

# The Superyacht Owners Report

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03/2018



Bob Book, owner, 47m M/Y Book Ends

BUYER

## Jim Eden

*“There will be a dramatic change in the way boats are sold in the coming years. If owners can put it all together, what do they need? Just a lawyer to close the deal.”*

DESIGN

*Luiz de Basto on record about plagiarism. Yachting sacrilege or an unavoidable by-product of form following function?*

TECHNOLOGY

## Relight my fire

Retrofitting new LED lighting is easier said than done, it seems.

FLEET

## The Superyacht Ownership Report

# 57%

The number of designers, captains and senior crew who have worked with an owner who has since left the industry.

OPERATIONS

Is the traditional role of the on-board engineer now redundant?

BUSINESS

## George Gill, project director, REV, on the art of project management

*“You hear about some people who build boats and they say, ‘Here is the cheque, I’ll come back in five years to pick it up!’”*

# Relight my fire

BY TIM THOMAS

*Modern LED lights are capable of so much that they can make traditional white underwater lights look dull and dreary by comparison. But how easy is it to upgrade your yacht's older underwater lighting to the latest generation of LED units?*

As in so many other areas of technology on board superyachts, lighting has come a long way in recent years. The transition from traditional light sources to halogen and, more recently, LEDs has transformed what designers and builders can achieve with the lighting scheme both above and below the water. Above the waterline, this has been shown by novel effects designed to highlight the contours of the yacht, subtle colour effects and more efficient lighting schemes, enhanced further as LED technology has matured and colour temperatures have been improved.

Below the waterline, the underwater light has always been an attractive feature, offering the chance to create magical auras around the yacht at night as well as illuminating the water both for viewing and for after-dark swimming. Here, progress has really accelerated over the past 10 years as light outputs have improved and new effects have become possible, thanks to a porting of advanced LED methodology from other industry sectors.

Among these advances are full colour-change underwater LEDs, first delivered to the superyacht market by relative newcomers Lumishore. The advance could certainly be seen as something of a step change in underwater lighting, giving owners and their guests the opportunity not just to enjoy illuminated water but also to control the tones. There has been development in advanced functionality with this shift, too – light-zoning and sound-to-light algorithms, for example, have enabled truly stunning effects.

The problems occur when owners of older yachts want to take advantage of these new technologies. When it comes to refit or retrofit, many aspects above the waterline can be addressed according to time and budget, but while replacing interior and deck lighting has its challenges, underwater lights are an entirely different proposition.

Usually mounted in tubes that are effectively welded into the hull early in the construction process, they are not so easy to switch out and replace. What's more, if you are considering boosting the number of light fittings to take advantage of the new tech or to keep up with the boat next door, that potentially entails a major structural alteration – and one that can have

wider implications on elements such as class. Anything involving through-hull fittings is, of course, going to require a more stringent sign-off to satisfy both class and – by extension – insurance. So what do you do if your owner wants to make the most of the latest LED colour-change technology and get rid of the ageing white HID lights in the original underwater lighting scheme?

“Many companies will say that you can simply swap your HID lights because that’s their entry point,” begins Ian MacDonald, president and CEO of underwater light manufacturer Sea Vision. “But what they forget to tell clients is that by adding their LEDs you face two problems. First, you might be endangering the yacht because you’re adding a component to a through-hull fitting, which is essentially what a lot of them are doing. Second, you just lost your class approval on those lights – and if there’s any warranty left, you’ve lost that as well. Plus, if something does happen there’s going to be an awful lot of finger-pointing when it goes to court.”

MacDonald continues, “The first part, and the most simple answer if you are looking to retrofit modern lights is to go back to the original manufacturer and ask them if they do a retrofit kit and whether it will keep you in class or if you’ll have to go back to the surveyor to get reclassification.”

The problem also goes beyond classification. The fundamentals of how LED lights work are completely different from older lighting technologies. Moreover, many older HID installations rely on air cooling to disperse the heat created by the light and that can present problems because the thermal characteristics of LEDs demand different heat-dispersion tactics.

