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Augmented reality and e-navigation

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Readers will (hopefully) forgive me for straying from my usual legal topics to briefly explore a possible future.

Electronic navigation has made numerous advances since radio-direction finders of the 1920s and radar in the 1940s. The global positioning system (GPS) has provided unheard of accuracy in location determination and the automatic identification system (AIS) has provided needed information concerning nearby vessels. To some extent, these information sources have been combined with the electronic chart display and information system (ECDIS).

A transformative technology has been invented and is now moving out of the laboratory that has the potential to allow radical improvement in numerous endeavors, including the navigation of ships. The technology is augmented reality.

Augmented reality (AR) is defined as a field of computer research that deals with the combination of real-world and computer-generated data. Most AR research currently involves use of live video imagery that is digitally processed and "augmented" by the addition of computer-generated graphics (think of the Wii computer/television game system where the user pretends to bowl or sword-fight and sees it apparently occurring on the screen). Advanced research includes the use of motion-tracking data, fiducial marker recognition using machine vision, and the construction of controlled environments containing any number of sensors and actuators.

Recently, the technology has been moving out of the science lab and into the marketplace, at least on a trial basis. A medical equipment company is marketing an AR machine called "VeinViewer." It shines onto the patient's skin a special light that is particularly absorbed by the blood veins. A digital video camera captures the reflected light and determines the exact location of the vein. A projector then shines a map of the vein network on the skin in real time, keeping up with movements of the patient, making hypodermic needle injections easier and more accurate. Somewhat similar equipment is being developed for hospital operating rooms.

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A tourist location in Portugal has installed an AR sightseeing viewer that allows users to not only see magnified images of the surrounding area, but also superimposes place names and explanatory text over the particular objects being viewed. Animated graphics has been added to show what some structures looked like in the past.

While it has yet to be developed, this technology could be combined with the data and sensors currently available in the marine sector to transform navigation as we know it today.

Imagine in the year 2020 that a ship is coming into the port of Jacksonville. The officer in charge of the navigation watch is wearing AR goggles. In addition to seeing the ocean and some ships in the distance, she receives text above each ship with the name, type, course, speed, and closest-point-of-approach (CPA). She also sees, superimposed on the ocean, her ship's trackline, giving her the ability to immediately determine if the ship is straying off course, possibly due to the current or weather or poor helmsmanship. The goggles can also display the position of endangered North Atlantic right whales. Course changes can be seen far in advance, as can the pilot boat. The goggles can even display data from below the surface, showing approaching shoals and other obstructions. It could also display fixed objects, such as bridges and piers, that may be obscured due to poor visibility.

The AR system could also be programmed to signal warnings in the event of danger. If another ship's CPA was below minimum, there could be an audible and visual alarm. If the ship was heading toward shoal water, an alarm could sound. The system could even be programmed to alert if an expected event, such as arrival of the pilot boat, was not occurring.

The navigator will no longer have to shift back and forth between looking out to sea and studying a radar or ECDIS screen or monitoring a fathometer. This would be a geographical information system (GIS) on steroids.

Such a maritime navigation system does not yet exist, but the technology is available. An internet search of the term "augmented reality" will turn up hundreds of hits. The technology, though, is only as good as the data available. Electronic charting is improving, but coverage gaps exist. AIS is here, but many ships are broadcasting inaccurate data because of installation problems and lack of training and familiarization among ship's officers. ECDIS integrates many sensors, but projects them onto an electronic screen in a variety of formats. It relies on the individual mariner to make sense of the display and translate that into useful information so that the appropriate action can be taken. If, instead, the information is overlaid onto the real world (similar to the "heads up" display in fighter aircraft), the mariner will find it much easier to interpret and understand the information being provided.

AR, when it comes to the maritime sector, will not be a panacea. Radar was expected initially to eliminate the risk of collision. While the risk of collision was significantly reduced, it was not eliminated. There have even been radar-assisted collisions. AR, though, has the strong capability to improve safety by eliminating the need to transpose information from a display module to the real world.

There will, though, be some legal issues to consider – there always are. Before AR can be installed on a ship and utilized in the electronic navigation thereof, the equipment must be shown to be both reliable and accurate. There must be a method for keeping the information that it displays up-to-date. Maintenance must be factored into the equation. Finally, the crew members who are expected to utilize the AR must be trained in its operation. None of these legal requirements are unique. They are the same ones that apply to radar, AIS, ECDIS, and the other devices that are commonly used on ships around the world. The difference with AR is that it would serve as a super-integrator of many ship sensors, providing the navigation officer with information from multiple sources combined into an easily-understood format overlaid onto an actual view of the real-world.