

Sextant Reflections

Celestial bodies have lost their star appeal

BY HENRY CORDOVA

I was in my early twenties when I first learned about celestial navigation. I had an interest in astronomy as a kid, was a fairly knowledgeable amateur astronomer as a teenager, and majored in astronomy in college. So when I joined the Navy, I finagled myself into the navigation department aboard a missile destroyer. I'd never been exposed to navigation before, but I soon fell in love with it — it fit right in with my interests and background. My shipboard training was in the practical aspects of piloting and dead reckoning, plotting and chartwork, publications, electronics, and aids to navigation. I was introduced to celestial navigation and even worked out a position or two as part of my training although, in the modern Navy, the sextant is rarely used and only by the officers and senior enlisted men.

Still, I loved the work and, after going back to school and finishing my degree, I became an avid sailor and had a chance to sharpen my wayfaring skills further. But it

wasn't until many years later, as a married man with a responsible career, that I decided I would buy a proper yacht capable of crossing an ocean. I realized I would need more than simple piloting and dead-reckoning skills; I needed to master celestial navigation. I bought a professional sextant, picked up a couple of books on the subject, and taught myself the arcane art of determining my position at sea by sighting distant objects in the solar system and the galaxy.

No great mystery

Celestial navigation is not really difficult. It sounds very mysterious, but in practice it has been reduced to a long and involved procedure of looking up numbers in published tables and adding and subtracting columns of figures. Knowing the mathematics (mostly high school trigonometry) is not really necessary. Understanding the math and science as I do may have made it more interesting for me, but it is important to keep in mind that we're not talking brain surgery or particle physics here.

Working out a position is like accounting — a lot of rules to learn, and some adding and subtracting on preprinted forms that keep you from losing your place and remind you what comes next. It's all been designed by geniuses to be done by idiots. I would compare it in complexity to figuring out the taxes for a small business, except navigation doesn't change the rules on you every year.

The physical skill involved in using the sextant to make celestial observations is comparable to firing a rifle. Anybody can do it, and after a few dozen shots you'll get good enough at it to not embarrass yourself. Sharpshooter skill is not really necessary.

Although the practice of celestial navigation can be reduced to a mechanical sequence of steps that lead you to

placing an "X" on a chart, it helps to learn the theory in order to understand what you're doing. You'll then know how the process ties together every aspect of navigation as well as

