

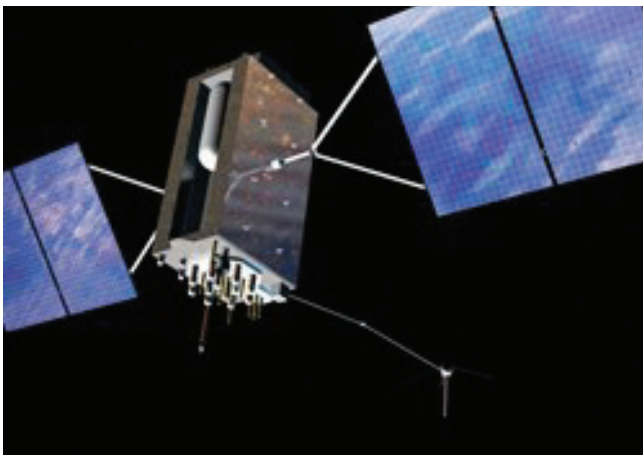
NEWS

Seamen depend more and more on communications technologies and modern satellite navigation. Hence, a step forward is presented in the next two titles:

- The USAF has declared the first GPS III satellite (GPS III SV01) to be 'Available for Launch' (reprinted with permission from <http://www.rin.org.uk/Newsitem/5042/First-GPS-III-satellite-ready/Feed>),
- Broadcom Ltd US company has introduced its BCM47755 as a mass-market, dual-frequency GNSS receiver (reprinted with permission from <http://www.rin.org.uk/newsitem/5038/Dual-frequency-GNSS-receiver-introduced>),
- ToMS tries to increase awareness of safety at sea. In this role, a contribution is reprinted from <https://www.wartsila.com/twentyfour7/innovation/raising-the-bar-on-safety> (with permission from Wärtsilä),
- ToMS also promotes green energy in maritime industry. In this direction, an article from <https://www.wartsila.com/twentyfour7/in-detail/catching-the-surge> is reprinted (with permission from Wärtsilä).

First GPS III satellite ready

The USAF has declared the first GPS III satellite (GPS III SV01) to be 'Available for Launch'.



The declaration is the final acceptance of Lockheed Martin's first GPS III space vehicle prior to its expected 2018 launch. GPS III SV01 now awaits pre-launch preparations; in the meantime, it is being stored in an environmentally-controlled clean room, where it can be maintained and serviced

Lockheed Martin explain that GPS III SV01 is the first space vehicle of an entirely new satellite design, using next-generation technology and capability compared with the 31 satellites in the current operational GPS constellation.

Benefits of the GPS III satellites include:

- Better accuracy, claimed to be a 3-times improvement on current capability.
- Improved anti-jam capability, claimed to be 8-fold with powerful transmissions; also a ~70 % digital payload, giving greater operational flexibility.
- Stronger design, with more resilience and a designed operational life of 15 years.
- Inclusion of new civil signal L1C - the common signal being adopted by other international Global Navigation Satellite Systems (GNSS) such as Galileo.

Dual-frequency GNSS receiver introduced

Broadcom has introduced what is claimed to be the World's first dual-frequency GNSS consumer receiver with centimetric accuracy.

US company Broadcom Ltd has introduced its BCM47755 as a mass-market, dual-frequency GNSS receiver designed to enhance location based services (LBS) applications for the likes of mobile phones, tablets and fitness wearables. It measures 15 × 9 × 5 mm.

It explains that the device is equipped with the latest GNSS innovations and is capable of centimetric accuracy with minimal power consumption and footprint - enabling new high-precision LBS applications, including lane-level vehicle navigation and mobile augmented reality (AR).

The higher precision is largely due to the fact that the delay of GNSS signals passing through the ionosphere - the



ionospheric group delay - is inversely proportional to frequency squared; hence, with 2 frequencies received from each satellite, an accurate estimate of total electron content (TEC), and therefore delay for each satellite used in calculations, can be made.

