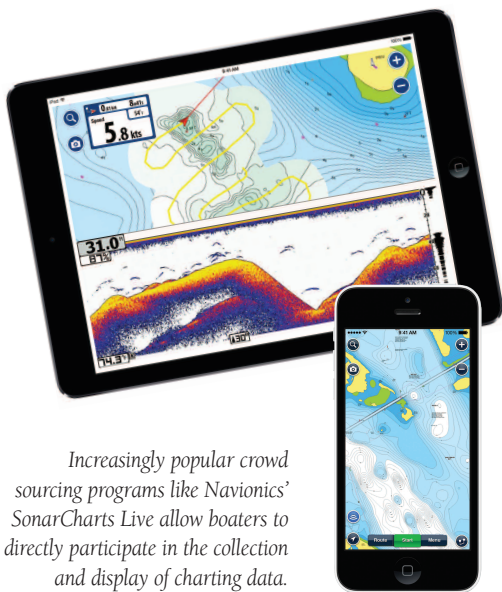# Electronic cartography

Mapping a future shaped by innovation and savvy systemwide

BY ZUZANA PROCHAZKA

I t's hard to talk about trends in marine electronic cartography without discussing onboard navigation in general. Today, getting from A to B involves complex concepts that are highly integrated and continually evolving.

Most of the key concepts come together in the onboard multi-function display—MFD—a highly specialized computer that evolved from the chartplotter. However, unlike your dad's Oldsmobile that stayed nearly the same over 30 years, much of marine navigation has leapt ahead over the past decade and the rate of change is accelerating. Staying ahead means recognizing what is happening from the point of view of hardware and software manufacturers, cartographic providers, dealers and boaters, and then rolling with it. Experts we talked to pointed to five evolving trends:

Evolution of the user interface

"The most significant recent evolution in navigation has been the user interface," says Jeff Hummel, Director of Business Development at Rose Point Navigation Systems, developer of Explorer PC software.

Ken Cirillo of Jeppesen, which owns C-MAP, agrees. "Cost effective and much improved capacitive touchscreens and cheaper processing power have changed the game."

The cartographic interface today has fewer menus and information collapses in a way that mirrors mobile apps we use every day. Multi-touch, with complete pinch-to-zoom capability, and

Increasingly popular crowd sourcing programs like Navionics' SonarCharts Live allow boaters to directly participate in the collection and display of charting data.

Furuno Senior Product Manager Eric Kunz (at right) shows off some of the many integrated functions and features of NavNet 3D. He says the "onus is on the industry to reduce chart management requirements on the customer."

large clear screens make information-packed cartography easy to see and use. Panning and zooming are fast. Cheap processing power crunches through complex cartographic detail and delivers faster redraw, enhancing safety because we know where we are at all times.

Adding ancillary information to the screen builds boater convenience. For example, Points of Interest (POIs) may include information on nearby fuel docks and restaurants so it is easier to plan ahead. Satellite photography allows the coastal cruiser to visualize the entry to a new harbor while cartographic overlays like laylines help sailors win races. C-MAP's 4D charts and Navionics Platinum+ add levels of editorial like fishing content to help fine-tune bait and lure information, sport fishing regulations, and angling records. Shane Coloney, Product Manager of Content and Cartography for Navico, says, "The boater benefits from layers of context and there's a demand for more."

Of course, all this adds on-screen clutter as more detail shows up on the chart. Cirillo and Hummel agree that the future will be about simplification and intuitive presentation. "Boaters have no tolerance today for an interface that is confusing or difficult to use," says Cirillo.

Hummel envisions the day when MFDs will have flexible, organic LED (OLED) screens, where every pixel is illuminated so sunlight will no longer be a factor. Michael Kaste, Digital Marine Program Manager for Navico's Go Free, gives a nod to the boat mimicking the home. "Boaters are used to 100 inch TV plasma screens at home so the expectations of what is onboard are high."

Other visions of the future include smart charts that automatically correct tracks to route around obstacles and MFDs that are completely agnostic as to the source of the cartography and will work with everything. "Everyone wants to own the glass," says Coloney. "Whoever can bring simplification will have it."

Enhanced situational awareness via integration

There is continued consolidation and integration in the MFD of non-cartographic information that is making navigation more comprehensive. Weather, sea surface temperature, AIS (Automatic Information Systems), DSC (Digital Selective Calling), onboard surveillance and night vision cameras, radar and sonar data and so forth are input to the MFD, which overlays much of this information onto the chart. These components communicate thanks to NMEA 0183 or NMEA 2000®, and are making integration seamless, resulting in enhanced situational awareness under way.

