From Tactical to Practical

By Ben Ellison

LookSea's "augmented reality" is a major innovation in marine navigation, with roots both usual and unusual.

BOTTOM LEFT PHOTO: COURTESY OF U.S. NAVY

While it's obvious that military vessels face much more difficult navigation challenges than we recreational boaters do, consider how those challenges compound as the boats get ever faster and the amount of relevant data multiplies. Specifically, picture yourself at the helm of an 88-foot LCAC—a "Landing Craft, Air Cushioned" in Navy-speak, the hairy hovercraft pictured at left to us lubbers—doing 40-plus knots headed straight at a hostile coastline. You have precise and constantly updated info on your proposed route and nearby hazards like reefs, mines, and fellow flying LCACs. But how do you put it all together in your head fast enough, especially given the noise and spray generated by your 16,000 hp of lift and propulsion fans, and especially if some of your "brain cycles" are needed elsewhere, like trying to avoid incoming fire?

No doubt the Navy uses the best chartplotters and radars, but don't you think it's also continually searching for even better tools? Well, it turns out that after a decade of R&D, the LCAC fleet is in advanced testing of a remarkable system called ARVCOP, or Augmented Reality Visualization of the Common Operational Picture. That's a long name for the essentially simple idea of geo-referencing

Chuck Benton (above) poses with some components of the LookSea system he first developed for mission-critical vessels like the LCAC (left).

LookSea needs a 15-inch, high-resolution screen to show its stuff.

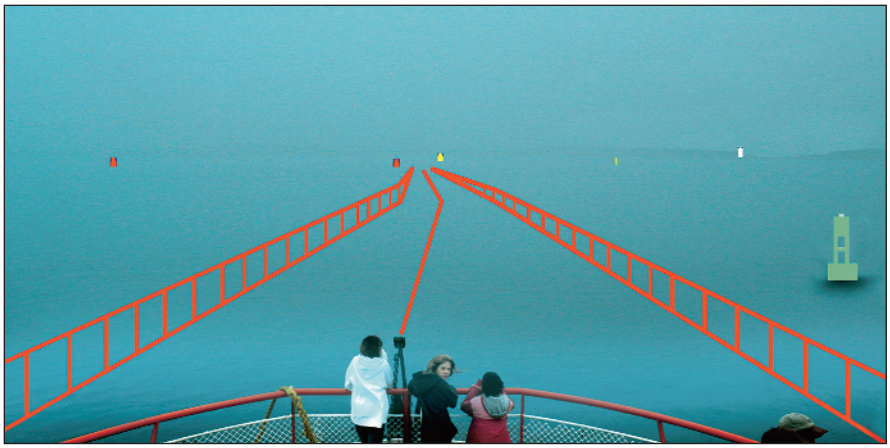
video camera output and then overlaying it with critical info. The system works so well that other branches of the Navy are interested, too, as are the Army and Coast Guard. More important, ARVCOP's primary creator, a contract R&D lab called Technology Systems Inc. (TSI), has decided to offer "augmented reality" navigation to yachtsmen, starting a new company with the more civilian title of LookSea and an initial $40,000 "Pro" product aimed at megayachts.

I was intrigued with LookSea Pro when it debuted at the Fort Lauderdale International Boat Show last fall. Since then I've taken a test ride in "perfect" conditions—blowing like stink and raining sideways—and also toured the TSI/LookSea offices with founder Chuck Benton. Both trips were easy because Benton's operation is located just down the coast from me in Wiscasset, Maine (which tickles me). At any rate, and state pride aside, I now concur with Benton that the LookSea idea is valuable enough—like radar and GPS before it—to transcend from mission-critical military to everyday cruising, or in his words "from tactical to practical."

After all, as big a leap as boat navigation took from pencil on paper chart to plotter or PC, the process still demands the more or less constant deciphering of cartography and matching it up against reality, especially in tight quarters. As we get used to high-quality vector charts, a feature that's really coming to the fore is the ability to eliminate unneeded detail, like deep soundings, from our displays. LookSea excels in both these areas. When you first see it establish a video-reality reference augmented with 3-D representations of just the important info, you're apt to exclaim, "Oh yeah!" Check out the foggy day screenshots at right; instead of interpreting the chart symbol for that green bell buoy, then eyeballing the real nav aid to confirm that you're in the right place and so forth, leg by leg down the channel, LookSea lays it out like an easy video game—integration simplified, brain cycles saved!

I'm not kidding about the brain-cycle business. The Navy did some testing in the early years of ARVCOP development, when the solution was thought to be headgear that projected data semi-transparently onto a helmsman's goggles. Matched boats ran complicated courses, with one driver seeing a regular chart on his display, the other just the 3-D icons. Besides navigational accuracy, the test measured free brain cycles by having the driver hit a foot pedal when he detected a certain sequence in a stream of numbers being spoken into his earphones (the poor swab). The testing was ultimately inconclusive because of flaws in the headset technology, but Benton says that in some runs the driver using the LookSea-like display scored several hundred percent more free brain cycles.