The BCM47755 can simultaneously receive the following signals:

- GPS L1 C/A
- GLONASS L1
- BeiDou (BDS) B1
- QZSS L1
- Galileo (GAL) E1
- GPS L5
- Galileo E5a
- QZSS L5

The manufacturer stresses that the BCM47755 delivers this higher level of location accuracy whilst also meeting rigorous battery power and footprint needs in devices such as mobile phones.

Raising the Bar on Safety

The International Convention for the Safety of Life at Sea (SOLAS) has existed in some form for over a hundred years, but it's certainly not sitting around gathering barnacles. Instead, the rulebook is continually changing to reflect the industry's enhanced capabilities when it comes to safety on the seas – particularly when it comes to a ship's powerhouse. With technology continually raising the bar on safety, keeping a vessel safe and sound means staying very up to date with both the rules and the technological possibilities. It means both staying informed, and taking action to ensure that a vessel's set-up meets the highest of standards.

"Engine rooms are, by their nature, hot spaces," says Wärtsilä Services' Senior Product Manager, Jyrki Salo, "but we've come a long way since the intimidating, steamy bunkers of a century ago. In fact, engine rooms these days are becoming, in every sense of the word, a whole lot cooler."

Digitalisation, 3D modelling technology, and real time

monitoring are just a few of the latest advances that are allowing for more reliable, cooler, and increasingly efficient engine rooms.

"While digital 3D scanning offers designers a real-life design environment, guaranteeing best performance of the insulation design in a specific engine room, real time monitoring systems, for example, detect fuel leakages in a very early phase thereby giving operators time for corrective actions.

And for Salo, it's obvious that SOLAS standards will rise to reflect our increased capabilities when it comes to safety.

Engine room safety a hot topic

Salo explains that Wärtsilä is already working alongside cruise ship companies and classification societies to prepare new class notations. They're aimed not only at lowering surface temperature limits, but also at increased monitoring of possible threats to the engine.

"It's not yet binding legislation, but that's only a matter of time," he states.

This means there's no point setting the bar low when it comes to investing in safety.

Wärtsilä's SOLAS solutions, including safety audits, training services and their wireless big-end bearing monitoring solution are all designed not only to meet legal requirements, but to exceed them, whether it's for retrofitting or a new build.

"Every day we are learning," says Salo. "The technology is improving, materials are improving – and we implement the latest."

This approach enables Wärtsilä to provide customers with the highest quality solutions, meaning there is never any reason to compromise on safety.



Figure 1. Engines inside Viking Grace's engine room.

Getting smart about monitoring

Thankfully, there are plenty of opportunities to enlist great tech when it comes to keeping ahead of the legislative curve, explains DNV GL Maritime expert, Hans Eivind Siewers.

"Today, almost everything on board a vessel, including internal equipment like engines, can be fitted with smart sensors to monitor performance and catch irregularities early on," explains Siewers.

Operators can even benchmark their vessels against the world's fleet, report real time functionality from ship to shore, or even model potential changes by running 3D simulations in a so-called "digital twin".

Siewers also sees an industry that's keener than ever to stay ahead of the game, explaining that voluntary class notations such as F-AMC (meaning a vessel has installed additional fire protection) have been introduced by DNV GL in response to a heightened willingness to address growing safety concerns. This means owners now have a way to officially demonstrate that they employ enhanced systems when it comes to issues like fire safety.



Figure 2.
The engine room of Royal Caribbean's Oasis of the Seas cruise ship.

Safe business is good business

As a Wärtsilä customer, Kimmo Heikkilä is also pleased to have been able to invest in measures that go above and beyond mere compliance. This is because, as Director of Powerplant & Technical Systems at Royal Caribbean Cruises Ltd., (RCCL) he sees the safety of passengers and crew as the highest priority.

"We've installed additional big end bearing temperature monitoring systems which allow faster engine shutdown in case of failure," he says. "Plus, we've also installed engine specific fuel oil shut-off valves."

According to Heikkilä, these upgrades allow for improved reaction times on the part of the crew, mitigating or eliminating any consequences that could adversely affect safety on board.