“You can’t just get an LED module and place it inside an existing fitting and expect it to have a lifetime of 100,000 hours and to work efficiently,” confirms Gareth Evans, CTO at Lumishore and an engineer with considerable pre-yachting experience at the cutting edge of LED lighting development. “You have to design the light around the LED module, not just take an HID out and put an LED in – but that’s what some people are doing.”

All Lumishore’s current underwater modules rely on water cooling and that means specific tubes and flanges to make the most of the thermal cooling

properties of the water the surrounds the hull. “It means they can be put behind panels very easily,” says Evans. “They can be enclosed in coffer dams if needed and you don’t have to worry about the things overheating. If you have them backing into an engine bay, for example, the heat sink on the back of the unit – the method employed for air-cooled units – actually absorbs heat from the engine room.”

It is critical that these issues are addressed, not least because LED lighting performance is intrinsically related to its thermal envelope. “LEDs will only work if you get rid of the heat,” adds Evans. “There’s a bit of a myth that LEDs don’t generate heat, but they do. The limitation is how you can get rid of that heat with an air-cooled system. The limitations are the amount of power you can put in the LED array and how much heat you can remove if you don’t want to affect the lifetime of the unit. We get around that because we know the ceiling is based on the amount of power we can put into the array.”

Lumishore’s method is to use a thermocouple in the unit that will measure the temperature of the array and if the temperature exceeds 65C the unit will power down to maintain that maximum temperature by delivering less power to the light. “Some lights will have that thermal protection in

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so they will just back off,” says Evans. “They will start at 120W but then pull back to 60W because there’s just not enough cooling. In others, where that thermal monitoring isn’t present, the LED will just decay – each LED has a phosphor coating which decays at high temperatures and that results in less light and less efficiency.”

Lumishore solves this problem by putting a large number of LEDs on each array, with each individual LED rated at 10W, although they are only driven at 3W. “It’s like driving your car at 100mph everywhere because that’s what the manual says the top speed is – if you drive it at 30mph instead you get better miles per gallon,” says Evans. “It’s the same for LEDs – if you drive them at a lot less than their maximum power you get a lot more out of them and much longer lifetime reliability. Our units, for example, might total 240W but we only drive them at 25 per cent capacity, or 60W, because power is not limitless – you can’t just keep adding power to get more light because it rolls over and the light starts to fall off because you can’t get rid of the heat quickly enough.”

“With underwater lights, the thermal characteristics are completely different between HID and LED,” agrees MacDonald. “With the old HIDs, it was projected through the glass lens into the water and the water acted as a

**“When you try to integrate new and old even the technicians don’t know what’s going to happen. On a retrofit, I would keep it simple and not try to go the whole hog.”**

*Modern underwater LED lights offer incredible power to illuminate the water, while also offering a diverse array of functions including zoned areas, full-colour change, and even sound-to-light capabilities.*

cooling agent along with the through-hull fitting. With the LED, the greater amount of heat is behind the LED unit so we’ve had to go to much bigger heat sinks and they’ve necessarily got larger and more complicated to control the thermal characteristics of the LED. In some ways, it’s not really a big deal, it’s just a matter of engineering.”

But what a larger, bigger-diameter heat sink does mean is that space can become a problem when it comes to retro-fitting. Longitudinals, laterals, frames, cabinets, piping, tankage and other elements of the core engineering structure of the vessel can get in the way. “Where you could sneak the HID’s which were put in at the new-build stage the space becomes tighter and tighter, and when you come to put in the LED that does create a few problems,” says MacDonald. “It’s not really a deal-killer, it’s more of a head-scratcher!”



Image courtesy of Lumishore

The implication, then, is that retrofitting underwater lighting is a potential minefield, particularly if you are looking to upgrade to the latest LED systems from HID or other earlier technologies. What options does a builder or refit yard and the engineering team have if the owner insists on pressing ahead? One course of action could be to buy a completely new lighting package and systematically replace the existing or original through-hulls with new units, but this is a major undertaking.

