Total connectivity

Ideas and innovations abound, but how to capitalize on it is still fuzzy

BY

One of the benefits of full connectivity is a better and safer experience at sea for the boater, who will have access to more information about the condition of his boat and its many components and systems. This includes, for example, knowing that the latest navigation software has been installed in his MFD and also that an engine fuel filter may be failing.

As most everyone knows, the Internet of Things—the IoT—is all about hyper-inter-connectivity—information sharing between everyday items such as washing machines, refrigerators, lamps, wearable items, engines, roads, bridges and a great deal more that is looming on the horizon. It not only connects people to people, but things to things. How will it impact the marine industry for the builder, dealer and boater is hard to tell right now but for sure, there will be a James Bond 007-type edge to boaters' time on the water in the not-so-distant future. For this discussion, we're calling the marine subset of the IoT concept the IoB—the Internet of Boats.

At the moment, the marine industry is mostly guessing at what the IoB is and how it will evolve, but no doubt everyone wants a piece of it and dealers are no exception. It's expected to make boating more efficient, with more proactive services. It may make boating safer, more enjoyable and definitely more social. It will at once simplify the game as well as make it more complex for the whole value chain from boat builders and systems manufacturers, to installers and servicing dealers, to boaters. And as with anything that relies on connectivity and sharing, it will be both more useful and less secure, requiring new products and business models to be developed.

Always stretching the boundaries, marine electronics companies are on the hunt, developing components—products and services—that utilize the IoB and in the process further expand it. Companies like Navico, GOST and Siren Marine among many others are rushing into the fray, trying to figure out how to carve out a piece of this future, which right now centers mostly on prognostics and diagnostics.

Sensing problems

Prognostics is an "engineering discipline focused on predicting the time at which a system or a component will no longer perform its intended function." In other words, if the boat could signal that a certain engine part, pump or other system was nearing failure, it would save quite a bit

of time and money for the boater as well as all those who have a piece of the value chain in the manufacturing, installing and servicing of this part. It's a predictive function that will identify and possibly address issues before they become problems.

"It's about increasing efficiency," says Brian Kane, Chief Technology Officer at GOST (Global Ocean Security Technologies), which manufactures vessel tracking and security systems and equipment that monitors and reports on things like bilge alarms, break-ins, battery voltage and more. "It will allow more complete knowledge of what's happening aboard and in so doing will increase enjoyment and safety."

Marine expert Nigel Calder admits there is almost nothing concrete to point to yet on the prognostics side but speculates about the near future. "I think smart fuel filters will be an early example," he says. "There is very little change in the restriction a fuel filter causes (i.e. the vacuum on the engine side) until it is mostly plugged and then the remaining capacity gets used fairly quickly. If we are monitoring fuel flow rates, engine rpm (i.e. load) and the vacuum, and we know the characteristics of the filter, we can predict when it will need changing and can inform the operator via WiFi built into the filter monitor."

Another example Calder gives is brush-type motors. "These motors have a changing amp draw as the brushes wear and the motor ages. If we know these characteristics and are monitoring the amp flow (which is done by digital switching systems) we can predict end-of-life and notify the operator."

However, at the moment, we have more on the diagnostic (vs prognostic) side with information that identifies what is happening now—and therefore after-the-fact reporting. For example, an engine with an ECU, or Engine Control Unit, can provide error codes from which you can determine what has gone wrong. Other examples include digital switching systems like CZone that can send reports on bilge pump cycles and battery levels which may tell us there is water intrusion or a light left on.

Customer service

Fleet tracking and management is a perfect first step in the IoB. Navico is testing their new GoFree product with charter companies, specifically The Moorings and Sunsail. With GoFree a base manager can see where each chartered vessel is via a Web interface on a PC,

tablet or phone. Not only does this reveal if the boat has gone beyond the designated cruising grounds, but it's also easier to find in case of breakdown. Also a geofence can be set to alert staff to meet a particular boat when it returns to the dock, thereby enhancing the level of customer service. With this kind of communication, the IoB is well on its way.

