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I. Introduction

Thank you for your interest in the Pacific Heritage Tour for San Salvador’s maiden voyage up the Californian Coast. This project has been in the works for almost 20 years – from board room discussions, academic conferences, and years of research to five years of active ship building. After thousands of volunteer hours and donations, San Salvador is ready to make her way to ports up and down the state, reintroducing Californians to our West Coast origin story. This exhibit guide is written to help you—as a docent or volunteer who will be interpreting the story—to become familiar with this beautiful ship and her many stories and points of interest for visitors.

San Salvador, our “Galleon of Discovery,” will introduce California’s most famous ship and its mission. That mission was to explore the uncharted Pacific Coast. However, it is important to note from the beginning that when we speak of “discovery” we do so knowing that Native Americans have been living in these lands for thousands of years, and that the arrival of San Salvador was not the first time people discovered this place. Instead, Cabrillo’s voyage marked the occasion when outsiders and the people who inhabited this land first became aware of each other’s presence. By becoming acquainted with the replica of the galleon San Salvador and its history, we can all rediscover our shared past and strengthen our claim that United States history began in California as well as on the east coast.

This exhibit guide provides docents with useful information in condensed format to help interpret the ship to visitors of all ages. However, it is by no means all there is to know about any of the topics or questions that San Salvador may suggest to visitors. That is why we have included a timeline of Cabrillo’s life and summaries of several key topics, along with points of interest regarding the dockside and on-board exhibits. There are many supplemental readings and references that have helped inform our staff and volunteers, and for those readers who want to add to their knowledge beyond this guide, we have provided suggestions for additional reading.

Like Cabrillo, we are constantly exploring and discovering. We hope that with your help, San Salvador will bring discovery and adventure to life for thousands of Californians today.

Gracias!

Susan Sirota
Vice President
Maritime Museum of San Diego
II. Juan Rodríguez Cabrillo / San Salvador Timeline

About 1499

Juan Rodríguez Cabrillo was born in Palma de Micer Gilio (later called Palma del Río), a village located near Córdoba in southern Spain.

1514

At about age 15, he joined the expedition of Pedrarias Dávila (Pedro Arias de Ávila) and sailed from Seville to Tierra Firme as a crossbowman (ballesteros). Although 15 seems young to us, he would have been considered a man on that expedition.

1515 - 1517

At some point, he left Tierra Firme and ended up in Cuba, from where he may have joined in short expeditions to the Mexican coast, helping to establish Spanish bases or handling supplies. He may also have helped with ship repair in Cuba’s busy Puerto de Carenas (now Havana). He then joined the expedition of Pánfilo de Narváez, which was dispatched to the Mexican coast by the governor of Cuba to arrest Hernán Cortés for disobeying orders.

1519 - 1521

Narváez landed his army on the Yucatan coast and soon clashed with the forces of his rival Cortés. Thereafter, Cabrillo switched sides and joined the army of Cortés in his sweep across Mexico through Aztec territory. He helped with construction of the barges used to transport Cortés’s invading force across Lake Texcoco to the Aztec capital, Tenochtitlán (now Mexico City).

1524 - 1532

After the conquest of Mexico, Cabrillo went south as a trusted lieutenant to Pedro de Alvarado when he conquered the Province of Guatemala. For his services, Cabrillo was awarded vast land holdings there. In 1532 he returned to Seville, Spain, to marry the sister of his best friend and bring her back to Guatemala. Records from 1532 reveal his use of the name Juan Rodríguez Cabrillo for the first time. Before that, documents record his name simply as Juan Rodríguez.

1533

At the port of Acajutla, Guatemala (now part of El Salvador), Cabrillo built the galleon Santiago, a vessel he intended to use for shipping Spanish trade goods to markets in Peru. He had set up this business venture with his father-in-law; however, Alvarado commandeered the galleon for his own use.
1536  By age 37, Cabrillo was a successful land owner, thanks in part to Alvarado’s patronage. At Alvarado’s request, Cabrillo established a shipyard on the coast of Guatemala near the town of Ixtapa. This became the site for building and repairing vessels to be used in Alvarado’s proposed plans to explore the Pacific Ocean and establish a trade route to Asia.

1539  *San Salvador*, which Cabrillo built as his own vessel, was the largest of the six or seven ships that he built at the shipyard. It was about the same size as his first vessel *Santiago* and was likewise designed to carry trade goods as well as sailors, soldiers, and arms. Experts often call such ships ‘merchant galleons’ to distinguish them from later galleons that were usually larger, sleeker, and designed more for speed and military uses than for carrying cargo.

1540  Sent by Alvarado to locate a departure point for expeditions to the northern and western Pacific, Cabrillo located a bay and lagoon about 600 miles north of Acapulco that he named La Navidad (now Barra de Navidad, a few miles north of present-day Manzanillo).

1542  Appointed captain-general of a fleet of three vessels, Cabrillo departed La Navidad on June 27. The primary goal of this voyage of exploration was to reach Asia by sailing northwest along the cost of Alta California.

On September 28, he entered and explored what he described as a well protected harbor, which he named San Miguel (present-day San Diego). In early October, continuing north, Cabrillo explored the Channel Islands and the central coast of Alta California north to a river (now the Russian River) a few miles beyond Cabo de Pinos (now Point Reyes), before strong winter storms forced their return south.

Mid-November found them exploring the Baya de los Pinos (now Monterey Bay) before returning to the Channel Islands to rest, make repairs, and prepare for another push north in the spring as weather improved.
On January 3, Cabrillo died, due probably to gangrene that developed from an injury he sustained 10 days earlier during an encounter with natives in the Channel Islands, perhaps from an accidental fall. Just before his death he turned command of the little fleet over to the pilot Bartolomé Ferrer, who pledged to make another attempt to complete the expedition.

On February 22 repairs had been made and, taking advantage of a strong south-southeast wind, the fleet again headed north. As the storms became more severe, their highest recorded latitude indicates they may have reached as far north as Cape Mendocino before the wind shifted sharply to the north. With huge waves washing over the deck, Ferrer gave up and turned the fleet south.

On April 14 the San Salvador expedition returned to La Navidad. Later in the year the three vessels were dispatched to Peru. There is no further record of the three ships after this date.
Historical Background

General Overview

The story of Cabrillo and his galleon *San Salvador* took place during the age of European exploration that began with the Portuguese sailing southward around Africa to reach India and the Spice Islands, and the Spanish sailing westward with the same goal—to tap into the riches of Asia. Columbus’s 1492 voyage never reached Asia; instead, it bumped into the islands and continents of the Americas, unknown to Europeans before then. After Columbus, dozens of Spanish voyages continued to explore the area and colonize islands such as Hispaniola (now Haiti and the Dominican Republic) and Cuba. By 1520, Spanish settlement, administration, and trade were well established in the islands, even though explorers and settlers still didn’t know how those lands fit into the geography of the world or how far away Asia might still be. In 1513 Vasco Núñez de Balboa came upon another vast ocean—the Pacific—on the other side of Panama, but it took a Spanish voyage around the world in 1519–22, led by the Portuguese Ferdinand Magellan, to show just how vast that ocean was. At the same time, Hernán Cortés was launching an invasion of Mexico. With the crucial help of local allies, Cortés defeated the Aztec Empire by 1524 and established Spanish rule in what was dubbed New Spain. Thereafter, exploration of the western coasts of North America aimed to figure out how the continent might connect to Asia and how to get there and back. Juan Rodríguez Cabrillo was a key figure in that effort and a classic example of the sort of men who triumphed during the first fifty years after Columbus. Cabrillo began his military career as a simple crossbowman, but his exploits in the conquest of Guatemala gained him wealth, noble (hidalgo) status, and appointment as captain-general of the small fleet that explored the California coast in 1542. In that role, Cabrillo became the symbolic founder of San Diego.

Military men such as Cabrillo were conquerors (conquistadores) of the new lands across the sea, and they signed on hoping to gain personal wealth, fame, and privileges from the Spanish crown. Instead, many went to their graves, outnumbered and cut down in battle or killed by tropical diseases in the steamy environments on the coasts and inland forests. Those who
survived were used to hardship and toughened by their experiences. The crown was glad to have their services in gaining new territories and spreading the knowledge of Christianity to new peoples, but it is not surprising that the goals of the conquistadores often clashed with official rules about how to behave and how to treat the new peoples they encountered. Many conquistadores were ruthless in victory as well as in battle, illegally enslaving indigenous peoples, exploiting their labor, and violently opposing priests and royal officials who tried to enforce legal and humane standards. As an added horror, diseases that were common and not very deadly in the Old World of Europe, Africa, and Asia had a devastating effect on New World peoples who had never experienced those diseases. No one at the time knew why, but the combination of conquest, exploitation, and unfamiliar diseases resulted in a huge decline of the indigenous populations, which did not begin to recover until more than a century after the conquest. As colonial society developed, some African slaves were imported to supplement the labor supplies, but the peak of the Atlantic slave trade would not come until more than two centuries later.

