

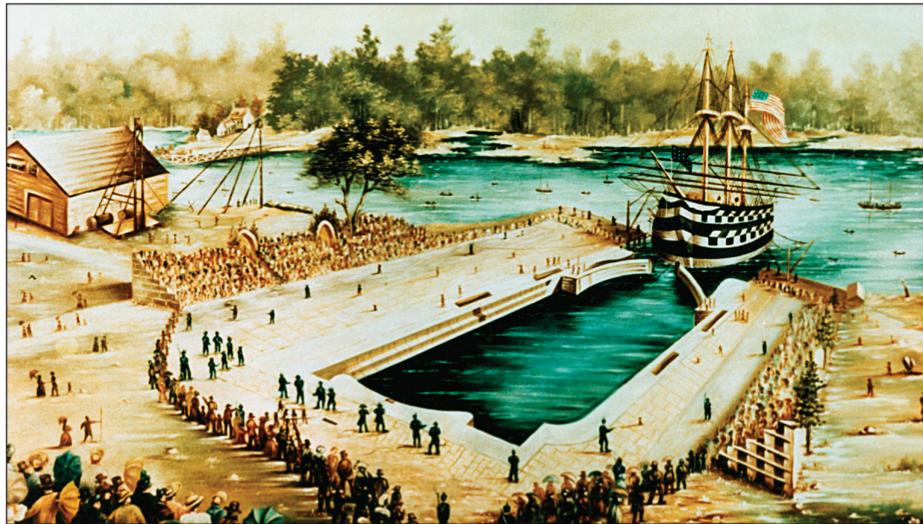
Sustaining the Fleet: The Charlestown And Gosport Dry Docks

The year was 1799 and 20 years had passed since General Charles Cornwallis surrendered Yorktown to the American and French armies, bringing the Revolutionary War to a close. John Adams was president, and the infant country was beginning to feel growing pains along its borders. Spurred by requests from Benjamin Stoddert, the secretary of the navy, Congress ordered the construction of two stone dry docks on the Atlantic Coast, one north of the Potomac and one south of it. Although they would not be constructed for another two decades, the dry docks—at the Charlestown Navy Yard, near Boston, and at the Gosport Navy Yard, near Norfolk, Virginia—were the country's first and they played an important role in building and maintaining the nation's naval fleet.

Before the construction of the dry docks, the common practice for cleaning the bottoms of naval vessels and other ships was called careening, or heaving down, whereby a ship would be pulled on its side so that its bottom could be cleaned and repaired. Not only was the process extremely time consuming because everything had to be removed from the ship first, including the top portions of the masts; it was also potentially harmful to the vessel owing to the unusual forces needed to turn the vessel on its side.

Congress agreed that the dry docks were necessary but was hesitant to appropriate the funds. In 1799 it appropriated only \$50,000 for the construction of the facilities, and in March 1801 it voted to drastically reduce the naval fleet in favor of a fleet of gunboats that would do no more than provide coastal defense. President Thomas Jefferson agreed with the measure, but he also wanted to ensure that the remaining ships would receive proper care and maintenance.

Congress quickly changed the nation's naval strategy after the War of 1812, during which the British navy invaded Washington, D.C., and soldiers from its ships burned much of the city. Congress appropriated \$8 million for the construction of 9 vessels equipped with 74 guns and 12 frigates equipped with 44 guns. To maintain the growing fleet, in 1822 Commo-



On June 17, 1833, the *uss Delaware* entered the Gosport dry dock, making that facility the first operational dry dock in the United States. One week later between 5 and 5:30 AM, the *uss Constitution* entered an almost identical dry dock situated at the Charlestown Navy Yard. Vice President Martin Van Buren, other national dignitaries, and 1,500 spectators witnessed the event.

dore John Rodgers designed and constructed the nation's first marine railway, the site being the Washington Navy Yard, in Washington, D.C. The railway could haul ships onto land in a way that preserved their hulls. The railway terminated at a covered structure in which ships were placed on submerged rail carriages and then hauled from the water.

The marine railway by itself, however, was not sufficient to maintain the navy's growing fleet. In March 1827 Congress passed legislation that would gradually improve the navy and its facilities. Included in that legislation was the construction of the two dry docks that had been conceived a quarter of a century earlier but had not been realized because of a lack of funds. Samuel Lewis Southard—then the secretary of the navy—recommended Loammi Baldwin, Jr., a prominent civil engineer based in Charlestown, to design and construct the two dry docks.

The person recommended was the son of a Revolutionary War veteran, Colonel Loammi Baldwin. The senior Baldwin was an accomplished civil engineer and played a key role in the design of several early American projects, including the Middlesex Canal, in Massachusetts, which was completed in 1803.