Phil Gaynor, Navico's Senior Telematics Product Manager, points to a neat GoFree feature. TripReplay captures location, weather, depth information and—along with photos the charter guests take—sews it into a recording of the outing. Guests can share this on social media, which serves as a memory play-book for them and also creates good sharable promotion for the charter company. "TripReplay videos can be put on Instagram or Facebook so we're really less in the electronics business and more in the activities business," says Gaynor.

Despite individual forays, for the moment the IoB as an overarching concept is still fuzzy and there doesn't seem to be a systemized, carefully laid-out construct as to its development. Many players have a piece of it and are working on components that will someday bring diagnostics, prognostics and who knows what else together to form a new normal.

Moving data

There's no doubt that the IoB will be data-heavy and there will be a great need to capture, secure and move all this information on and off the boat. Steve Spitzer, NMEA's Director of Standards, believes the answer lies in the deployment of NMEA OneNet® and IPv6. OneNet is the new standard for transmitting NMEA 2000® messages over the IPv6 Internet protocol using standard Ethernet in a common non-proprietary format. (IPv6 replaces the current workhorse, IPv4, but OneNet will supplement rather than replace NMEA 2000.) OneNet will provide greater bandwidth, up to 10 gigabits of transfer speed, which will be more than 40,000 times the speed of NMEA 2000.

"The industry has to come at this [the IoB] from an open protocol standpoint to harness information without restrictions," adds Kane. And with OneNet, this seems to be the case.

"With OneNet married to IPv6 and to the IoT, marine electronics manufacturers may develop products that we once thought unimaginable," says Spitzer. He expects a OneNet launch late this year or in early 2018.

"We're giving people a toolbox—who knows what they will build. Expectations are pretty high."

Dan Harper, Chief Executive Officer at Siren Marine, which makes vessel tracking and monitoring equipment, points out that the two biggest hurdles to free sharing of high volumes of data are power and communication. A boat off the grid (away from 110v power) is a huge challenge because keeping all the monitoring systems powered on batteries alone isn't easy and moving information on and off boats that travel long distances out of reach of WiFi can be a non-starter.

The good news is that the cost of connectivity is decreasing as broadband Internet becomes widely available and today most devices are integrated with multiple data-gathering sensors and WiFi capabilities so they can capture and share information. "Communication will be key with information coming via VSAT, cellular and marina WiFi with Long

Advancements in connectivity will also impact smaller vessels as network innovations trickle down from larger yachts. Apps that offer remote control of onboard systems are expected to play a growing role in boaters' lives.

Term Evolution (LTE) high-speed modules that can keep up with the data transmission rates that are needed," says Kane.

Turning data into cash

Once you get the data, how can you monetize it? What's the future of the IoB if there's no revenue stream associated with it?

Data alone is fine but it's not enough. Whoever turns data into information [processing raw data into useful information that provides meaning and context] will be the first to capitalize on the IoB and monetize some part of it. Navico's charter company example is a good start. Charter operators can gather more data to share (with boat and engine manufacturers) because of the volume of users and number of outings, and they can also benefit from the distilled data coming back to better predict maintenance requirements so their boats are always ready to go out and produce revenue. It's a good jumping off point but will charter companies pay for data once it's for sale and no longer experimental?

A vessel that is GoFree cloud-enabled can store manuals and documents like work orders, invoices and maintenance notices. When connected to service techs, this makes everything easier to access and share and would keep everyone on top of maintenance and upgrade needs, which may be a way to create a revenue stream. With the help of usage data from the field, engine manufactur-

ers may be able to build more fuel efficient and robust engines that are easier to service. But what would they pay for this data? Certainly, this information has value so it's a matter of figuring out how to collect and communicate it and of course how to price and sell it. Right now, most of the concepts are one giant beta test. "There are more questions than answers," says Spitzer.

Gaynor agrees that the picture is uncertain for now but notes that as data transfer and storage costs go down, more will become possible. Also, as companies eye the IoB, the number of competitors will increase and true innovation will kick in, leading to solutions we've not even thought of yet.

A smart boat may save OEMs money by lowering warranty costs and the boater may benefit if insurance companies catch on and start offering lower premiums for connected vessels. "Data is a product with partners and it develops collaborative boating," says Gaynor. "And many of the products being developed today can pay for themselves in various ways."