Juan Rodríguez Cabrillo: Origins and Career before the 1542 Voyage

Today many monuments, streets, commercial enterprises and public institutions bear the name of Juan Rodríguez Cabrillo, but until recently, we knew very little about his origins, and all the documents we had identified him only as Juan Rodríguez. Then, in 2015, a document came to light recording his testimony as a witness in an official investigation in Spain in 1532. During his swearing in as a witness, he identified himself as Juan Rodríguez Cabrillo and said that he was a natural or native of Palma de Micer Gilio, a small town near Córdoba, Spain, that is now called Palma del Río. You can learn about how the mystery about his birthplace was finally solved by reading the news story included in this guide.

So, what do we know about his career? Juan Rodríguez arrived in what Europeans called the New World in 1514 at the age of fifteen. Classified as a crossbowman, in 1519–1521 he joined the expedition of Hernán Cortés that marched inland from the Mexican coast to
conquer the Aztec Empire. Cabrillo helped to build the boats that crossed Lake Texcoco to invade the Aztec’s island capital of Tenochtitlán (now Mexico City). After the conquest, Pedro de Alvarado took Juan Rodríguez with him to conquer Guatemala. To reward his services, in 1524 Alvarado gave Juan Rodríguez extensive estates. He became a wealthy rancher and in 1529 received permission to mine gold from streams on his land. In 1532 he sailed to Spain and, incidentally, testified in the previously mentioned investigation that proves his Spanish identity. During his time in Spain, Cabrillo married Beatriz Sánchez de Ortega, who returned with him to Guatemala in 1533. They settled on Cabrillo’s vast and productive estates, and he and his wife had two sons by 1536, the first named Juan Rodríguez Cabrillo. The senior Cabrillo became involved in a variety of commercial and domestic affairs in Guatemala. Among other ventures, Cabrillo built a 200-tonelada galleon named Santiago in the Guatemalan port of Acajutla in 1534, which Pedro de Alvarado promptly requisitioned for his own use.

Alvarado, then governor of Guatemala, enlisted Cabrillo’s help to assemble a fleet of thirteen ships. Records suggest that between 1536 and 1540 Cabrillo’s shipyard built six or seven vessels, of which San Salvador was the largest, and six other vessels were extensively refitted. The work required skilled shipwrights, woodworkers, and talented foremen to produce and refit so many vessels at once. That was possible because Alvarado and the viceroy, Don Antonio de Mendoza, had royal permission to reassign shipwrights and other workers from all over New Spain. Estimates of the size of the workforce overseen by Cabrillo range as high as 400, including some slaves, all of whom were forced to work at a rapid pace. When San Salvador was finished, Cabrillo took her on a profitable trading voyage to Peru, which gave him and his crew experience in long-range sailing.

The ships that Cabrillo and others built at Alvarado’s request were intended to seek routes to the Spice Islands (Moluccas), Japan (Cipango), and China (Cathay or Catayo). One possible route was to sail due west, though Magellan’s voyage had shown how very wide the Pacific Ocean was. However, because maps of the time often showed Asia not too far from the coast
of northwestern America, many thought it would be quicker to sail toward the north and northwest, following the curve of what is now California and Oregon and eventually reaching Asia. To test both possibilities, one group of three vessels would sail west across the Pacific. Another three vessels would sail up the northwestern coast in search of a shorter route to the riches of Asia.

Alvarado wanted a more suitable base for his expeditions away from busy Acapulco, and he commissioned Cabrillo to sail north to locate a site. Cabrillo found an appropriate bay eventually called La Navidad, located near present-day Manzanillo. When Alvarado was called away to quell a native uprising, he left Cabrillo in charge of preparations for the voyages. Unfortunately, Alvarado was killed during the uprising, and Viceroy Mendoza took charge of the fleet. Following two failed attempt to sail up the northwest coast, Mendoza named Cabrillo as captain-general for the third such expedition.

**San Salvador, those on board, and Cabrillo’s Voyage**

In California, images of the galleon *San Salvador* appear almost as often as the name Cabrillo, even appearing on San Diego County and City government letterheads and seals, but they are based on what little we know about other ships of the period. From descriptions and drawings of the era, we believe she was a full-rigged galleon with square sails on the mainmast, foremast, and bowsprit, and a lateen mizzen, with a low fore-castle, a beak-head under the bowsprit, and a high aft-castle and taffrail. She had two fully planked decks and reportedly measured about 200 *toneladas* in the reckoning of the day. She was about 75 feet in length on the main deck, with a 25-foot beam.

Manning ratios of the time suggest that *San Salvador* may have carried 20–30 sailors and the same number of soldiers—in other words, about 40–60 persons—probably including some slaves. The sailors would mostly have been adult seamen (*marineros*), plus younger
apprentices (grumetes), and even a few boys (pages). Officers, bureaucrats, and a clergyman or two added to the total. The sea officers would have included Cabrillo as captain general (capitán general), plus the ship’s master (maestre) and his subordinates; the ship’s pilot (piloto); a carpenter (carpintero) and caulker (calafate); and perhaps a few other craftsmen and a medical officer (barber-surgeon, cirujano). Cabrillo would be the ultimate commander of the soldiers on board, aided by a lieutenant (alférez). If Cabrillo brought along a few trusted colleagues, they would have helped to keep the soldiers in line. The bureaucrats would have included a representative of the crown with his servant or slave, and the official scribe (escribano), who kept a record of the voyage. Altogether, there may have been between 75 and 90 people on board, but this is guesswork. We don’t have a list of who was on board, so we have to rely on what we know about other ships of the period, along with official rules about manning Spanish ships for exploration.

We also don’t what the sailors and soldiers earned on San Salvador. However, marineros on Spain’s Atlantic fleets seem to have earned about 26.5 silver reales per month in the mid-sixteenth century, grumetes earned 17.6, and pages earned 13.2. Depending on the price of food, the crown may have paid twice as much to feed a sailor than to pay his wages. The basic pay for a soldier could be considerably more than an adult sailor earned, but soldiers typically had to pay for their own rations, weapons, and medical care if they were hospitalized on land. Complicating matters, sailors who had particular skills and soldiers who had proven their worth could earn bonuses that were larger than their base pay.

Ships built on New Spain’s west coast were the product of what shipwrights had learned in Europe. Although indigenous laborers soon learned the techniques of European shipbuilding, large vessels such as San Salvador would not have borrowed much from local traditions. There are no plans available for the original San Salvador, and such plans may never have existed. Instead, Cabrillo and other experienced shipbuilders would have known the traditional proportions of the ship they wanted to build—for example, the relationship between the maximum breadth of the ship (beam or manga), and the length of the keel.
and the first planked deck *(eslora)*. They would then assemble the timbers for the keel, shape and attach the ribs and other structural elements to it, and close in the hull with planking. As soon as the keel was laid and the master rib was attached, experienced shipbuilders had a very good sense of what the finished vessel would look like. There was a variety of suitable woods for ships’ timbers and spars available in nearby forests, and fibers for rope and rigging could also be obtained locally. Similarly, there were forges to make iron nails, spikes, and ship fittings for the project. However, materials such as sails, guns, tools, and ready-made rigging and fittings were imported from Spain to the Caribbean and carried overland to Pacific ports by local workers and African slaves.

Cabrillo’s 1542 fleet consisted of three vessels: *San Salvador*, also known as the *capitana* (flag ship) or *Juan Rodríguez; La Victoria*, a smaller ship with two masts; and *San Miguel*, a 30 ft. pinnace or long boat known as a *bergantín* or *fragata*, with a partially covered fore-deck and a sail and benches for 13 pairs of oars. *San Miguel* might also be towed, but it was too big to be brought aboard *San Salvador*. Armament for the vessels probably would have been light. The soldiers’ weapons included crossbows, lances, swords, and possibly a few matchlock harquebuses. *San Salvador* and *Victoria* each carried several wrought-iron guns (*bombardetas*) and rail-mounted swivel guns (*versos*). Both types were breech-loading weapons that could be quickly reloaded with a removeable prepared charge (*serviola*). Another rail-mounted swivel gun may also have been carried aboard *San Miguel* to protect shore parties.

