, and development team to analyse and explore all available technologies to look within and far beyond the boundaries of the marine industry. Exciting stuff!

When a vessel is being propelled purely by sail, there are, in principle, no noxious gases being released. But add to that how to hoist and trim the sails, steer, have light, heating, cooling, cooking, a functioning black-water-treatment system, navigate, communicate – or drink a cold gin and tonic? It's pretty simple – batteries right? No combustion engines and no generators, and therefore no fuel tanks (or exhaust fumes). Plenty of room for batteries. But how do you develop batteries that have sufficient energy density to be able to actually fit the multi-megawatt banks in the hull, and have sufficient room for a galley, cabins, crew quarters and a main salon for example? As has been done with Tesla, we are finding solutions.

But, of course, batteries do not magically generate their own power, they need charging! Alongside the dock, it's straightforward – the yellow umbilical cord takes care of that. But once you leave the dock you are immediately depleting the batteries as you use the electric motor to propel the yacht out of the harbour.

To power the shore-based electrical grids to heat and light our houses, there is plenty of development in generation through ocean currents and tides. On a yacht, once sailing merrily along, with hydro turbines one can propel the vessel or reverse the blades and charge. So, for a small sacrifice in velocity, an abundance of electricity can be generated.

This means there is a premium on weather routing to ensure that one can sail a course that is both efficient in terms of arriving at your destination and of doing so with charged batteries along the way. Not too dissimilar than tea clippers used to do to achieve the highest price for their cargo when they sailed back to England. They developed the most efficient routes through empirical data. We have used plenty of computer power and human brainpower to look at the best routes for some of the principal passages – Gibraltar to the Caribbean, Galapagos to Fiji for example. For ocean racing yachts, there are software packages, but they do not take into account the necessity for charging batteries, they simply try to get you from A to B along the quickest and shortest route trading off course sailed versus VMG based on the theoretical velocity prediction characteristic of the yacht. We have a different mandate – not one purely driven by the shortest elapsed time between two points.

Then what happens when you are at anchor? You are depleting the batteries with no sailing velocity to charge them – unless you are anchored in a raging river. Photovoltaic is a fairly mature technology. So, adorning the yacht with solar panels will help, but not sufficiently. Then one needs to look further and consider wind turbines and nascent kite power technologies to charge the batteries – and then of course, as the afternoon sea breeze fills in, one can simply go for a sail. Good for the yacht and good for the soul.

We humans are constantly innovating and inventing, and, as the saying goes, necessity is the mother of invention. We recognise that we need to protect the planet and through innovation and clear thinking we can harmoniously still do the things we love – solve the problems with a higher level of thinking than that which created them. PW

A new reality

BY BRYONY MCCABE

While virtual reality and augmented reality technologies have been available for some time – and their benefits as superyacht sales, marketing and design tools have been made clear – the industry has been a slow adopter. But, with the complete collapse of the boat show calendar and a marketplace hamstrung by physical viewing restrictions, nothing has reinforced virtual technology's potential value like the COVID-19 pandemic. As such, TSR *assesses whether the new reality we are all living in has, in fact, changed the industry's attitude towards the adoption of virtual and augmented reality.*

Photo: Sergey Kaptilkin

The key benefit of virtual reality (VR) and augmented reality (AR) for the superyacht industry is that the technology can be used to assist the design, build, refit and sales stages of a vessel's lifecycle, with the ability to immerse a client inside a yacht, even before it is built. And in a new COVID-19 reality, VR and AR has the potential to further benefit the superyacht industry by facilitating client viewings from afar, within both the secondhand brokerage and new-build markets, at a time when travel and the physical meeting of people are both heavily restricted.

"The superyacht industry is a global industry, with stakeholders and yachts located in different parts of the world, and it is also a very emotional industry, where relationships are being built on the basis of personal interaction and personal chemistry," says Anastasia Yushkova, CEO and founder of AnchorVR. "The COVID-19 pandemic has caused travel restrictions and boat show cancellations and, of course, VR cannot rebuild this ecosystem (at this point in time) and simulate personal interaction. However, it can help in many other ways and become a better alternative to Zoom, Skype or Microsoft Teams due to its fully immersive and interactive nature."

Vripack is one design studio at the forefront of the superyacht industry, in terms of utilising such technology, having used VR for more than six years to offer its clients a flexible approach to yacht design that allows for greater creativity, significantly reduces lead-times for owners and makes real-time changes possible at the touch of a button. "We have been using VR quite substantially during the pandemic," explains Marnix J. Hoekstra, co-creative director at Vripack. "We are currently involved in a 70m project where, even during lockdown, the client has a VR set at home to which I can send files and he can be on board in an instant and give feedback on the areas he likes and doesn't like, as well as sight lines and all those practical things that you would never be able to see from a two-dimensional computer rendering."

While a handful of forward-thinking design studios and shipyards are making full use of VR and AR technology, it's still a very small minority. But there are signs that others in the industry are taking small steps towards growing a digital offering, even if this is only scratching the surface of what virtual technology can offer. With the aim of bolstering marketing and sales activity in the wake of a cancelled boat show calendar, many brokerage houses and event organisers have been exploring the use of virtual tours and virtual boat shows. These virtual tours aim to enable clients private viewings of existing yachts for sale anywhere in the world from the comfort of their own home – from live video walk-throughs using tools such as WhatsApp, Facetime or Zoom, to a selection of 360-degree virtual tours.

"While we pride ourselves on offering a personalised service to all of our clients, it has been clear to us for a while that this needs to be supported by an enhanced digital offering," explains Nick Dean, managing partner at Ocean Independence. "This has become even more apparent with the global COVID-19 pandemic and travel restrictions introduced this year – our owners, brokers and crew have really stepped up to the

While a handful of forward-thinking design studios and shipyards are making full use of VR and AR technology, it's still a very small minority.

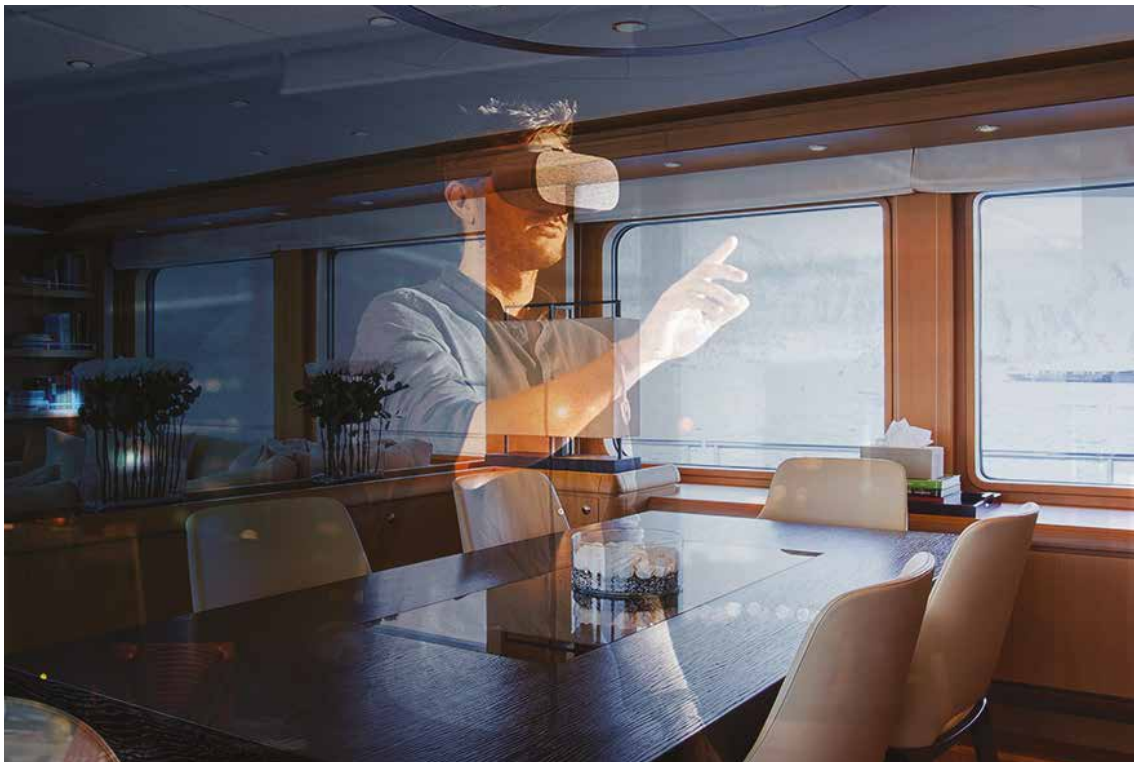

Photo: Sergey Kaptilkin

Vripack (top) and Anchor VR have both utilised virtual reality technology for a number of years.

“Shipyards have a big part to play in improving the service offered to clients during the pandemic, and being able to send a headset to the owner, rather than have them travel to the shipyard, is a step in the right direction.”

plate with the creation of additional video content, walkthroughs and 3D tours. Our virtual tours have been well received by our clients, even generating an agreed offer on a yacht, subject to sea trials, survey and contract.”

Even without the travel restrictions caused by COVID-19 in place, Dean appreciates that using these assets as part of the overall brokerage experience has proven invaluable in allowing clients to view and shortlist yachts without having to fly internationally, with the additional benefits of time savings, cost savings and eco-friendliness. “As technology continues to develop, we aim to grow with it and continue to offer virtual viewing options alongside the expertise of our team,” he adds.

When talking about virtual technologies, however, it is important to distinguish the difference between VR and AR, and the 360-degree virtual tours that are more commonly used by virtual boat shows and brokers. Essentially, 360-degree video is what you experience when using many everyday applications such as Google Earth or virtual tours of real estate, which gives the user a panoramic view of a scene from the perspective of the photographer. Because the view is actually a 2D panoramic, the images become distorted and there is no depth or feel to the environment.

Therefore, 360-degree virtual tours are quite different from AR, which allows the overlay of the real and digital world where physical and virtual objects co-exist, and VR, which is a 3D computer-generated immersive media experience that includes the use of hand controllers, voice activation or head-mounted displays (commonly headsets). The headset measures head movements and this technology increases the user’s normal field of vision, which results in the immersive sensation with the virtual world.

The common misconception that 360-degree virtual tours and 3D technology constitutes VR is something that Sam Slater, CEO of immersive technology company V360 Marine, knows only too well, and he feels that the COVID-19 pandemic might have given rise to more examples of this. “In the early stages of the pandemic, there was a lot of focus on virtual boat shows and all kinds of bad applications of the technology,” he explains. “The yachting sector can be very ego driven and it is often about being the first to do something over adding actual value. But people are starting to realise that these virtual boat shows are just a collection of yacht tours that were being used anyway, as part of the marketing material. It has shown that you can’t budget when it comes to VR, and you need to spend the money to leverage the technology for it to add value.”

Since the pandemic started, however, Slater has noted an uptick in interest in VR technology for the purpose of supporting new-build and refit projects. “We are in discussions with one shipyard in the UAE that is looking to start leveraging VR technology throughout the build process; rather than getting the owners flown over to the shipyard to look at designs, they want to send them a headset and have multiple people in the VR environment at any one time, wandering around the model and discussing the design concept,” he says. “It is simple applications like this that have always been possible, but are now becoming a lot more relevant because of the travel restrictions and multiple waves of lockdowns.”

From what Slater has seen, shipyards have been quicker to respond to the possibilities of VR technology during this time, more than any other industry stakeholder, because of the timing pressures of their projects. “What COVID-19 has brought home is that it is significantly affecting the way people travel and the ways in which businesses operate,” he adds. “Shipyards have a big part to play in improving the service offered to clients during the pandemic, and being able to send a headset to the owner, rather than have them travel to the shipyard, is a step in the right direction.”

So will the pandemic shift the industry’s attitude towards the adoption of AR and VR? “It might take this pandemic for someone to say, ‘Wow, this is a great tool’,” considers Hoekstra. “But it should be noted that we have already been using VR as a tool since 2014 and it was already great, so it’s a bit of a

shame if it takes a situation like this to push the industry forward. At the same time, if this was what was needed then let it be so, because it is a valuable tool that will help attract new clients to the industry by helping them understand what to expect, and it will improve the discussions between shipyards and their clients."

"In my opinion, the COVID-19 pandemic has certainly impacted the superyacht market's interest in digital communications in general," adds Yushkova. "Distant communications and remote collaboration have become the new norm. However, eight months is not enough time to switch the industry towards virtual reality, as it will require industry players to change their current pipelines. But, it is absolutely essential, if the industry would like to win in the long run."

While the pandemic may have shone a light on the virtual technologies, the superyacht industry is still a long way off using VR as a mainstream tool in the sales and marketing process. For the superyacht industry to see greater adoption of the technology, Yushkova believes that there needs to be increased awareness and understanding of its potential. "First of all, the industry needs to understand that VR is for adults, not just for gaming, and that it is affordable, comfortable and easy to use," she continues.

"The biggest contradiction is that our industry develops the most advanced objects in the world, in terms of technology, but it preserves a very conservative way of doing it. This is very different from the automotive or aviation sectors, where Product Lifecycle Management (PLM) is everywhere and VR is viewed as an end-to-end technology and could be used at any stage of a product's life. I would love to see superyacht industry professionals start to use VR as a common language that can help them to navigate an environment filled with dozens of different PLM solutions and understand each other quickly. It would speed up project development and make the whole process more smooth, transparent and fun, especially in the context of travel restrictions and social distancing."

With VR, clients can step aboard their vessel before it's even been built.

After almost a year of living in a world dominated by COVID-19, it is undeniable that the pandemic will have a significant impact on the way that people travel and utilise technology as an alternative means of doing business. Going forward, the client-facing sectors of the industry should be prepared to understand more about VR and AR technologies and how they can add value, particularly in the design and build phases. With some progressive individuals paving the way, it is likely that increasingly more organisations will implement VR and AR technology as part of their future strategy to ensure they adapt to a changing business landscape in the wake of COVID-19. BM

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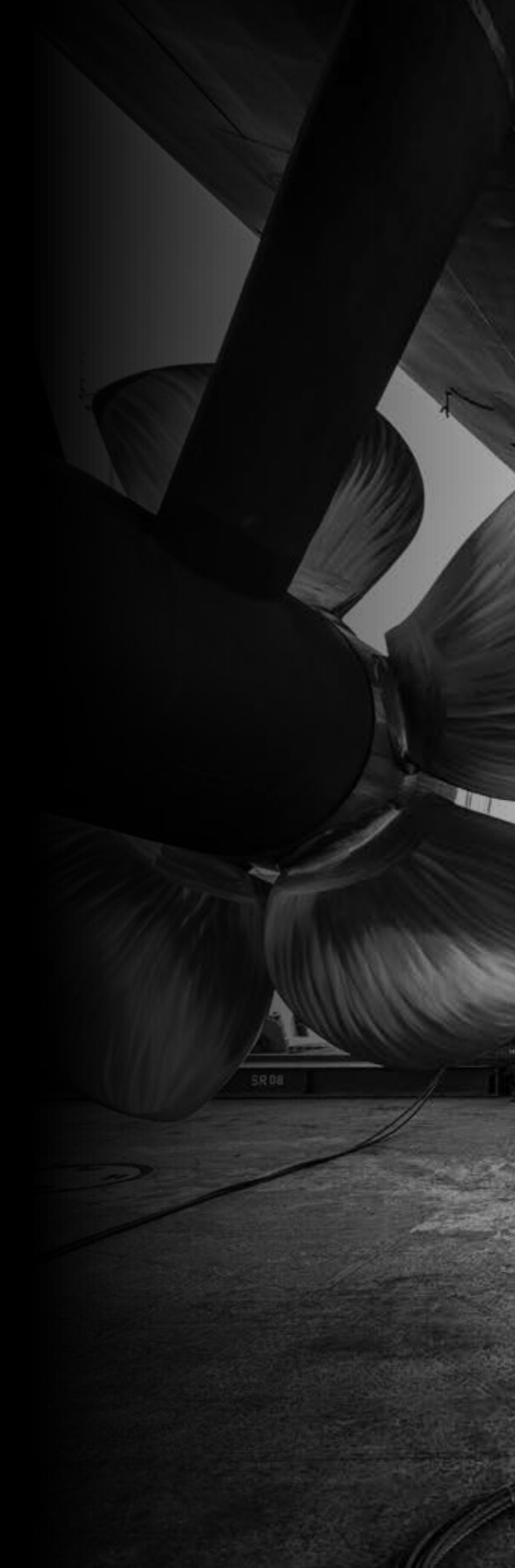

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Guillaume Plisson

What does ‘innovation’ mean to you?

BY WILLIAM MATHIESON

We speak to luminaries from two ancillary spheres of design – automotive and land-based architecture – about the concept of ‘innovation’ and how it occurs in practice.

Around a month before sitting down to write this piece, I tuned in to Oceanco’s NXT webinar not knowing what to expect. Having run the webinar gauntlet over the course of lockdown, I was somewhat web-weary and I went into this latest iteration with few preconceptions.

The webinar took the format of a round table and was presented by the shipyard thus:

‘*Oceanco unveils its vision for future demands by reflecting across industries, with the ultimate goal of zero impact on the environment. Oceanco NXT brings together a cohort of luminaries in the yachting, technology and design worlds to marry innovation and sustainability in an authentic and meaningful way that will transform how we spend time on superyachts.*’

However, despite the slick presentation skills of compere Peter Economides and the honesty, candour and insight provided by Oceanco CEO Marcel Onkenhout and Captain Chris Gartner of S/Y *Black Pearl*, it was the views of external sources Giles Taylor (global vice president of Design at FAW Group), and Tommy Kleerekoper and Sanne Schenk (co-founders of TANK) that made me sit up and take notice.

At the time, I was in the midst of planning our first ever ‘Innovation Report’, and then by pure coincidence, I was presented with this somewhat ontological discussion in which the key theme that kept pervading the discussion was ‘innovation’.

So, with the help of Oceanco, I set about speaking to Sanne, Tommy and Giles about this most nebulous of concepts. The aim was to understand the true meaning of the word, in the minds of these respected creators, and to better

conceive both the pace and place of innovation within our own industry. The result was something of an existential journey, and a fascinating discussion about both our ability to innovate and the commercial demand to do so.