Boosting returns for dealers

Are installing dealers and techs prepared to move into that ever-higher-tech world of full integration and total connectivity? Does anyone have a plan?

Harper understands that a connected boat has value for everyone in the marine industry value chain and especially for installing deal-

ers and techs. "Service providers can subscribe to Siren's data portal and be more productive by recommending service when or before it's needed," he says. Like the connected car with OnStar, the boat can create value for others to participate in. "We believe that system and engine manufacturers will work to make installation easier so with some training, service techs will be part of the overall solution."

Spitzer adds, "Today, dealers have to go look at the boat to evaluate a problem but with the connected boat, they could monitor it from a remote screen without a physical service call, saving time and money both for themselves and the boater."

Furthermore, it's expected that the connectivity of the IoB will allow dealers to form closer relationships with boaters as well as OEMs as they tie into it and are able to provide on-time delivery of complete systems. Efficiencies should lower costs at the dealer level and the process will create an accountability trail as well. But the dealers will need to develop a unique expertise (proprietary apps, network know-how, etc.) to differentiate themselves. "Dealers will have to analyze their processes and potentially change their business models to keep up and excel," says Spitzer. "Finding a niche will be the challenge and not getting hacked [security] will be key."

Kane agrees, adding that, "New systems [and the IoB] will not be DIY and NMEA certified dealers will have a large role in it. But they will need training for installation and service. Once you start talking about the network this takes to implement, it gets a lot more complicated."

What's the plan?

So does anyone have a plan? Calder thinks Navico does, but it is to "sell the 'glass' [MFDs] on which everything is displayed and to a significant extent let others develop the bits of kit and software necessary to make all this work—i.e. they will provide the platform but not the content."

Overall, there seem to be few answers right now but it's time to start asking the right questions and for dealer that includes, "Are we ready for the IoB, do we have the right personnel and training, will our current business model allow us to grow into this, and what value can we add at each step?"

"What this [the IoB] will do is give us a mass of information across all the systems on the boat—likely more than we can handle,"

says Calder. "The key to making this useful is understanding the aging and failure characteristics of all our systems and their components, and having smart people who can process all this information."

Better for boaters

That's true for the industry but what about the boater?

Kane points out that the average boater is between 58 and 72 years old and they're not exactly hip on the IoT, much less the IoB. But adoption rates are expected to increase among the younger chartering and boat club crowd that can somehow work the benefits into social media. "Adoption rates will be higher if it comes through different doors other than [actual] boat ownership," adds Kane.

We do know that boaters of all ages like the idea of remote control of the vessel. If you can set the mood with music and lights, turn on the A/C and get the livewell cycling remotely, the enhanced boating experience starts before you even step aboard. If you know whether a hatch has been opened or if the vessel dragged anchor, that's useful enough for boaters to reach for their wallets. Also, for the boater the IoB may translate to increased confidence, knowing that the engines are healthy and that the latest navigation software has been installed. It's also comforting to know that the response time to fix problems could be shorter so there's a more supported adventure every time the dock lines are untied.

"JBL, Clarion and Lumishore are among the many who are already working on the details and remote app control," says Kane. "And it will trickle down quickly from yachts to center consoles and other smaller boats so the whole spectrum of boating will be impacted."

"We believe that this will change the boating experience for the better because boaters will have greater confidence to leave the dock when maintenance is proactive and the boat is ready to go," adds Harper. "Even being able to turn on spreader lights via an app when returning to the boat at night will make them worry less."