Cabrillo’s small fleet departed La Navidad on June 27, 1542 and headed north. It was a difficult voyage along an inhospitable and uncharted coast, going against the prevailing winds and currents. They frequently hove to at night to avoid running aground or encountering other hazards, and they sought anchorages to avoid rough weather. Often they encountered local natives, took soundings, and recorded descriptions and locations of potential harbors.

They entered the bay we call San Diego on September 28, probably landing at what is now Ballast Point—the West’s Plymouth Rock. An ancient Kumeyaay petroglyph of what might be a galleon has been located and documented in the desert east of San Diego, which suggests that
local residents had observed the ships sailing along the coast. Natives they encountered at first fled in fear. When they returned later, they explained their fear by indicating that bearded men like Cabrillo’s were not far inland, and that they had killed many natives. To make the encounter more terrifying, some of the Spaniards were riding horses, which the Indians presumably had never seen before. After six days in San Diego Bay, during which the Spaniards and natives exchanged small gifts, Cabrillo’s ships continued their journey. They made many landings and met with larger populations of natives as they progressed north, who continued to tell stories about warlike Spaniards traveling inland. Cabrillo surmised that the inland Spaniards were part of the land army of Francisco Vázquez de Coronado—perhaps the contingent of Hernando de Alarcón, which had been sent to explore the Colorado River. Continuing north along the coast, Cabrillo landed on and described several of the Channel Islands before sailing as far north as what is now the Russian River area of Sonoma County. As stormy weather impeded their progress, Cabrillo decided to return to the Channel Islands for the winter, where he hoped to rest his crew and make some repairs before again pushing north. It was on one of those islands, likely San Salvador / La Capitana (now Santa Catalina), that he died. The exact circumstances surrounding his death are not clear. He seems to have suffered a shattered shinbone or a broken arm during a hostile encounter with natives, perhaps from an accidental fall. In any case, the injury became infected and resulted in gangrene. Cabrillo died on January 3, 1543, at the age of 44. His burial place remains unknown.

The pilot, Bartolomé Ferrer, then took command of the expedition, promising to fulfill Cabrillo’s dying orders to complete the mission. San Salvador and her consorts resumed their arduous voyage north, initially making good progress but later encountering contrary winds and seas. After reaching nearly to what is now the Oregon border, winter storms again drove the small fleet south. Battered and exhausted, the vessels returned to La Navidad on April 14, 1543. The governor took over San Salvador and her consorts, along with three vessels from the Alarcón (Sea of Cortés) expedition. After a period of refitting, the six ships embarked on a trading voyage to Peru late in 1543. Few of the men and none of the ships were heard from
again, and that is where the record ended. Sixty years passed before another attempt was made to explore the coast of Alta California.

The San Diego Maritime Museum and the Replica San Salvador

The purpose in building San Salvador was to create an iconic educational tool similar to the East Coast’s Mayflower and other colonial-era ships and to serve as a symbol of West Coast history. The Museum aimed to produce a vessel that is historically accurate in appearance while complying with U.S. Coast Guard requirements for carrying paying passengers. The replica incorporates modern safety features and navigational equipment, auxiliary engines, and electrical, plumbing, and freshwater systems. The Museum will sail San Salvador as an aid in teaching a host of subjects that stand at the intersection of California history and social studies. As a modern representative of that history, San Salvador will operate as a passenger-carrying vessel as well as a learning center. Visitors will have access to the upper and main decks, which will house period elements, and to the hold, which can be used for exhibits.

Construction of the vessel did not try to replicate the methods used in 1540. Instead, modern engineering drawings were prepared and followed in conformance with U. S. Coast Guard requirements, although many traditional shipbuilding techniques were used as well, such as caulking and tarring the seams between the hull planks. No image of San Salvador is known to exist, although the galleon was included in a painting of Alvarado’s fleet that was carried to Spain in about 1540. Moreover, there are only a few specific historical references to the size and appearance of the original vessel. The first task in the San Salvador replica project was to obtain a consensus of opinion by an international panel of historians and marine archeologists about what the ship would have looked like, based on the limited historical references available and on the kinds of vessels being built and used by Spain in the middle of the sixteenth century. Once the research team assembled by the Museum had settled on the most likely size and appearance of the original vessel, a detailed set of construction plans was developed. From the basic concept drawings circulated to the consulting panel to the final
design and engineering specifications, all of San Salvador plans and drawings were prepared pro-bono by San Diego-based naval architect Douglas Sharp, of Sharp Design. From the beginning Mr. Sharp maintained an active consulting role in every facet of the construction process. On May 30, 2014, Spain’s ambassador to the United States, Ramón Gil-Casares, officially knighted Mr. Sharp with the Order of Isabella the Catholic. The order recognizes those in the Americas who have made important contributions to the promotion of Spanish culture and heritage.

The San Diego Port District approved use of the West Spanish Landing parking lot and access roads near the airport for a shipbuilding site. A workshop and lofting area was located under the Harbor Drive overpass. The shipway, project offices, tool and material storage sheds, forge, information center, gift shop, and Kumeyaay (Native American) demonstration village were located on the existing parking lot and along the walkway facing the bay. The work began with laying the shipway to support the vessel and setting up the work yard. Next came lofting—that is, scaling up the naval architect’s drawings to full-size and creating templates or patterns for building the frames and parts of the stem and stern that attach to the vessel’s keel. On April 15, 2011, the two sections of San Salvador’s keel were joined together in a public celebration marking the official beginning of the shipbuilding process.

There was a brief delay in construction when the proposed method for fabricating laminated frames out of white oak failed, and a new method of building frames and a new source of wood had to be found. Within two months Cross Sawmill in Iron City, Georgia, began delivering sufficient quantities of Southern Live Oak for fabricating the frames, and work began. By the end of 2011, the sternpost, transom, and stem (except for the beak-head) and deadwood were attached to the keel, and nearly half of the massive double-sawn oak frames were in place on the keel. Visits to San Salvador Village started to increase as the vessel took shape in sight of traffic passing along Harbor Drive.
While Cabrillo had convenient access to a variety of suitable tropical hardwoods as well as coastal fir trees from his location in Guatemala, this was not the case in arid San Diego. Woods used in the *San Salvador* construction come from around the world and included:

**Angelique (a.k.a. Guiana Teak)** – *San Salvador*’s keel is fabricated from two long pieces of this wood. Angelique is a dense, hard, straight-grained wood that comes from French Guiana.

**Apitong (a.k.a. Yaang Yuung)** – Harvested in Southeast Asia and the Philippines as well as India and Brazil, this wood was used to plank the transom. It is dense with a tough, coarse grain; shrinkage is uniform in both directions. It stands up to abrasive wear and resists rot, fungus, and termites.

**Black Locust (a.k.a. False Acacia)** – Dried dowels made of this wood were used as trunnels (treenails, trenails or pegs) to take the place of metal nails and spikes to fasten wooden pieces together. This wood is found in the southeastern U.S. It is extremely hard, durable, and resistant to rot. A trunnel driven into a hole drilled through several pieces of wood will expand with moisture and hold the pieces securely together just as a screw or nail could but without introducing corrosion that can weaken joints.

**Douglas Fir (a.k.a. Oregon Pine or Douglas Spruce)** – Shipped from Washington, this straight-grained wood weathers well and resists rot. It was used as deck beams; decking on the main, poop, and quarterdecks; masts and spars; planking above the wales; and as bilge stringers.

**Hackmatack (a.k.a. Tamarack Larch or American Larch)** – A deciduous conifer tree native to eastern Canada, the wood is tough and durable but also flexible in thin strips. A plant favored by Bonsai enthusiasts, it has also been used by the Algonquin People for snowshoes and other products where toughness with some flexibility is required. To shipwrights, however, hackmatack means “knees.” A knee means the ninety-degree curve in grain that occurs where the tree’s trunk and branch (or root) meet. The knee provides a natural right-angle that can be used to support the ship’s many wooden joints. *San Salvador* has approximately 100 knees that support beams, stiffen joints, and restrict their lateral movement.

**Purpleheart (a.k.a. Amaranth or Violet Wood)** – Used in one set of frames and in parts of *San Salvador*’s stern, engine bedding, capstan, mast steps, and other major structural
components. Grown in northern Brazil and parts of Central America, this wood is quite dense and very hard; a sharp carbide blade is required to cut it. The wood is prized by craftsmen for woodturning, cabinetry, flooring, and furniture. Exposure to the dust generated by cutting, routing, and sanding can cause irritation and nausea, due possibly to compounds in the wood.

Sapele (a.k.a. Sapelli or Aboudikro) – Employed in structural parts of the stem and stern as well as planking and wales. Native to tropical Africa, primarily Nigeria and Congo, this hardwood has a grain similar to mahogany. It is commonly used by makers of guitars, harps, and percussion instruments, including Taylor and Gibson guitars.