In your experience of superyachting to date, how does it compare to your industry, in terms of product design and development?

Giles Taylor (GT): Whether it's Rolls-Royce or Audi or Citroen or Peugeot, we're in a mass market design industry. We design for the mass consumer. So whether we're Rolls-Royce competing with Bugatti or Bentley, we're making sure the value equation between the cost of getting it on the road, the price point and the number we're going to sell makes commercial sense. Therefore we're tapping the horizon all the time to get a competitive advantage.

As far as I'm concerned, there's none of that market pressure on a shipyard. The guy rocks up, he's very rich and he says, "Can you build me a yacht please?"

If we don't actually respond to that marketplace and that mass consumer in the right way, we're dead. I don't think that sort of dog eat dog or that competitive edge exists between Amels or Feadship or whoever it may be. I don't think it does but it could do and that's an interesting conversation to have.

Tommy Kleerekoper (TK): What we always do, and that makes this assignment a bit weird, is that we really focus on the clients and we get into the way it might work and all the things that are important to them. And based on that, we start designing.

Oceanco is our client, so what we

Giles Taylor.

"Innovation has to be visible. I think that's exciting and I think it's a really interesting conversation ... The story is everything."

do now is a bit out of the box, but that's what they wanted – to just come up with ideas that are based on what we think is new and what the customer really needs. It's quite comparable I think, because in general, they're just private clients, whether it's a villa or a boat.

Sanne Schenk (SS): Yes, I think it's very comparable. Normally there is a client, but many times we have a pitch phase before we start a big project, and we haven't even spoken to a client. So actually, in the first phase, we always design from our own imagination, desires or wishes, so we're kind of free-flowing. And then once a client comes into the picture, we funnel towards their specific needs.

That's one thing about being a designer, I guess; just when you think you know it, there's someone else that wants things differently. It's our work to try to figure out new ways. So yes, I don't feel insecure about it; it's the fun part.

Do you think superyacht design and manufacturing lacks genuine innovation? If so, is that a market growth inhibitor?

GT: Innovation costs shed-loads of money, innovation is hugely risky and if a guy knocking on your door says, 'Can you just do me another *Black Pearl* please? Can we have another print-off but just paint it differently or use the same bricks as the house next door because I just love those bricks and the shape of the windows?' All of that is totally normal in a bespoke industry. It's like Savile Row.

I think of Henry Poole tailors – you're going to go there and you're going to say, 'Wow, can I have the same cloth cut for Marlon Brandon in 1950'. It's like, 'That's what I want and please make my lapels a little bit tighter and extenuate my shoulders and I'm happy.'

I think there is a romance in luxury industries and I trip into that area quite often because, coming from Rolls-Royce,

The 2016 Rolls-Royce 103ex concept featured many innovations, including AI modular platform construction and driverless autonomy.

TANK's design for the Park Hoog Oostduin 'Pinnacle' penthouse in Den Haag.

my customers were in love with the brand for deeper reasons than most people can really imagine. I think if we said, 'We want this hydrogen version of the Rolls-Royce and we just think that you should be ready for this new purist era where you can talk to people on the street. You can apologise for the fact you're rich just by having this really green Rolls-Royce and we've taken the flange off because that was the symbol of decadence.' You've missed the whole point about coming to Rolls-Royce.

The conversation that we are having right now with Oceanco is fascinating because it's actually a lot more than being green. It's actually a complete look at what yachts really are, in a user scenario sense as well. That's the bit I find very interesting. I really enjoy that debate and that space that's up for grabs right now, in terms of the first company to come into that space and say, 'We're about to do something very different'. It's like, 'Wow, why?' The answer is, 'Because we can'. It's not because the guy turned up and asked for it, it's just because now we think the time is right to explore those spaces. That's really interesting for me.

TK: In yachting, we've seen lots of over-materialisation; it's about luxury. Because you're saying a lot is about functionality, which is also true. If you think of good designs like a chair, a table or even how a house is built, the most beautiful houses are the ones where you can actually see how it's made. And the construction is the aesthetic.

But if you have, well, if there's another layer over it, so that you don't see how it's made, it's a bit ...

SS: It would be nice to increase the focus on material development, for example, as there are a lot of possibilities in yachting. At Oceanco, they're really open to new developments. Like I said, we'll be able to develop our own materials that are more luxurious in terms of research, sustainability, maybe customised for a client, that sort of stuff, instead of just applying expensive stuff. It is the case that we looked for more 'story' behind the materialisation.

Who drives innovation – the client or the industry?

GT: That's an interesting one because I had one of the car journalists who came to interview me at Rolls-Royce and he spoke about yachts and he said, "One day you'll have to put a big fence up around the Monaco harbour to stop the Extinction Rebellion people coming in and putting limpet mines on the side of the boats." And he was deadly serious. He's actually right because it's the perception of them. Anyway, the point is this, I think we drive it. We do, the clients don't drive it. There's nobody saying, 'Giles, when are you going to put a hydrogen tank in a Phantom?' I think that's the opportunity for the industry to say, 'OK, now I'm going to tell you what you need and, maybe, what you want.'

SS: I remember Oceanco's *Black Pearl* – it was completely new, innovative and very much based on the client's desires. They really stressed over everything being sustainable and just kept on making this effort.

TK: Maybe the difference is, if you're making a consumer product that's slightly affordable, you can just make it and wait for someone to buy it. But I guess with 100 million euros or more, you can't just make it and see what happens. Right?

“If you look at innovative design, we always try to keep in mind that people should feel good within the space.”

Tommy Kleerekoper and Sanne Schenk.

Photo: Peter Sabelis

How does yachting facilitate greater levels of innovation?
GT: It’s not just a beautiful line on a hull. It’s about expelling the myth of the champagne or the gin palaces all sprayed in white and ‘mine is bigger than yours’ and ‘I’ve got more space than you have’.

TK: In a way, of course, there is already innovation, right? I mean, they’re making amazing things, amazing craftsmanship and all that stuff. That being said, we’re just thinking that maybe the focus is somewhat in the wrong place. Maybe that’s the focus because it’s more about what is missing.

How important is it to distinguish between innovation and novelty?
GT: You want something that grandstands you and the world in which we’re about to step into. Those people need to choose their next step very carefully because, I mentioned Extinction Rebellion, but they’ve got to understand the next era.

Going back to your point, there is a lot of novelty in luxury design and long may it be so because if you start to put function before form and you start to rationalise what is so gloriously lovely about an E type that’s pretty difficult to drive and you can’t get out of, then you’re a heathen.

SS: The propulsion solutions they’re looking into could become more of an innovation, and that’s really sincere and that’s not bull. They’re really making an effort to look for new means of propulsion.

TK: But it’s also how progress works. I mean, there’s a certain amount of novelty, as you call it, and then all of a sudden there’s an innovation. Usually

De Hooch apartments in Amsterdam.

it starts with a technical development ... new possibilities, and that makes for a paradigm shift, which is true innovation. And from there, people again start building on that paradigm shift with novelty, novelty, novelty, and I think that's how progress moves; it's not a straight line.

In your experience, when creating something tangible, what is the most important catalyst for genuine innovation?

TK: We do a lot of hospitality projects, so restaurants for instance. And what I notice is the people. I mean, do you really want to introduce a totally new way of having dinner in a restaurant? No. People want a table, a candle, real wood, warmth, you know?

So it's complex. If it involves people, it's a difficult line between innovation and romance, beauty ... Our idea of beauty is usually based on things we know, and I guess that's how people use novelty – they want something that the neighbour has but just a little bit better. Do you want your bedroom to look like a sci-fi movie? Probably not. (Laughter.) It's fun in a hotel room but do you want to live in it?

So once people come into the mix socially, then it's a complex give and take between novelty and things we know and feel comfortable with. If you look at innovative design, we always try to keep in mind that people should feel good within the space.

Which spheres of design or technology are we witnessing innovation from right now?

GT: I think we're in a bit of a reset situation where coming back to the common denominator has to be the foundation of good design in the future ... whether that's using materials that are recycled ... Yes, absolutely, plastic is a dirty material in the way it's produced and what happens to it in its end-of-life scenario. I think that sustainable thinking is here to stay. We're all aware of that in the design industry.

In terms of innovation in my industry now, it's about weight. Whether it's electric or the fuel cells from hydrogen energy sources, it's weight and it's getting rid of excess weight. Therefore, structures and materials in their own right are forcing the designer's hand to be more clever, maybe more innovative in that respect.

It's an interesting conundrum because innovation has to be visible. I think that's exciting and I think it's a really interesting conversation. We have to condition ourselves as the purveyors of fine goods, whether it's Harrods Deli counter or it's the new Miu Miu store up in Mayfair or it is this new bamboo cloth that's coming from sustainable sources from Japan right now. The story is everything and if you're bull s*****ing as a global brand on the world stage, you can be had, whether it's on my daughter's TikTok or on Instagram, you can be had in a nano-second.And if you're found to be style over substance in an era when everybody is expecting this new level of social responsibility, with socially aware branding that has full authenticity, you could be over.

SS: Spaces that contribute to your well-being, and that's on different scales. It's about the shades you choose, materials, the lights, the amount of natural light obviously, and the presence of plants. Everything that relates to our origin as humans coming from nature. That's what we try to involve in our interior designs as well; we're not mimicking nature, we just try to relate to it. That should be a way to make people feel better in a space. To us, that's really important. WM

FROM BOW TO STERN

BY WILLIAM MATHIESON

These are the products and systems that will make up the superyachts of the future. We have assembled a diverse selection of industry innovations that stretch the length and breadth of the vessel. While their functions may be varied they share a common commitment to future thinking and industry disruption.

Ordinarily, the creators and manufacturers of these products would have enjoyed a busy quarter, touring the world with their latest invention and garnering interesting from captains, project managers, designers and naval architects alike.

Alas, this has been no ordinary year, and the industry shop windows have been closed, chiefly among them METSTRADE, which is usually a rich source of new technology and innovation, but was this year forced to cancel the physical event due to Covid restrictions.

Fear not, though; while the industry may not be able to convene in person, we, The Superyacht Group, have reached out to the supply chain anyway. We have an unrivalled relationship and depth of technical coverage going back almost three decades, and we know where to find the quality, reliability and innovation that drives our industry forward. And that is precisely what we have done over the following pages, with a curation of some of the most innovative superyacht solutions on the market today.


This is
NOBISKRUG
GERMAN SUPERYACHTS FOR THE 22nd CENTURY

INTRODUCING UNICA

Besenzoni targets the superyacht market with the development of a new brand, Unica.

After 50 years of operating in the production yacht market, primarily within the 20-40m size range, Besenzoni has shifted its focus for commitments by creating a new brand dedicated to the superyacht market. Unica (Unique Yacht Accessories) has been developed with the specific intention of satisfying the growing demand for large-yacht accessories for both shipyards and owners.

"Besenzoni is one of the most well-known brands in the nautical sector," starts Dario Tosto, sales manager for the Middle East, North Europe and Far East at Unica. "We are very strong in the 20-40m sector but, over the years, the superyacht market has grown significantly. The average length of superyachts continues to grow and, thanks to our structure, know-how and technology, we are able to cater to this market and build bigger accessories to reach clients of all sizes. The development of the Unica brand is to make it clear to shipyards and clients that we are dedicated to competing in this market."

While Unica is a division of Besenzoni, the two brands should be considered as distinct owing to the different challenges presented by the large superyacht sector. Unica will be operating out of a different workshop, with its own staff members who are experts in the specific regulatory challenges and processes associated with the large superyacht market.

From gangways and doors to canopies and terraces, Unica offers an incredibly diverse set of custom products. Among Unica's most recent projects is 'Balcony', which has been designed for superyachts over 35m. Balcony is a balcony-window, to be installed at the bow section at the height of the owner's cabin, where the curvature of the ship's side makes it difficult to customise the yacht.

"The idea behind Unica is not simply to present bigger version of the projects that have made Besenzoni so successful,

but to bring something entirely unique to the sector as well," continues Tosto. "Over 60m there are few series projects, most vessels are unique and, therefore, so must our products be. Every client wants some sort of personalisation, tweak or customisation and we are able to provide that."

Simply satisfying the need for custom accessories, however, is not enough to guarantee the continued success of a business in this highly competitive sector. Unica will go beyond custom product delivery and ensure support for on-board assembly as well as a world-wide after-sales service.

"The superyacht market is very small. When you work in this sector there are very few shipyards and we have even fewer competitors," explains Tosto. "Everybody knows each other and new projects immediately become known around the world. The biggest differentiator in this sector isn't actually the products themselves, but the level of service provided and, at Unica, we believe our service is market-leading."

Thanks to the business' diversity, areas of specialisation and qualities of its workforce, Unica has the expertise, experience and scale to cater to the superyacht market both in terms of product quality and continued world-wide service.

"The biggest differentiator in this sector isn't actually the products themselves, but the level of service provided and, at Unica, we believe our service is market-leading."

FOR FULL COMPANY AND PRODUCT INFORMATION, VISIT SUPERYACHTNEWS.COM/SYINDEX AND SEARCH 'BESENZONI'

TOP OF THE CLASS

A new range of topcoat products offers superyacht clients unrivalled levels of customisation to their paint jobs.

Boero has launched its new market-leading topcoat system. The Challenger PRO range has been developed specifically for the superyacht market.

"With Challenger PRO we can apply three different types of topcoat," explains Cristiano Bighetti R&D, technical & product manager for Boero's yachting division. "One is solid colour direct gloss, another is solid colour with clear coat and the third is the effect colour (pearlescent and metallic) white clearcoat. If the customer chooses solid they can have white, blue, red or any other colour; if they choose metallic or pearlescent they can create a special effect like, for example, the Italian pavilion in Dubai."

The pavilion Bighetti refers to is the Italian pavilion at the 2020 Dubai EXPO, where Boero created a special colour scheme for the coating of the pavilion's roof. It was a more challenging task than it may first appear because of the extreme conditions the topcoat is exposed to, being as it is, under extreme daylight heat and sun, and then facing a dramatic drop in temperature when night falls, as well as a level of humidity regularly pushing 95 per cent.

The brief was not only to provide a robust and reliable topcoat, but to deliver a unique colour scheme that resembled not only the colours of the Italian flag, but that the white section produced the same shimmered effects as a fluffy white cloud in the sky.

The Challenger PRO range comprises Direct Gloss, Two-Layer and Special Effect versions and is now available to superyacht clients.

"We do not just sell topcoats; we sell the total paint package, from the primer, filler to the undercoat and topcoat. And where possible we recommend clients to purchase the complete package," Bighetti explains. "Challenger PRO has permitted us to develop 200,000 colour formulas and we can also undertake touch-up work.

"Historically, with superyacht paint there were only two popular colours – white and blue – but now clients are seeking greater customisation and this can make repair work harder. So we have worked to produce a product that is easy to touch up if there is damage or wear."

Bighetti says that the ultimate aim with the Challenger PRO is to deliver a versatile topcoat that can meet the demands of any client. And with the sheer number of nuances to both the colour scheme and effects that this adaptable range can offer, the Challenger PRO is truly reflective of the bespoke level of quality demanded by today's superyacht clients.

"Clients are seeking greater customisation and this can make repair work harder. So we have worked to produce a product that is easy to touch up if there is damage or wear."

FOR FULL COMPANY AND PRODUCT INFORMATION, VISIT SUPERYACHTNEWS.COM/SYINDEX AND SEARCH 'BOERO'

Italian Pavilion 2020. Renderings by CRA.

TECHNOLOGY LIKE RUNNING WATER

Through consultancy and management, Bond TM gets the most out of AV/IT systems.

As superyachts continue to grow in size and complexity, AV/IT systems continue to grow in scale and importance. Far from being an entertaining addition, AV/IT systems now form the backbone of the superyacht experience. Through consultancy and management Bond TM ensures that client requirements are translated into enjoyable systems.

"Having been an ETO for seven years, Bond was created to solve a single problem. After a three-year build project, how could people get it so wrong?" asks Will Faimatea, founder and director of Bond Technology Management & Consultancy. "As an ETO I grew tired of being blamed for technology not performing as it should – especially when guests were on board – when the issues lay with the technology itself. Had anyone actually taken the time to ask the owner what they wanted?"

The superyacht industry often proudly proclaims to be at the forefront of technological integration; however, it is not uncommon to find a disconnect between what owners and guests expect and what is delivered. The fault, it must be said, does not lie with any particular party; rather, there is a space in between the shipyards, designers, integrators and owners that, when left unfilled, can yield poor results.

"The most important element of any AV/IT project is to get it right for the principal. Whereas AV systems were once considered luxurious additions to a project, today entertainment and connectivity are like running water – it needs to work all the time and it should never run out," continues Faimatea. "When Bond was first created there were no technological consultants. Today, clients invest a significant amount of time and money in their AV/IT systems; getting it wrong is not an option."

In recent years, the complexity of on-board AV/IT systems has grown astronomically and so has their primacy. Consultation, installation and delivery, however, is just part of the technological lifecycle. With owners and guests notoriously cash-rich and time-poor, it is paramount that the systems continue to work year-round and, in the event of a systems failure, that advisory teams and management are on hand day and night to resolve the issues.

"Consultancy and delivery are just the beginning; management and support are essential and Bond provides the shore-side constant for ETOs."

"Support is a critical element of the superyacht experience. The superyacht industry does not shut down at the weekend. When a vessel requires assistance, it requires assistance immediately. Waiting around is not acceptable," explains Faimatea. "Consultancy and delivery are just the beginning; management and support are essential and Bond provides the shore-side constant for ETOs."

Simply put, it is unacceptable for AV/IT systems not to be functioning optimally, Bond TM has built its reputation on ensuring that the disconnect between expectation and delivery is bridged.

FOR FULL COMPANY AND PRODUCT INFORMATION, VISIT SUPERYACHTNEWS.COM/SYINDEX AND SEARCH 'BOND'

CELLWEAVER SUPERCHARGED PREPARES SUPERYACHTS FOR 5G

CELLweaver's next generation aggregator provides a future-proofed, super-performing internet connection on board.

Founded in 2015, CELLweaver's one-of-a-kind technology allows superyachts to achieve a secure, reliable and high-bandwidth internet connection on board by aggregating multiple mobile network signals. Available to order now, the company's next-generation aggregator – the CELLweaver SuperCharged – provides an even more powerful solution that is future-proofed for the advent of 5G, enabling everyone relying on it to keep up with the ever-increasing bandwidth demand of applications such as social media and streaming services.