Hummel believes that ever-improving sensors will allow great progress in this area. Down-, forward- and side-scanning sonar is already a reality and each manufacturer has made tremendous progress in clarity, but exceptional multi-beam sonar will take this to the next level. One striking example of what may be coming is the Echoscope by CodaOctopus, which does real-time 3D imaging with sharp results like those from a camera on a nuclear submarine.

Additionally, geospatial or georeferenced information (think Google Maps overlay) will increase accuracy and recognition of surroundings. Improved interoperability and open standards are key to making the result seamless to the user. Eric Kunz, Senior
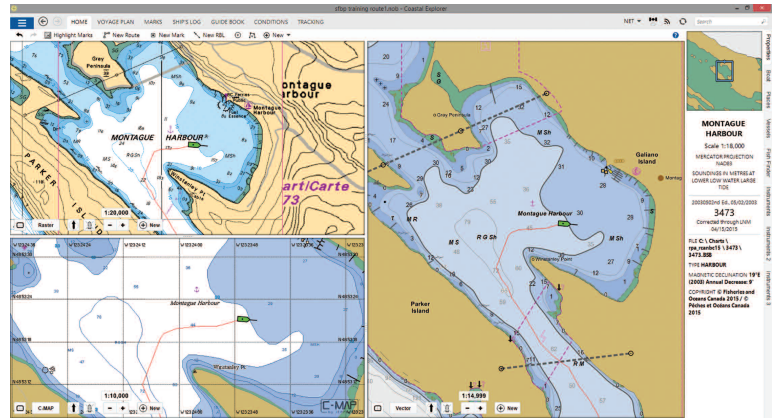
Above are screen shots of Rose Point Navigation Systems software using multiple chart formats. At top left is a CHS raster. Below it is a C-MAP vector. A CHS vector is on the right.

Below is a C-MAP vector chart with some of the additional features that can be seen with a guidebook in electronic charts.
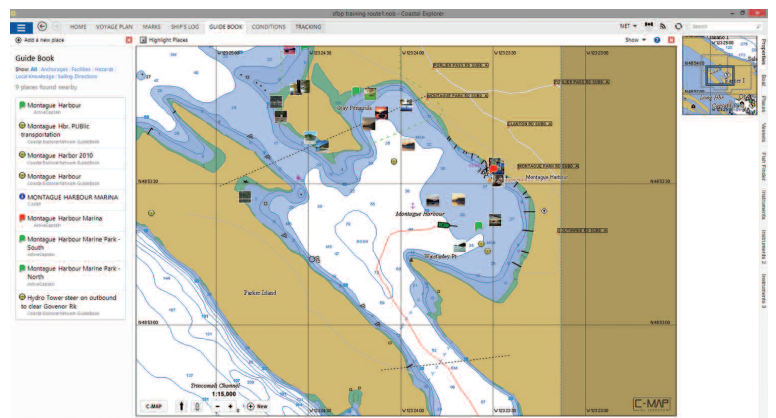
Product Manager at Furuno, says, "The onus is on the industry to reduce chart management requirements on the customer."

Cirillo adds, "The boater doesn't care how it works, just that it works."

Increased use of crowd sourcing

Crowd sourcing has come to boating in two ways—as Personal Bathymetry Generators (PBGs) and as a social hub of shared information. Navico and Navionics led the charge in recognizing that fishermen are the ideal providers of supplemental cartography and launched Insight Genesis and SonarCharts, respectively.

This use of bathymetry is the most visible version of crowd sourcing and allows boaters to record sonar and GPS data generated via their boating outings, upload the two for crunching by the cartography provider or MFD manufacturer, and then receive back a custom digital chart. This is particularly useful on uncharted lakes and obscure fishing spots and enhanced detail is making even charted coastal data better. "We've gotten 7.5 million acres of user logs in SonarCharts in one year," says Paul Michele, National Sales Manager for the Americas at Navionics. "We've empowered boaters to create their own information."

Supplemental and embedded charts work together to improve cartography

C-MAP MAX-N+ 2015 features like high-resolution bathymetry, tides/currents projections and custom depth shading are aimed at giving anglers a technological edge when it comes to figuring out where and when the fish are going to bite.

and everyone is getting in the game. Navico's Insight Genesis charges $19.95 for each download and uploads are free, or you can join for $99 annually and receive unlimited downloads. With their Social Mapping, you determine levels of sharing so you can be the only user of your recorded data, if desired. Navionics' Freshest Data automatically shares your uploads.