There are many signs to indicate that ship owners are more willing than ever to embrace technology. The industry's best are keen to stay one step ahead of the requirements, rather than

find themselves caught out when new rules inevitably come into force.

Thankfully, with a range of advanced technological solutions at Wärtsilä's fingertips, there's an ocean of exciting solutions for customers when it comes to playing it safe.

Catching the 'Surge'

Capturing the power of the waves is a complex task, as the sea is constantly changing. One of the most promising wave energy devices is WaveRoller, a submerged panel equipped with Wärtsilä's components.

When the British naval architect Chris Ridgewell visited Wärtsilä's Vaasa offices at the start of the project to develop the first LNG-fuelled passenger ship at Turku shipyard, as a surveyor for Lloyd's Register, he saw first-hand how adept Wärtsilä can be with developing technologies.

So after he returned to Finland to become Chief Technology Officer for the wave energy start-up AW Energy, he knew where to turn.

"LNG has now really taken off and Wärtsilä is a main player," he says. "They've built it from a new technology to an established industry. Now we are at the same point in the development cycle, and Wärtsilä again is involved in that transformation."

Wärtsilä has supplied AW Energy's first full-scale WaveRoller with metallic bearing housings, composite bearings, lip seal housings, and hydraulic couplings. The equipment was being fitted this summer before the device is shipped to Peniche, Portugal, for a year's trial operation in the early autumn. In September, Wärtsilä announced it will partner with AW-Energy adding wave power generation to its capabilities as energy system integrator.

WaveRoller is unusual among wave energy devices, because it generates energy from the 'surge', the back-and-forth motion waves make when they travel from the deep ocean to shallower waters. It has the potential to be one of the most popular devices for power utility customers.

The device consists of a steel panel, which is fixed to the seabed, near the shore, at a water depth of about eight to 20 metres.

The back and forth movement drives a closed hydraulic circuit, which in turn drives a generator. An energy storage system then turns the pulsating output into smooth, grid-compliant electricity.

Being near the shore brings the advantage of a short grid connection, while being fixed to the seabed, under the surface, means the device is not as exposed to extreme waves as most rival devices. For power utilities the more even generation and easier maintenance WaveRoller promises bring clear advantages over rival devices.

The wave forward

Wärtsilä's parts are essential to the device's durability as they withstand rough weather and require minimal servicing.

"The majority of the year, the waves are quite small: one to two metres," Ridgewell explains. "And that's why the bearings are so important: they allow the panel to move in small wave heights. Because we're structurally efficient, we're very responsive to the waves."

Ridgewell approached Wärtsilä. The request filtered down to Les Creak, Wärtsilä's Business Development Manager for Hydro, largely because his team had worked extensively with other developers and start-ups in Ocean Energy over the past decade.

"AW Energy have come up with a fantastic invention, which has been proven to work at sea, but the information they are able to extract on the longevity of the bearings and seals is from simulated exercises," Creak explains. "What we're giving them is a balance of mature technology in the equation — so they're able to use the past performance figures to a degree."

Even if the core technology is new, both investors in AW Energy and the company's potential customers will gain assurance from the fact that key components have been used for decades, and come from a reliable supplier such as Wärtsilä.

"They're able to use the past performance figures to a degree," Creak says. "Derivatives of the seal and bearing technology have been operating in other applications for over 50 years. This gives a sense of security and reliability."

Ridgewell, who spent 17 years working for Lloyds Register, says WaveRoller has tapped established, respected suppliers for other parts as well.

"We try to take as much off-the-shelf technology as possible to limit the risk. There's lots of new stuff in there already."

Wärtsilä's seals and bearings business, based in Havant, UK, has unrivalled experience supplying seals to the emerging wave and tidal energy industry.

When the Marine Current Turbine device was pulled out of Strangford Lough at the start of 2016, it had produced most of the world's tidal energy. So Wärtsilä, by extension, had at that



point sealed 90 per cent of the world's tidal power produced.

