

New Technology Makes for Safer, More Precise Navigation

Fathom recently interviewed RAdm. Richard D. West, Navigator of the Navy. Rear Admiral West discussed the Navy's transition to digital/electronic navigation, an initiative that will make maritime navigation safer and more precise in both the merchant and military fleets. During the interview held at CINCLANTFLT headquarters in Norfolk, Va., the admiral also discussed the impact of navigation technology on bridge watchstanding requirements.—Ed.

Admiral West, why is the Navy transitioning to digital/electronic navigation?

Simply put, it's the smart way to go! By taking advantage of the latest advances in navigation technology, our fleet will operate with greater safety, our precision weapons will get on target more effectively, and our manpower requirements will be reduced. This equates to greater efficiency at less cost!

Traditional navigation methods tell you where you were at the time the last radar or visual fix was taken. By the time the fix is plotted, it is time-late and subject to some error, and it is "historical data." Combining electronic navigation with GPS enables you to know where you are at any given moment, without having to wait for the fix and plot. It is instantaneous and constantly updated; it's real-time!

Digital charts are "smart" charts with layers of information incorporated into them. And they are interactive. You can add data into them, take



data out of them, and display selected "layers" of information. For instance, on a harbor approach, you have the ability to display landmarks, navigation aids, obstructions, hazards, soundings, etc. You can click on any of these things to display important information relative to the symbol, and, eventually, you will be able to bring up visualizations of them. It's a phenomenal capability and an immense improvement over paper charts.

We've reconstructed some recent groundings and determined that, in most cases, those incidents would not have happened if the ships had had an operational electronic navigation system to

enhance their situational awareness. Commanding officers who have purchased their own electronic navigation systems swear by them. I don't leave home without one! When properly used, electronic navigation provides a far wider margin of safety, and I believe the Navy needs to adopt it very quickly. In the Navy, it's in its infancy, whereas the merchant fleet has been using it for about 10 years.

How do we get there from here?

Well, Navy vessels already are using electronic navigation systems in conjunction with more traditional methods to enhance situational awareness. But the Navy needs to set certification standards, and we are working actively on that. We also need to train our navigation teams to utilize these assets to maximum advantage, and that is another area where we are making great strides.

You are a former commanding officer of the Surface Warfare Officer School (SWOS)—are there any anticipated changes in how we train our SWOs in the field of navigation?

First, let me say that we will not stop training our navigation teams in traditional methods. Understanding basic celestial and manual navigation techniques will always be a fundamental part of good seamanship. But we need to expand the training to include electronic and digital systems, and an understanding of geospatial referencing and the importance of chart datums.

We're also looking at the use of simulators. Marine Safety International (MSI) actually started providing simulator training at the Surface Warfare Officer School (SWOS) in Newport, and then later expanded it to San Diego and Norfolk. The use of realistic, high-fidelity simulations really has enhanced training for ship-handling, maneuvering, and bridge resource-management. The simulator wasn't originally designed for navigation training; it was more for complex ship-handling skills like coming alongside or leaving and entering port. It evolved into a navigation trainer because it offered us realistic simulations on key navigation evolutions in restricted waters. Most simulators—not only in DoD but also in the commercial maritime world—use digital charts with real-time positioning via GPS, so you can learn how to navigate electronically in simulators.



Photo by Matthew J. Thomas

Is navigation training going to be more expensive now, since we have to incorporate electronics into both training and into our ships' systems?

Initially, we'll have an expense during the transition because we haven't really embraced electronic navigation. That's the mission we're on now and have been for about the past year and a half. We already have introduced some training on electronic navigation to Navy schools—from the quartermasters and junior officers to the navigators, executive and commanding officers. The transition from the old way of doing business to the new will add some expense but minimal additional classroom time. We must bring this capability to the fleet. Eventually, we hope to go paperless and run solely on electronic charts, and there will be monetary savings because of manpower reductions and the costs associated with paper-chart production and upkeep.

How about modern warship design? Are ship-handling characteristics changing significantly, whereby the curriculum has to be changed because of modern warship design?

No. We haven't made any radical changes in ship design that would change how we drive ships;



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seamanship has not changed. But surface effect ships (the LCACs and some faster vessels) have introduced a speed factor. This means you really have to be thinking ahead, and the ability of electronic navigation to show you exactly where you are in real time, and then project ahead, becomes more important. We also are operating more frequently in the littoral, and the complexity of that environment requires a greater deal of precision, which electronic navigation also provides.

Are hydrofoils a dead issue in the Navy?

I think hydrofoils had their time, and they were very effective for their high speed. There’s a lot of interest now in surface-effect and twin-hulled (SWATH) vessels for high-speed transport

of troops and supplies. New ship designs for littoral operations no doubt will explore those hull designs.

In terms of ship collisions and groundings: Does the Navy have a zero-tolerance-for-error policy and always hold the captain responsible when a vessel is improperly hazarded?