Sharing data has been controversial for two reasons. First, there seem to be more data takers than givers, but that's changing. Sec-

ond, fishermen are loath to give up their secret spots, but as Coloney and others agree, the secret spots aren't really all that secret. About 70% of recreational users share, which is not the case for commercial fisherman. "Sharing may be done in tiers like on Facebook," says Kunz. "That's when crowd sourcing is not really for the crowd."

If you want a chart but don't want to share at all, Humminbird Autochart is a $199 software package that generates charts from your pings with no need to go online or give up your data.

Some have worried about the integrity of the uploaded information, but software algorithms compare data and reject anomalies and, says Kaste, there are actual humans reviewing the results. Using this kind of

bathymetry can be challenging. When your very own chart comes back to you, it's missing nav aids like markers or contour lines that appear on standard charts but you can view both on a divided screen and interact with them seamlessly.

Crowd sourcing is not limited to fishing. ActiveCaptain is a Web-based interactive cruising guide that collects a variety of information like fuel dock and ramp locations, photos, marina amenities and contacts via an extensive member base. The information is displayed through various apps and PC-based charting programs, such as Furuno's MaxSea TimeZero 2, Rose Point's Coastal Explorer and Garmin's BlueChart Mobile app.

Most MFD manufacturers use more than

The value chain & the dealer

Ten insights for success

Change is good so long as your business model changes with it. The way cartography and navigation are sold has been evolving from the days we bought paper charts to when we ordered preloaded chart cards. Today, some dealers create custom-loaded chart cards and even teach a boater how to use them, perhaps when installing a suite of new electronics.

However, as distribution of cartography and supplemental information moves toward direct delivery over the Internet, how will it affect each party in the value chain? What happens when charts no longer live on cards but rather reside in the "cloud"? If charts are delivered via a subscription model, say like music on Spotify, will that work in a niche market that doesn't have the user volume to be profitable when charging pennies per transaction? And how will costs be amortized in what is, sadly, a shrinking industry?

The value chain is changing and everyone must evaluate their place in it. This isn't easy because the evolving market is a moving target. However, change creates opportunity and there are some bright spots. Below several industry players share some insights:

1 A fragmented customer base means specialization will be a key competitive advantage. There are multiple functional customer segments (sailing, power cruising, fishing, megayachts, etc.). A deep understanding of the details of various cartography packages will allow manufacturers and dealers to segment the customer base and surgically target boaters' specific needs. For example, fishermen tend to update charts more often than cruisers. Boaters in the Northeast, where high tidal activity means shifting sandbars, may need more fresh information than boaters in other parts of the country. "There is no substitution for a thorough qualification of the customer," says Jamie Reme of The GPS Store.

There are also differences based on age and comfort with technology. "There are basically two groups of people," says Furuno Senior Product Manager Eric Kunz. "Tech-savvy captains are likely to adopt changes while salty sailors may be happy with what they have, and as an industry we need to know how to work with both."

2 The market is growing—in different areas. At the high end, the proliferation of the glass bridge has brought sophisticated equipment to vessels sized far below megayachts. Today's 50 foot coastal trawler will have at least two MFDs and probably four, along with multiple sensors, cameras and other bells and whistles that previously were the realm of superyachts.

On the other end of the spectrum, small boats including fishing skiffs and even kayaks are becoming cartography enabled. When a 4 inch MFD that includes a sonar sensor like Raymarine's Dragonfly starts at around $200, the volume of boaters who can now afford advanced cartography skyrockets. Don't ignore the small boater or even the standup paddler.

3 It is easy to fear shrinking margins or see selling opportunities evaporate as customers download cartography directly from manufacturers. But there are dealer benefits in this cycle, especially in troubleshooting. Customers can upload screen shots directly via the MFD, which gets everyone to a solution faster because they can see the scenario right on the water. Dealers save money by avoiding non-revenue producing calls. And with the advent of full onboard diagnostics and preventive maintenance schedules moving via the MFD, manufacturers will be able to pass on leads to dealers in a customer's area when it's time for service.

4 There is a push to professional maritime navigation. Many of the leading recreational electronics players are chasing the lucrative commercial customer. Furuno, JRC and Koden are already there and Navico is fast on their heels, while C-MAP and Navionics are carving out their own niches in the market even as they deal with government-controlled mandates for charting systems. There may be newer kinds of customers in different markets.

5 Tech is king. Listening to Kunz describe the versatility of an Ethernet hub system as it pertains to navigation, it becomes clear that the days of wrenches are gone and if a dealer isn't highly tech savvy, survival is doubtful. Maritime Communications' Ken Englert summed it up this way: "I used to be a boating guy, but now I'm a computer guy."