Southern Live Oak (known to hybridize with Encino Oak or Bay Live Oak) – Used for San Salvador’s frames and other massive structural parts, this wood comes primarily from 200-year-old trees harvested in southeast Georgia. Southern Live Oak is a slow-growing, extremely dense wood (over 75 lbs. per cu. ft.) with a long history of use as a shipbuilding material. This type of oak was the principal material used in building the frames and planking of the original six frigates of the U.S. Navy in 1795.

White Ash (a.k.a. Biltmore Ash) – Abundant in eastern North America, this hard, durable wood was used for blocks, belaying pins, and other implements on San Salvador. It is commonly used for baseball bats.

White Oak (a.k.a. Post Oak or Chestnut Oak) – Native to eastern North America, cleats and hatches were fabricated from this wood, as were various other pieces on or above the deck. It is rot resistant.

Yellow Cedar (a.k.a. Tree of Life, Arbor Vitae, or False White Cedar) – A strong yet lightweight and rot resistant wood native to northeastern North America, Yellow Cedar was used for the ship’s upper frames and top timbers. This wood is honored by the Ojibwe People as “Grandmother Cedar,” a gift to humanity for a variety of uses in crafts, construction, and medicine. In shipbuilding, the use of lighter woods well above the waterline can improve the stability of a vessel.

By the end of 2012, portions of the 88-ton lead ballast had been installed both below and above the keel. The lead accounts for about half the weight of San Salvador when launched. All of the double-sawn oak frames and four watertight bulkheads were also completed and
two diesel engines were installed. By the close of 2013 planking of the main, quarter, and poop decks had been completed and planking of the hull was underway. Early in 2015, construction was estimated to be approximately 80 percent complete, and San Salvador was launched on July 29, 2015.

The five-year construction period generated strong public interest and satisfied the Museum’s initial educational goals. Once launched, San Salvador was moved to the Museum, where her topmasts were run up and major construction and rigging were completed. Work on the interior compartments continued in 2016, even as sea trials were carried out.

In recent years, the Maritime Museum of San Diego has been involved in the building and restoration of several replica vessels from the age of sail. The Museum currently owns two such replica ships: Californian and HMS Surprise, formerly Rose. Since both of those vessels have required substantial maintenance, the Museum staff already possessed most of the skills necessary to build San Salvador. The services of an experienced naval architect, two experienced master shipwrights, and a project director were engaged to manage her construction. Museum staff and more than 450 volunteers worked with a small team of specialists in the various traditional shipbuilding trades—some local and some from out of the area—to form the building crew. The ship faithfully replicates the physical appearance of the original galleon, while including modern features to support day cruises and extended voyages. As the Museum planned, San Salvador meets U. S. Coast Guard requirements and, equipped to navigate with precision, she will be able to meet a schedule. Best of all, the Museum’s San Salvador is much stronger and more durable than Cabrillo’s original galleon.

Cost for the construction of San Salvador was approximately $6,800,000 in public and private funds, plus $6,000,000 in donations of skilled labor, materials, site use, and professional services. In addition to the steady flow of the Museum’s operational funds, the ship was built with contributions from an impressive roster of private and public donors. The California Coastal Conservancy provided major funding, as did many private foundations, including the
Ellen B. Scripps Foundation, the Hervey Family Foundation, Price Charities, and many others. Hundreds of individual donors contributed funds at all levels. In addition, there have been many donations of in-kind goods or services. For example, Goodrich, Inc. (now United Technologies, Inc.) donated 88 tons of lead and cast it into specified shapes for use as ballast. Finally, as with the rest of the Museum’s collection and vessels, the Maritime Museum has drawn heavily on the incomparable and highly skilled contributions of our many member volunteers. From April 2011 through June 2016, exactly 454 volunteers contributed 128,109 hours (64 man-years!) to the construction of San Salvador.
# Specifications

**San Salvador (original)**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Length on deck</strong></td>
<td>Approximately 75 ft. on the lowest planked deck</td>
</tr>
<tr>
<td><strong>Beam</strong></td>
<td>Approximately 25 ft. at the widest point of the hull</td>
</tr>
<tr>
<td><strong>Size</strong></td>
<td>Approximately 200 toneladas, according to the gauging practices of the time</td>
</tr>
<tr>
<td><strong>Description</strong></td>
<td>Spanish galleon or merchant galleon</td>
</tr>
</tbody>
</table>

**San Salvador (replica)**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sparred Length</strong></td>
<td>114’ 8” Tip of bowsprit to tip of boomkin</td>
</tr>
<tr>
<td><strong>Length on Deck</strong></td>
<td>75’ 6” Main deck</td>
</tr>
<tr>
<td><strong>Length overall</strong></td>
<td>93’ 7” Beak head to aft end of poop</td>
</tr>
<tr>
<td><strong>Beam</strong></td>
<td>25’ 1” Maximum hull</td>
</tr>
<tr>
<td><strong>Draft</strong></td>
<td>10’ Fully loaded, maximum draft</td>
</tr>
<tr>
<td><strong>Displacement</strong></td>
<td>206 long tons, full load waterline</td>
</tr>
<tr>
<td><strong>Gross Reg. Tonnage</strong></td>
<td>92.8 tons</td>
</tr>
<tr>
<td><strong>Rig</strong></td>
<td>3 Masts (square sails on fore &amp; main masts, lateen rig on mizzen mast, spritsail on bowsprit)</td>
</tr>
<tr>
<td><strong>Sail Area</strong></td>
<td>4,160 sq. ft. (main mast 2,276 sq. ft., fore mast 1,284 sq. ft., mizzen mast 314 sq. ft., spritsail 286 sq. ft.)</td>
</tr>
<tr>
<td><strong>Rig Height</strong></td>
<td>82’ 3” Main topmast cap</td>
</tr>
<tr>
<td><strong>Auxiliary Power</strong></td>
<td>2 Diesel engines (John Deere, 280 hp each)</td>
</tr>
<tr>
<td><strong>Crew</strong></td>
<td>10 for daily operations, 12 to 16 for longer voyages</td>
</tr>
<tr>
<td><strong>Passengers</strong></td>
<td>Berths for 36 passengers</td>
</tr>
</tbody>
</table>
Dockside Exhibit Layout
IV. Points of Interest

Sleeping Quarters

During the voyages of exploration by the Spanish in the Pacific from 1525 to 1565, the ships had little space below the main deck for men to work or sleep, given that it was stuffed with cargo and supplies. Instead, most of the designated berthing areas were on the main deck: the enclosed space at the aft end for the officers and gentlemen, the tolda area above and behind the enclosed space for the captain, and the rest of the main deck for the sailors and soldiers—wherever they could find room.

Bedboxes

On Spanish ships of the sixteenth century, the planked decks were called cubiertas (later called puentes). At the aft end of the main deck, there was an enclosed chamber for berthing the crown’s representative, ships’ officers, and any high-status passengers aboard. The area was lined with bedboxes or open bunks built against the inner planks of the enclosed area. For
privacy, there were curtains that could be pulled shut. Each bedbox had a sleeping mat. A mattress would not have been feasible, because mattress stuffing (straw, feathers, etc.) would get wet and rot.

The bedboxes were used not only for sleeping but also for storing necessities and personal items reflecting each person’s status and job title. Normally, an individual would have one set of clothes that he wore every day, though the principal officers and high-status passengers presumably had more items of clothing available. They would also have had a heavy water-resistant cloak that could double as a blanket. If the cloak had a hood, it could also serve as a pillow or night cap.

A gentleman or crown official on board would have bags made of sheepskin and canvas to store his belongings. He would also likely have a sword and a dagger or side knife in his bedbox. These items would demonstrate his status and could also be useful in case he was called upon to help keep order on board or quell a mutiny. He might also store a limited number of other personal items below deck in chests or boxes. Any armor he owned would be placed in sheepskin bags to protect against the damp and would be stored in a readily accessible space in the hold.

**Likely bedbox assignments on San Salvador**

1. *Procurador* (Spanish crown’s representative on board—a lawyer and gentleman)
2. Storage area for use by the *Procurador*; his servant would sleep on a mat on the deck nearby
3. *Escribano* (Scribe; responsible for keeping all legal records on board); his bedbox would contain a laptop writing desk, paper, quills, containers for ink and sand, sealing wax, and books
4. Unassigned
5. *Barbero/Cirujano* (Barber/Surgeon), essentially the ship’s medical officer; his bedbox would contain tools of his trade, such as a bone saw and various medicines
6. Unassigned
7. *Maestre* (Master of the ship), responsible for the physical ship and everything on board.
8. **Piloto** (Ship’s pilot and navigator); his bedbox might contain an astrolabe, quadrant, charts, sand-glass (*ampolleta*), sundial, cross-staff (*ballestilla*), and a logbook for recording the ship’s movements.