Born in 1780, the junior Baldwin seemed destined to follow in the engineering footsteps of his father. Seven years after he earned a Harvard law degree, he abandoned his

practice in favor of engineering. He traveled to England in 1807 and examined the spectacular public works achievements there. When he returned he opened an office in Charlestown and began working on military forts and other civil engineering projects in Massachusetts, Pennsylvania, and Virginia. In 1821 Baldwin engineered the Union Canal, in Pennsylvania, a waterway that stretched 79 mi (127 km) and included a reservoir covering approximately 800 acres (324 ha). In 1824 he returned to Europe and examined engineering achievements in France and the dry docks in Antwerp, Belgium. Upon his return to the United States the following year he helped design and erect the monument in Boston to those who had fallen at Bunker Hill.

Before he accepted the navy's commission to design and construct the dry docks, however, Baldwin insisted on complete and unrestricted control of the projects, which he was granted. He decided from the beginning to construct each dry dock from the same set of plans. He appointed as his assistant at Charlestown Alexander Parris—an architect who had also worked on the monument at Bunker Hill and who was well known for working with granite. At Gosport, Baldwin appointed Captain William P.S. Sanger, the navy's first civil engineer, as his assistant.

Work began first on the Charlestown dry dock in June 1827 and on the Gosport dock that November. During construction, Baldwin traveled between the two facilities. In the summer he would supervise the work on the dry dock in Boston, and the winter would find him at the Gosport Navy Yard.

Baldwin's plans called for the construction of a cofferdam at the mouth of each new dock to protect the excavation site from the tide. Each dam comprised two rows of piles that were spaced approximately 12.5 ft (3.8 m) apart. The piles measured 13 in. (330 mm) square and were spaced approximately 8 ft (2.4 m) apart along each row. Timbers of yellow pine were attached to the piles, and clay from the excavation was used to fill the space between the rows.

Once the cofferdams were in place, workers proceeded to excavate the docks by hand. At the Gosport dry dock the workers encountered sand, blue clay, and an impenetrable layer of gravel. Complicating matters, a spring found approximately 6 ft (1.8 m) below the excavated surface seeped upward through the wooden piles that were placed there. The force from the spring was so great that water would issue forth whenever an auger was used to bore a hole in the top of a pile.

After the painstaking process of excavating the dry docks, foundations comprising 15 to 30 ft (4.6 to 9 m) long piles spaced approximately 3 ft (1 m) apart were driven into the ground using a large pile hammer that was raised by hand and then dropped on the top of the pile. Then layers of 3 in. (76 mm) thick pine planking and 16 in. (406 mm) square oak timbers were placed on top of the piles. The space between the timbers was filled with waterproof concrete to level the foundation.

The 500,000 cu ft (14,160 m³) of granite blocks used to construct the floor and stepped walls formed perhaps the most notable facet of each dock. The walls were 35 ft (10.6 m) thick at the bottom and 7 ft (2.1 m) thick at the top of each dock. The thick walls at the bottom counteracted hydrostatic pressure from beneath the foundation and the offsets made it possible for workers to access any portion of a ship's bottom for repairs. The granite was supplied by quarries in Massachusetts and was transported by train to Boston and sent down the coast on barges to Virginia.

The granite cornerstones for each project were laid in the summer of 1829. Baldwin was aware of the skill of several slave stonemasons in the Norfolk area, and his unfettered control of the project enabled him to cut costs by employing them, much to the dismay of white stonemasons in the area. Enraged, several of the latter appealed to navy officials but to no avail. Baldwin insisted that he was acting in the best interests of his employers in that he was saving money by paying \$0.62 per slave per day—plus a \$0.10 daily incentive—rather than the daily wage of \$1.50 to \$2.00 earned by white stonemasons. Baldwin's decision was upheld by his superiors and he later praised the skill of the slave stonemasons and the quality of their work.

Each dry dock featured a complex drainage system of arched culverts that were built into the granite walls and led to nearby wells. Moreover, the entrance to each dock took the form of an inner gate comprising a set of thick wooden doors clad in copper to avoid infestation by the elongated marine clams called shipworms. These doors were convex and were operated by means of steam-powered pumps. A floating wooden gate was placed in front of the inner gate and was slipped into indentations in the stone walls, providing additional protection against the tide.

The Charlestown Navy Yard had planned to inaugurate its new dry dock as early as May 1833. But owing to circumstances that included preliminary repairs to the *uss Constitution*—the first ship to enter the dock—and a planned visit to Boston by President Andrew Jackson, the inauguration was postponed. Meanwhile, however, the *uss Delaware* entered the Gosport dry dock on June 17, 1833, making that facility the first in the United States to go into operation. The opening of the Charlestown facility one week later between 5 and 5:30 AM included 1,500 spectators and national dignitaries, among them Vice President Martin Van Buren (Jackson being unable to attend because of illness).

Together, the dry docks cost approximately \$1.6 million. Both have been enlarged to accommodate larger ships, and they are still in use today. The Gosport dry dock is listed in the National Register of Historic Places; the one in Charlestown forms part of the Boston National Historical Park, which also is listed in the National Register of Historic Places. Both docks have been formally recognized in ASCE's National Historic Civil Engineering Landmark Program.

—Brett Hansen