6 To update is to upsell. "Bundling is a great way to make extra margin," says Raymarine Marketing Manager/Americas Jim McGowan. Reme notes that Garmin also has a high attachment rate (upselling detailed charts with hardware purchases) due to bundling and rebate structures. Encourage the customer to update cartography and MFD software to take advantage of additional features and benefits.

7 Sell the sizzle. Ok, that's not new but if manufacturers and cartography developers fail to make benefits clear in their product offerings, dealers who understand detailed features and can translate them into boater benefits for buyers will earn loyal customers. Always be able to tell a customer how the next product/service/chart will make their time on the water cheaper, safer, simpler or more enjoyable, and it will sell itself.

8 Ask for better training. Push the manufacturers for more comprehensive training. A thorough understanding of the product makes the dealer's job easier, so take advantage of free training and ask for tech support whenever necessary.

9 Prices are lower but there's a threshold below which nobody makes money. So instead of paying less, customers are getting more. Take the iPhone 6—it's pretty expensive but consider what this pocket computer can do versus yesterday's cellphone. It's good to point out to your clients the power and convenience they're getting with today's navigation tools.

10 The patience factor. According to Michael Kaste, Go Free Digital Marine Program Manager, as cartography makes a home in the cloud, updates can happen faster than waiting for the next chart card revision. "Expectations are for information to be real-time," agrees Navionics National Sales Manager/Americas Paul Michele. "It's all about immediate gratification, so whoever can provide the fastest, simplest and most useful solution will have an edge."

You can't hold on to past business models or you might become the premier buggy whip manufacturer in a world with no buggies. The best strategy is to embrace change, learn where the value in the value chain is moving, and catch the next wave.

Like most MFD manufacturers, Raymarine uses more than one cartography supplier. Raymarine works with C-MAP and Navionics, and has its own Lighthouse products based on Northport Systems technology.

one cartography supplier. For example, Raymarine works with C-MAP and Navionics, and has its own Lighthouse products based on Northport Systems, which also supplies cartography to Fugawi. In the US, NOAA is the largest provider of charts followed by regional hydrographic services. Most of the raw data, in the form of raster charts, is free.

International hydrographic organizations tend to sell data and prices vary wildly. In some countries, like Denmark, they get exorbitant. Navionics even has a small fleet of survey vessels to generate their own pings in notoriously difficult areas like the Bahamas. It's clear that data sources are somewhat limited, which is why processing supplemental data generated by thousands of boats is bound to make cartography more accurate.

Better connectivity

One thing is for sure, the marine industry is closely watching innovations in mobile devices such as smartphones and tablets as well as developments in the personal computer industry. Meanwhile, increased connectivity is making it possible for onboard functionality to emulate land-based devices. "Smart devices have molded some high expectations on both functionality and usability," says Jim McGowan, Marketing Manager for the Americas at Raymarine.

MFDs from most of the leading manufacturers include WiFi capability but the term causes confusion. When they hear WiFi, boaters think they can surf the Web from their MFD. Today, MFDs are mostly limited to cartographic and software updates that no longer have to be done via the home PC.
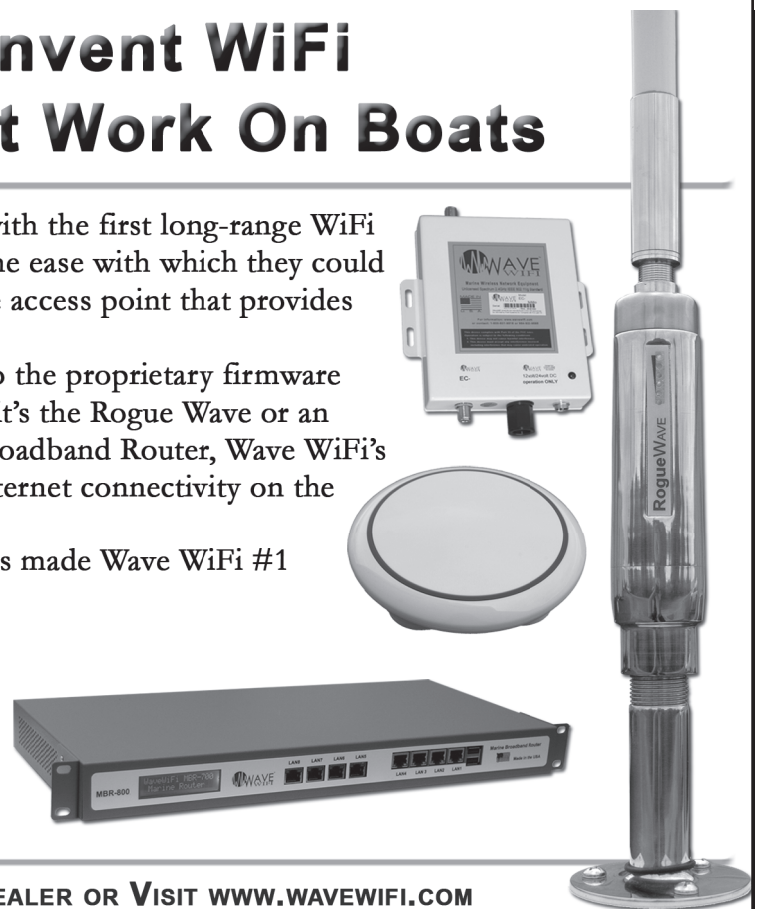
Navico's Go Free is one example of how new chart details can find their way directly onboard via a WiFi gateway linked to a Navico MFD. Navionics' Plotter Sync allows data to be downloaded onto an iPad at home and then uploaded via WiFi to the MFD onboard. Nice,