Well, that’s not really my area of responsibility, but I wouldn’t say we have a policy of “zero tolerance.” Every collision and grounding will be subject to an investigation and a determination made, based on the facts and any mitigating circumstances. There are times when a commanding officer has taken every reasonable precaution to avoid a situation, but the circumstances are beyond his control. If the commanding officer has done every-

thing reasonable to prepare and operate his ship at sea safely, I think there is tolerance. If not, then he is solely responsible for the circumstances of hazarding his ship and crew. I do believe, however, the use of electronic navigation systems, coupled with a robust training program, will reduce the number of collisions and groundings.

What's the budgetary impact when the Navy has to spend unforeseen millions of dollars to repair ships after collisions or groundings?

We're spending millions of dollars a year on groundings and collisions! You don't budget for catastrophes, but they clearly take money away from the top line of the Navy's budget.

Shipboard Manning—what automated bridge-control systems do we now have in the works? Are we going to be able to reduce the size of our bridge-watch teams?

Definitely. Evolving technology for navigation and ship-handling eventually will enable us to reduce manning significantly. GPS positioning, automated display, and electronic updates to charts will take much of the burden off of the navigation team. Voice-activated charts, electronic monitoring of the engineering-department functions, and autopilot functionality will reduce other bridge-manning requirements. Many commercial vessels now operate with one person on the bridge. Obviously, the Navy's requirements are much more demanding than those of commercial vessels, but I do foresee a significant reduction in bridge-manning needs.

Actually, many merchant ships have, for several years, sailed with only one person on the bridge who relied on a bridge monitor, or "tell-tale" box, to indicate the status of various shipboard engineering functions. This does require additional knowledge on the part of the lone bridge watch-stander, and the United States Merchant Marine Academy accordingly has modified its curriculum. The academy used to teach two separate tracks: one for bridge watchstanders and the other for engineers. They are now combined.

Could a ship today conceivably be on autopilot?

Yes. In fact, I had an FFG-7 several years ago that could be put on autopilot, with proper safeguards. For long ocean transits, that is the way to do business because it keeps down the rudder changes and saves fuel. In fact, the merchant-fleet ships are on autopilot most of the time, just for that one reason: to save fuel. A rudder is basically a huge "barn door" that slows down ships and burns off fuel. The Navy has had autopilots on ships for years, and I used it frequently, except for when I wanted to maintain helmsman proficiency. Obviously, you don't use autopilot when you go alongside to unrep, when you're going into port, or during any other restricted, critical maneuvering evolution. You still need to have highly proficient helmsmen.

Do we have the capability to install devices that record a ship's movement data like the black boxes aboard aircraft, which could be used for mishap analysis?

Commercial industry has developed voice-activated logs and tapes and other experimental devices. Many shipboard systems, such as the Aegis combat system, automatically record parameters. Some integrated bridge systems also record data. There is a new international agreement which





Photo by Matthew J. Thomas

proposes that by the year 2003, all new-construction, large merchant ships will have an Automatic Identification System (AIS) that acts like an aircraft's IFF ("Identification - Friend or Foe.") The system will include a transponder to constantly transmit a ship's name, course, speed, and cargo information—all the identifying data of that ship. When you come within visual or line-of-sight range, you automatically will receive that transmission. That data will be displayed on a screen on your ship's bridge. The merchant fleet soon will be going to that, and we probably will endorse a military version for Navy ships in the near future. The second piece of at-sea safety coming along is a "black box" recorder, which will record data pertinent to accident and incident investigations.

With everything being electronic and electronically stored, how does that work in terms of backup data?

The electronic navigation-system capabilities we're putting onboard ships require total, but separate, redundancy. If you lose one part of the system, the other immediately must be up and online. Obviously, if you lose total electrical capability on a ship, you'll probably have bigger problems

than figuring out exactly where you are, although you certainly knew where you were right up to when the load was dropped. You'd have to lose the entire electrical load because each system has a different power source. You're still better off with electronic charts than with paper charts when the lights go out.

Is there a system currently in place or under development whereby a ship preparing to get underway has only to send a message requesting an electronic update to its navigation charts?

Yes, there is. It's called Vector Product Format Data Base Update (VDU), which has been developed by the National Imagery and Mapping Agency (NIMA). The ship will receive the digital maps and charts on a disk and they'll be automatically updated and displayed. Rolled up charts on the bridge soon will be a thing of the past. An analogy can be made to e-mail; e-mail has effectively replaced paper letters due to speed and convenience.

NIMA is the DoD-authorized producer of all digital and paper charts for the Department of Defense. They have an immense problem right now because they have mandated requirements to produce both paper and electronic products with limited resources. We quickly must get out of the paper business and focus our resources on the digital business.

Any closing thoughts about where we are headed with navigation?

I've been going to sea for many years, and I'm really excited about the Navy's transformation to digital and electronic navigation. It provides you with real-time, instantaneously updated positioning to an accuracy measured in feet! It's a safer, more precise, and more efficient way to navigate, and it is the geospatial grid for all warfighting interoperability. It is essential to maintain the best-trained and combat-ready Navy in the world! 🌐