"To get our clients ready for 5G, the next generation of CELLweaver is designed to be a straightforward replacement for their existing units," explains Wilko Darger, CEO of CELLweaver. "This features a different antenna layout, different hardware design and different software for the ETO to control the unit, but from a user perspective there is little difference."

As well as ensuring clients are 5G-ready, which will be most relevant for yachts when in port, the CELLweaver SuperCharged is also future-proofed for the continuous developments happening on the 4G spectrum, where more frequency bands with further reach are being added. "Our focus is to combine resilience, high performance, cyber security and operational range so that clients can have coverage as far off the coast as possible," adds Darger.

CELLweaver also offers bolt-on amplifiers, which triple the range and improve bandwidth and connection quality. For larger yachts, multiple CELLweaver SuperCharged units can be stacked to create an even higher bandwidth on board. This increased bandwidth can then be managed more flexibly in the yacht's firewall so that different percentages of the bandwidth can be allocated to owners, guests and crew, depending on priority.

Alongside the hardware, CELLweaver also provides a fully managed service to its clients. This includes providing a dedicated counterpart unit on shore, in addition to the unit on board, between which aggregation is achieved. "The other element of the service package that CELLweaver provides is the SIM cards," says Darger. "The SIM cards do not run out of data and most do not need to be replaced when the yacht changes location. In areas where there are special requirements, CELLweaver ensures its clients have the appropriate SIM cards for the itinerary."

CELLweaver's managed service also provides a secure and encrypted connection. Using a proprietary technology, data is split in unpredictable asynchronous combinations between four connections, with each connection highly encrypted. That way, CELLweaver ensures unparalleled cyber security for its users.

Furthermore, clients can choose a country-specific public dedicated IP address to be assigned to their CELLweaver unit. A comparable solution to the more commonly known VPN, the internet connection can then be used to enable the AV/IT systems on board access particular media services only available in a certain country, such as BBC iPlayer or a Netflix account in the UK, no matter where the yacht might actually be located.

Another benefit of CELLweaver's innovative managed service is the company's overview of all connected systems on board. "While our managed service focuses on supporting our clients with CELLweaver services, our team also has experience working with AV/IT systems," says Darger. "So, we often help clients with the other software or systems they have on board, which is particularly helpful for yachts that don't have a dedicated ETO."

FOR FULL COMPANY AND PRODUCT INFORMATION, VISIT SUPERYACHTNEWS.COM/SYINDEX AND SEARCH 'CELLWEAVER'

NEVER A DULL MOMENT

CeraShield's Duplex system protects paint's gloss far beyond its typical lifecycle.

Paint has always been one of the superyacht industry's most discussed topics owing to the incredibly high standards that owners expect. Small changes to polyurethane paint systems have meant that they are no longer as durable as they once were. However, with CeraShield's Duplex system a cost-effective solution to bolster gloss and durability is now available the owners, yards and paint manufacturers.

"There are two key products in our range. The first is a 10-micron clear ceramic coating that produces gloss and durability. It can be applied to new paint and it can also be applied to older gloss-restored paint. This product has been designed for exhaust areas of hulls where they experience issues with soot and exhaust fumes engraining into the paintwork. The product has an anti-graffiti property, as it was originally designed to protect the paintwork of the Deutsche Bahn trains from vandals. This product is excellent for protecting large flat surfaces, but, to protect more complex surfaces, such as a superyacht superstructure, the 10-micron coating is paired with a seven-micron coating that is perfect for rounds, reveals and returns," starts Andy Williams, partner at CeraShield.

By now the benefits of ceramic clear coats on superyachts are well known – they offer performance, protection and durability. The ceramic coating bonds chemically with the substrate of the polyurethane paint coat and cures at atmospheric temperature. In essence, the ceramic coating provides a durable, sacrificial layer of protection to the polyurethane coating, allowing a superyacht's finish to maintain its gloss and appearance for longer periods. However, until recently, ceramic coatings had been seen as a solution for wearing paint coatings, rather than being adopted at the beginning of projects to be used as a preventative and enhancing measure.

"It is inexpensive to apply the Duplex system and owners can be safe in the knowledge that they will not need to do a complete paint overhaul for five to seven years."

"Even the manufacturers accept that polyurethane paints today don't hold up for four to five years like they used to because the chemicals that provided the gloss and durability have been quite rightly removed because they had harmful trace elements," continues Williams. "It must be said, that the paint systems today are still absolutely excellent, but they typically only last for around three years before they start down-glossing and becoming matt in the high-wear areas. However, when a client engages in a new build project or a new paint job, they are still led to believe that the coating will retain its gloss for five years, which has created a disparity between expectation and reality."

Paint and finishing has traditionally been one of the most contentious and litigious elements of any build project. However, Williams believes that with CeraShield's new Duplex offering, which will see ceramic coatings included in the initial options list for clients, many of the stresses associated with paint can be mitigated. By using the Duplex system owners' will receive an end product that meets, or indeed outperforms, expectation. Additionally, the option of the additional ceramic system will allow yards to be more transparent with clients when they outline the unavoidable limitations of typical paint systems.

"We were first contacted by a well-known management company which was concerned that their clients were not receiving what they paid for," explains Williams. "A number of the market's most respected paint surveyors have also concluded that the paintwork needs protecting and, increasingly, shipyards and paint manufacturers are also inclined to agree. The paint systems they provide are excellent, but they require a sacrificial coating to protect their excellent work. CeraShield's Duplex system can be applied to new paint and topped up on high-wear areas as and when required. It is inexpensive to apply the Duplex system and owners can be safe in the knowledge that they will not need to do a complete paint overhaul for five to seven years."

Transparency and cooperation will be some of the central pillars of progress in the superyacht industry for years to come. Where transparency and cooperation are concerned here, they yield gloss, durability and performance.

FOR FULL COMPANY AND PRODUCT INFORMATION, VISIT SUPERYACHTNEWS.COM/SYINDEX AND SEARCH 'CERASHIELD'

‘BULLETPROOF TECHNOLOGY’

The switch from analogue to digital may have taken longer than one might expect for crew radio systems, but the shift is an operational imperative.

Rather than produce a ‘range’ as such, channel28 systems are developed in a bespoke fashion, working as they do with the crew of individual vessels to understand their operational needs.

A decade ago, superyacht security meant a physical presence on the deck. But the industry has slowly woken up to the idea that the threat to both the asset and its passengers is far less likely to come from a physical attack and far more so from the various ‘soft’ access points that present themselves to potential attackers.

One of the less talked about but historically most vulnerable targets is the on-board crew radio network. Historical analogue systems offered open networks to any party that wanted to, quite literally, tune in. Theoretically, this presents a serious compromising of on-board security, with details of passages and guest whereabouts being circulated over the airwaves.

“[In contrast to years gone by], nowadays we are being asked for ever higher levels of encryption,” explains Adrian Hicks, director of communications engineering and software development company, channel28, which builds on-board digital radio communication systems for superyacht crews.

When the business was founded, the concept of digital radio was only really embraced by the custom end of the fleet. However, a mission channel28 has taken on is to educate more of the market on the shortcomings of analogue radio to bolster digital adoption. The radio system is still an essential tool in a crewmember’s arsenal, and the ability to add additional bells and whistles (or alarms and monitors, as the case may be) only adds to their utility.

Rather than produce a ‘range’ as such, channel28 systems are developed in a bespoke fashion, working as they do with the crew of individual vessels to understand their operational needs.

“When you get onto the boat, every boat works in a different way, and they have different ways of using the systems,” Hicks explains. “We’re being asked for a wider range of integration, whether it’s bridge alarms for the navigation officer, to engineers’ alarms or stew calls. But rather than just being blared out in the crew mess, it is targeted to the right people.”

Hicks estimates that about 40 per cent of any brief is hardware design, while the remaining 60 per cent is programming the software that meets the needs of the client. “If a good hardware isn’t programmed correctly, it’s probably worse than having bad hardware. So it’s about understanding and talking to the crew about how they want it to work and being able to implement that in a way that is seamless for them.”

As channel28 continues to push the envelope, in terms of system innovation, the company is now rolling out support for TETRA, which is the radio technology used by most emergency services. “TETRA is a fully managed system and an expensive technology. But in almost every way, it is also a bulletproof technology; it offers users a constant radio signal and has now become both more widely accepted and more cost-effective.”

FOR FULL COMPANY AND PRODUCT INFORMATION, VISIT SUPERYACHTNEWS.COM/SYINDEX AND SEARCH ‘CHANNEL28’

CONTROL & STABILISATION WITH CMC MARINE

The latest developments in electrically actuated control and stabilisation technology.

The growing integration of control and stabilisation technology on board yachts has led to significant improvements in performance, manoeuvrability and comfort. So much so that stabilisers are now considered a necessity, rather than a luxury, by the yachting community.

Founded in 2005, CMC Marine has grown and strengthened its position as a market leader in the production of control and stabilisation systems for yachts and passenger boats over 30m in length. The company's innovative, flexible and reliable product portfolio includes some of the most sophisticated electric fin stabilisers, steering systems, thrusters and intruders on the market. This includes the Stabilis Electra range, the world's first electrically actuated – as opposed to hydraulic – stabilisation system and one of the brand's flagship products for the superyacht market, as well as steering systems Directa, the thrusters Dualis and the intruders TRIM, all of which are electrically actuated.

The brand's ethos of integrating the latest generation technology and innovative design has been central to CMC Marine's success. "Technological developments move very fast, so we are constantly innovating and making our systems more sophisticated, which allows us to deliver more features and value to our clients," explains Alessandro Gallifuoco, marine business development manager at CMC Marine.

"For example, we are now able to integrate all of our equipment and systems – stabilisers, thrusters, steering systems and intruders – into a single platform with a strong software backbone so that all systems can be operated together. This allows the optimisation of the components and delivers greater benefits for the clients in terms of performance, manoeuvrability and comfort, as well as for builders in terms of space saving and ease of installation."

The latest addition to CMC Marine's product range is the intruder – the perfect complement to the Stabilis Electra for total platform control. Built up out of stainless steel, it requires minimal power to quickly control roll and pitch.

Another recent development by CMC is Waveless, a range of new electric and ultra-compact stabilisers for yachts from 12-40m, which uses the same technology as Stabilis Electra, but re-engineered into a smaller, more compact machine. "We have always been present in the superyacht market, developing products for yachts from 30-70m," continues Gallifuoco. "But, as technology has moved forward, the increased availability of electrical components has enabled us to offer the same technology to much smaller yachts, which is why we created Waveless. It is a product range for the broader market of smaller vessels but with uncompromised performance."

Being close to the end-customer is one of the cornerstones of the corporate philosophy of CMC Marine, and at the heart of this is its rapidly expanding service centre network, which spans the world from the United States to New Zealand, from the Caribbean to the Far East region. This network has been established both to support its clients and create opportunities for the company. "We need to be able to serve our clients around the world, but it is also an enabler of new business," says Gallifuoco. "CMC's systems are so reliable, there is not much maintenance or failures for these service centres to deal with, so what is really driving profit for them is the ability to sell our systems for retrofit projects".

As a result of its innovative and performance-driven product development, CMC Marine has established strong relationships with 13 of the world's top 20 superyacht builders, to which it sells the majority of its systems and actively works with on both new build and refit projects. The company continues to innovate and pursue the integration of its control and stabilisation systems for the benefit of yacht builders and owners.

FOR FULL COMPANY AND PRODUCT INFORMATION, VISIT SUPERYACHTNEWS.COM/SYINDEX AND SEARCH 'CMC MARINE'

SPACE-SAVING AND SIMPLICITY

CNSAT directly tackles two of the central issues with on-board entertainment systems.

Over the past decade or so the superyacht industry has gone through somewhat of a technological revolution. As technology has developed apace globally in the realms of telecommunications, home entertainment and hotel services, such technologies have come ubiquitous and, therefore, they have become a central element of every superyacht project, bringing with them a unique set of challenges. In response to a growing demand for integration and technological performance, CNSAT, the telecommunications and entertainment specialist, has developed a system architecture and software the deals directly with issues relating to space, weight, power consumption and user experience.

"Today, everything from telecommunications and automation has to be merged and integrated," starts Mauro Cominale of CNSAT. "The development of our system architecture started from a single specific request from a superyacht owner. The owner requested a 35m superyacht with the space of a 45m project. Starting from this point, we developed 'SMART' architecture, which merges all the necessary technologies into one single system, thereby improving performance, reducing weight and reducing power consumption."

SMART, which stands for Software Managed Architecture with Reliable Technology, is a system architecture that makes all the needed services work as software instances. Unlike standard architectures, where each service is managed by a single box running a software that provides the service itself, SMART runs all the software inside a single powerful piece of hardware. The SMART system includes all the typical services found on board superyachts including a firewall/router unit, PABX system, CCTV managers, video on demand, music on demand, journey information and IPTV manager, as well as the option to add additional services if required.

"We have physically built a system, based on normal hardware, that includes all of the services needed," continues Cominale. "At the end of the story, you have one 1.5m powerful rack unit that provides all of the services that clients need. The standard architecture provided by our competitors typically requires around 16 rack units in total, which requires a great deal of space and power output to yield the same results."

As impressive as the SMART architecture is, it is only one part of the story. No matter how efficient a system is, without an intuitive user interface, the technology will simply not satisfy the requirements of the superyacht industry's discerning clients. SMART, therefore, is supported by Hydra and Connected On Board, an intuitive user interface and a remote monitoring system for senior crew.

"Companies will typically provide you with an iPad, through which you can control movies, music and so on, but every user interface is different and every iPad depends on the programmer that programmes the user interface," explains Cominale. "Over 20 years we have learnt that these systems are still too confusing from the customer side. Therefore, our user interface uses Apple TV and its control system as its foundation, reducing controls to the Apple TV controller that most users are familiar with. Through Apple TV you can control on-demand services, home automation, hotel services and whatever else is required."

The technologies on board superyachts today may be ubiquitous, but there are still those companies that fail to meet the most basic of requirements, namely space and simplicity. CNSAT's SMART architecture, supported by Hydra and Connected On Board, places these requirements as its central principles.

"At the end of the story, you have one 1.5m powerful rack unit that provides all of the services that clients need."

FOR FULL COMPANY AND PRODUCT INFORMATION, VISIT SUPERYACHTNEWS.COM/SYINDEX AND SEARCH 'CN SAT'

INNOVATIVE SOLUTIONS FOR CREATIVE DESIGNS

Custom Marine Developments delivers bespoke systems for superyachts and tenders.

Makefast's custom division, Custom Marine Developments (CMD), specialises in producing bespoke, one-off features and accessories for the superyacht industry. Building on Makefast's 30 years of experience producing cutting-edge electric sunroofs, awnings and bimini hydraulic units for the production yacht market, CMD branched out three years ago with its own factory and workforce.

CMD works closely with superyacht design houses, management services and builders, to design, engineer and build custom solutions for superyacht tenders, including electric sunroof, anchor, door and window systems. More recently, the company has started applying its expertise to larger projects on board superyachts, for both new-build and refit projects.

"For the superyacht projects, CMD mostly delivers larger versions of the sunroof systems and powered sun awnings that Makefast specialises in for the production yacht market," explains Jack Miller, general manager of CMD. "Most of our work is in the superyacht tender market, where the trend is for tenders to be designed by the same design house as the mothership to mirror certain styling points or features. We often work with tender designs that have come off the drawing board with beautiful lines and curved windows, doors and roofs that open up in imaginative ways."

Allowing designers to be creative and push the boundaries in terms of design, CMD provides innovative solutions to realise any designed concept into a working reality. "Often a designer or builder will come to us and say, 'We want this system, it needs to do this and this is the space we have to do it'," adds Miller. "And typically there is not much space allocated for these systems, especially for tenders, so we have to squeeze a lot of technology into very small spaces and make the systems work. It means working closely with both designer and builder to develop a system that meets everyone's requirements."

As well as creating innovative solutions for limited spaces, another important factor for clients is the ease of installation of these systems. As such, CMD ensures turn-key solutions by building each system at its factory in its entirety, including the glass and painted surfaces, and then installs the system into the vessel as a whole package. As well as being heavily involved in the design and engineering phases, CMD then offers ongoing after-sales and service support, with the ability to use on Makefast's well-established infrastructure and services points to send engineers out to where their clients are.

Having worked directly and indirectly with many of the superyacht industry's leading design houses, including Espen Øino, Nuvolari Lenard and Winch Design, one of CMD's latest projects includes the supply of the retractable sunroof for the 27m chase boat *Atlantico* by Alia Yachts. The custom sliding roof system features two glass panels of 3m² that slide away into the vessel's superstructure, and is a prime example of the bespoke solutions that CMD is known for.

FOR FULL COMPANY AND PRODUCT INFORMATION, VISIT SUPERYACHTNEWS.COM/SYINDEX AND SEARCH 'CUSTOM MARINE DEVELOPMENTS'

TREAT YOUR WATER RIGHT

Exploring HEM's one-stop-shop solution for high-quality water-treatment systems

With water and its treatment on board superyachts more important than ever before, *TSR* speaks with the team at HEM, member of the Evac Group, about HEM's unique business model and product offering by focusing on three distinct business functions: solutions, spare parts and services. With solutions for 40m-plus superyachts, HEM is a superyacht water-treatment market leader.

HEM's success can be attributed to several factors. "The business was founded in 1980 in the south of France so we have 40 years experience in the desalination of seawater and also the treatment of freshwater using high-quality products," says Jaco Conradie, head of superyacht sales at Evac Group

He explains that the company's route to market has typically been through direct relationships with shipyards, captains and engineers. "Through these relationships, we have been able to create feedback loops that continuously allow us to improve and refine our products. At the same time, it has enabled us to create a consultancy-based model that ensures our clients are receiving exactly the right products and not off-the-shelf solutions."

While most people are under the impression that HEM's business starts and ends with the installation of water-maker systems, these systems, in fact, only account for around 30-40 per cent of the complete water treatment systems typically provided by HEM to superyachts. Beyond the aforementioned items are all the smaller systems that account for vital processes throughout the water-lifecycle on board superyachts such as water softeners, chlorine dosing, silver ion sterilisation, hydrophore systems, circulatory systems with automatic pH and chlorine monitoring/adjustment systems.