but it's hardly the heady world of full online access.

The gold standard of connectivity will be apps, like those we use on our smartphones. Today, Navionics Mobile or the AIS app ShipFinder are hot, but the goal is to develop apps for use directly on the MFD and interface with them in a way we already recognize. Go Free's long-term goal is to become a sort of iTunes for downloadable boater information and apps. Coloney's vision is to have a proliferation of $4.99 apps that work on the displays directly.

Consider Facebook, Yelp and others that provide user-generated content we reference every day, and now think about how boaters can benefit. We want access to shore-side concierge services and to be able to share experiences and aspects of boating without necessarily being together with friends. That's why programs like SailTrac (which is like Facebook for boaters) are gaining traction. "The conversation extends beyond the location and beyond the boat," adds Michele. "People love to share."

Take the user-generated vehicle traffic app, Waze, and imagine a marine app that would show real-time nautical hazards and vessel congestion right on your MFD. Let's face it, the MFD has become a social hub and the variety of ways it may be used is about to explode—if boaters can get hyper-connected, that is. "Content may be king but data [like cartography] is a commodity," says Cirillo. "Connectivity is a way to bring the chart back as the heart of navigation."

Of course, connectivity is currently hampered by satellite access that is expensive, cellular 3G and 4G that is limited to coastal excursions, and marina WiFi that is sometimes sketchy and unable to support large file downloads or Web surfing. Nevertheless, social boating is coming and connectivity will make it possible. "There is still a gap between the smartphone and the MFD," says Cirillo. "But the next step will bring practical, everyday use to navigation systems."

Predictive navigation

Predictive solutions are being used in various industries like fire suppression systems and occupational safety technology to increase efficiency. The goal is to build on past performance to create a set of scenarios that will help predict outcomes and build a safer or more enjoyable future experience.

Professional shipping is already using these elements to optimize cargo loading, fuel efficiency and safe routing for ocean-crossing ships while commercial fishermen use past data to find hotspots faster and fish longer to make more money in a single outing.

Although it's early in the game, some of these concepts are bound to trickle down to recreational boating. Algorithms that use data from past outings will work behind the scenes for future voyage optimization. The boat may anticipate where the boater wants to go, how fast, what route to take to save time or fuel, how to route around disruptive weather and more, and then display the information that will be needed and/or prompt the captain as necessary.

It's a bit futuristic at the moment but Cirillo understands that predictive navigation will capitalize on enhanced cartographic capabilities and system integration. He is convinced it's in the not-too-distant future and adds, "A boat, like a car, can learn our patterns and make our trips safer, faster and more fun."

So where is all of this heading?

There are many points of view and some strong opinions when it comes to marine cartography, but one thing the experts recognize is that currently everyone is playing in, or at least near, each other's sandbox. The lines between hardware, software, connectivity, cartography and the distribution channel are fuzzy. Will that result in consolidation or fragmentation of the industry? Will there be vertical integration? Will some entities purchase and absorb others or will there be room for creative entrepreneurs, like app developers, to add unique value? It's hard to tell. The only thing that is constant is change and like your dad's Oldsmobile, getting from here to there will evolve over a bumpy path, so fasten your seat belt and roll with it. **ME**

About the author

Zuzana Prochazka is a freelance writer and photographer who contributes regularly to over a dozen sail and powerboating magazines and Web publications. A USCG 100 Ton Master, Zuzana has cruised, chartered and captained flotillas in many parts of the world and serves as an international presenter on charter destinations and technical topics. She is the Chair of the New Product Awards Committee for the National Marine Manufacturers Association, which judges innovative boats and gear, and a nine-year member of the board of Boating Writers International.