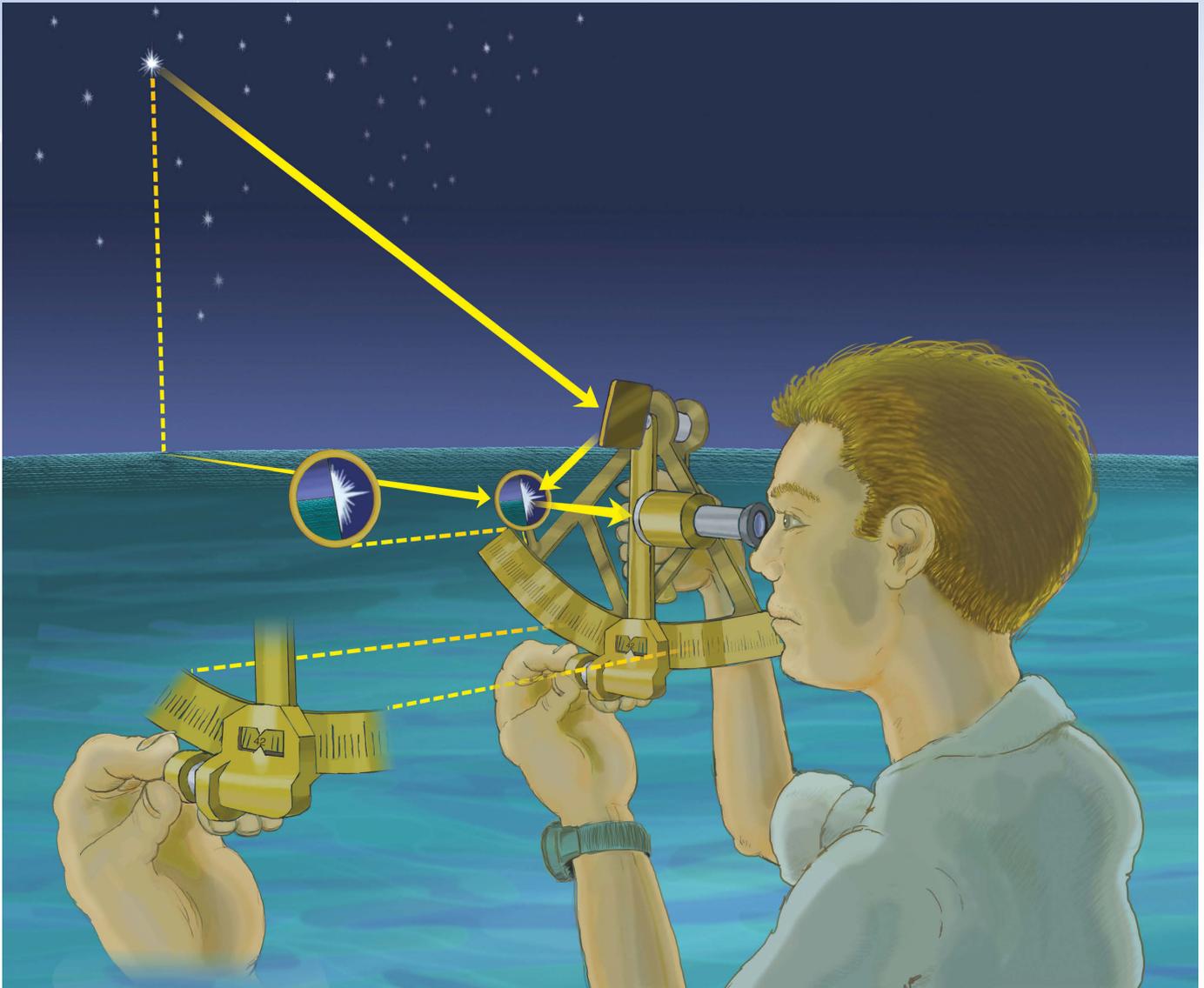
other disciplines: mathematics, astronomy, timekeeping, the calendar, cartography, and geography.

When you put it all together, it makes sense in such a way that you no longer need to memorize the steps; it becomes an integrated body of knowledge, you grasp how it all fits, and it gives you immense confidence and valuable peace of mind. You can still get lost, but being lost will never terrify you again. You and your ship become part of the sea, connected to the world and the heavens themselves. There is no feeling quite like it. Knowing you understand celestial navigation gives you a feeling of pride that's difficult to communicate but others can sense in you. Besides, if you're the only one who can navigate, your crew is not likely to mutiny, at least not when you're out of sight of land.

Shooting stars

At any given moment in time, every star and planet is directly overhead at some spot somewhere on Earth, and the Nautical Almanac lists these "terrestrial positions" for a large number

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of heavenly bodies used for navigation. (The earth spins around once a day and flies around the sun once a year but, if you know the date and time, you can correct for that.)

With the sextant, you can measure the angular distance between a star, for example, and the horizon, which allows you to calculate how far it is from the point that's directly overhead your position. That in turn allows you to determine how far away you are from that star's terrestrial position. If the star is 40 degrees away from your horizon (50 degrees away from your zenith), then you are 50 degrees away from its terrestrial position. A degree is 60 nautical miles. That's all there is to it.

In practice, it's a bit more complex. First, you estimate your position, which you call your assumed position. It need not be accurate; anywhere within a hundred miles or so is good enough. Then you measure the elevation of the body above the horizon with your sextant, noting the exact time of

the observation. You then go through a rather involved table look-up procedure to determine the star's terrestrial position (from the almanac) and another one to determine where it should appear in the sky at that moment. Comparing the distance you measure with the one you expect tells you how far away you are from your assumed position. You draw a line on the chart and you are somewhere on that line.