"The element that truly makes us stand out is the aftersales and technical support that we provide," continues Conradie. "We have a team of technicians that we can send anywhere in the world. We also support the vessels by telephone and email whenever they have a problem with a particular system. The effectiveness of our remote aftersales care is a direct result of the simplicity and intuitive nature of our systems. By understanding the vessels and our clients, we can create systems that are easy to operate and maintain, allowing our aftersales to be more flexible."

Working with the vast majority of major shipyards in Northern Europe and a number of the large shipyards in Italy, HEM has developed unrivalled knowledge of the superyacht build and aftersales process.

Joining Evac Group in 2018 has enabled HEM to engage in research and development of a larger scope of high-end products for superyachts. Evac products such as vacuum toilets, black-water treatment, food compactors and ballast water management can now be utilised with HEM's offering and service for a one-stop-shop solution for superyacht clients.

"By understanding the vessels and our clients, we can create systems that are easy to operate and maintain, allowing our aftersales to be more flexible."

FOR FULL COMPANY AND PRODUCT INFORMATION, VISIT SUPERYACHTNEWS.COM/SYINDEX AND SEARCH 'EVAC OY'

BRINGING WATERMAKERS OUT OF THE ENGINE ROOM

HP Watermaker provides the only fully automated and integrated water system for superyachts.

As superyachts continue to grow in size and complexity, certain legacy systems have been left behind. Even today, most water marker systems on board superyachts require manual operation from the engine room. However, HP Watermaker has created the only fully automatic, bridge-integrated water management system, thereby reducing complexity, saving time and improving the ability to monitor.

"For a number of years now HP Watermaker has been providing the only fully automated water maker for superyachts, the HP RP Tronic," starts Gianni Zucco, co-founder of HP Watermaker. "Now, however, we have taken the technology one step further by fully integrating the system with all the market's top navigational brands, including Raymarine, Garmin, Furuno, Simrad, Lowrence and B&G. We are the only company with worldwide interface with these plotters."

For as long as water makers have been in existence on vessels, they have primarily been operated and managed manually from the engine room. Today, many of the systems on board superyachts remain manual or, at best, semi-automated. Captains, chief engineers and other stakeholders are still obliged to go down to the engine room to manually adjust valves, flush the system and check on pressure. While technology on board superyachts has evolved and modernised, water systems have remained unnecessarily archaic and complex.

"When using the equipment of one of the aforementioned navigational brands, simply enter the applications page and alongside systems like Spotify, Seakeepers, Lumishore and so on, you will find an HP Watermaker option that will allow the user to control the system that is located in the engine room," continues Zucco. "The interface allows users to turn the system on and off, reset the alarms, monitor the operations and check all of the data related to the water system, such as working hours, total water production, the working pressure and the actual production and water quality. Additionally, via a pin-protected service, users will be able to adjust the water makers settings."

HP Watermaker's products are suitable for all vessel sizes from around 50ft up to the very largest 100m-plus superyachts. As superyachts, in general, have continued to grow in size and complexity, the burden of administration and operation has grown exponentially for captains, chief engineers and senior crew, and the use of cumbersome and time-consuming legacy technologies should no longer be considered acceptable. By bringing the operation and maintenance of the water system to the bridge and away from the engine room, HP Watermaker has hugely simplified the task of monitoring and adjusting water makers and dramatically reduced the time necessary to focus on them by creating an intuitive interfaced system.

"There are still those who prefer manual systems and who fundamentally distrust the additional electrical systems," explains Zucco. "However, for these individuals, it is important to note that the automated system has been designed with redundancy so, in the event of an electrical failure on board, the water maker system can still be operated manually when needed."

By bringing water out of the engine room and onto the bridge, HP Watermaker has created a remote, timesaving and monitoring tool that simplifies the operation of water systems.

FOR FULL COMPANY AND PRODUCT INFORMATION, VISIT SUPERYACHTNEWS.COM/SYINDEX AND SEARCH 'HP HIGH PRESSURE SRL'

COMPACT SCR SOLUTIONS FOR FAST YACHT APPLICATIONS

HUG Engineering has produced an emission-reduction system that works for the sub-500gt market.

By the time most people read this, one of the most significant regulatory shifts to impact yachting will have come into force. As of 1 January 2021, the IMO's Tier III regulations on exhaust emissions will apply to all new-builds under 500gt, extending the scope of the rules to encompass the entire superyacht fleet.

This change has long been feared by production yacht builders, who feared its imposition would destroy their market, due to the need to extend the size of engine rooms to an unviable extent.

The regulations have been the subject of debate and lobbying for almost a decade, and as such, in anticipation of their inevitability, prudent companies such as HUG Engineering have been busy in the background working on smart solutions that can help to preserve the health of the <500gt market, with the development of a compact version of its Selective Catalytic Reduction (SCR) system for this segment of vessel.

"Based on the very robust and well-known functionalities that we have within our portfolio, we have been able to validate a variety of designs that align with existing engine configurations so that they can fit within existing engine room designs," explains Lukas Cavegn, product line director for marine applications at HUG Engineering.

"We have a variety of designs that align to two main types of engine," adds Carlo Bertoglio, Hug Engineering Italy general manager. "Because, depending on the speed of the yacht, there are generally engines of one megawatt and two megawatts. We had to produce a solution that worked for yachts of 15 knots or 40 knots, and thanks to the last high-performance SCR developed in HUG during the past three years, this is now feasible."

Integration by Mive Eco Srl

The challenge for HUG Engineering, and the consideration that had most concerned the industry, was producing a SCR system that made no physical imprint on the size of the engine room and, at the same time, did not add a disproportionate amount of weight to the vessel. No easy task!

The company has managed to meet both these core objectives, having tested its designs across several vessel types, and it will be bringing the system to market in the spring of 2021.

"We know we had to deliver a solution within the same footprint as the engine", Carlo Bertoglio continues, "and to stay within a height limit of no more than 500mm above the engine. We are now in the final stages of improving the ventilation process so that heat is able to dissipate efficiently."

"We know we had to deliver a solution within the same footprint as the engine and to stay within a height limit of no more than 500mm above the engine."

HUG Engineering's SCR technology has long been proven effective for custom vessels; the challenge was to reduce its size to be able to meet the extremely stringent limits imposed on yachts under 500gt, both in weight and size terms. The fact the company now has a solution in place that meets both those requirements could yet be the saviour of the production yacht sector. Regulations are not going away; in contrast, they will only grow in scope and application. With this technology available, owners and builders of sub-500gt can be sure of safe passage moving forward.

FOR FULL COMPANY AND PRODUCT INFORMATION, VISIT SUPERYACHTNEWS.COM/SYINDEX AND SEARCH 'HUG'

SCR + DPF = A COMPLETE SUPERYACHT SOLUTION

HUG Engineering has developed a solution that simultaneously meets Tier III regulations while eliminating soot.

While regulations may have forced the industry's hand in terms of developing effective SCR solutions, it was comfort and aesthetics that galvanised the development of diesel particulate filters (DPF) to eliminate the rather unpleasant soot residue that is deposited as a by-product of combustion.

Now the two have conflated, with the large custom superyacht fleet requiring both SCR, following the introduction of IMO Tier III regulations in 2016, and DPF to work in tandem.

"The DPF was suitable for removing the black carbon, but it was not suitable for the IMO rules that came into force", Carlo Bertoglio explains. "There were 50- or 60-metre yachts obliged to follow those rules, asking whether SCR would solve the problem of soot, but it wouldn't, so they began asking us to add a DPF."

With IMO Tier III rules well established, demand for an integrated sol-tion is pronounced. "If they have to install an SCR after-treatment anyway," Lukas Cavegn adds, "then they will install both."

HUG Engineering's solution, developed over the past three years, is to integrate both systems into the same physical footprint as the generator, with scope for customisation depending on the configuration of the space and the various exit piping routes. The integrated solution is certified as Tier III-compliant by DNV GL.

Carlo Bertoglio makes a very important distinction between the HUG solution and the compliant engine propositions from the OEMs; the latter have not presented a solution for eliminating the diesel particulate. And while owners accept their obligation to be compliant, it is invariably the soot that they are more preoccupied with, hence the true value of the combined HUG proposition. Furthermore, while OEM SCR configurations require DPF to be retrofitted, within the HUG system, the DPF actually precedes the SCR, which means the exhaust entering the SCR catalyst particulate is already free of soot.

Clients can also switch seamlessly from IMO Tier II compliance (applicable to all yachts cruising the Mediterranean), to IMO Tier III compliance. For the large percentage of the fleet who do the milk run from Europe to the waters of Florida and the Caribbean, this will be a welcome consideration from a performance and efficiency perspective.

"Our historical competence is DPF, and now our leadership with SCR is affording us a lot of success," Carlo Bertoglio says. "In Italy, we are dealing with all the big shipyards, but even in Germany and in the Netherlands, we are well positioned."

By way of example as to the practical benefits of this system, HUG has delivered it to a 47m explorer yacht, delivered to her client by San Lorenzo in summer 2020. Both the engines and generators have been filtered, while the main engine configuration has been fitted with an SCR integrated in the filter housing.

"For the owner, the vessel will be sailing in Arctic, Antarctic, Baltic ... where no soot can be left behind," Carlo Bertoglio explains. "We are now able to deliver this solution from the very biggest Lürssens to an explorer of 47 metres. Our target is to be the complete solution for exploration vessels from 40 metres upwards."

FOR FULL COMPANY AND PRODUCT INFORMATION, VISIT SUPERYACHTNEWS.COM/SYINDEX AND SEARCH 'HUG'

COST-SAVING, EASE AND CONTINUITY

Exploring how IDEA Data Solutions management software can vastly improve the efficiency of superyacht operations.

In recent years, superyachts have grown in terms both of their size and complexity. Typically, when one considers the growing complexity of vessels, there is a tendency to think about advanced and novel technologies, however, not only have various systems become more complex, but the administrative burden to run the vessels has also grown exponentially. We speak with the team from IDEA Data Solutions about the need for management software.

"The key challenge for superyachts today is how to manage all their data," starts Tobias Allebrodt, executive director of IDEA Data Solutions. "These are incredibly complex environments. In the past it may have been sufficient to use Excel sheets and handwritten records, but today ISM, ISPS, flag state and various other entities require a great deal of up-to-date information. It is true that each can be managed without management software, and some relatively inactive superyachts are able to do this, but for most large superyachts it is just impractical to do so without the aid of intelligent software."

Whether it be maintenance management, including predictive maintenance and condition-based maintenance, inventory and purchasing, document management, engine room logging, safety management, crew and guest management or beyond, the administrative burden on board superyachts has become so large that an integrated system is the most effective way to manage everything that superyacht operations encompass.

"It goes without saying how expensive the operation of a superyacht is on a daily, weekly and monthly basis," continues Allebrodt. "So expensive, in fact, that the cost of a management system is insignificant by comparison. However, the potential cost of the risks associated with a poorly managed vessel are by no means insignificant and they have the ability to ruin an owner's experience. Additionally, a streamlined system has the ability to considerably reduce the administrative burden on captains and senior crew."

It is fair to say that, in many instances, the transitional nature of the superyacht industry results in a lack of continuity. In a market where crew frequently jump from vessel to vessel, it is not uncommon for on-board systems to change in order to cater to the skillsets of the present senior crew. In these eventualities, when authorities require data and documentation, it may be that a number of different formats and systems are presented, confusing and elongating the process. In the instances where management software is used, its simple user interface and intuitiveness makes it far easier for superyachts to maintain continuity in the event of personnel changes.

With over 1,100 vessels now using IDEA Data Solutions management software, whether that be the full suite of service or specific elements of it, it is clear that the technology yields tangible benefits. In a market that is at times becoming bogged down in administration burden, to the detriment of the market's core values such as service and guest satisfaction, the technology simply aims to create a system that provides cost-saving capabilities, ease of use and operational continuity.

"A streamlined system has the ability to considerably reduce the administrative burden on captains and senior crew."

FOR FULL COMPANY AND PRODUCT INFORMATION, VISIT SUPERYACHTNEWS.COM/SYINDEX AND SEARCH 'IDEA DATA SOLUTIONS'

THE FINAL FRONTIER

We may be on the cusp of a new era for satcomms, but superyachts can and should future-proof their vessels now ...

Satcomms is one of the most competitive and challenging sectors in the superyacht industry. Mobile communications on shore are developing at a tremendous pace, with users now able to experience similar connection speeds when roaming as they do in the home or office, and these high expectations continue when an owner or their guests and crew board a yacht. Yet delivering seamless and efficient connectivity at sea is a demanding task: gaming, video streaming, 8K TV, on-board cinema, socialising and entertaining all require high bandwidths, and owners and guests may also need office facilities to maintain vital business communications. All this must be delivered – sometimes simultaneously – at speeds and service levels ideally equivalent to those on land.

The logistical challenges to delivering seamless connectivity to superyachts may be many, but the satcomms sector is going through a period of exciting and profound change, with a number of private enterprises in a space race of sorts to launch new low-earth orbit (LEO) and mid-earth orbit (MEO) satellite constellations. These services will virtually eliminate latency – the delay experienced between making a request and receiving a response, particularly noticeable in dynamic applications such as video calling and networked gaming – and bolster coverage for the maritime sector.

The new networks achieve these swift response times by the satellites being closer to Earth, but proximity poses its own problems for antenna designers. "Geostationary satellites that we work with now, and have done for the past 50 years, are always fixed in one place relative to the Earth's rotation," explains Matt Humphreys, sales director – EMEA at leading maritime connectivity solutions provider Intellian. "LEO satellites are constantly moving, so to maintain an uninterrupted connection we employ a dual antenna system that means while one antenna is connected to a particular satellite the other is connecting simultaneously to a different one – ensuring total and seamless coverage wherever you are."

This solution is made possible through Intellian's NX series of Ku-Ka Dual-band convertible GEO/MEO/LEO VSAT Terminals, designed and built to empower future-proof satellite communication. With the mediator – the hardware needed to automatically manage dual antennas – built into the Below Deck Unit (BDU), and the ability to track any satellite orbit, the NX series is that rare thing – an existing piece of technology that will future-proof a vessel for the forthcoming switch to LEO and MEO connectivity. Humphreys compares it, in layman's terms, to televisions when the switch was made to HD; ahead of the switch, prudent consumers ensured they were future-proofed by purchasing HD-ready TVs, and the NX Series affords the same possibility for forward planning to satcomms customers.

"The advantage we have is that the NX series is ready for this new technology, so when it comes online users will just switch over to that network and it will work with very little effort from the user," Humphreys explains.

A swift proliferation of LEO and MEO networks seems likely over the next few years, which will deliver two key benefits from a user perspective: a reduction in the residual cost of connectivity and a significant leap in performance while aboard. But disruptive technology in the sky is of no use without similarly innovative equipment on the ground. Through forward planning and smart design, Intellian are enabling users to plan for the future and to reap the benefits of the new networks as soon as they are available.

FOR FULL COMPANY AND PRODUCT INFORMATION, VISIT SUPERYACHTNEWS.COM/SYINDEX AND SEARCH 'INTELLIAN'

SUSTAINABLE YACHTING WITH KONGSBERG MARITIME

Current and future solutions that will maximise performance and increase sustainability in the superyacht industry.

Current products and systems

Following Kongsberg Maritime's acquisition and integration of the former Rolls-Royce Commercial Marine in 2019, the expertise of both former companies has been utilised to develop solutions for the integration of bridge, control and propulsions systems. With the maritime industry's increasing desire to reduce its environmental footprint, Kongsberg Maritime is well positioned to deliver integrated products and systems that meet this demand for greater efficiency and sustainability.

"With the increasing focus on hybrid electrical systems, both for electrical and mechanical propulsion, Kongsberg Maritime has established a battery factory and we now make our own digital switchboards," explains Roger Trinterud, sales director at Kongsberg Maritime. "We have also set up an energy lab where we have generators set, hydrogen fuel cells and many types of batteries to test and refine control strategies."

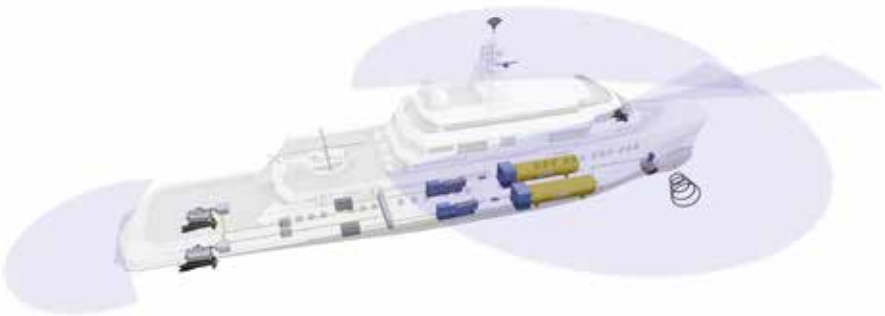
This investment in innovative technologies has led to the development of Kongsberg Maritime's energy control systems, which consist of mixing different energy producers, connecting them to a switchboard and distributing the energy to wherever needs it on board. "When you include knowledge about the yacht operational profile, then you can also control the propulsion, heating, ventilation, etc. and the system can divide the energy between the producers more effectively," continues Trinterud. "This means it can ramp up energy production while keeping the engines running in the most efficient range and thereby using a battery or other energy storage to optimise the whole energy chain."

To further increase on-board efficiency, Kongsberg Maritime is now looking into creating a better link between the bridge system and the energy control system. "If the energy producers know how much energy the vessel is going to need in the near future, by linking in time of arrival from the autopilot and the speed that needs to be maintained, then you can decrease the overall energy used, as well as decrease noise and vibration to improve general comfort on board," adds Trinterud. "Here we are talking about technology that the offshore industry uses for staying in position, but turning it into a completely new energy and comfort tool for yachts."

For vessels with electric propulsion systems, Kongsberg Maritime also recommends the use of Azimuth propulsors, such as its Elegance POD and AziPull, where the propeller and rudder is one unit and can turn 360 degrees around itself. As well as increased manoeuvrability with less power, less interior volume is required for the propulsion system and there is increased flexibility with the positioning of the engine room.

