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Electronics for the Real World

By Capt. Bill Brogdon / Contributing Writer

Suppose you are buying a new or used boat. The plethora of electronic navigation equipment available today is almost bewildering. So how do you go about choosing the right combination of electronics to meet your needs? I will try to provide some help. My assignment was to outfit two theoretical boats: a small outboard boat with a budget only for essential electronics, and a boat 30 feet or larger with a higher budget. While your electronic navigation needs don't necessarily depend on boat size, the equipment does depend on budget and available space, as well as the areas in which the boat is operated. I'll start with the small-boat, limited-budget scenario.

The four essential instruments for navigation measure time, direction, depth and speed. I use a digital wristwatch with a stopwatch function for time, though there are many alternatives. Please yourself, but remember that a stopwatch feature is handy.

A high-quality, properly adjusted magnetic compass is essential for providing accurate, reliable direction. Don't skimp on the compass and remember it is hard to build a good compass for a smaller boat. A small boat has a lively motion that makes a compass card dance around. Plan on spending at least $100 for a good magnetic compass. I prefer the flat-card type because they are more natural to use than the direct reading type, which appear to turn "backward." In addition, you can take bearings easily across a flat card compass.

Why shouldn't you use the GPS receiver's compass feature? It is readily available, after all. There are several reasons. First, it doesn't give the boat's heading; it gives the direction of travel. If you have to steer to correct for current, an ordinary GPS receiver will give you not a clue as to the boat's heading. Second, the GPS "compass" doesn't change as quickly as you would like when the boat is turning. You have to steer a steady course for a while for it to approach the correct reading. Lastly, it is susceptible to power failure, interference and short periods of signal loss.

In addition to a timepiece and compass, a depth finder is essential. Even a small outboard skiff should have one. In my opinion, a small monochrome LCD graph depth finder is the best choice where expense is a concern. The graph shows the history of depth changes, unlike a digital depth finder that can only show the momentary depth. If you operate in areas of shallow water, such as Chesapeake Bay, be sure to get a depth finder with a lowest scale of 0 to 10 or 0 to 15 feet. Where it is shallow, these scales provide the best data for those last few feet before an unwelcome bump.

You should be able to measure boat speed through the water with an electronic log. Most speed logs allow you to display distance through the water, based on the speed readings. Many depth finders also measure speed and water temperature. Surface water temperature is an important consideration for anglers.

GPS and VHF

The next logical piece of equipment is a navigation receiver. Prices for GPS receivers range from around $100 to $3,000 or more. A GPS receiver is essential to finding your way to distant places, especially in poor visibility — for example an underwater structure that holds fish. The simplest portable GPS receivers will meet 90 percent of your navigation needs. They will store waypoints, and show the distance and direction to a destination, in addition to providing a constantly updated position. Don't leave home without one.

Be sure to get a GPS receiver that is programmed for the WAAS corrections, which give higher position and speed accuracy than "raw" GPS. A portable GPS also can be used ashore, an advantage if you hike, fish or hunt.

Fixed-mount GPS receivers have larger displays and control keys. This is important on smaller boats. We older sailors don't like to wear our reading glasses all the time. It also is easy to hit a wrong key on small units. Several companies offer combination depth finder-GPS receiver units — a good option if space is limited.

Any GPS unit's usefulness depends on the operator's skills. I encounter a surprisingly large percentage of boaters who have yet to master the basics of their GPS receivers, much less get the most out of the unit. There is a section in my book, "Boat Navigation for the Rest of Us," (International Marine/McGraw Hill) devoted to beginning with a navigation receiver. The receiver manual is essential, but most of them explain how to

perform various functions, not when and how to use these functions. Plan to spend some time learning.

Along with the GPS receiver, you'll need a VHF-FM radio. Plan on spending about $150 to $250, plus the antenna. A fixed-mount receiver has higher power output than a portable, and a fixed antenna also enhances performance. Most smaller powerboats use an 8-foot, 6-decibel antenna, and it is a good match. Larger powerboats can use a 12-foot, 9-decibel antenna that has a flatter radiation pattern. Most sailboats use a 4-foot, 3-decibel antenna to provide an adequate signal at large angles of heel.

A hand-held VHF radio can function alone on a small boat, and most larger boats carry one as a backup to the fixed mount. In fact, last summer I tried to call a friend whose boat was a couple hundred yards away but couldn't raise him. My fixed-mount VHF radio had been receiving well all morning, but for some reason it wouldn't transmit. I raised him easily with the hand-held radio.

If you live in an area that has frequent fog, you may want to add radar. The smallest units are available for less than $1,000 and add unique navigating capabilities that are especially valuable in low visibility. If you get radar, plan to spend a significant amount of time learning to use it.

A larger boat

Some of the items I recommended for the smaller boat remain the same on a large boat: an excellent compass, VHF radio, speed log and depth finder. But on larger boats with a larger budget you might want to add a fluxgate compass or one of the new GPS compasses, rather than a magnetic model, to provide direction data for such equipment as radar or an autopilot. (Keep the magnetic compass, too; it's reliable and should be your backup.) Sailors will have increased requirements, such as wind instruments, cockpit remote readouts, and perhaps duplicates of some equipment.

An autopilot is a natural addition to a larger boat with an expanded budget. It handles much routine steering in suitable weather on open waters, freeing you to do many other tasks. Remember, it bears close watching — this is important — but at least you don't have to manually steer every moment.

I'd have two depth finders, one of them a large-screen color unit. It is best if the finders can operate on different frequencies so they won't interfere with each other. Why a second depth finder? It's just so important, especially in shallow areas, that I wouldn't ever want to do without if one finder acts up.

On a larger boat you will face some choices in terms of the increasing capacity to combine instrument functions. Yes, you want a chart plotter that shows electronic representations of paper charts, shows your GPS position and allows track planning and viewing. The question is whether you want a chart plotter that is part of a GPS receiver, one that accepts input from a separate GPS receiver, one that is part of a depth finder, or even part of the radar.

You definitely want radar on a larger boat. If you haven't used one previously, you will be happy to learn how useful it is in clear weather. A larger boat allows you to install an open array antenna, which enhances performance significantly over the smaller radomes. You should be able to connect a GPS receiver to the radar to show waypoints on the screen. This is a real advantage when there are many boats in the vicinity of an entrance buoy. Some radars now can show a radar overlay on a representation of a chart. Some people like this; others think it makes the display too busy.

I feel an electronic compass connected to the radar is a big advantage. It allows you to do two important things: use a stabilized display and get a radar with mini-ARPA (automated radar plotting for collision avoidance). A stabilized display (course-up or north-up) increases the accuracy and ease of plotting greatly, and is especially beneficial for collision avoidance. A mini-ARPA takes over some of the manual plotting functions so vital to avoiding collision in fog. You will have to learn to use the mini-ARPA in addition to understanding relative motion and knowing the navigation rules cold. It is no substitute for that vital knowledge, but it does eliminate much of the tedious plotting.

All together now

Connecting various pieces of electronic equipment depends on the communications bus. The old standard, NMEA 0183, is rather limited. The new NMEA 2000 is excellent, though it is catching on slowly. In the meantime, some manufacturers, for example Raytheon and Furuno, have proprietary buses. You simply can't make a working combination of electronics that use different buses if you expect them to communicate with one another.

Plan to spend enough time studying and learning how to use each piece of equipment wisely. This is particularly important for types of electronics that you haven’t owned previously, such as a chart plotter or radar. Remember, the more features a piece of equipment has, the longer it takes to learn how to use those features competently.