Although much of the crux of what makes up the IoB will happen behind the scenes, an intuitive user interface is critical to make boaters want to get involved and enable the process. That's why we already see MFDs mimicking the functionality of personal electronics like smartphones and tablets with pinch-to-zoom touchscreens and swipe commands. Expect to see more app-driven functionality

Remote monitoring is a popular and useful option for a wide range of boaters. Siren Marine's app allows users to track their boat's location and several functions on a portable device. GOST's Phantom is a wireless security and monitoring system that supports up to 64 sensors and alerts users if a problem occurs.
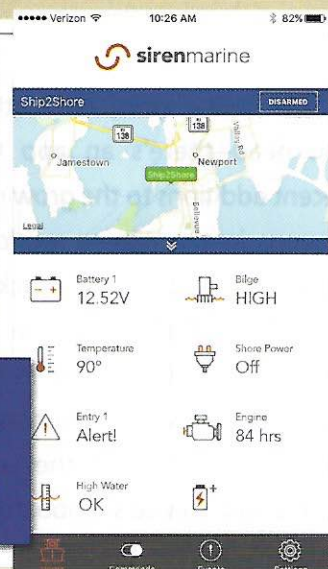
pop up on the chartplotter, where the IoB seems to be getting much of its start.

The idea is to have a boat that virtually takes care of itself. Calder adds, "It's impossible to know at this time, but it is fair to assume that a significant part of the monitoring of our systems will become unnecessary as the boat will do this for us and let us know when we need to take certain actions."

Fifteen years ago, Bill Gates predicted the development of personal assistants like Google Now and smart household items like the Nest thermostat. These everyday items are changing our lives in ways we couldn't have anticipated. Now, think of all the attention around self-driving cars, which is an exciting proposition that is also a little scary. That's a bit like the IoB. Who will adopt it? What will it cost? How much will it save? What will boating look like in another decade? How can dealers get in on it? Who knows at this time? But we do know

Tools for CAN and NMEA 2000

problems. Another display that can be added to this tool is the Signal (fields) module that can show selected signals for the CAN database, covering the Application Layer of CAN/NMEA 2000.

Fig. 8: The 3-in-1 Analyser Concept

Interfacing with the NMEA 2000 CAN bus

To connect the above tools to the NMEA 2000 data bus, several specialized connectors were utilized that are available from Warwick Control. For interfacing to the PC-based X-Analyser software, any Kvaser CAN interface can be used. In the Warwick NMEA 2000 maintenance kit, the Kvaser Leaf Light is used. Most Kvaser interfaces connect to the USB on the PC, and connect to the CAN bus via a D9 connector. There are Kvaser models that have the NMEA 2000 M12 connector option, but if you are utilizing the standard D9 connection version, Warwick Control offers a M12 to D9 adaptor cable.

For connecting the oscilloscope option, the PicoScope PC-based software is used. In the Warwick kit, the PicoScope model 2206B is used, which is a USB/PC based oscilloscope interface. The software is supplied by PicoScope. The two-channel interface is connected to the two CAN wires on the NMEA 2000 CAN bus via a specialized M12 to dual BNC connector supplied by Warwick Control.

Connecting the above devices to the NMEA 2000 Trunk Line is a simple matter of adding a M12 T-connector at any point of the NMEA 2000 trunk line. These are easily acquired by many manufacturers. Fig. 9 reviews these options that are available in the Warwick Control NMEA 2000 maintenance kit.

D9 to M12 Adaptor

M12 Tee Connector

BNC to M12 Adaptor
Connected to M12 Tee

Fig. 9: Connections for the NMEA 2000 trunk line.

Throughout this article we have covered the aspects of CAN and how it maps into the NMEA 2000 standard. The article is meant to provide a brief overview of CAN and NMEA 2000. **MEJ**

> ✱ For more in-depth information, please contact Warwick Control at sales@warwickcontrol.com.

Standards Update

recommendations based on the findings of the Beta Team testing to date. To maintain positive momentum, a Virtual Private Network (VPN) has been established so the Beta Team can continue to interact and interoperate as if they were in an actual room together. Hopefully this will facilitate the delivery of final beta products.

The goal is to have another Beta Team face-to-face meeting in September to demonstrate the interconnectivity and interoperability of all the OneNet Draft Standard modules. Publication and release of OneNet Version 1.000 is scheduled before the end of 2017. Yet, that date is flexible based on the final results of the Beta Team discoveries and findings and any subsequent technical changes to the OneNet Standard that may be required.

We will update you at the NMEA Conference & Expo in Bellevue, WA, Sept. 26-28. Hope to see you there.

Total Connectivity

that it will take the effort of many and that we're only limited by our imagination, so grab your 007 gadget kit and let's see where it takes us.

Abo