Kongsberg Maritime's latest development is an advanced manoeuvering systems, having recently worked with two Norwegian ferries to develop an automated docking system. "This involved taking the software from our dynamic positioning system and turning it into a system that moves the vessel automatically, in the best way possible, from one location to another," says Trinterud. "This means that the system can find the perfect parking approach and execute it automatically." With the majority of hardware and software in place to integrate such a system on board a superyacht, Kongsberg Maritime hopes to see the demand for the technology from its yachting clients soon.

"The system can find the perfect parking approach and execute it automatically."



Innovative solutions for the future

With its ongoing investment into research and development, Kongsberg Maritime is also looking into a number of innovations that could be beneficial for superyachts in the future. According to Oskar Levander, senior vice president of Business Concepts at Kongsberg Maritime, there are two main trends with regards to emerging technology in the maritime industry, and these are digitalisation and the environment.

"In terms of digitalisation, the key is to connect the vessel in a completely different manner and enable new ways of operating, managing and designing it," Levander explains. "For example, there are exciting opportunities coming from the situational awareness technology that we are working on. By integrating cameras, radars, sonars and lidar that can detect what is around the vessel, the system could create a realistic 3D world for the captain to better experience what is happening."

Not only would a situational awareness system be beneficial for the navigation of the yacht, but would enable owners and guests to experience the yacht in a completely different way by enabling them to see below the water's surface. If the technology becomes reliable enough, Levander believes it could even have the potential to negate the need for a bridge situated in the traditional position, and therefore open up exciting opportunities in terms of yacht design.

The other trend, in terms of future innovations, for Kongsberg Maritime is the environment. "One of the biggest challenges today is that we need to reduce greenhouse gas emissions to combat climate change," says Levander. "Many yacht owners are very keen to be able to minimise their carbon footprint and, for them, there are a range of different technologies out there that could improve efficiency or even enable zero emissions."

To help yacht owners achieve their environmental goals, Kongsberg Maritime has been developing solutions that incorporate different fuelling options. For example, the company has been working with Liquefied Natural Gas (LNG) for 20 years, which is an odourless fuel that is cleaner than diesel, however, is still fossil based. As a next step on from LNG, Kongsberg Maritime is researching non-fossil-based fuels like biogas and hydrogen.

"At the moment we are working on hydrogen-fuelled ship concepts for ferries and cargo vessels," says Levander. "In some cases, we have used compressed hydrogen and, in others, liquified hydrogen. We then take that fuel to fuel cell, it creates electricity for the ship. Usually we combine the fuel with battery packs, which would create zero emissions, meaning no carbon footprint and no exhaust. The only byproduct is water and it is also very quiet in operation, but the drawback is the cost of the fuel cells."

While the technology to develop hydrogen-fuelled vessels exists, these projects are still in the R&D phases. "We think going green will be a trend for some yacht owners and hydrogen is one option, but biogas is another," concludes Levander. "Biogas would allow vessels to use gas engines, as opposed to fuel cells, so it would require a smaller investment. These are all technologies that we are developing for commercial shipping, but we see will have a lot of positive features that will benefit yacht industry, such as improvements in comfort."

FOR FULL COMPANY AND PRODUCT INFORMATION, VISIT SUPERYACHTNEWS.COM/SYINDEX AND SEARCH 'KONGSBERG'

SUSTAINABILITY IS THE NEW LUXURY

Lanéva Boats sets out to dispel the myths about electric watercraft.

"We see a lot of interest from lake regions such as Switzerland, Italy and Germany, and these are places where people are already driving electric cars such as Tesla or Porsche."

Marine electric propulsion is far from being a new trend. As stated on Lanéva Boats' website, hybrid and electric boats have existed for over 100 years. "The first electric boat was developed by the German inventor Moritz von Jacobi in 1838 and was presented to the Emperor Nicholas I of Russia on the Neva River," begins Francois Richard, CEO (chief exploration officer) at Lanéva Boats. "The 24ft (7.3m) boat had a passenger capacity of 14 and a speed of three miles per hour (4.8km/h)."

From the 1920s, gasoline or diesel-powered outboards overtook electric. However, with increasing rules and regulations to promote sustainable behaviour at sea, mindsets are shifting and solutions such as electric propulsion are being rediscovered – and they are better than ever.

There is a myth that the performance of an electric boat being used as, for example, a superyacht tender when compared to a diesel tender outweighs the 'green' benefits of the e-tender. Lanéva is keen to dismiss this myth and does not believe it is a valid point of comparison when considering the purpose of a tender or day boat.

"The 7.9m Lanéva boat can reach a top speed of 30 knots (55km/h, 34.5mph), as well as a range of approximately 40nm at a speed of 20 knots (42.5km/h, 23mph). Those are high-performance characteristics for a day boat," emphasises François.

Lanéva Boats does not stop at sustainable propulsion and seeks to ensure the entire boat is as green on the outside as it is within. "We source the best worldwide parts in accordance with our exceptional nature and technology triptych," clarifies François, whose team checks and cross-checks all of its partners and suppliers.

In terms of its appeal to the luxury market, Lanéva Boats has seen great interest from some of the most forward-thinking parts of the planet. "We see a lot of interest from lake regions such as Switzerland, Italy and Germany, and these are places where people are already driving electric cars such as Tesla or Porsche," explains François.

"There's a culture in these parts of the world of people wanting a smaller carbon footprint, to sustain the fragile eco system of their lakes etc. We also receive requests from luxury resorts situated on lakes that want to extend their CSR policy onto the water, made possible through our luxurious, silent mode of water travel."

Within the superyacht industry, Lanéva Boats has started to see a growing interest and growing audience in Monaco. "We were also hoping to release the new version of our day boat at MYS 2020, to show our reliable, exceptional day boat. Now we can't wait to be in 2021 and for the next real yachting season to begin," François comments.

With a top speed of 30 knots – ample for a day boat, a charging time of three hours to reach full battery – and increasing numbers of harbours being equipped with charging stations (or superchargers), it is now a case of who wants to come forward and be seen as an innovator and an early adopter of this technology.

FOR FULL COMPANY AND PRODUCT INFORMATION, VISIT SUPERYACHTNEWS.COM/SYINDEX AND SEARCH 'LANÉVA BOATS'

PREPARING FOR THE NEXT GENERATION

Plexus Unity answers current challenges and prepares for the future.

In recent years, the demand for connectivity and bandwidth has grown astronomically as users become increasingly accustomed to the ubiquitous adoption of certain technologies. In order to account for this growing demand, as well as prepare the industry for next-generation satellite infrastructure, OmniAccess introduces Plexus Unity.

"The industry is at a point of inflection. VSAT technology has not changed for the last 15 years, it's the same satellites with slight improvements made to modems and to the efficiency of the links. We are more or less using the same technology, but the client demand for connectivity and bandwidth has changed drastically," starts Jens Ploch, CCO at OmniAccess. "If you look at traffic or the data requirement from users over the last 10 years, it has grown exponentially."

The growth in demand for bandwidth and connectivity on the part of the end user has been driven hugely by the number of devices that users carry today and what they are able to do with them. We are all used to having internet access with us at all times and, increasingly, the expectation is that we will have this unfettered access in all places. We are so used to having access to the internet in the palm of our hands, with access to WhatsApp, Instagram and various social media platforms, streaming services and more, it seems unfathomable that a superyacht owner or charter guest wouldn't have such access given the amounts they are paying for the privilege of being on board.

"What we are able to deliver is considerably higher bandwidth by using more efficient platforms like NewTec Dialog, but we still have the issue that we are working with satellite infrastructure that is 35,000km from earth and mechanical equipment. Today, we are at a point of inflection because while the technology hasn't changed substantially, it will soon. With the introduction of Low Earth Orbit (LEO) satellites in the next few years, the bandwidth that we can deliver to superyachts will grow exponentially while at the same time improving the experience by reducing latency," continues Ploch.

Therefore, it is imperative the industry begins the groundwork and that the technologies on board superyachts are updated and prepared for this step change in connectivity infrastructure. OmniAccess, with its Plexus Unity product, has created a system that lays the groundwork for the adoption of next-generation technology, as well as resolving a host of present challenges relating to bandwidth management, cyber security and on-board electro-technical engineering.

"Plexus Unity is the first step towards achieving this goal. Today, on-board vessels, you have the modem, the router, a firewall, a content streaming device and potentially a traffic management device and, all of a sudden, your rack is full without room for redundancy," explains Ploch. "The Plexus Unity integrates all of these services into one device and also adds this critical redundancy to the setup. Two next-generation modems, a traffic management tool, through which captains and ETOs can manage traffic to certain users and devices via an intuitive interface, as well as an integrated content streaming platform that enables compressed streaming through our teleport and vastly reduces bandwidth usage. Within Plexus Unity we also have the processing power and to add intelligence and deploy SD_WAN services for traffic steering and bonding, cyber security tools in line with the IMO regulations due to come into force in 2021, as well as creating the foundations for the adoption of LEO technologies."

Fail to prepare, prepare to fail, so goes the old adage. As the communications industry hurtles towards the next generation of satellite infrastructure, it is paramount that the industry prepares for its widespread adoption, as well as answering the market's current demands. Plexus Unity provides both.

FOR FULL COMPANY AND PRODUCT INFORMATION, VISIT SUPERYACHTNEWS.COM/SYINDEX AND SEARCH 'OMNIACCESS'

ONEOCEAN OFFERS ONE OVERARCHING SOLUTION

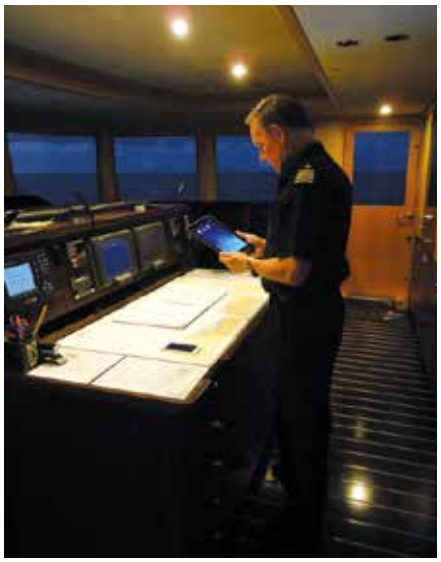
OneOcean 2.0 is a comprehensive digital compliance tool, encompassing multiple operational elements.

'The paperless transition in yachting is way, way behind commercial maritime. Yachting is still heavily paper-reliant, and there is a good reason for that. The official Electronic Nautical Chart (ENC) data is mainly focused on the main shipping routes around the world. AVCS data [for key cruising grounds] can be atrocious.' It is a commonly acknowledged problem for the superyachting industry, and yet one that is rarely challenged – in part, because yacht crew have become used to referring to paper charts and unofficial digital charts for navigating areas where official ENCs are lacking.

While yacht management companies play a very active role in operational safety, from a certification standpoint, they are historically hands-off when it comes to navigational compliance. But, with the spike in gross tonnage witnessed in recent years, larger superyachts, as well as those operating commercially, have come into stark focus among regulators and port state control.

"The general appetite within the industry is that everyone wants to do it properly, but feel they don't always have the time to produce detailed passage plans that go above and beyond the minimum requirements," explains OneOcean head of superyacht Chris Warde. "By giving them the tool with 2.0, we have a proven track record of saving substantial amounts of time on board which enables people to do a more complete preparation and planning phase. At the end of the day, if something went wrong or if plans changed halfway through the route, they have the information and tools at hand to make sensible decisions."

Warde cites a diligent first officer, aboard a custom motoryacht, whose conscientious approach to paper route planning meant one passage could take anything up to two days to map, which then went down to somewhere in the region of two hours, with the introduction of OneOcean on board. But unfortunately, he estimates that the number of vessels following best practice at around 20 per cent of the fleet.



"With OneOcean we are slowly transitioning from back of bridge to front of bridge."

OneOcean 2.0 is an all-encompassing software solution, currently undergoing sea trials and coming to market in January 2021. It comprises a number of complementary operational tools: PassageManager (navigation and route-planning modules); Regs4yachts (regulations); EnviroManager (an environmental control application); DocMap (HSEQ document transfer tool); LogCentral (digital logbooks); FleetManager (an online, web-based interface that has been designed for shore-side support, so that a DPA can track their fleet's location and monitor their progress).

"What FleetManager does is give managers the opportunity to look at all of their navigation, regulatory compliance, and check that both are up to the bar that the management company deems to be the minimum acceptable; and all from the comfort of their own desk. This frees up valuable time on board to focus on areas that can't be looked at remotely," Warde explains.

The superyacht industry is historically reactive rather than proactive when it comes to regulatory compliance. But there are tools available that can provide the intelligence to anticipate and manage regulatory parameters.

"With OneOcean we are slowly transitioning from back of bridge to front of bridge. Because we have NMEA feeds with real-time positioning, Enviro-Manager now becomes a product that is providing real-time information," Warde adds. "Furthermore, if you've submitted your passage plan via the platform, then EnviroManager can show the chief engineer what they can do at the time, but also what options are available to them at each stage along their route."

Ultimately, it's about efficiency and optimisation at the front end, and the result of that is better situational awareness and decision-making when things are happening.

FOR FULL COMPANY AND PRODUCT INFORMATION, VISIT SUPERYACHTNEWS.COM/SYINDEX AND SEARCH 'ONEOCEAN'

IS IT A BIRD? IS IT A DRONE?

Robin Radar provides the world's smallest 3D drone detection, tracking and classification radar.

In the majority of cases, 'normal' radars cannot detect small objects, such as birds, because they are not made to. In the modern world, however, small objects can often be the most threatening and certainly should be detected as early as possible and tracked. As drone technology is here to stay, Robin Radar has now launched the world's smallest 3D drone tracking and classification radar, with an impressive track update rate of one second.

There are two challenges to consider when it comes to small objects and radars. Being able to actually detect such small objects is the first challenge, but as a radar is not a camera, in most cases it's not a small object being detected, it's a bird. The second challenge, therefore, is to distinguish birds from drones, preventing false alarms.

"It's a special skill to be able to detect, track and classify drones," begins Siete Hamminga – CEO at Robin Radar Systems. "We do this in an innovative manner using radar technology together with advanced micro-doppler technology in one sensor, whereby we look at speed differences within the object, and those speed differences come from the presence of rotor blades."

Robin Radar's latest flagship radar, IRIS®, launched in November 2020 and is a 3D purpose-built drone detection, tracking and classification radar that can automatically distinguish birds from drones – a world first. "Almost all radars out there that are capable of detecting drones either focus on tracking OR classification, not both," emphasises Hamminga.

IRIS® does this as it features two radars back to back, similar to the lights within a police siren. "This design means we hit the target twice in every rotation, enabling us to do unprecedented tracking and classification." (More info on **www.irislaunch.com**)

With 360-degree azimuth coverage and elevation coverage of 60 degrees, IRIS® provides early warning of approaching drones in all directions, giving those in the drones' pathway time to react. "We now have over 800 systems being deployed, mostly in Europe, but recently we made our first deployments in Australia and Asia," comments Hamminga on the growth of Robin Radar.

"We came to realise when working in the defence and security industry that VIPs are a relevant market. Navy ships, for example, are sensitive if they are anchored and not able to switch on large radars in a harbour setting. We then also received attention from large-yacht builders, who often have VIPs present who need privacy."

Orders are now being placed for IRIS®, and the first batch of deliveries will be from April 2021?? onwards. "The maritime industry is a new market for us, but based on responses from the maritime world such as superyacht builders, this product is really relevant to them to ensure added levels of privacy and protection," Hamminga reiterates.

"Drones, as a platform for hacking devices, can also be used to hack or disturb; for example, the WiFi routers of these vessels collect mobile phone data or other information from electronic devices on board so the radar also provides an element of cyber security, protecting them from remote intrusion," adds Bill Haraka – defence and security business developer at Robin Radar.

Drone threats are dynamic, so as the technology of a drone improves, it is necessary to stay up to date in how to combat them. When it comes to having invaluable cargo on board a multi-million-pound vessel, both in terms of the belongings on board as well as people, the superyacht industry must be prepared to protect itself with innovative technology such as IRIS®.

FOR FULL COMPANY AND PRODUCT INFORMATION, VISIT SUPERYACHTNEWS.COM/SYINDEX AND SEARCH 'ROBIN RADAR'

A BRIDGE BETWEEN INNOVATIVE TECHNOLOGY AND THE SEA

TEAM Italia celebrates its 20-year anniversary.

This year marked the 20th anniversary of the specialist marine electronic technology applicators TEAM Italia. With three sites and two showrooms located in Italy, and a network of carefully selected associated international partners, TEAM Italia truly provides a bridge between innovation technology and the sea.

With its i-Bridge® to its i-Chart® products, TEAM Italia has developed a specific solution for integrating multiple essential on-board systems that is quick, user-friendly and assures the industry of increased safety levels at sea.

"We are certainly focused on the megayacht market," begins Massimo Minnella, co-founder and CEO. "Specifically, we work with yachts ranging from 30m to 100m, but we also have some special projects for slightly smaller boats, where a unique level of technology and innovation is required," he continues, illustrating their flexibility to support the superyacht market.

Thus far, TEAM Italia has delivered over 500 projects with 320 integrated bridge solutions to superyachts sailing around the world, and continues to work on many new projects – a testament to the quality of this long-serving Italian company. "When we say 'integrated bridge', we do not just mean display integration. Our I-Bridge solutions not only encompass the electronic engineering for the full control of the system through a touch panel, but also the ergonomic engineering in order to have a high level of usability and of aesthetic result," emphasises Daniele Ceccanti, CTO of the company.

TEAM Italia indeed prides itself on providing solutions that meet the requirements for both the style of the vessel as well as the ergonomic engineering. "We have to consider the owner and we have to consider the captain, and meet the requests of both," Minnella explains.

Last year, TEAM Italia revealed an exciting collaboration which is currently underway with MTU Power Systems, the business unit of Rolls-Royce. The combination of all the I-Bridge® TEAM Italia features and of Onyx Marine Automation monitoring with the features developed in cooperation with MTU merge perfectly into the 'MTU SmartBridge'.

"[The MTU SmartBridge] marks a new generation of integrated bridges that include a high level of integration with the propulsion system," concludes Minnella. They will in fact integrate the propulsion system, automation, navigation, communication and digital functions, and the modular concept underlying this new solution can be customised according to the owners' requests.

