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The Caravel--The Most Important Engineering Feat in History

Thousands of engineering developments in the past millennium have led to discovery and an improvement in our way of life. However, there are three compelling reasons why the development of the caravel, a 16th Century sailing ship, had more impact on further discovery than any other feat of engineering. The caravel made possible the discovery of the New World, trade and culture exchanges between Europe, Africa and Asia, and necessitated further discoveries in other scientific fields.

Prior to the development of the caravel, ships were ill suited to long voyages of discovery. The carrack was state-of-the-art in ship design, and featured square-rigged sails, a low length to width ratio, and high structures both fore and aft. This design was fine for short trade routes, and the high "castles" fore and aft were useful for repelling attacks from smaller pirate vessels, but the carrack was not maneuverable enough for exploration of inland waterways, and its' bulky form and high castles made it unstable in heavy seas on the open ocean.

Nautical engineers made three crucial changes in developing the caravel. First, the decks and planking were tightly fitted and sealed with pitch. This made the caravel more "water-proof" in heavy seas than earlier ships. Second, the caravel was designed with a shallow draft and a greater length to width ratio (4:1 instead of 2.6:1 as in the case of the carrack). The high fore and stern castles were removed, greatly improving the maneuverability of the caravel, and making it possible to navigate rivers and inland waters. Finally, and most importantly, the caravel was designed with square sails on the mainmast and foremast, and a lateen (triangular) sail on a mizzenmast that could be moved with a boom apparatus. This new sail apparatus made the caravel the best sailing vessel of the age. Unlike ships rigged with only square sails, the caravel was not a helpless, wallowing hulk in unfavorable winds. The boom on the mizzen could swing

to catch the wind and the ship could “tack”, making progress even in a headwind. The engineering of the caravel made it possible to conduct any type of voyage of exploration, even transoceanic voyages.

The caravel changed history. To begin with, exploration began from Portugal and Spain. The coast of Africa was explored first, and contact was made between Europe and previously unknown lands. The Age of Discovery followed, led by such explorers as Vasco Da Gama and Christopher Columbus, leading to the discovery of the New World, and trade routes to Asia. An indication of how good the caravel was is found in Columbus’ writings. The *Nina* and the *Pinta* were caravels, and were highly praised by the explorer for their speed and ease of handling. The *Santa Maria* was a carrack. It was chosen for the 1492 voyage to the New World because of its larger cargo capacity, but Columbus described it as being “too slow,” and “unwieldy under sail”.

The development of the caravel had an even more important impact on further discovery than even the discovery of the New World. Because this ship type made open-ocean voyages possible, new methods of navigation, map-making, astronomy and studies of winds and tides had to be made. Old methods of navigation became obsolete, because line-of-sight dead reckoning was impossible without landmarks to read bearings from. Tables and sextants were invented that used the sun to find latitude. In addition, celestial navigation on the open sea was discovered. As caravels traveled to new, and uncharted, lands more accurate map-making techniques had to be developed to make future voyages to those lands possible, and studies of tides and currents had to be made.

A discovery of a New World, increased trade, and an explosion in scientific discovery were all made possible because of naval engineers who invented a small ship call the caravel—the most important engineering feat in history.