After repeating this process for several stars, and correcting for the motion of the ship during the intervals between observations, you have several lines on the chart. Where they intersect is your position. How closely they intersect gives you a rough idea of the error in your position (which may vary considerably due to conditions, your skill as an observer, and mistakes such as misidentifying a star or making a mathematical blunder).

You need a minimum of two observations, but taking several will allow you to discard any obvious errors. Under



ideal circumstances, you can locate yourself to within about a half mile. In general, your true position will be within several miles of the position you calculate.

With some practice, the whole operation takes about an hour, most of it spent with books and tables in front of you, scribbling furiously.

On an ocean passage, you would normally do this twice a day: at twilight, when it's dark enough to see the navigational stars but still bright enough to see the horizon, and at dusk, when you can see the stars through the sextant while you can still see the horizon. You might also get a simple latitude by shooting the sun at noontime. Identifying stars is easy. You can use a gadget called a star finder until you learn how to use the star chart printed in the almanac. After a while you will learn their names and where they live, and they will become old friends.

Angles and mirrors

The question I'm most frequently asked is, "What do you see when you look through the sextant?"

The instrument is basically an arrangement of mirrors that allows you to look in two separate directions at the same time, superimposing both images in the field of a small telescope. A reading involves twisting a knob until the reflected image of the glowing dot of a star or planet, or the edge of the sun or moon, just touches the horizon. At that moment, you note the time to the second and read the angle indicated on the instrument.

By the time I taught myself how to use a sextant, I had been laid off from my posh Silicon Valley job and had to shelve indefinitely my plans to go sailing. Over the next year, as I looked for work and went through the money I had saved to buy my boat, celestial navigation became a part of my life. It kept me going through a stressful time, one when I came to question my own ability to earn a living and support my family. But no matter what, I could take some comfort in knowing I could take a ship anywhere on the planet the old-fashioned way with the help of the stars and a compass.

I took several offshore trips with sailing friends, so I was able to satisfy myself that I had the practical skills and theoretical knowledge. As a means of digging deep into the intricacies of the spherical trigonometry and nautical astronomy involved, I also developed navigational software that ran on a pocket calculator. By the time I had done that, I considered myself an expert.

I had hoped to sell my software and perhaps earn a living as a yacht navigator on offshore races or as an instructor, but the times had changed. While I was learning the craft, inexpensive Global Positioning System receivers became ubiquitous on all but the smallest boats. Celestial navigation became as obsolete as Morse-code telegraphy, hard-hat deep-sea diving, or muzzle-loading firearms.

Archaic exercise

No one seriously studies celestial navigation anymore except as a hobby. The skill that was essential to the safe passage of

the world's commerce has now become a pastime for dilettantes, a quaint art for armchair sailors. Real mariners are better off spending their time learning first aid, diesel repair, or any of a hundred other essential shipboard skills than investing the time and effort in learning celestial navigation and in the constant practice required to keep the skill sharp. Short of total war or a breakdown in civilization, it's highly unlikely the GPS satellites will be allowed to deteriorate. Nonetheless, the Nautical Almanac is still faithfully published for the convenience of navigators.

I still have my sextant, neatly packed away in its polished-hardwood felt-lined box. It's a beautiful instrument with an indescribable feel and even a unique smell to it from the lubricants and the mahogany. I take it out occasionally and admire it. Once a year or so, I take it to the beach, shoot some sights, and calculate a fix, just to prove to myself that if I had to, I could still guide my ship wherever she needed to go.

It's a good feeling, but a bittersweet one. The sextant has become a memory of my youth, relevant only to me, and a reminder that times change irrevocably. It can take me anywhere in the world but it can't take me back. Its ties to the past are there, of generations of seamen braced against a bulkhead on a rolling deck, bringing a star down to earth. I am tied to that past, but it is a past. I am one of the last generation to have used a sextant as anything other than just an amusement. There is some grandeur to that, but also a great sadness. 

Henry Cordova is a retired geographer and lives in Florida. He was a navigation technician aboard a guided missile frigate, studied mathematics and science in college, and has owned a San Francisco Pelican and a MacGregor 22. Henry enjoys writing, astronomy, celestial navigation, and collecting star atlases.

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