And a Star to Steer Her By

by Christopher Hearn

Marine navigation has long been considered both a science and an art to its practitioners. The science is the methods used for monitoring and controlling the movement of the vessel, and the art is in the application of specialized knowledge to perform the task.

Since our ancestors first discovered that you can float your way across water – thus opening up a new means of getting around – they soon realized the fundamental challenges that navigation presents. Where am I going, how can I check on my progress getting there and, probably most important, how do I get back to where I started.

Early mariners developed knowledge of visual landmarks, tides and currents, and the position and movements of stars and the sun to help figure out where they were. With the advances in ship building and the growth of trade, the need for getting boats further and having them come back became a necessity. Early astronomers and mathematicians had worked out a process for following stars and knew that some remained in a nearly continuous position such as Polaris in the Northern hemisphere. Early navigating tools made use of this fact and were designed to reference these bodies. These included "star hooks" and astrolabes. European mariners stayed close to shore and it was not until the Vikings started crossing the North Atlantic that voyages went several days beyond the horizon.

The introduction of the magnetic compass allowed mariners to keep track of their heading independent of landmarks or using stars. When the processes for calculating latitude (the measure of how far north or south you were of the equator) came into use, navigators could venture across oceans. The practice was to determine latitude, sail a heading, and use knowledge of current and winds to track their progress over time through a process called dead reckoning. As good as dead reckoning was, there were considerable errors that could creep in, and there was no way of determining longitude (the measure of how far east or west of a reference line you were). The invention of the marine chronometer in the mid 18th century provided

an accurate time piece which could be used to reference time and allow for the calculation of longitude. The tools for measuring angles to calculate position also improved through the quadrant, the octant and finally the sextant. The tools for open water navigation were now complete; the ability to set and keep a course, determine position and track progress on the improving charts has remained unchanged for centuries up to today. It is the continued art form practiced aboard yachts to tankers.

The modern era of navigation really began with the developments with long range radio wave equipment. The Radio Detection Finder (RDF) was the first new navigation system to use this technology. Stations along the coast would broadcast signals that could be picked up using a special directional antenna and, with one or more signals, a position could be fixed through triangulation. Radar was also introduced with ability to take ranges using its radio wave to detect objects and give a range and bearing. Hyperbolic navigation systems, using time differential in reception from several stations, were developed during World War II for bombers during raids over Europe. From this technology came the long range frequency systems such as Decca, Omega and Loran. These units made use of chains of stations to broadcast waves which were measured in sequence at the receiver's computer. These systems allowed for position fixing independent of other previous methods and greatly improved accuracy. There were still limitations, however, especially for deep sea ships as the transmitters were land based.

With the advent of satellites orbiting the earth, the military started development of technology using Doppler Effect through satellite transmissions for more global coverage. These early TRANSIT systems provided accurate position information as long as they were visible to the ship's receiver. As computer hardware and software technology improved, the effect of satellite navigation systems also advanced to its current level with the Global Positioning System (GPS) providing high frequency with near constant highly accurate positions. For position plotting, traditional paper charts are slowly being superseded with electronic chart systems that allow for continuous position display and tracking and overlaying of other navigation information such as depth, GPS position, tidal or current data and even targets detected through radar or AIS (Automatic Identification System).

Technology available to the modern mariner far exceeds what was available even twenty years ago, but the adage "check, check and check again" is as true today as it was hundreds of years ago. Above image shows radar and GPS on board a ship.

The technology available to the modern mariner far exceeds what was available even twenty years ago. Yet for all the improvements and those to come, the undertaking of a voyage requires deep understanding of navigational fundamentals. The adage to "check, check and check again" using every means at your disposal to know where you are is as true today as it was hundreds of years ago. That is the mark of a navigator.

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