"We had experience, and still have to this day, we believe, that no other seal manufacturer has," says consultant engineer Simon Thompson, one of Creak's team members.

Striking the right balance

But AW Energy was drawn to Wärtsilä for the company's expertise as well as for its equipment.

"When you look at a technology there are a lot of rules and standards that people use. However, there's a lot of conservatism in that, and it's really unravelling that conservatism," says Ridgewell. "With renewable energy, you cannot justify having a lot of the costs."

When Simon Thompson, Kerry Jones and Ross Strickland first met Ridgewell at Wärtsilä's in-house composite manufacturing facility in Slough, outside London, it did not take long to find ways that Wärtsilä could improve the WaveRoller product.

"I think AW Energy had limited in-house resources and expertise available," recalls Creak. "They certainly understood about the bearing and what they wanted the bearing to do, but they had limited understanding of what the performance limitations and requirements could be on their seal."

Wärtsilä consulted on the overall seal and bearing arrangement and recommended a transition towards a totally water lubricated solution. This simplified the application and at the same time addressed another environmental concern.

"There are studies and papers out there that look at the portfolio of seal offerings in the market and the general consensus, specifically in tidal applications, is that a mechanical face seal is the go-to choice," Thompson says. "But those don't respond well in high-duty reciprocating motions."

Wärtsilä also decided to invest more time into supplying the WaveRoller by developing a structural composite housing for the lip seals at its in-house composite manufacturing facility in Slough, outside London. This will reduce the weight of the device, making it easier to install and service.

The other attraction for AW Energy is Wärtsilä's Services Division. Ridgewell is aware that operation and maintenance is key to the WaveRoller's cost-effectiveness and appeal to utilities. It has ballast tanks that allow it to float back to the surface for easy servicing, limiting the need for expensive and dangerous diving operations.

The 'glocal' touch

Having a global supplier such as Wärtsilä manufacturing key parts means that when the device is rolled out globally, it will be easy for utilities to service and replace these parts wherever they are located.

"If you look at the service centres and representative offices of Wärtsilä and then you place on that a global map of the world wave resources, they pretty much match," Ridgewell points out.

But there are challenges as well as benefits for a small start-up in working with a company of Wärtsilä's scale, particularly in navigating through Wärtsilä's many divisions.

"There's a lot of expertise, but it is finding the expertise that's the challenge," says Ridgewell. "You need to find that person who has sufficient contacts to find the person that knows."

Creak is similarly conscious of the challenges that come with working with a much smaller company.

"We are very aware that we're a very, very big company and they're a very, very small company. That can create some challenges in communications," he says.

The other issue is financial. The value of the equipment sold to AW Energy for its maiden project provides very little immediate return for the time Creak's team has spent.

"We would be disingenuous to say that it's a major contribution to our annual turnover and profitability. However, we make these investments because there's a potential," says Creak

If WaveRoller is successful and deployed around the world, it has the potential to be one of the most popular devices for power utilities.

"It's a really big opportunity for them at the end of the day," Ridgewell argues. "When this industry really takes off, which it will, we're talking tens of thousands of units. And for every

WaveRoller, you need two bearings, so we're talking about a very large business opportunity."

With AW Energy, the opportunity is considerably greater, but so is the competition, with more than 200 devices under development.

But Wärtsilä believes AW Energy, which is the first device to receive a technology certification from Lloyds Register and to be certified against DNVGL standards, is among the most promising.

"There are a lot of players out there, but it doesn't take a lot of time and investment to work out the likely winners," Creak says. "And then we would typically offer our services to the ones that we perceive have the greatest chance of success."

The double certification, together with reliable, time-tested components, and the knowledge that service engineers are nearby, will help utility customers convince their own financial backers and project insurers that the risks have been as much as possible contained, making it easier to get the first projects off the ground.

It seems to be working. AW-Energy has a pipeline of commercial projects and active business development in six countries on four continents. And when WaveRoller ends its trial on Portugal's Atlantic coast in late 2018, AW Energy's device will be one step closer to the market.