The new solutions will therefore have one development platform which will implement the TEAM Italia I-Bridge® with the Onyx monitoring of all on-board systems and, additionally, of the propulsion system, up to managing the data in the cloud. This design is intended to make it easier for users to deal with all vessel management activities, including the 'Analytics' activities – essential for the R&D and engineering departments of shipyards.

TEAM Italia's latest bridge projects can be found on Benetti's 70m *FB273* and 107m M/Y *IJE*, Sanlorenzo's 64m M/Y *Attila* and 44Alloy, the Pershing 140, the 50m Riva M/Y *Race* and, most recently, the Codecasa C123, which was launched earlier this summer.

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VEINLAND SEES INCREASING REQUESTS FOR CYBER SECURITY SUPPORT

Christoph Niendorf explains the solutions that can be provided by Veinland.

Based in Seddiner See, Germany, Veinland GmbH was founded in 2006 and specialises in creating certified products and systems for the maritime and industrial sector, developing solutions that implement specific customer requirements.

"The first field of our business is the development and manufacturing of hard- and software which enables the receiving and processing of digital and analogue system signals," begins Christoph Niendorf – sales director at Veinland. "The second field is the development and manufacturing of hard- and software which displays the information received from the digital and analogue system signals in end-user applications, which is followed by the third field: the development of higher-level management systems, which make use of the previously received and integrated system signals. The final field is the promotion and integration of systems from other vendors, enhancing Veinland's portfolio."

Further to the challenges that the Veinland team had seen on board, they decided to convert their ideas of how to solve these issues into a product. In order to ensure high levels of quality control, all of the equipment Veinland supplies to its global market is type-approved according to specified standards. "From vibration and temperature, to electromagnetic compatibility, we are very sure that when our service technicians or service partners are installing this equipment on board any ship, our equipment will not interfere with any other equipment on board," emphasises Niendorf.

Veinland's major market is not only on commercial ships, but also on megayachts. However, it is clear to see that the demands from both markets are similar, with clients investing heavily into a topical and vital aspect of technology on board.

"We are seeing a lot of customers looking into cyber security systems," adds Niendorf. Customers can be reassured to look to Veinland for support on this matter, as they are a member of the IEC, the leading organisation for maritime standardisations. "The IEC set up new standards, and most of these new standards require new products. Veinland, for over two years, was the only company to have their products [created in response to these new standards] approved globally," comments Niendorf.

"We created a system to protect secured and unsecured networks on board ships when dealing with onshore/offshore communications," clarifies Niendorf, discussing Veinland's 460 Gateway product. The 460 Gateway establishes a secure connection between network and systems through a variety of protocols and transmission methods.

"The gateway features six ports, each with its own firewall, and can connect to all the major equipment on board. This gateway can control remote access to the ship without the need to send or download files between a computer on board to a computer elsewhere. Safety is increased as the captain remains the only person able to activate remote access to the ship," he concludes, noting how this can help to prevent systems on board from being attacked by dreaded hackers – a threat that the maritime industry is not unfamiliar with.

In the future, Niendorf hopes that the transfer of knowledge between megayachts and commercial ships will be more transparent, whether that is in aid of navigation, in aid of performance or, crucially, in aid of security.

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RACK CENTRALISATION WITH VIDEOWORKS' KEY CORE SOLUTION

Reduced space and energy consumption, as well as increased safety, with the new centralised rack arrangement.

Videoworks has launched its Key Core Solution – a solution designed to centralise the on-board entertainment control system in an extra slim rack for yachts up to 50m. The rack measures just 550mm in width, 600mm in depth and 38-42 rack units in height, depending on the required options and the size of the yacht, and works in combination with the latest version of Videoworks' MyInfo App, which collect all the media and information available on board a yacht to allow guests and crew easy access to smart applications and services at any time.

With the Key Core Solution, Videoworks installs all electronic equipment related to the on-board entertainment control system in a centralised rack technical area. With each rack engineered and designed by the Videoworks technical office, the rack is assembled at the Videoworks headquarters, where a software engineer carries out a pre-test in order to reduce system debugging on board.

This configuration, as opposed to a traditional non-centralised configuration, offers many benefits for superyacht clients, the first of which is ease of installation and maintenance. "The centralisation of most of the electronic devices in one rack enables us to optimise the installation, making it easier and faster," explains Alessio Musetti, yacht service division director at Videoworks. "In addition, any servicing or technical problems can be solved in one place, therefore minimising the impact on on-board life."

Furthermore, the Key Core Solution allows for significant optimisation of space on board, with technical space savings of 40 per cent compared to a traditional non-centralised system. It also significantly reduces the hardware required in cabins. "It eliminates the need for local and dedicated racks and there is no need to add any device to integrate new experience categories into the application," adds Musetti. "With the solution, the only hardware needed in the cabins are TV screens, speakers and access points for WiFi, so there is more space for the guests."

The Key Core Solution allows for a wiring reduction of 20 per cent, power consumption is reduced by 25 per cent and heat emission is reduced by 30 per cent, as well as weight savings due to less hardware.

Compared to a traditional non-centralised configuration, the Key Core Solution allows for a wiring reduction of 20 per cent, power consumption is reduced by 25 per cent and heat emission is reduced by 30 per cent, as well as weight savings due to less hardware. The system is also easily expandable and upgradeable via IP Encoder and Dante protocol system.

Finally, the MyInfo App embodies the experience and the capabilities achieved by Videoworks in its 20 years of activity. A Smart TV or tablet is all that is needed to access the App and provide any service that a client needs, including video and audio on demand, lighting and temperature control, access to security cameras, messages to welcome guests on board, and much more. With the App, there is also no need to have a box behind the TV to receive video streams from the central rack; just an ethernet connection to the TV is needed. Full customisation is possible, including a graphic design application that can be personalised to include images and the logo of the boat and new widgets can be added at any time.

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VIKAND'S JOURNEY TO PROTECT THE INDUSTRY FROM COVID-19

Its 'PYURE' technology recently kept an outbreak on a superyacht from spreading.

This year, the superyacht industry was reminded of the crucial role that healthcare solution providers such as Vikand play. Serving the superyacht market, luxury cruise, ferries, commercial and fishing vessels, Vikand have had an incredibly busy year and have ensured they could provide solutions to an industry unprepared for such a health threat.

"At the moment, we are focused on solving health challenges (COVID-19 currently our primary focus) with PYURE Air and Surface Decontamination System, VIKAND Direct, TeleHealth, COVID-19 Protocols, Mental Wellness and more," begins Mattias Hallberg, director of business development at Vikand.

Within the sphere of maritime medical services, there are many elements that separate Vikand from its competitors. "Our well-experienced team, as well as our ability to constantly stay at the forefront of finding and adopting cutting-edge technologies that make a difference to both our customers and their stakeholders, are the reasons we believe we stand out," continues Hallberg.

Vikand have provided much needed help to the industry throughout this year and have aided many sectors within it to overcome such a challenge as COVID-19. "Maritime organisations, companies and owners have turned to us for advice and product solutions," adds Hallberg. "Fortunately, Vikand offer complete proactive telehealth technology and a medical team second-to-none to address chronic disease management, a mental wellness programme and hotline, COVID-19 Hotline, and protocols with a highly skilled epidemiologist and his team."

The global VIKAND Medical Network endeavours to ensure that all vessels are safe and comfortable, and understand that there are first-class services in the event of an outbreak on board. In addition, its FDA-approved (MDU/Rx model, Medical Class II) air and surface decontamination technology, PYURE, is proven to break down COVID-19 rapidly. "No other technology comes close to these results. The PYURE technology recently kept an outbreak on a superyacht from spreading and we received a confirmation and much love from them! The yacht came out of quarantine and was quickly back in service," emphasises Hallberg.

In light of this year, Hallberg anticipates that the industry will rely on Vikand far more in the future.

"I think that health, work environments and safety will continue to stay in [as] profound focus as through the pandemic. People are much more aware and concerned about their personal well-being and that of others. Things like a proper air-cleaning systems are becoming a 'hygiene factor' as important as WiFi on board for owners, guests, and also crew. I know of many yachts where crew are suffering from congestion, irritation in eyes and itching skin caused by black mould. A system like PYURE eliminates this problem."

At present, Vikand's foremost client request is protection against the airborne COVID-19 virus. "Clients recognise that we are the only company in yachting who, during the past five years, has been talking about the importance of air cleaning that works. By that, I mean that we break down the pathogens on a molecular level, completely sanitising the entire boat several times a day, 24/7, year-round," Hallberg concludes.

Within the next five to 10 years, Hallberg wishes to see the yachting industry go greener, safer and healthier – and considering the environmental and health issues the world has faced in 2020, this is the industry's only option for a successful future.

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VIRAVER: MODERN PIONEERS IN GLASS

Innovative glass solutions for superyachts that challenge the laws of physics.

Viraver works with clients across a diverse range of sectors, including the yachting, transport, automotive and architecture sectors, to develop innovative glass solutions. With 20 years of experience, the Italian and family-run company's philosophy focuses on ongoing product research and development, a deep understanding of its markets and its hands-on approach to meeting customer needs, supporting projects throughout the design and engineering phases to create bespoke glass products that challenge the laws of physics.

As a demonstration of its dedication to innovation, Viraver is the leading glass company for the production of the largest chemical strengthening sheet of glass measuring 8 x 3.21m. In 2020, the company has also invested in new sag bending furnaces for the production of curved glass sheets of 6.5 x 3.1m, the biggest autoclave and a Suite 3D experience for project development and design.

Sustainability also forms a significant part of Viraver's vision. "We start from the production, where we divide the excess glass after the cut and send 200 tonnes per year for recycling and send the rest back to the factory in the form of new slates, where it will once again be used for new projects," explains Cristiana Mazzarolo, marketing manager at Viraver. "We want to secure the resources of our planet for future generations."

Viraver's expertise in innovative glass solutions has led to its collaboration with top brands in the superyacht industry, who appreciate the company's 360-degree approach to project development. "Every project is developed by following six steps: 3D development, planning, production, installation, testing and maintenance," adds Mazzarolo. "Our technical, functional and creative teams work together to allow us to produce both a structural and design element."

While there are many challenges to glass design and production, Viraver does not shy away from them and encourages its teams to find solutions. A recent example of this was the production of the windshield for the Sanlorenzo SX76, for which Viraver was required to develop new forms and proportions of glass to create a window to fit the elegant, modern and flowing design of the wheelhouse.

"In order to fit the totality of the glass surface of the wheelhouse windshield, Viraver developed a single piece of glass, approximately six metres in length with double curvature, offering for the first time front and lateral windows with no vertical pillars," describes Mazzarolo. "The real challenge for the project was moving to such large dimensions with a double curvature – a challenge that Viraver solved with an innovative product. All of the latest technologies were implemented, including the chemical strengthened glass plant and sag bending ovens. The end product is a 5.7m stratified glass with double curvature unique for both size and shape. "

While Viraver sets production and quality standards that reflect customer expectations, it also works in collaboration with classification societies and certification and technical standardisation companies. To ensure the constant support expected by its clients, the project manager is the connection between Viraver and the client. The result is a seamless process, which reduces time and costs, and makes life simpler for the customer.

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A BALANCE BETWEEN TECHNOLOGY AND EFFICIENCY

Ward's Marine Electric's switchboard automation system updates on-board power management quickly and easily.

With 70 years of experience, Ward's Marine Electric's diversity of services spans electrical installation, modifications, refit and repair, as well the sales of all types of tools and equipment needed to perform an electrical refit. Understanding the complexities involved with electrical upgrades on board, the company specialises in its ability to find a balance between technology and efficiency.

"The most common variables in the discussion of every refit project are time and location," advises Kristina Hebert, COO at Ward's Marine Electric. "If the time period was without limits, the refit market could and would be twice the size it is today. There are so many talented contractors and yards that, without the limitation of time, their work would be a masterpiece. In reality, the time period allotted is always too short for the required work list."

With owners wanting to maximise the use of their yachts, however, it is understandable that the time allocated to refit and maintenance periods is constrained. This is why Ward's Marine Electric has developed a switchboard automation system for power management on board that accommodates the variables of time and location involved in a refit, while fulfilling requirements set out by classification societies.

Many older superyachts are in desperate need of an upgrade to their automation and how the power is distributed on board, but the perception that such works are extensive and time consuming often leads to delays in having the work carried out. "Seamless transfer to shore power, load sharing and paralleling generators are just a few examples of the way in which power management has been automated on superyachts over the last decade," Hebert adds. "Unfortunately, many associate this type of work with a major six-month refit project and modification to the hull structure."

With its switchboard automation system, Ward's Marine Electric's goal is to update the technology on board in an efficient way, while maintaining the pedigree of the vessel's control room. The system is designed to be a full replacement of the yacht's current automation system (including PLC-based systems), and offers additional capabilities such as load balancing, run time management, load shedding, remote access and SMS alerts.

"The entire switchboard does not have to be removed and much of the work is prefabricated in our shop and installed on board," Hebert explains. The doors are then updated, painted, and new overlays are fitted to give the switchboard a finished look in keeping with the original style of the vessel. All works can be performed in-situ in about half the time of a full switchboard replacement project."

The integrity of a superyacht's electrical system is the most important element to a safe and enjoyable vessel – the galley, AV/IT, navigation, water purification and heating, air conditioning and stabilisation, to name a few, are all dependent upon a stable, safe and robust electrical system. With its switchboard automation system, Ward's Marine Electric wants to make it quicker and easier for superyachts to have a power management system that is optimised with the latest automated technology.

FOR FULL COMPANY AND PRODUCT INFORMATION, VISIT SUPERYACHTNEWS.COM/SYINDEX AND SEARCH 'WARD'S MARINE ELECTRIC'

NAVIGATING IN UNCHARTED WATERS

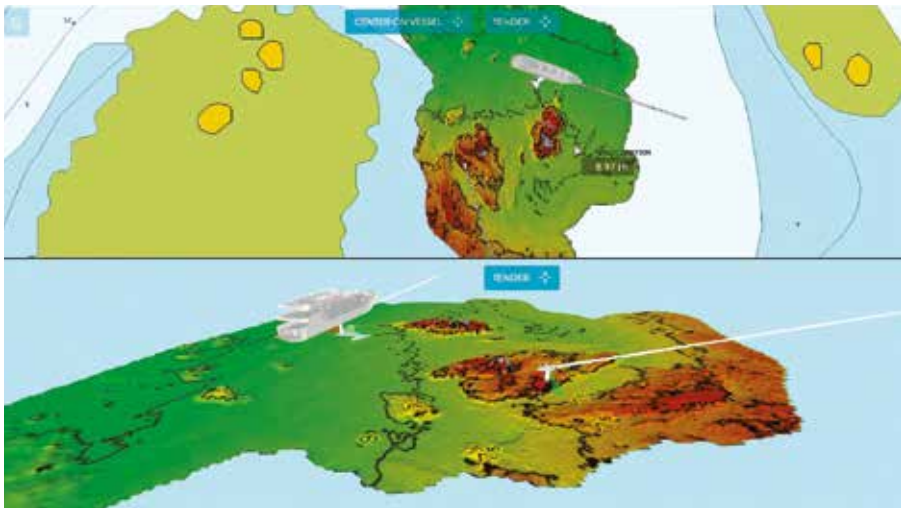
WASSP technology allows superyachts to explore more effectively than ever before.

As superyachts continue to grow in size, as well as becoming more adventurous in terms of the areas in which they are choosing to cruise, it is becoming increasingly important that, when exploring uncharted waters, the mothership can generate her own navigational data to ensure her safe passage. WASSP Multibeam Sonar allows captains and owners to have far greater control than before over where they wish to explore.

"WASSP is a sonar system that measures the depth below the waterline of a particular vessel, whether that is a superyacht, tender, survey boat or other. The difference between WASSP technology and standard echo-sounder technology is that it produces multiple beams to measure the depth spread over 120 degrees from port to starboard using 224 depth/position points, providing a far greater map of the seafloor. Once the data points are collected they are transmitted to the bridge via a wireless link and overlaid on existing electronic chart systems to provide a detailed 3D or 2D map of the seafloor, allowing the captain or user to spot wrecks, rocks, reefs or any other potential uncharted hazards," states Justin Kiel, regional sales manager EMEA at WASSP Europe.

Traditional charts and common technologies only highlight the most basic of information, such as the outlines of landmasses. The problem then occurs that, should a superyacht want to explore a fjord or lagoon, they will not be able to tell whether or not their passage to the desired area is safe. Indeed, even when using typical forward-looking sonar systems, the field of view is extremely limited in its scope.

"Some years ago we had a request from a superyacht to harness WASSP technology to map the seafloor in front of the mothership in real-time," continues Kiel. "They had found that forward-looking sonar fitted to the yacht was unable to look around corners as needed and to fit such a system required a significant refit. We decided, therefore, to fit a WASSP system to the tender rather than the yacht."



By fitting the WASSP system to the tender rather than the mothership the WASSP was able to create a seafloor mapping system that was far more versatile and accurate than anything else available to the superyacht market. With the tender able to enter fjords or lagoons ahead of the mothership and with no depth-related risk, the tender could map whole areas in short periods of time and, via a Wi-Fi connection, transmit the data points to the mothership in real-time, where they would be saved and overlaid on top of navigation systems. The colour-coded 3D and/or 2D image of the seafloor indicating the depth or bottom hardness (for example sand, rock, mud etc.) would then enable the mothership to ascertain whether or not it was safe to travel in the area.

All of the information gathered by WASSP systems becomes proprietary to the superyacht using it and, as such, the real beauty of WASSP technology is that it can be scaled to suit the need of the client. Indeed, Kiel describes a client who owns a fleet of large vessels, all of which have WASSP systems on board their tenders. The various vessels are now sharing WASSP data so that they can safely explore the areas that their sisterships have travelled as well as adding to the data as they go. Equally, more than one tender per mothership can be fitted with WASSP technology to increase the efficiency of mapping areas.

Such has been the popularity of WASSP systems over the past two years they have been available to the superyacht market that a number of the most renowned tender manufacturers are now including the WASSP system as an initial specification option when speaking with clients.