9. **Alférez** – Officer for the soldiers; larger contingents of soldiers would have a **sargento** (sergeant) as well. As mentioned above, Cabrillo would have held ultimate military command.

10. **Arms locker**: quarter pike, boarding ax, capelin helmet, celeda helmet

11. **Contramaestre** (Boatswain), and perhaps the **Guardián** (Boatswain’s Mate), sharing the bunk on different watches; together, they were responsible for overseeing the sailors.

12. **Despensero** (Dispenser, responsible for keeping track of the food supplies and distributing them to all on board; often selected by the **Maestre** and answerable to him)

**(The wood door will be locked when the interpreter is not present.)**

**Tolda**

The captain resided in the **tolda**, located aft of the whipstaff and above the main deck. The **tolda** included the captain’s cabin and its roof. The **tolda** was strictly for the captain, although he could invite high-status passengers to join him. On our **San Salvador**, the **tolda** is only a half deck; the helmsman’s viewing bubble and the tiller flat intrude into the captain’s space but are not considered part of it. On a period ship with a full-sized **tolda**, the captain’s quarters would be furnished with a table and chairs, and a bed. His personal belongings would include a breast plate and weapons.

**Sailors and Soldiers Sleeping Quarters**

The upper deck had to accommodate most of the people on board. The sailors and soldiers off duty slept on the open deck on sleeping mats that they rolled up when not in use. There were probably livestock in pens as well. Crowding and exposure to the weather created hardships for all. Bedding down on the fore-castle (**castillo**) was difficult, because it was full of rigging and equipment and could easily become soaked, since it was so far forward above the ship’s bow. The lower deck was already crowded with cargo and supplies, and the hold was not an alternative either, for a variety of reasons. Apart from the officers and important passengers, the people on board had to find places to sleep wherever they could.
Fortunately, not everyone slept at the same time, as the sailors were assigned to different “watches” during each 24-hour period. Sailors on watch followed orders from the pilot and captain, tending the sails, looking for potential hazards, taking turns at the whipstaff, and doing whatever tasks they were ordered to do. Often at night, especially when close to the coast, they would be ordered to “heave to” (adjust the sails and whipstaff so as to maintain their position), rather than take a chance on running into some hazard along the uncharted coastline. Soldiers on watch followed orders from their officers.

It is likely that the ordinary sailors and soldiers had little more clothing than what they wore every day. They may have had a small canvas bag containing personal items, or they may have had a small sea chest. Each sailor and soldier was required to purchase at least one weapon, a shield, and a helmet, as they were sailing into unknown territory with unknown dangers. The sailors had to have their rigging knife on them at all times, but more serious weapons were all kept under lock and key.

**Steering San Salvador**

**How do you steer a sailing ship?**

Sailing ships are steered by two means: adjusting the balance and set of the sails and altering the flow of water past the stern with some kind of blade. Until the twelfth century, European ships used a steering oar pivoting from one or both sides of the stern. The development of a rudder attached to, and pivoting directly on, the sternpost was one of the great inventions of maritime history.

**How was the rudder controlled?**

Early rudders were controlled by a horizontal lever called a tiller, which attached to the rudder and projected through the transom at the stern of the ship. However, as ships grew larger with more freeboard above the water line, the tiller became increasingly surrounded by superstructure, and it was impossible to see anything from the steering position. Also, the
distance from the tiller to where the captain stood was too far for efficient communication. The whipstaff was developed to solve those problems.

**What does the whipstaff do?**

To improve visibility, a vertical lever (the whipstaff or *pinzote* [pin ZO tay]), linked to the tiller at one end, raised the steering position at the other end to a height where the helmsman could at least look out to see the set of the sails. This arrangement was awkward at best and allowed only a few degrees of rudder angle, but it worked most of the time if the sails were carefully balanced.

In heavy weather the whipstaff could be augmented by “relieving tackles” running from the end of the tiller and attached to each side of the ship. This allowed the helmsman to apply more force to the tiller and to achieve a greater angle on the rudder, but at the expense of visual control. The helmsman stood in an enclosed space underneath the poop deck and steered the ship by pushing the whipstaff from side to side. Pushing the whipstaff to port turned the ship to port; pushing it to starboard turned the ship to starboard. Because the helmsman’s forward visibility was limited, he peered through a small hatch to communicate with the officer setting the course and guiding the ship.

**Why not just steer *San Salvador* with a ship’s wheel?**

When the original *San Salvador* was built, the whipstaff was the only proven method for steering large European sailing ships, and that is why our *San Salvador* uses a whipstaff. Ultimately someone thought of leading the relieving tackles up to a wheel situated on the deck. The ship’s wheel, optimizing control and visibility, was another great maritime invention, but it didn’t appear until around 1700—some 160 years after *San Salvador* sailed!
Navigational Equipment

During the sixteenth century, ships’ pilots used equipment that was very simple in nature and limited in accuracy. Latitude (the distance of a ship’s position north or south of the Equator) was crucial for determining the ship’s position. A pilot needed to keep track of the ship’s current latitude, the latitude of its destination, and the distance between the two. With this information and a good portolan chart, ships sailing in known waters could simply get on the right compass course and reach their destination. In unknown waters, calculating the latitude was even more important. In the Northern Hemisphere, ships’ pilots could begin to calculate the latitude of their current position by observing the North Star at night or the sun at noon. There were several instruments that could assist them (see below).

Once they had noted the angle with the sun, for example, they could consult published tables that told them the changing position, or declination, of the sun at noon for every day of the year. With all this information, they could calculate their current latitude. It wasn’t easy to get a good reading at sea, and the instruments weren’t very accurate by modern standards. (Moreover, longitude could not be determined with precision until the eighteenth-century invention of the marine chronometer by John Harrison.) Nonetheless, the methods used in Cabrillo’s time worked well enough to pilot ships all over the world, and Spanish navigational manuals were translated into a number of languages within a few years of their publication.

Quadrant

The quadrant allowed ships’ pilots to read the position of the sun at noon or the North Star (Pole Star) at night in relation to the horizon in the Northern Hemisphere. They tipped the quadrant until they could sight the celestial object through two peepholes, while letting a plumb bob hang down vertically. They could then read the angle off a scale inscribed on the curved edge of the quadrant. Errors could be up to ½ degree or 30 miles, due to the loose hanging weight and the movement of the ship.
Astrolabe  The astrolabe was also used for sighting celestial bodies. For centuries, it had been used for that purpose by astronomers and astrologers. The astrolabe was hung by the loop at its top, and the moveable alidade (sighting rule) attached to the apparatus was turned so that the celestial body could be sighted through the two peepholes, and the altitude was then read off the scale inscribed on the ring. As with the quadrant, the movement of the ship made it difficult to get a good reading. Though the heavy weight of the astrolabe (often about 10 lbs.) and the fixed alidade were more stable than the quadrant, the astrolabe was still very difficult to use on a moving ship.

Cross-staff (*ballestilla*)

The cross-staff was a long wooden rod with degrees of angle inscribed on it. The pilot, or whoever was doing the observation, slid a moveable crosspiece along the rod until one end aligned with the horizon and the other end aligned with the celestial body. The observer then read the angle at the point where the crosspiece met the rod. As there was no swinging weight to worry about (unlike the quadrant), and the cross-staff was much lighter than the astrolabe, many mariners considered it superior to those instruments.

Mariner’s Compass (*brújula magnética*)

The compass allowed mariners to determine their direction on the open sea, even when they couldn’t see the sun or the stars. In the center was a ‘compass rose’ with 32 points indicating directions. The compass was mounted in a wooden box or bowl, and some were small enough to fit in a pocket. The moveable needle in the center of the compass had to be continually re-magnetized with a lodestone. Magnetic compasses have built-in
errors, since magnetic north is different from the rotational North Pole (geographic north), and up to 15 degrees of compass error were not uncommon.

**Lead and Line**

To measure depth in shallow places, a heavy lead weight (sounding lead) attached to a line was tossed overboard and allowed to sink to the ocean floor. The length of the line told the pilot the depth of the water, so he could know if it was safe for the ship to continue without running aground. A sticky substance such as *alquitrán* (tar, pitch, and oil) might be smeared on the bottom of the sounding lead, so that it would collect a sample of whatever was at the depth where it landed. Depending on what stuck to the weight—sand, pebbles, and so on—the pilot could judge whether it would hold an anchor. In known waters, the quality of the bottom could even tell the pilot if the ship was near a known port or river estuary.