Benton also showed me amazing videos of LCAC drivers using ARVCOP to successfully blast by dummy mines in limited visibility while in tight formation (that's one use for those cross-track error "guardrails" seen in the screenshots). They seemed relaxed, implying that their brains weren't overloaded. Now I'm sure you're

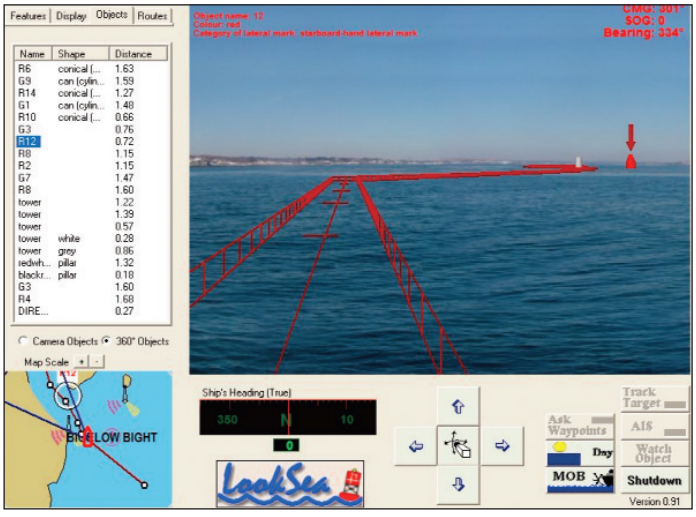


These are LookSea video screens, without (above) and with (below) route and buoy overlay, from early testing in Maine aboard a Casco Bay ferry boat, whose captains became quite fond of the system.

PHOTOS: COURTESY OF LOOKSEA

not planning to cruise around mines or enemy beaches anytime soon, but wouldn't you enjoy having some extra brain cycles available as you noodle around an exotic isle in your expedition yacht?

Of course there's more to LookSea Pro—much more. A full charting program running C-Map's commercial-level CM-93 cartography is built in, and you can specify just which elements of it are overlaid on the video window, like the presence or dimensions of those guardrails. The range slider seen on the screen below controls how far away you want to visualize data. Then if you go to the "objects" screen, you'll get a list of that data sorted by name or distance. Click an object anywhere you see it—list, map, or video—and it's highlighted everywhere else. In other words, the camera view, whose footprint is marked in blue on the map window, not only shows but also nicely organizes the data most important to you.



LookSea is also a full chartplotter, with the video view, marked in blue on the charts, organizing data objects (which can be queried in any window).

You can tilt and pan the camera, either freely or in fixed increments, and also ask it to stay aimed at a particular object like a man overboard or a radar target. I haven't mentioned the latter yet, but LookSea can receive and display NMEA target data from ARPA radars as well as the new AIS (Automatic Identification System). Both are becoming common, at least on large yachts, creating a sort of digital network something like the military's "common operational picture," though we never call it that. At any rate, refer to those foggy day screenshots again and imagine a target icon popping up and helping you to quickly identify the real ship as it emerges from the murk; you could even have the camera focus on that spot until it does. Given that AIS signals include a vessel's size and type as well as course and speed, LookSea could draw a custom 3-D icon for each AIS target. (That's a feature still on the drawing board, but feasible, as is the plotting of DSC calls discussed in this month's "Electronics" column.)

None of these target features were installed for my demo trip, but I did get to see LookSea perform in tough conditions. The visibility was atrocious, and the 28-foot water taxi was bouncing around Portland harbor like a jumping bean. Yet LookSea's augmented-reality display never stuttered and never lost accurate track of where it was. We couldn't see actual unlit buoys until we were right next to them, but there they were, right where the display indicated. LookSea in action is pleasantly simple, but what's going on under the hood isn't. The output of that wide-angle camera is going through a computer and being reprocessed before it hits the screen; if there were any lag, you'd get sick. The geophysical dynamics of the camera lens, GPS antenna, and boat bow must always be perfectly and instantly accounted for, or the result will be distorted, rather than augmented, reality.

Benton rolls his eyes when discussing the prodigious "art and science" behind LookSea's performance; it may seem like a particularly well-thought-out new product to me, but in fact he's been at this for a long time. And snooping around his office, I'm struck with the kaleidoscope of creative experience he brought to the venture. Framed testimonials applaud TSI's late-1980's contributions to SimNet, a giant networked battlefield-training simulation still in use. There's a cool mockup of a solar-powered autonomous underwater vehicle (SAUV) whose complex communications system is a current lab project. Beyond the tactical, other keepsakes suggest the whimsical. Back in 1981 Benton taught himself programming by writing a slightly salacious game that eventually became the famously funny Leisure Suit Larry series. He's also the guy who created the Frogger arcade game my grown-up kids still remember with glee! The scene reminded me of the wonderful serendipitous quality of much technological innovation and also suggested that LookSea's inventive juices flow from a deep well. I'm guessing that this first Pro product will be a welcome addition to many a megayacht bridge and am stoked to see whatever comes next. ❁

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PHOTOS: COURTESY OF LOOKSEA