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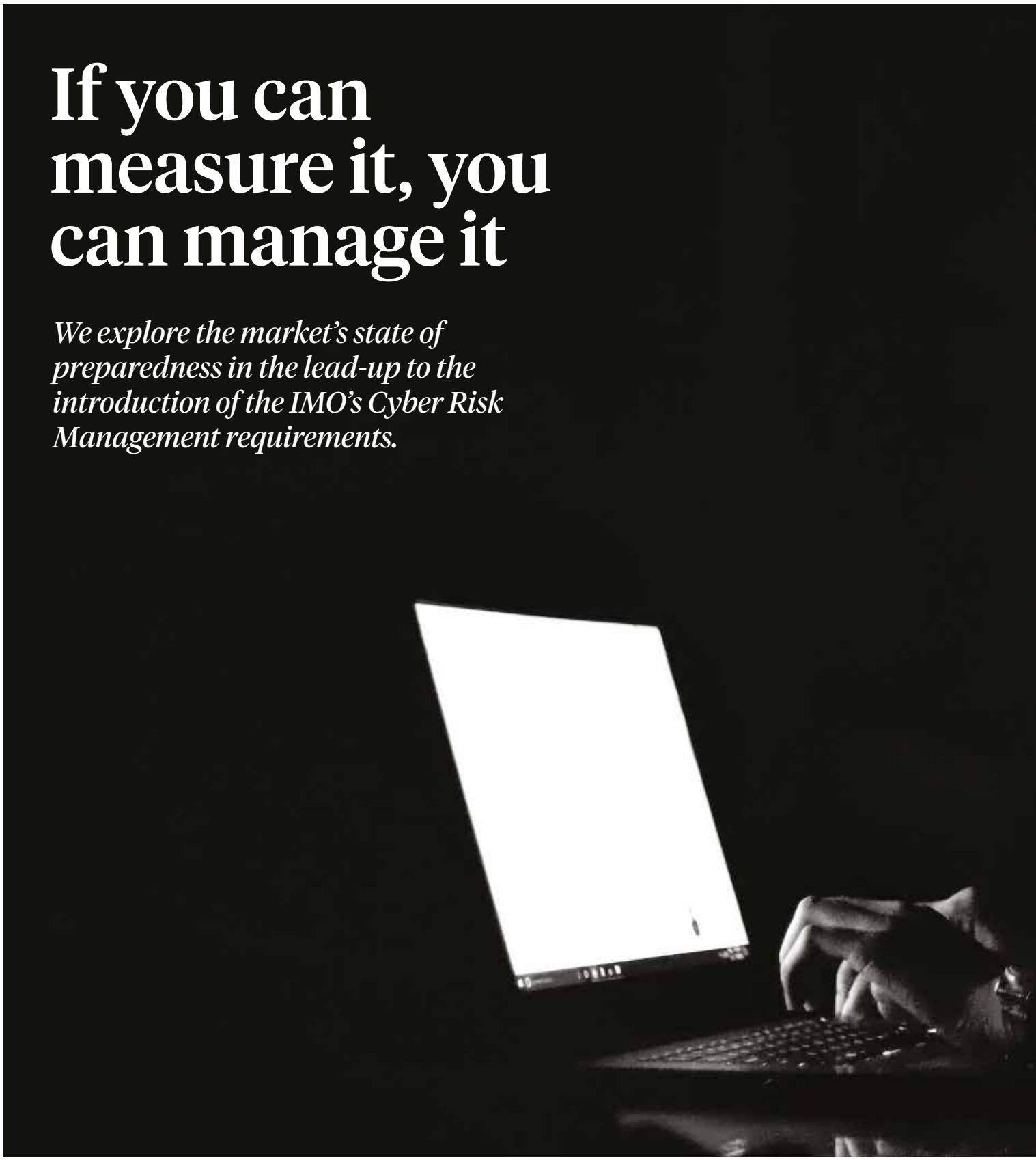
If you can measure it, you can manage it

We explore the market's state of preparedness in the lead-up to the introduction of the IMO's Cyber Risk Management requirements.



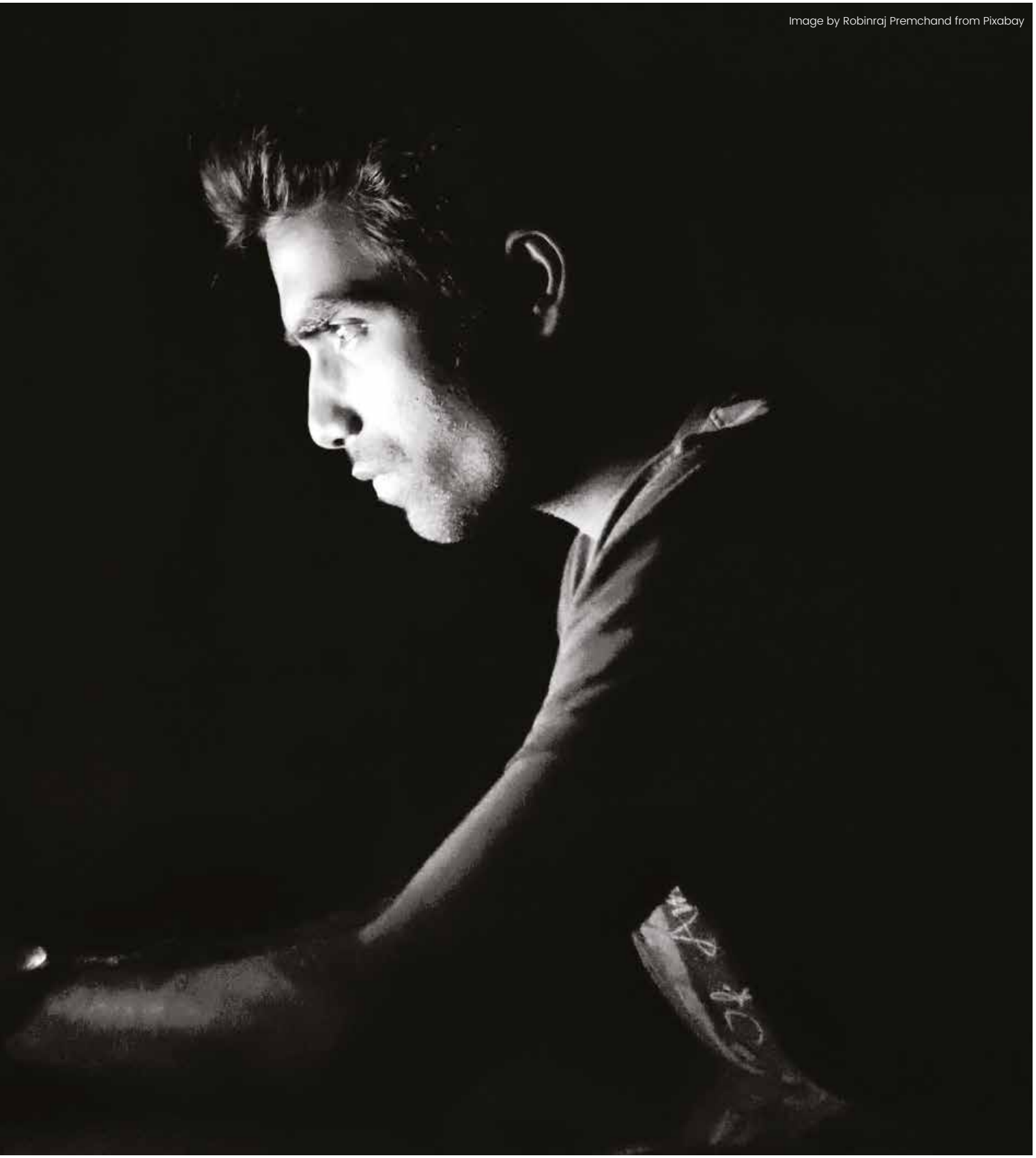


Image by Robinraj Premchand from Pixabay

For a number of years now, cybersecurity has been one of the superyacht market's most discussed topics. However, talking about a subject and acting upon it are quite different. With the IMO having identified cyber security as a risk to be addressed within vessels' safety management systems (SMS) and the handling of cyber risks to be verified in audits from 1 January 2021, *The Superyacht Report* speaks to the team from Atlas Cybersecurity (Atlas) following the publication of its research project that clearly highlights systemic cyber security issues within the superyacht market.

"There are two elements to consider when exploring where the superyacht market is in terms of cyber security," starts Ben Dynkin, co-founder & CEO of Atlas Cybersecurity. "Firstly, how is the industry handling cyber security in terms of regulating it? Secondly, how is the industry handling the issues of cyber security from the perspective of the yachts, the supply chain and the ecosystems? It is fair to say that, on both counts, the superyacht industry's cyber risk management is in its infancy. Crew, captains and management companies are aware that there are issues, but there isn't the same maturity that we see in other markets in terms of being able to identify, protect, detect, respond and recover, as required by the IMO in 2021."

Speaking on the introduction of the IMO requirements, Dynkin commends the IMO for having clearly applied best practice for a broad high-level regulation. However, while it is at the behest of the IMO that cyber risk management will now be a part of the International Safety Management Code (ISM), ultimately the IMO will not be conducting audits on the international superyacht fleet. It is, therefore, the responsibility of flag states and class societies to manage the application of cyber security measures on board superyachts.

"Class societies have looked at the IMO guidance and determined a baseline from which to build upon. Several societies have come out with optional class notations that are robust and many of them have a staggered level, so you can have a basic option or adhere to a more robust standard," continues Dynkin. "But the more likely scenario is that the standards will be set by flag states because they are ultimately responsible for ISM laws. What we have seen currently from flag states is a wide array of implementations. Some states believe their current standards are sufficient and have, therefore, not amended their policies and procedures. Other states have provided detailed criteria for what they will be assessing in their audits and highlighted that they will be conducting a thorough cyber audit. Whereas other states are yet to determine how they will be developing to meet the IMO's requirements."

It is concerning, given the short amount of time left until the cyber audits are due to begin, that some flag states have not yet made clear how they intend to approach the problem. Seemingly, certain flag states are dawdling on the issue and waiting for others to lead the way. Once the implementation is required and the auditing begins, it could conceivably transpire that there will be a spectrum of implementation policies from flag states, with some pushing to aspire to high standards and others hoping to make registry with their flag seem more appealing by limiting the administrative burden required by yachts, by developing minimum standards and a simplistic 'tick box' attitude towards auditing.

Having launched its cybersecurity solution at Monaco Yacht Show 2019, Atlas has spent the past 12 months gathering data to help refine its commercial offering. Having worked with 14 superyachts in the 55-110m-plus range, gathering data, protecting them from threats and preparing them for the IMO cybersecurity requirements, Atlas has identified a number of trends in how cybersecurity is treated aboard superyachts and has subsequently published them in a report. While the report yields a number of interesting conclusions, all roads lead to the fact superyachts face serious cyber risks and have not yet implemented sufficient cybersecurity risk management.

"We are a business and the research has clear commercial interest, but the idea was, over the last year, to refine our offering by gathering data and understanding what is actually happening aboard superyachts," explains Dynkin. "We have discovered various trends and identified consistent and systemic cyber security failures aboard superyachts. It is clear to us that industry stakeholders have an understanding of cyber security, but they still seem to consider it an amorphous issue – ephemeral and impossible to touch. With our data, we are hoping to make the issue of cyber security more tangible."

Of the 14 superyachts that were analysed by the Atlas team, 100 per cent of the vessels have cyber vulnerabilities

of one sort or another, 84 per cent had critical risk vulnerabilities and 16 per cent had the highest risk detected. Additionally, 64 per cent of the vessels had active malware infections and, on average, the vessels scored 8.7 out 10 in terms of the severity of their vulnerabilities. A further 57 per cent of the vessels had individuals on board who were using Bittorrent services to download material and, while Bittorrent is not directly malicious in and of itself, it is frequently used by criminals to infect systems through the downloading of pirated material.

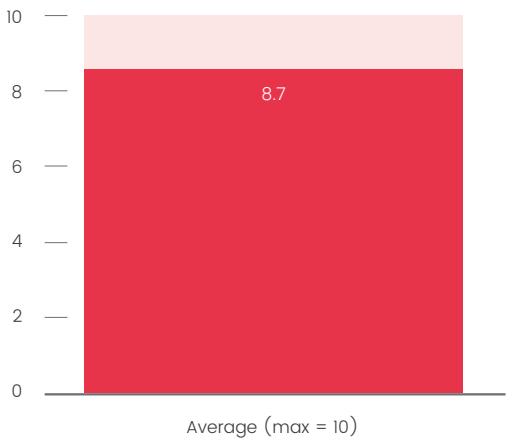
"Through the use of hard numbers and cases studies you can highlight that the problem is not amorphous, it becomes a problem that needs tackling, it becomes actions that need to be taken because the problem is real and not just existent within captains' anecdotes," says Dynkin. "There is one takeaway from our research that is perhaps more important than any other: it is not so much that Bittorrent is being used on board, nor even that there are criminals actively attacking the vessel, it highlighted that there is a systemic inability to look at what is going on inside the vessel. At present, cyber security risk management aboard superyachts has a perimeter approach; it is all designed to keep the bad guy outside the vessel. However, they have no clue what is actually going on inside the yacht."

The inability to gain these insights, according to Atlas, is exactly the space that criminals like to operate within – in the shadows, away from prying eyes, where nobody is able to detect them. However, if you are able to measure the vessels – the issue – you are able to manage it.

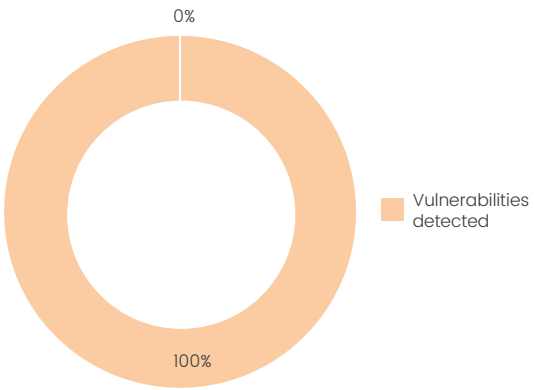
"Basically, the most prevalent issue was not updating systems; patching is ad hoc to say the best and frequently we saw whole systems that had been forgotten – for over a decade in some cases," explains Dynkin.

"By far the worst offender was unpatched systems; 100 per cent of the yachts that we assessed had vulnerable systems and, when it's high severity, it is an attackers hay bed," adds Eric Stride, chief technology officer at Atlas. "Criminals love that kind of stuff. We found everything from less risky adware all the way up to Trojans that

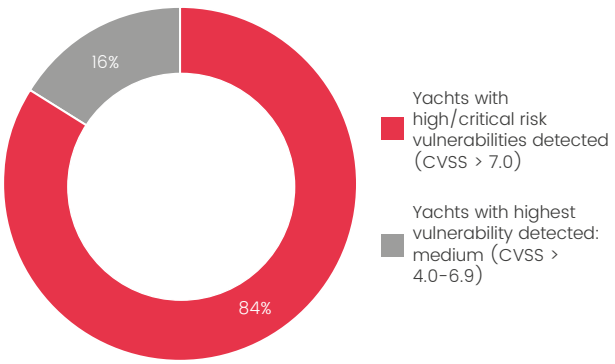
Vulnerability score average per superyacht



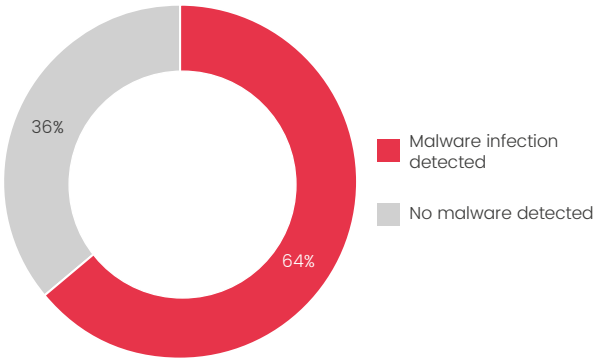
Percentage of yachts with vulnerabilities



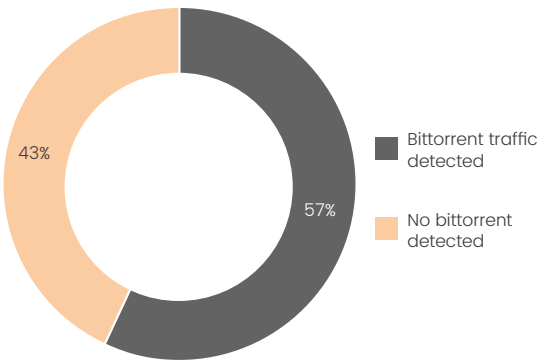
Severity of vulnerabilities detected



Percentage of superyachts with active malware infections



Percentage of superyachts with bittorrent traffic detecter



are stealing data and sending it to the attackers. Within 24 hours of being on board one yacht we had to get one of the crewmembers to reset and wipe their phone because it was completely 'owned'. The device was reaching out to sites it should never be reaching out to."

Working on board a superyacht is a unique environment. Unlike many professionals who work in a typical nine-to-five environment, crew both work and live aboard the vessel. For most, it is easy enough to arrive at work for the day, use all the systems required to complete the job without using websites or downloading content that has the possibility of being nefarious. For crew, however, the lines between work and home are blurred and, regardless of the policies that are set on board the vessel, this does lead to occasional (or frequent) misuse of the Internet. That being said, whose role is it to monitor the use of on board systems without invading privacy and how effective are these individuals?

"To say that the role of monitoring and updating on board systems is clearly defined would be a stretch," continues Stride. "We speak to some ETOs who own that role and are aware that it is their responsibility, but we also speak to a number of other ETOs that are more akin to an audio/visual (AV) technician than an IT expert. Their role, as defined by the owner and understood by themselves, is to ensure that the AV systems on board work."

"Everything is being done ad hoc without any consistency and that often leads to very serious structural issues that, in and of themselves, may not be malicious, but that is exactly the avenue that criminals will seek to exploit," adds Dynkin. "The criminals live within what we call 'the noise'. If there is no noise, then we are able to catch them very quickly. However, they like to find or generate noise in order to attack certain environments and that is when the issues become serious."