**How fast are we going?**

Estimates of the ship’s speed were approximate at best. The pilot might simply have someone toss a chip of wood into the water at the stern and then estimate how quickly it receded as the ship moved forward.

**Charts**

Charts that showed coastlines and harbors of previously unknown areas were highly prized, such as the chart at the right from 1541 showing the Mexican coast, Baja California, and the Gulf of California. A master chart that recorded all the new information gathered by Spanish expeditions was kept in Seville. A copy from 1527 (the *Padrón Real*), now in the Vatican Library, was surprisingly accurate about the coastlines of the world explored by 1525. By contrast, many of the famous maps published in the sixteenth century are hopelessly inaccurate by modern standards.
**Portolans**

Portolans were late medieval charts drawn and painted on sheepskin, showing known coastlines and ports and with an extensive array of directional lines coming from various compass roses. As noted above, in known waters, pilots could use a compass and a good portolan to get from one port to another, simply by following the appropriate compass direction. Engraved printed charts superseded portolans in the sixteenth century and made their information more widely available.

**Rutters (Sp. derroteros; Fr. routiers)**

Written sailing directions for various routes from place to place were as highly prized as accurate charts, especially for previously unknown destinations. They included information about local phenomena (such as sources of fresh water), winds, currents, and other conditions, as well as information about routes and ports. Such information was considered so important that Spanish pilots were ordered to destroy their *derroteros* if they were in danger of being captured by an enemy.

**Dead Reckoning**

The sailor’s last resort! When weather conditions made it impossible to take celestial measurements, pilots had to estimate their current position and future course, based on their last known position and their estimates of direction and speed since then. This is known as ‘dead reckoning’. An experienced pilot could do a fair job of calculating his ship’s position by using dead reckoning, but the method was far from ideal.
Seaborne Weapons

_San Salvador_ carried guns and other weaponry to defend the expedition from potential threats posed by both the indigenous peoples encountered on the voyage and also from sophisticated maritime powers like the Portuguese and Chinese on the far side of the Pacific, should they get that far. Nonetheless, Cabrillo and his companions were specifically instructed to develop peaceful relations with indigenous populations through non-violent interactions. As a further precaution, they were also advised to avoid any contact with unknown vessels.

_San Salvador_’s armament can be estimated from what is known about contemporary expeditions, together with the results of archaeological excavations of similar vessels and details provided by historical narratives, illustrations, and examples of the guns themselves in historical museums. Using such evidence, we know that _San Salvador_ carried several wrought-iron guns (_bombardetas_) and rail-mounted swivel guns (_versos_).

**Bombardeta (Bombard)**

_Bombardetas_ were the biggest guns on _San Salvador_. They were about seven feet long, weighed about 1,500 pounds, and were capable of firing shot that weighed about five pounds. There may have been four _bombardetas_ with 36 balls each (144 balls total) on _San Salvador_. The bombardetas were breech loading and mounted on simple two-wheeled carriages. _San Salvador_ had gun ports, so it is likely that the _bombardetas_ would have been lashed along-side those openings.

In 1542, using artillery aboard ships was still a fairly new concept. It is unlikely that a _bombardeta_ would be considered a ship killer, because it could not have penetrated a ship’s hull at anything farther than point blank range (less than 100 yards). The main component of _San Salvador_’s defensive and offensive firepower was the _verso_ (swivel gun), designed to be mounted to the rail.
Verso (swivel gun)

Galleons like San Salvador undoubtedly carried a number of versos (swivel guns). They had smooth barrels and were designed primarily as anti-personnel weapons. Versos could be mounted on the rails in the waist (combés) of the main deck, or on more elevated parts of the ship such as the half-deck. Like bombardetas, versos were breech loading and could fire a series of projectiles in swift succession by using prepared charges in their own canisters (serviolas). They were noted not only for being devastating against the crew of other vessels, but also for having the potential to explode and maim or kill their own gunners.

What did they eat?

Cabrillo estimated that his voyage would last approximately two years, and he had to calculate how much food to bring to feed all the men sailing on the three vessels. In preparation for the voyage, he had tons of ship’s biscuit, salted fish, pork, beef, and cheese, along with dried beans, garbanzos, peas, rice, and olive oil brought on board in heavy barrels and stored in the hold of the ship. Onions, garlic, water, and wine rounded out the provisions for the journey. In addition, there were probably livestock on board in pens—sheep, pigs, and chickens—which would be slaughtered and eaten during the voyage. Officers and passengers might supplement the basic fare by bringing small quantities of food with them, typically pickled vegetables and dried fruit such as quince, figs, and raisins.

Cabrillo intended to supplement the preserved food on board by having the crew catch fish in the rich fishing grounds off Baja California and sending parties ashore for fresh food, including game, native fruits and vegetables, and fresh water to replenish their supplies.

Standard rations on Spanish ships included a regular schedule of meat days (19 per month), fish days (9 per month), and cheese days (3 per month), along with a daily mixture (menestra) of dried legumes and rice. Food was cooked on a fogón (fo GOHN), an iron
firebox open on one side, with several inches of sand in the bottom for a wood fire to be built. It was available on a first-come, first-served basis during the daylight hours. A servant or a page would cook the food for his employer or ship’s officer. Groups of ordinary sailors and soldiers seem to have pooled their rations and cooked them together, perhaps organized according to the watch schedule, or simply among a group of friends.

When the seas were too rough to build a cooking fire, hard cheese and ships’ biscuit became the common fare. Food was eaten from wooden plates while sitting on a blanket or piece of coarse cloth laid on the deck.

All in all, the daily ration provided adequate nutrition and upwards of 3,000 calories per day, if the rations were distributed according to regulations. The real deficiency was liquid. One liter of wine and one liter of water were issued daily to each person, but that was inadequate, as the water had to serve for cooking the dried, salted rations, as well as for drinking. Even counting the wine, the daily ration provided less than the 3 liters of liquid needed by an average sized, hard-working adult male. Unfortunately, water took up valuable storage space on the ship. The result was that everyone on board was perpetually dehydrated, and undoubtedly constipated as well.

*Bizcocho* (ship’s biscuit, [bies CO cho]) was the dietary staple. It was a thick cracker of flour-and-water, baked to a rock-hard consistency that was supposed to stay edible for years at sea. Ship’s biscuit was nearly impossible to eat in its dry state, but soaking it in a little water created a porridge-like mush that was flavored with pieces of meat or fish, garlic, onions, oil, and a dash of vinegar. Weevils often infested the storage containers for the
biscuit and created a pattern of perforations that made the *bizcocho* easier to break up into chunks, but that didn’t improve the flavor.

**Livestock Pens**

Livestock—especially chicken, pigs, goats, sheep, or even cattle to be slaughtered during the voyage—were not uncommon aboard ships in Cabrillo’s time, and we assume they were on *San Salvador* as well. The livestock would be housed in pens on the open main deck, where the men worked, prepared and ate their meals, and slept or relaxed when they could. The large pens took up valuable deck space, and the livestock needed to be fed and cleaned up after as well. Some voyages even carried horses. Cabrillo’s son—who was a young child in 1542, later recalled that his father had at least one horse on the voyage, and *San Salvador* made landfall many times, so that a horse would have been useful.
Cargo Hold

Cargo and supplies were stored in the hold of the ship or on the lower deck. Food and water would be stored where they were easily accessible to the *despensero*, as he had to distribute the rations. Frequently used supplies, guns, armor covered in sheepskins, and wood for the *fogón* were also stored where they could be reached easily. Valuables and delicate cargo were kept under lock and key in trunks. In case of running aground, fire, or other mishaps, the valuables could be more easily removed. Officers, gentlemen, and any merchants on board were also allocated some storage space in the hold. As Cabrillo was an experienced merchant in his own right, it is doubtful that there were other merchants on his 1542 voyage.

Heavy cargo and items less likely to be affected by water damage were stored in the hold in wooden boxes, barrels, or sea chests that were stacked and secured as well as possible with netting to prevent shifting at sea. Beneath the floor (*plan*) at the bottom of the ship near the keel, there would be ballast in the form of rocks or iron bars to help stabilize the ship; sand seems to have been used as ballast on some ships as well. Not surprisingly, the lowest level or bilge of the ship accumulated seawater from leaks and other liquids such as human waste. Even though the ship’s pump was used to clear the bilge and pump its contents overboard, the putrid stench emanating from the bilge was enough to knock a man unconscious if he got too close.
V. Cabrillo’s San Salvador Pacific Heritage Tour 2016

Key Messages and Talking Points

What do we know about Cabrillo?

