Technology in the Age of Exploration

By Malcolm F. Purinton

In the 1400s, European explorers started voyaging across the oceans. This was enabled by ideas and technologies from across Afro-Eurasia.

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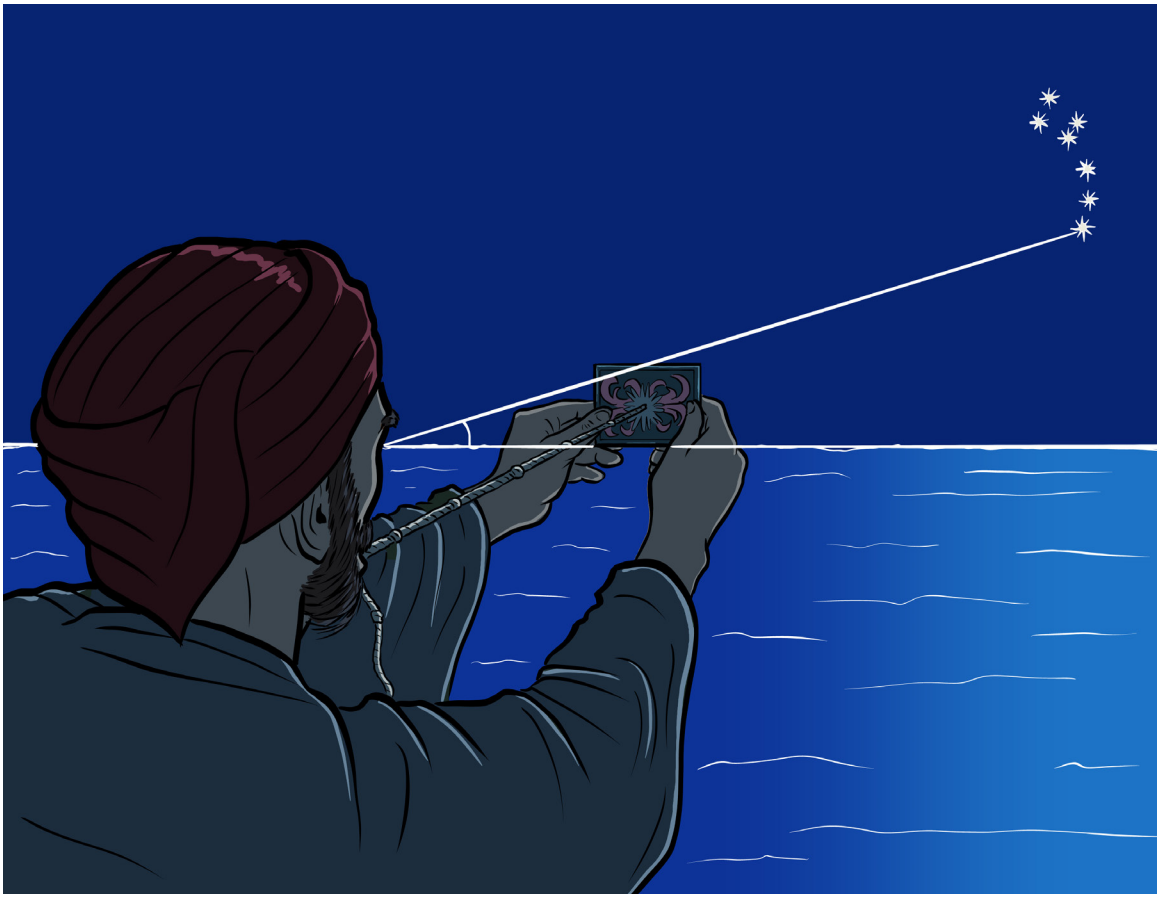
Introduction

The 1400s saw growth in global networks. Exploration and trade expanded. This is shown by the crossing of the Atlantic Ocean. It was also the time of the Columbian Exchange. The Columbian Exchange was the trade of ideas, technology, and food between the Old World and the New World. Voyages across the oceans of the world became common because of technology. The tools that these traders and explorers used were based on innovations that developed in many parts of Afro-Eurasia.

Kamal

One navigation tool was the *kamal*. It measured altitude, or the height above sea level, to figure out latitude. Latitude is the north or south position of a ship. The kamal helped sailors find their way home after a voyage.

The kamal was developed by Arab sailors. It was a piece of wood with rope attached to it. At their home port, the navigator would tie knots into the rope. He used the position of the knots relative to the North Star to determine the ship's latitude. When sailing back home they would hold the kamal in the same way to be at the same latitude.



An illustration of how a kamal was used to determine latitude. By WHP, CC BY-NC 4.0.

Quadrant

The North Star helped sailors navigate the ocean. They needed a way to measure the height of the star above the horizon. This helped sailors determine their position on the ocean.

One of the tools they used to measure the height of the North Star was the quadrant. When you knew the star's height, then you knew your latitude.

An astronomer using a quadrant. © Getty Images.