When it comes to the superyacht market's attitude towards cyber security there seems to be a clear disparity between the notions of cost and value. Indeed, cost is a complex term in a superyacht context. On the one hand, the initial investment in a superyacht is huge and the yearly running costs alone are equally astronomical. As a result, captains and management teams

are always looking for areas in which they can reduce the costs and please the owner. However, we also know that the amount spent on any given week or weekend on board would dwarf the monthly cost of additional cyber security systems. It is perhaps more prudent then to consider the value proposition of adequate cyber security because the costs associated with losing sensitive financial or private information could be dramatic in terms of financial value and reputational damage.

"Cyber security is not typically budgeted for on board superyachts beyond the initial installation of technology and systems," continues Dynkin. "To successfully tackle cyber security you need three things: people, processes and technology, as well as continued monitoring. It is perfectly possible to hire an individual to do this internally on board, but this is not cost-effective and it takes up space on board that would otherwise be filled by another crewmember. However, ETOs do not typically have the capability in the cyber domain to do this, nor do they have the time or inclination given the pressures of their roles. The most cost-effective solution, therefore, needs to be 'plug and play'; simple and monitored remotely."

The specific contours of the capabilities required for an IMO compliant cybersecurity program must include certain key features. First and foremost, in the visibility to see security event data at the network and system level. These are generally referred to as Network and Host-Based Intrusion Detection systems (NIDS & HIDS). Once this data (also referred to as 'Security Telemetry') is generated, it must be aggregated, correlated, processed, and analysed, this occurs with a Security Information Event Management (SIEM) platform. The next step is to apply cyber threat intelligence, to identify if there are any indicators of compromise that have been seen by other cybersecurity experts across the world. As the final catch-all, a proper security solution should be able to identify anomalous activity and enable security analysts to engage in threat hunting. Finally, these processes must not only apply to a superyacht's IT systems (for example computers, phones, etc.), but also the OT (such as navigation, engine controls, ECIDS, etc.) and IoT (AV/IT systems, cameras, appliances, etc.).

An effective solution must have a small footprint, perform all processing on board to preserve security and bandwidth, and must not spawn new tasks for on-board crew.

In a traditional enterprise IT environment, these systems would all be disparate, individually managed, and heavily leverage the cloud. None of these characteristics would be acceptable on a superyacht, but rather an effective solution must have a small footprint, perform all processing on board to preserve security and bandwidth, and must not spawn new tasks for on-board crew.

Cyber threats are not an amorphous issue. Atlas' research highlights exactly how prevalent cyber threats are aboard superyachts. The industry needs to fundamentally reassess its attitude towards cyber security, if not because of the requirements laid down by the IMO, then because of the genuine threat cyber threats pose to the interests of owners, guests, crew and third parties. The Atlas project provides tangible proof of the issue, but it also provides the framework for tackling the various challenges posed by cyber threats. If we can measure the problem, we can manage it. RJ

Race for Water

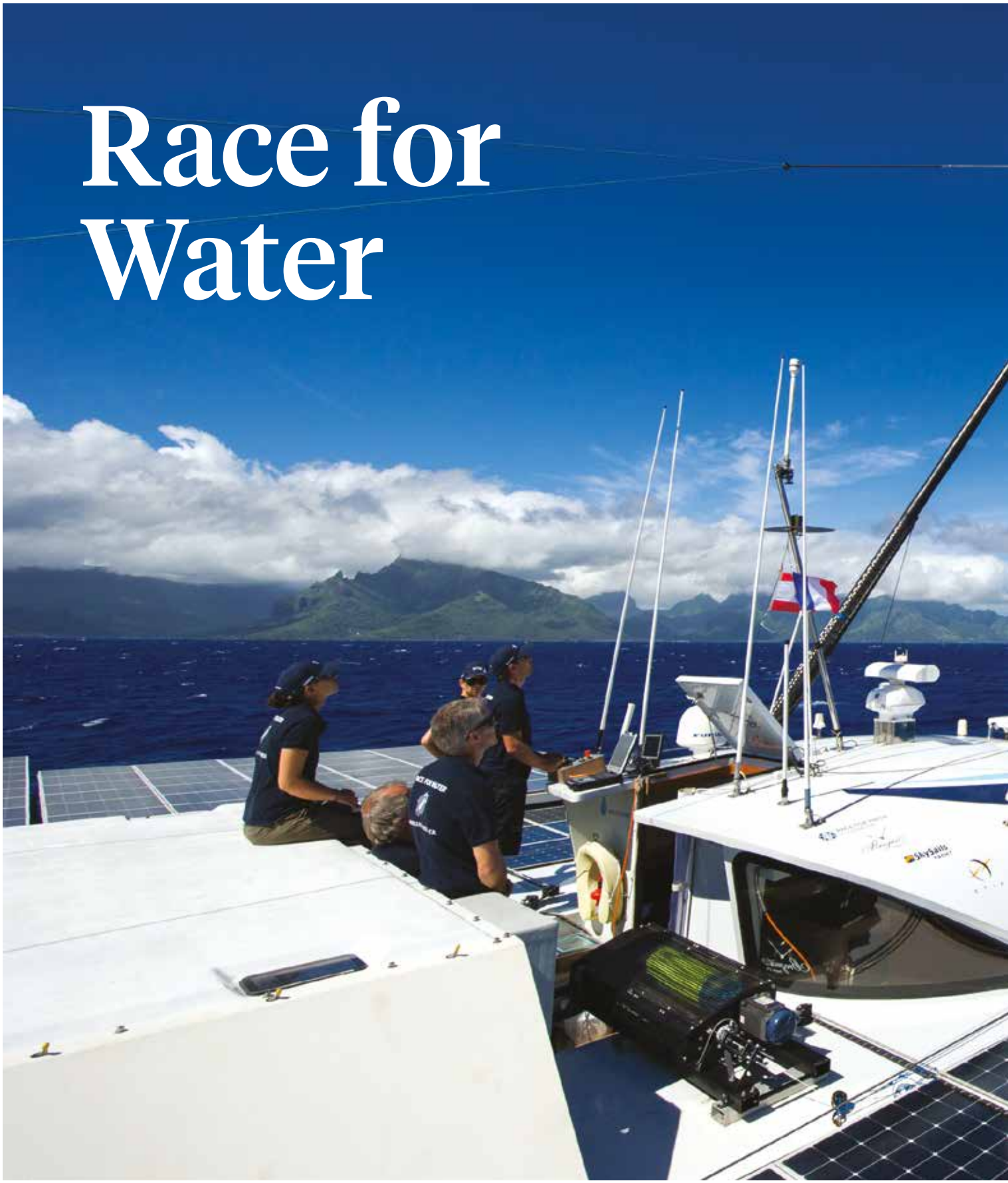


Photo: © Julien Girardot

Opening image: a kite with an area of just 40sqm can propel a 110t vessel.

We speak to Captain Jean-Marc Normant about the unique voyage of philanthropy he is overseeing aboard an incredible floating experiment.

BY WILLIAM MATHIESON

Created in 2010 by Marco Simeoni, a Swiss entrepreneur passionate about the sea, the Race for Water Foundation is an organisation dedicated to the preservation of water – specifically the world's oceans. Through its expeditions, the team studies the impact and extent of plastic pollution on ecosystems, while providing pragmatic and relevant solutions to prevent plastic waste from reaching waterways.

The work and research take place aboard the foundation's dedicated 'ambassador' vessel, which was formerly M/S *Tûranor PlanetSolar*, a 35m LOA catamaran designed by LOMOcean Design and built by Knierim Yachtbau.

Having launched its first global expedition in 2015, the Race for Water Odyssey 2017-2021 is well underway, with some 35 stopovers around the world either completed or planned, helping to raise awareness, identify, promote and deploy local solutions for transforming plastic waste into energy.

What piqued my interest about this project was its overarching relevance to us all, not just as superyacht industry stakeholders, but as human beings. The technology you are trialling has the power to change not only the world, but also our little industry. We face challenging times in yachting and we have to find ways of engaging a new generation of client, and that comes through technological optimisation. Could you start by explaining about the project and what's been achieved so far ...

We are looking at a project with a lot of innovation. It's kind of an old vessel now but she has already sailed around the world purely on solar power. And when the foundation took control, we enhanced the boat with two major innovations: one was hydrogen; the boat is able to store more energy than we have from our lithium-ion batteries. The batteries store 750kWh, whereas the hydrogen system stores 2,800kWh, which is four times the amount! This was a great improvement for the boat because on the lithium batteries we were able to cruise for one and a half days, whereas now we can cruise for five without any sun, which is amazing for a solar-powered boat. When you are not producing power from the solar system you have to be able to cruise without the sun, so to be able to do this for five days is wonderful.

The second is the kite system, which is interesting because it is relatively small – at only 40sqm it makes no

"On lithium batteries we were able to cruise for one and a half days, whereas now we can cruise for five without any sun, which is amazing for a solar-powered boat."

Captain Jean-Marc Normant on 'deck'.

shadow, which is an important point because a mainsail cannot usually be used on this type of boat because you lose energy due to the shadow created. So it was very important to find a system that could fly away from the boat and tow it as the kite does.

Is the plan for the vessel to use it as a testing ground for various renewable technologies or is the focus predominantly on the development of hydrogen as a fuel source?

The aim is to enhance the energy capacity of the boat, as a starting point, and then to prove that we can cruise with a hydrogen system. To my knowledge, it is the first boat able to do that with real efficiency.

For Plastic Omnium, the builder of the hydrogen system, it was the first prototype of its kind, so we have provided a good ship to show that the technology is working very efficiently today.

You can imagine that when the boat is docked in the harbour it is another way to generate and store the energy because the boat isn't consuming energy that is being produced via the solar panels and the capacity of the lithium batteries is not enough. So we decided to increase the capacity of storage with this hydrogen system.

We are not sourcing our hydrogen from the ground; it comes only from the sea. We take sea water and purify it with a watermaker. We call it the DI system because it is deionised water. We then electrolyse this very pure water using electricity generated from the solar installation.

The hydrogen we create is very green because there are two types: hydrogen from the oil and gas industry, and 'green' hydrogen produced from sources of renewable energy.

Of course, the objective of the project has always been to demonstrate the viability of renewable energy sources for the maritime sector. In your opinion, under the rigorous testing your vessel puts this technology, do you feel it will eventually be scalable to the level of a superyacht.

Yes, I think so. It's not exactly the same system. But I think something similar could be used but without producing hydrogen on board. That is the real difficulty. But you can easily imagine, in the future, hydrogen storage within marinas and then you can fill up at these stations.

The difficulty for us was to produce hydrogen on board because it is in such a sensitive state. And the electrolyser

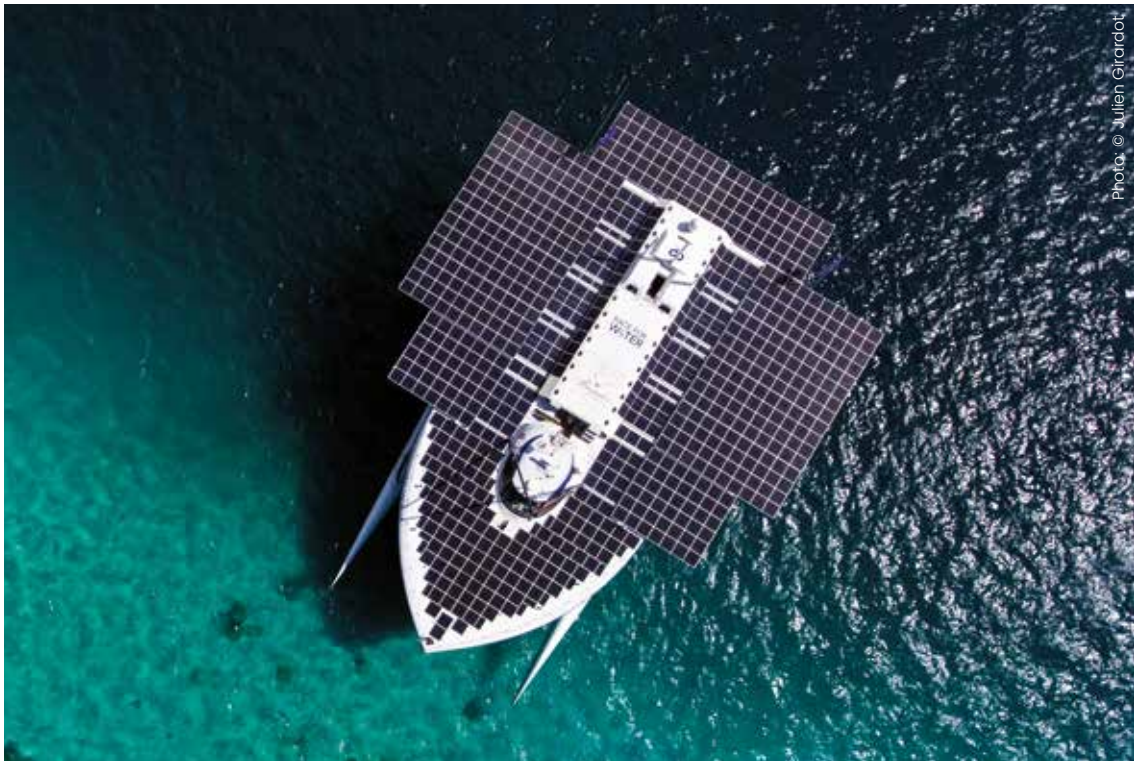


Photo: © Julien Girardot

Photo: Peter Charaf

As well as being an experiment in and of itself, Race for Water is also tackling ocean plastic pollution.

> “The technology is here and we know how to achieve a system that offers both efficiency and capacity.”

needs a lot of maintenance, so you need an engineer specialised in hydrogen systems, which is quite difficult to imagine on a large scale.

What superyachts do have is an abundance of money to spend on qualified engineers, but what the world is lacking at this time is an abundance of engineers with experience of this type of system.
Yes, the biggest challenge is to find this type of engineer.

Do you feel another key element of this project is to catalyse knowledge transfer with maritime sectors such as yachting?
Yes, the boat is a good example as the first to cross the Atlantic, then Pacific and soon the Indian Ocean with this system. This is the first boat, so we are showing it is possible. There are a lot of superyacht owners who would want to adopt such a system and show that they are concerned about the green agenda.

I spoke with Peter Lürssen about a year ago about renewable energy and he said that while all of the talk is about hybrid propulsion, it is already an outdated solution because the manufacturing process for the batteries is not actually ecologically sensitive. He is already thinking that the endpoint for maritime propulsion is hydrogen and that it is a race of sorts to get there, so we can utilise the world’s most abundant resource ...
Absolutely. The technology is here and we know how to achieve a system that offers both efficiency and capacity. Our boat was not very reliable during the first two years of cruising, but now it is. Every step is always behind us, and it is now a question of saying ‘I want one’. And that is why I think Lürssen is on the right path.

I am also in discussion with the provider of our lithium-ion batteries and they want to develop a new system that utilises hydrogen instead of lithium. They understood that they have to shift because the future of propulsion will be hydrogen; not right now, but within a decade.

As you say, hydrogen is the most abundant resource on earth so we have an obligation to go in that direction.

So, it seems appropriate to wrap up by asking you what is next for the Race for Water project?
Now we are going to increase the size of our kite because it can already tow the boat at a speed that makes it look like a classical sailing boat and it is really, really efficient. But now we are looking to generate electricity with our propeller. Imagine that we can sail without having to use an engine and instead turn that engine into a generator. The goal now is to make something more efficient; increasing the size may well be the solution. We currently only have a 40sqm kite, which is unbelievable because it is so small for a vessel that weighs 110 tonnes. This system is really efficient but to generate energy we need to increase the size of the kite to be able to generate energy at low winds. In high winds the sea state worsens, and it is a problem for the current configuration because the boat moves too much for the kite and its flight is not stable. So we have decided to produce a bigger kite to be more efficient in low winds and then we will be able to generate energy from reversing the engines and turning the propeller.

We also need to undergo maintenance of our solar panels because most of them are already 10 years old, so we are looking to replace around a third of the 783 panels on board.

And so the expedition will continue into the future?
Yes, we will probably stop again in March, in Japan. And the goal is to cross the Pacific again, with a few other projects in Europe, but the goal is to continue the odyssey that has been underway for almost four years. I’m really proud to be part of this project and to have had the chance to meet Marco Simeoni; we’ve been working together for 10 years and he is really impressive for his commitment to green technology production and ocean preservation. For a sailor like me it is a privilege to work on such a wonderful project. WM

SO LONG, 2020

Reflecting on a year of COVID-19, Bryony McCabe questions what lessons might be learnt ...

BY BRYONY MCCABE

Well here we are, just over a year since the world first heard about a deadly virus emerging out of China – and what a year it has been. For me, this year has been a rollercoaster of emotions, as I'm sure it has for many others, as the world's population has experienced what can only be described as a collective trauma. As this surreal milestone passes, and the news of imminent vaccinations against COVID-19 provides hope for the future, many will be reflecting on this year gone by and how it might impact their lives once the world returns to (some kind of) normality.

For some, the pandemic might simply represent a slight bump in the road – a bit of a nuisance that got in the way of plans and the ability to see family and friends for a year – and will likely go back to living their lives exactly the way they were before, without giving 2020 another thought. For those who have lost loved ones, livelihoods or even their mental health, however, the pandemic will always represent a major turning point that changed the course of their lives forever.

I don't think it's even possible to define the spectrum of different ways in which the pandemic and the resultant consequences might have impacted different people, but one thing is for sure: the pandemic has highlighted society's ability to very quickly and decisively adapt. Around the world, the pandemic has seen people change ingrained habits and stop doing things that they previously might have thought they couldn't live without.

For example, it appears that lockdowns during the pandemic may have had some direct and positive impacts on the environment, especially in terms of emissions and air quality, due to the sudden decrease in air travel. Although these impacts are likely to be temporary, and might disappear altogether once normal travel resumes, the amount of travel taking place in the superyacht industry is certainly something that needs to be reassessed.

With and endless stream of boat shows and events to attend throughout the year in the B2B sector of the industry, air travel has always seemed so unavoidable. But as the industry becomes well-versed at Zoom meetings, webinars and virtual boat shows, has the pandemic presented a prime opportunity to reimagine and reinvent the whole boat show and event calendar? In line with the theme of this report, which seems to have metamorphosed from innovation to sustainability, I think that the superyacht industry could really use 2020 as an argument to question the necessity of the endless air travel that the traditional event calendar dictates. BM

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