Until recently, Cabrillo’s origins were unknown, and some believed he was from Portugal. In 2015, however, legal documents were discovered in Spanish archives in which he identified himself as a native of Palma de Micer Gilio (now Palma del Río), near Córdoba, Spain. That provides definitive proof of his origins.

We know that he spent his entire career in service to the Spanish crown. He took part in the expeditions of Pedrarias Dávila, Pánfilo de Narváez, Hernán Cortés, and Pedro de Alvarado, four of the most important conquistadores of the early sixteenth century. He joined Cortés in the conquest of the Aztec Empire and later took part in the conquest of Guatemala with Alvarado. As a result of his military exploits, he became a very wealthy man, married well, and became a public figure. Eventually, he received the commission to explore the west coast north of New Spain, no doubt hoping to increase his wealth and status as well as serving the crown. Instead, Cabrillo died on the voyage and is buried on one of the Channel Islands.

The History

What was the original San Salvador?

San Salvador was the capitana (flagship) of a small armada of three ships commanded by Juan Rodríguez Cabrillo on a voyage of exploration that began in 1542. Research indicates the ship was an early galleon, about 75 feet long on the lower deck, gauged at about 200 toneladas in the reckoning of the day, built somewhere on the western coast of New Spain (modern Mexico and Guatemala). She probably carried the majority of the men in the expedition and many of the supplies, as she was the largest of the three ships in Cabrillo’s fleet. After the expedition returned, San Salvador was sent on another trading voyage to Peru, and at that point faded into history.
What was the purpose of Cabrillo’s voyage?
Earlier exploration of the Gulf of California had proved that California was not an island. Cabrillo was commissioned to explore the vast uncharted coastline to the north under the flag of Spain. The goal was to find a shorter trans-Pacific route to China that would facilitate regular trade with Asia.

What was the significance of Cabrillo’s voyage?
His was the first European expedition to explore what is now the west coast of the United States, and Cabrillo is believed to be the first European to come ashore somewhere near present-day Point Loma in San Diego Bay. Because the expedition failed in its primary mission, it wasn’t considered decisive in the development of Spain’s seaborne empire, nor were the territories discovered deemed sufficiently promising to warrant settlement, especially in comparison with the rich empires conquered from the Aztecs in Mexico and the Incas in Peru. Nonetheless, the information gathered by Cabrillo’s voyage contributed to the growing knowledge about the North American continent and its place in the world. Later expeditions would benefit from that knowledge, and two decades after Cabrillo, another Spanish expedition would sail from Asia back to New Spain, following the route along the northwestern coasts that Cabrillo and his men had pioneered, but in the opposite direction.

What was the route of the expedition?
San Salvador and her smaller consorts, La Victoria and San Miguel, sailed out of Navidad and entered uncharted waters for the first time about 100 miles below the present-day Mexican border. In the following weeks, the expedition explored the coastline and the Channel Islands between San Diego and Point Conception in southwestern Santa Barbara County. Three attempts were made to get beyond Point Conception: One sailed northward along the coast past San Francisco Bay (which they did not find), and another attained the latitude of present-day Oregon, although far offshore.
The Replica

Why was the San Salvador replica built?
Cabrillo played an important role in the history of California and of San Diego in particular. His story gained renewed prominence at the close of the nineteenth century, when Portuguese immigrants to this area established a connection between their new home and the iconic explorer, whom they believed was Portuguese. Eventually Cabrillo was accepted by Californians everywhere as an important figure intertwined with the state’s origins and with a chapter in the great voyages of Pacific exploration. The project to build a full-scale, seaworthy replica of San Salvador acknowledges Cabrillo’s contributions to our maritime heritage and provides a unique educational platform for children and history buffs of all ages.

How long did she take to build?
After 20 years of planning, construction of the replica began in 2011. The new San Salvador was launched five years later. Under auxiliary motor, she led the Parade of Ships in the 2015 Festival of Sail, and she did the same under full sail in the 2016 Festival of Sail.

Where did construction take place?
She was built near Harbor Island at Spanish Landing between 2011 and 2015. The construction site was open to the public, allowing visitors to watch construction activities and view a number of exhibits that explained the ship’s history and 1542 voyage.

How much did the construction cost?
The cost was figured at approximately $6.8 million in private and public funds, plus another $6 million in donations of skilled labor, materials, and professional services. The California Coastal Conservancy was a major source of funding, along with the Ellen B. Scripps Foundation, the Hervey Family Foundation, Price Charities, and many others. Hundreds of individual donors also contributed money, labor, and services.
Who built her?

The San Salvador replica was built by dedicated volunteers and Maritime Museum of San Diego employees, who joined with a team of specialists in the various shipbuilding trades. More than 450 volunteers provided nearly 50 percent of the labor during the construction.

What did you use for plans?

While no actual plans, drawings, or paintings of the original ship exist, we drew on extensive research from archival sources, shipbuilding treatises, artwork from that era, chart pictographs, votive models, and archeological excavations for vessels sharing the same timeframe and technology with San Salvador. Naval architect Douglas Sharp created the construction plans and was knighted by the Spanish government in 2014 for his extraordinary contributions to the project.

Did you use the same materials and techniques as the original ship?

No. Our aim was to faithfully replicate the physical appearance of the original vessel while also achieving a ship that meets U.S. Coast Guard requirements, can navigate with precision, and is equipped with modern conveniences such as auxiliary motor power, communications equipment, electricity, and an onboard restroom. She looks like the original would have looked, but she’s much safer and considerably more comfortable.

What is the purpose of the new San Salvador?

She has joined the Maritime Museum of San Diego’s fleet and plays an active role in the Museum experience enjoyed by visitors and locals of all ages. As part of the Museum’s integrated educational program, San Salvador is a floating classroom, a vibrant exhibit space, and a sail-training vessel. She will also be available for regular day sails on San Diego Bay, longer ocean-going voyages, and chartered events.

San Salvador will offer visitors and teachers a robust educational platform and will become a resource for exploring and learning. Distance Learning Programs and Lesson Plans for grades K-12 will include a host of activities and experiences for students, including building paper
models, studying historical ship plans, photography and videos, and much more. Additional information can be found at sdmaritime.org.
V. Cabrillo’s *San Salvador*: The Pacific Heritage Tour & Maiden Voyage Celebration

**What is it?**

The tour and celebration mark the maiden voyage of *San Salvador*, introducing her and her story to a broader audience in several California locations. All locations will include onshore exhibits and ship tours. Three ocean-going adventures are also offered for voyagers age 12 and up. Hours and prices will vary by venue.

**What is the Pacific Heritage Tour itinerary?**

The tour and celebration begin at the Maritime Museum of San Diego on the downtown Embarcadero, Labor Day Weekend, September 3 – 5, during the West Coast’s Largest Tall Ship Festival – The 2016 Festival of Sail.

**San Salvador’s other tour venues:**

- **Ventura** – Hosted by the Channel Islands Maritime Museum - September 15 – 18
- **Monterey** – Hosted by the Monterey Historic Park - September 23 – 25
- **Morro Bay** – Hosted by Central Coast Maritime Museum - September 30 – Oct 9

The tour also includes the opportunity to take one of the three ocean-going excursions described below:

**What is the Channel Islands Sailing Experience?**

This is a special opportunity to sail aboard *San Salvador* and explore the Channel Islands on one of the three ocean-going excursions:

- **Leg I:** Morro Bay to Channel Islands to Ventura October 10 – 14
- **Leg II:** Circumnavigate Catalina – Avalon to Avalon October 17 – 21
- **Leg III:** Avalon to San Diego October 23 – 26
Do I have to know how to sail?

No. Our experienced crew takes care of that. Just bring a love of adventure and your toothbrush.

Is there an age limitation?

Yes. The Channel Islands Sailing Experience is limited to passengers 12 years of age and older.

What is the cost?

$995 per person or $3,500 for a party of four on each leg. This includes onboard accommodations and meals.

What will we do aboard San Salvador?

Step aboard and step back in time. Adventure Sailing Legs on the Pacific Heritage Tour 2016 inaugural sails are for people who love history and sailing – and want to be a part of history. Very few people have sailed on galleons of the sixteenth century, and our first San Salvador Sailing Legs will be the first time the public will get a chance to experience California through the eyes and experiences of sixteenth-century explorers.

Join us as we set sail on these three unique tall ship experiences. For the novice or the experienced sailor, each leg allows passengers the opportunity to join the crew with sail training lessons and shipboard activities, including hands-on demonstrations and practical experience of traditional and celestial navigation, cartography, and sail handling, including knots. Evening programs on Channel Islands archeology and natural resources, Cabrillo’s journey and California’s origin story, and first people’s encounters with the unknown are sure to entertain and educate all aboard.