Another option could be simply to take out the existing lighting units and replace them with LEDs in the existing through-hulls but, as explained above, this can be fraught with potential problems and in most cases, if it is presented as an option, serious consideration has to be given as to whether the full implications have been thought through. The exception, perhaps, is either where a manufacturer has developed a specific retrofit kit for its existing units or where a lighting manufacturer has designed an LED unit that specifically caters to retrofit in another manufacturer's through-hulls.

For the latter, Lumishore has developed a solution which it launched last year. "While all our LED units are created around carefully engineered water cooling, with retrofit lights we are stuck with the flange that has already been welded into the hull," says Evans. "So we designed a solution that allows you to unscrew the original HID unit from the back and then you bolt on our LED unit – and in fact it's the only product we do that is air-cooled.

"However, it gives you all the advantages of LED, it's a similar size (to the HID units), has the same thread design and it's only the coupler that needs to be changed – and we have created thread designs for the majority of existing units out there. It means you can effectively unbolt the HID and put in our LED unit, it can be done while the yacht is in the water and it takes two minutes – and now you've replaced HID with LED and have all the advantages of LED." The retrofit LEDs don't give out

quite the power of the latest generation of Lumishore's water-cooled lights – approximately 9,000 fixture lumens compared to 20,000-plus for the top-of-the-range SY300 units – but they still match or beat the output of other manufacturers' lights.

For MacDonald, the process of retrofit revolves around developing solutions for Sea Vision's existing line of legacy products. "We've always designed our improvements over the years to fit our fixtures, so the through-hulls have remained the same – and there's no reason to change them because they are very good and are still there after 15 to 20 years," he says. "So when we add an LED to an old HID light it's all designed to fit and to work together, everything from the thermal characteristics to the light output and the watertight integrity. We are also always very careful to maintain the type approval as we obtained it – we have to be very aware that changing any component means it technically changes class."

When it comes to using existing wiring, generally this isn't a problem. Either the original cabling can be reused or can be used as a mouse to guide new cabling assuming, of course, that the original wiring run has not been complicated in any way. However, that does require an additional run of a DMX cable for the latest colour-change LEDs. "Really, you need to rewire but that shouldn't be a big deal," confirms MacDonald. "However, if you are looking to integrate the underwater lights with some of the other on-board systems then it's probably easier to do that at the new-build stage rather than the retrofit stage because when you try to integrate new and old even the technicians don't know what's going to happen. On a retrofit, I would keep it simple and not try to go the whole hog."

MacDonald also has a strict policy for Sea Vision when it involves retrofits with other manufacturers' original units. "We won't do it," he asserts. "We'll change the whole fixture out, including the through-hulls, but we won't add our LEDs to someone else's through-hull fittings or vice versa – we'll always tell

them to go back to the original manufacturer. We are also very diligent in making sure any yacht has the right information to make the right decisions."

For Lumishore, it comes down to the product. "Safety is paramount mechanically, electrically and electronically," states Evans. "Arguably LED retrofit lights are consequently safer than HID and halogen. Classification societies have a difficult task and they are a bedrock with much responsibility lying with individual surveyors as well as the Type Approval process. At the moment their inputs into underwater lighting are primarily related to hull integrity – and retrofit lights such as ours do not affect that because primary and secondary sealing is not affected by Lumishore retrofit lights. On projects we have done so far, we have not been asked to do any additional testing."

It seems, then, that it's very much horses for courses, and to a large degree it comes down to due diligence when selecting new products to replace existing lighting systems, including ascertaining what Type Approvals are currently held with the classification societies themselves and what might be required to retain class sign-off.

There are, of course, additional questions that arise. If retrofitting LED lights is far from straightforward, what does this imply for future refit projects? And are LEDs here to stay or are there other technologies on the horizon that might mean it would be better to wait before committing to a major lighting overhaul? Here, at least, there appears to be more straightforward advice.

"I know laser has been looked at," says MacDonald. "But I'm not sure what's going to happen next because the LEDs have got to the point now where what can you do next? We've gone through a learning curve where we've got a lot more light output from them, we've got the colour temperatures right, we've got the reliability, they look good in the water and we've got the beam angles right. Now it's really just small incremental changes and I don't see any big 'wow' moments coming in the next few years." ■