Astrolabe

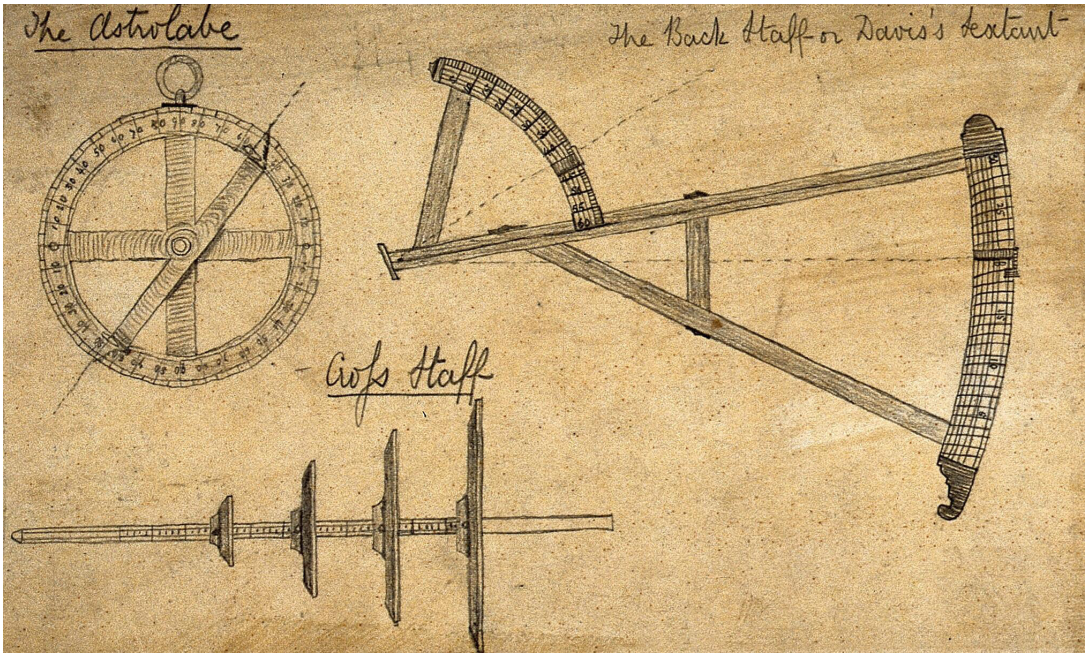
The astrolabe was an important navigation tool. It was used by many European explorers, including Christopher Columbus. With the tool, soldiers could measure latitude, time, and the position of stars or planets. The astrolabe looked like a stack of disks. It had writing to help with measurement.

Seventeenth-century astrolabe from the Islamic world. © Getty Images.

Cross staff and back staff

Two other tools used to find latitude were the cross staff and the back staff. The cross staff was usually about three feet long with a cross piece called a transom. It also had four movable cross pieces of different sizes. It was inspired by the design of the kamal. The cross staff was held up by a navigator. The top edge of the transom needed to line up with the North Star or the sun. The bottom edge lined up with the horizon. Using the cross staff in daytime required staring directly at the sun.

In the 1600s, Captain John Davis developed a new navigation tool called the back staff. It relied on the *shadow* of the sun, eliminating the problem.



Drawn examples of an astrolabe, a cross staff, and a back staff from the seventeenth century. From the Welcome Collection Gallery, CC BY 4.0.

Magnetic compass

The magnetic compass was useful for determining a ship's location. Using a magnetic needle that points north, you can know where you are and where you need to be going. Early magnetic compasses came from China. They were brought to Europe through trade.

A magnetic compass from the seventeenth century. © Getty Images.

Traverse board

Sailors need to record the speed and direction of the ship. That's where the traverse board came in. This wooden board had a compass rose attached to the top with thirty-two different points on it. Eight holes extended out from the center of the rose to each point on the compass. Sailors could record the direction of the ship every half hour. Sailors could also use the board to record the speed of the ship.

A traverse board that was used to keep track of a ship's speed and direction for four hours at a time. The large circle is the compass rose, and below it are four rows, each representing a half hour of travel. © Getty Images.

Ships: caravel and carrack

Sailors used several types of ships in this age of exploration. The caravel and the carrack were important. The caravel was developed in Portugal for long-distance trade. It had two or three masts that used square sails on open water. The ship switched to triangular lateen sails when closer to shore. Caravels were very fast, and because of this many pirates liked to use them.

Another important ship design was the carrack, which combined the Mediterranean and Northern European styles of ships. The carrack had a rounded stern and two large structures on top. They also used lateen and square sails. Carracks could weigh up to 2,000 tons. That's about 4,000,000 pounds.

An illustration of Portuguese carrack ships with several square sails and a triangular lateen sale in the rear. © Getty Images.

Cannon (yes, that's plural and singular)

Long-distance trade was dangerous. Ships needed weapons to have an advantage. Weapons might help traders get what they wanted from ports or other ships.

The best-armed ships of the day had cannon that could fire several kinds of shot. The round shot could damage the hulls of enemy ships. The chain shot had two smaller balls attached by a chain. Chain shot could destroy sails and riggings. The English developed a powerful navy with their superior ship cannon.

A painting showing carracks and galley ships in battle with smoke coming from cannon fire. © Getty Images.

These technologies made it possible for ships to travel long distances. Of course, they weren't the first oceanic technologies. Polynesian people had used their own technology to travel the vast Pacific Ocean for hundreds of years. But these new innovations quickly increased the number of voyages for exploration and trade, changing world history.

Sources

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