No experience necessary, only good attitudes for uncharted adventure!
VI. San Salvador Sail Plan
VII. Supplements

[Image and text content not legible for transcription]
Solving the Mystery of the Winds

Sixteenth-century sailors were limited by their navigational tools and by the sailing abilities of their ships:

- The compass let them sail in a straight line on a determined course.
- The sand glass let them estimate how fast they were travelling.
- The quadrant, astrolabe, or cross-staff, plus navigational tables, let them calculate their latitude (plus or minus 30 miles).

All long-distance voyages depended on finding the right prevailing winds and setting your sails to take the best advantage of them. You could rarely, if ever, make a long trip by simply pointing your ship towards your destination.

- By 1540 the Spaniards had learned that the Atlantic Ocean had predictable winds that blew from east to west just above the equator. That enabled them to follow a predictable route westward across the Atlantic.
• They also knew that at about 40 degrees latitude north or south, strong prevailing winds blew across the Atlantic from west to east. That enabled them to follow a predictable route eastward back to Spain.
• Early on, Spanish mariners realized that the Pacific Ocean had east-to-west winds along the equator like the Atlantic. That enabled several voyages to reach Asia in the 1520s and early 1530s, but they couldn’t find the proper winds to make the return voyage to America.
• It was not until 1565 that a Spanish voyage proved that the Pacific – three times the size of the Atlantic – had the same west-to-east winds at North latitude 40 degrees that existed in the Atlantic. The return route from Asia was pioneered by Andrés de Urdaneta, who had sailed to Asia from New Spain in his youth and had studied the problem of the return route for several decades thereafter.

Juan Rodríguez Cabrillo did not know it, but he had been assigned an impossible task – that of sailing west across the Northern Pacific.

• His route north along the California coast ran into both winds and currents that blew from north to south along the California coast.
• The fact that he got as far as he did (the Oregon/California border) before giving up indicates that he was a first-rate navigator.

Despite fighting contrary winds and currents on the way north, all of Cabrillo’s ships and most of the crew made it back to Mexico. Ironically, his encounter with the powerful winds and currents flowing southward laid the groundwork for Urdaneta’s pioneering voyage in 1565.
California: A Bountiful Land

By Dr. Jim Cassidy, Associate State Archaeologist, California State Parks

Though it was the intent of Juan Rogríquez Cabrillo’s voyage on the San Salvador to discover a new route to Asia, his lasting legacy was to be the first European to map the coast of California and make record of these densely populated lands. He was peacefully received by diverse individual tribes who were well adapted to a wide array of ecological settings. These people originated from six different language families and spoke a multitude of separate languages (map from Heizer and Elsasser 1980:5). It would be realized much later that this bountiful land was occupied by the most diverse population of Indigenous people in the American continents. This could only be the case if California was one of the earliest places to be occupied when people first entered the New World.

This voyage only came into direct contact with people living along the coast who were well adapted to either near coastal estuaries and tidelands, or marine mammal hunting and fishing. The people who occupied San Diego Bay and coast were the Kumayaay who gathered plant, fish and shellfish from coastal estuaries during the summer and then moved to the mountains and deserts for the rest of the year on their seasonal rounds. This was distinctly different from the seafaring Tongva who occupied the present day Los Angeles/Orange County coast and the southern Channel Islands, as well as the Chumash who occupied the Santa Barbara/Ventura coast and northern Channel Islands. Both the Tongva and Chumash were organized as complex Chiefdom communities and intensely harvested marine resources, such as seals, dolphins, sea otters, fish and shellfish.

As the voyage explored north of Point Conception they encountered the exposed central coast, known for its strong southeasterly winds, ocean currents and winter storms that were unsuited for the Chumash and Tongva plank canoes. As San Salvador sailed north Cabrillo sighted a prominent crowned shape volcanic plug and named it “El Morro.” What is now Morro Bay was the home of Obispeno Chumash villages who exploited the rich resources of the estuary and Morro Creek as it empties into Estero Bay.

Cabrillo is thought to have travelled as far north as the Russian River before turning back to record Monterey Bay. This well sheltered bay was home to the Costanoan people who occupied the area south from San Francisco Bay to Point Sur and used balsa canoes to gather plants, fish and shellfish from the coastal tide lands, river mouth estuaries and the coastal plain. Resources in the form of salmon, shellfish, waterfowl, plant seeds, acorns, deer, elk, antelope, and rabbit were abundant. Rich environments such as Monterey Bay would have supported large villages politically organized by chiefs who oversaw the distribution of surpluses.
References:

Heizer, Robert F.

Heizer, Robert F. and Albert B. Elsasser

Heizer, Robert F. and M. A. Whipple

Moratto, Michael J.
Differences between *San Salvador* and other
Maritime Museum of San Diego Sailing Ships

- David Clark, Sail Crew, Maritime Museum of San Diego

*San Salvador* represents a mid-sixteenth-century Spanish galleon from an era two to three centuries earlier than the other ships of the Maritime Museum of San Diego (MMSD), which are late-eighteenth-century to mid-nineteenth-century designs. Differences can be seen in many details of the rigging and hull of *San Salvador*, including a distinctive projecting beak at the bow and a high stern castle and forecastle. Unlike ships of later eras, *San Salvador’s* standing rigging is fiber rope, rather than steel wire.

The bowsprit (the large spar that projects forward of the bow) anchors the stays that provide support for the fore mast. Note that the bowsprit is not on the centerline of the ship but is offset to the starboard side of the stem. Only in the mid-to-late-seventeenth century were bowsprits moved to the centerline.

Other MMSD sailing ships have rigging underneath the bowsprit to counter the upward pull of the fore mast stays. Bobstays, dolphin strikers and martingale stays were innovations introduced in the seventeenth century for this purpose. *San Salvador’s* bowsprit has only gammoning, a very heavy rope lashing, to secure it to the stem of the ship.

*San Salvador* carries a spritsail – a square sail on the bowsprit – to provide balance to the turning effect of the lateen sail and high stern castle at the stern. This is unlike the more modern ships in the MMSD collection, which have fore-and-aft-rigged staysails and jibs at the bow. These were introduced in the seventeenth century.

Notice the fore and main masts. The tops – the platforms at the head of the lower parts of the masts – are round, rather than squared off on the aft side, as began to be seen in the early eighteenth century.

The fore and main yards are not fixed at the head of their masts but can be lowered to the deck with a system of halyards and lines called tyes for furling sails and maintenance. The tyes and halyards are connected by ram’s head blocks (a type of very large wooden block) that leads to knights, the large wooden posts with sheaves in them, on deck. The fore knight is in the forecastle and its halyards lead through a scuttle in the deck above.
The yards are attached to the masts with parrels, wooden roller bearings that allow the yards to move up and down the masts and to brace around to catch the wind while still being held securely against the masts. The parrels can be tightened or loosened as needed to allow the yards to move slightly away from the masts so they may be braced farther around. This allows the ship to sail closer to the wind.

Martnets, a system of small lines that attach to the leech (vertical edge) of the fore and main sails, are used to bring the sail up and under the yard when furling. In the mid-seventeenth century, these were replaced with a simpler system of leechlines and buntlines to gather the sail to the yard.

Unlike more modern ships, the original San Salvador had no footropes, the ropes that were hung under the yards for sailors to stand on while working aloft. These were not introduced until the mid-seventeenth century. San Salvador’s sails are furled by using the martnets to control the outboard sections of the sail. The inboard sections are then reached by standing on the shrouds, or by bringing the yard down to the deck to furl. In the sixteenth century, sailors also crawled or even walked out along the yards to work on the sails, a dangerous practice that is not used today on San Salvador.

The mizzen mast carries a long lateen yard and a sail, a Mediterranean design that was the precursor to the spanker sail seen on more modern ships such as “HMS” Surprise and Star of India.

San Salvador does not have a ship’s wheel, which is an innovation from a later era. The ship’s rudder is connected to a large tiller, which is controlled by a vertical spar called a whipstaff. The helmsman stands in an enclosed space underneath the poop deck and steers the ship by pushing the whipstaff from side to side. Visibility is very limited, so the helmsman communicates via a small hatch with the officer on the quarter deck who is guiding the ship.

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In the text above, estimated dates for the introduction of various innovations are drawn from:

- Anderson, R.C., The Rigging of Ships in the Days of the Spritsail Topmast, 1600-1720, Salem, 1927
VIII. ADDITIONAL READINGS

The following list of items can be found in libraries, as well as bookstores and online sellers. The many articles about San Salvador that appeared in the Museum’s Mains’l Haul are downloadable from the MMSD’s website: sdmaritime.org. Mains’l Haul material is copyrighted by the MMSD.

Books:


