An Architect and Engineer in the Early Nineteenth Century:

Alexander Parris's Engineering Projects

In the first half of the nineteenth century, a number of prominent architects also practiced civil engineering and called themselves "architect and engineer." Yet with one or two exceptions, their engineering work has been overlooked by historians. This is the case for the New England native Alexander Parris (1780-1852), one of the most important architect-engineers of the early nineteenth century.

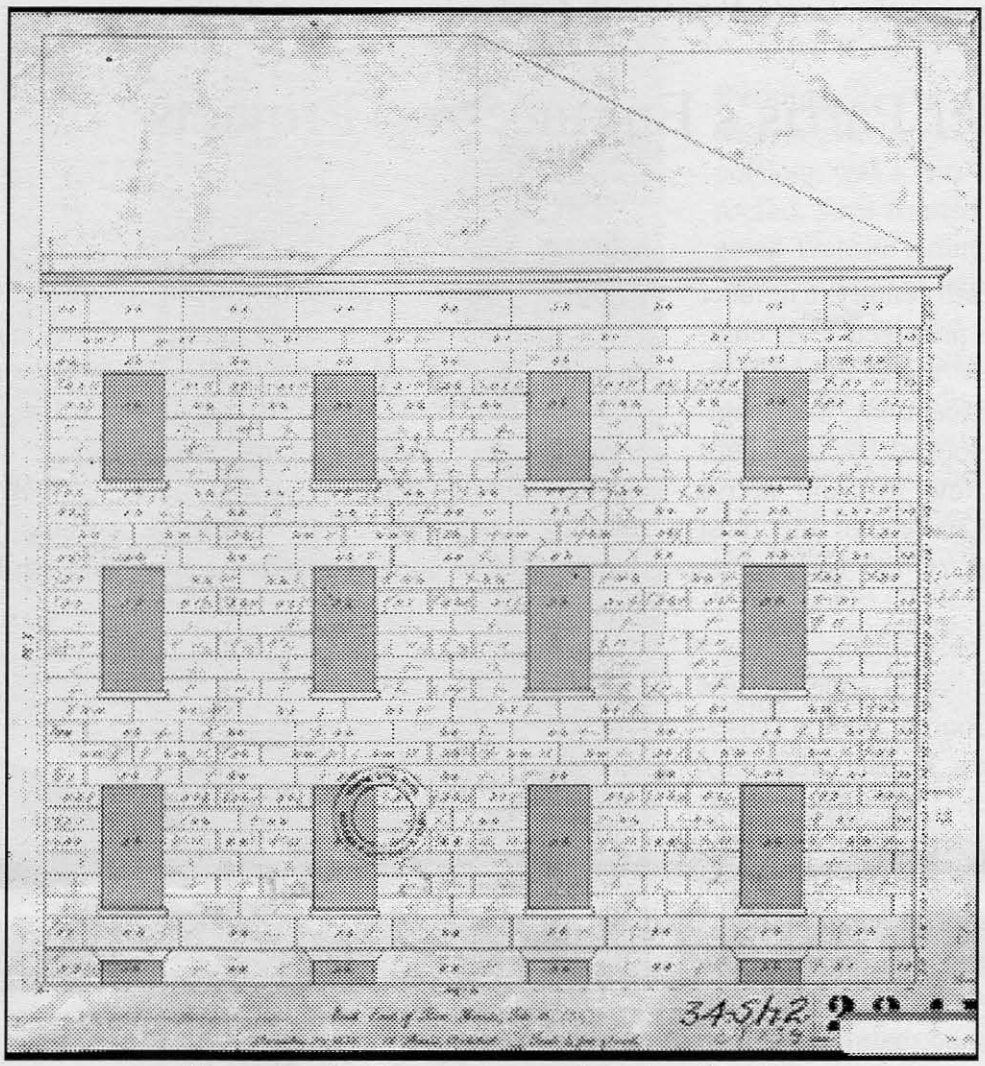
Today Parris is known only for his architecture – his monumental, classical-style granite buildings such as St. Paul's Church, Boston (1819-20); Quincy Market and stores, Boston (1824-26); and the Stone Temple, Quincy (1827-28). Yet during his professional career, Parris spent less time practicing architecture than he did working as an engineer. The period he practiced as an architect principally lasted only about ten years, from around 1818 to 1828. Then, from the late 1820s to the end of his life, Parris worked mainly (although not exclusively) on engineering projects, which included gunpowder magazines, a rope factory, lighthouses, beacons, seawalls, and dry docks. The client for most of these structures was the federal government. Importantly for enthusiasts of historic structures, many of his engineering projects are still standing.

Born in Halifax, Massachusetts, in 1780, Parris was apprenticed to a carpenter as a youth and later designed and built houses on his own account. He settled in Boston around 1808 and during the War of 1812, he served as a Superintendent in the Corps of Artificers, or builders. At the close of the war, he resumed working as a masterbuilder while trying to establish himself as a professional architect – meaning that he would offer design and construction supervision services, but not contracting. At this time, the profession of architect was hardly known in America. Moreover, given the dearth of architects, Parris had to teach himself how to draw and design. He got ideas for designs and structural systems from traveling – visiting important new buildings – and architectural books, including British building manuals such those by Batty Langley and Peter Nicholson. He eventually owned a large library of architectural and engineering books.

Structural engineering projects

Although he had an active architectural practice in the 1820s, at the end of the decade, architectural commissions apparently dried up, and Parris sought steady, if not particularly well-compensated, employment with the U.S. government. In 1827, he became a salaried assistant to Loammi Baldwin, Jr., who was the engineer for constructing the granite dry docks at the first two federal navy yards, in Boston and at Norfolk, Virginia. After these docks were largely completed, in 1833, Parris worked for the Board of Navy Commissioners on various projects at the Boston Navy Yard. Among the buildings he designed for the Navy were three structurally novel ones: a ropewalk, a sawmill, and a vaulted gunpowder magazine.

The ropewalk, a factory for spinning rope,



Alexander Parris storehouse elevation drawing, Charlestown Navy Yard, December 24, 1835.

was designed in 1834 and built 1835-37. It was an unusually large building, consisting of a three-story headhouse that contained the steam engine and boilers for driving the rope-making machinery, attached to a 1,265-foot long wing in which workers spun out rope. But the most novel feature of the building from a structural standpoint was the floor over the cellar rooms that housed the steam engine and its boilers: to prevent a fire in the engine room from spreading throughout the building, Parris made the floor over it out of cast iron beams filled with brick arches. This type of fireproof floor had been introduced in the late eighteenth century in Britain for constructing textile factories and warehouses, and Parris would have known of it from the English books he owned. This is the earliest known building in the United States to have iron beam and brick arch floors – a type of floor that became standard in iron-framed buildings from the 1850s until the 1890s.

At the same time he was working on the ropewalk, Parris built an unusual vaulted gunpowder magazine for the Navy at Chelsea, Massachusetts (1834-37). The ceiling of this one-story, rectangular structure was divided logitudinally and had seven shallow domes on each side; these were supported at the springing on ribs that spanned between pilasters at the outer walls, and granite posts in the center. Parris had already used this form of vaulting in three earlier projects, none of which are standing any longer. He wrote that he preferred what he called the "spheroidal form" to groin arching because it exerted less thrust. Although the Chelsea magazine still stands, it has been enlarged – surrounded by new walls on all sides and covered with a new roof. Parris's building survives, lacking its roof, inside these walls.

A final project at the Boston Navy Yard was a sawmill, built as an addition to the dry dock engine house (1837-40). In order to eliminate columns from the interior, Parris introduced unusual, iron and timber girders to span the 40-foot opening from wall to wall and support the second story. Each girder consisted of an iron frame roughly in the form of a queen-post truss, between timber beams. The top chord of the truss was made of cast iron bars, and the bottom chord consisted of

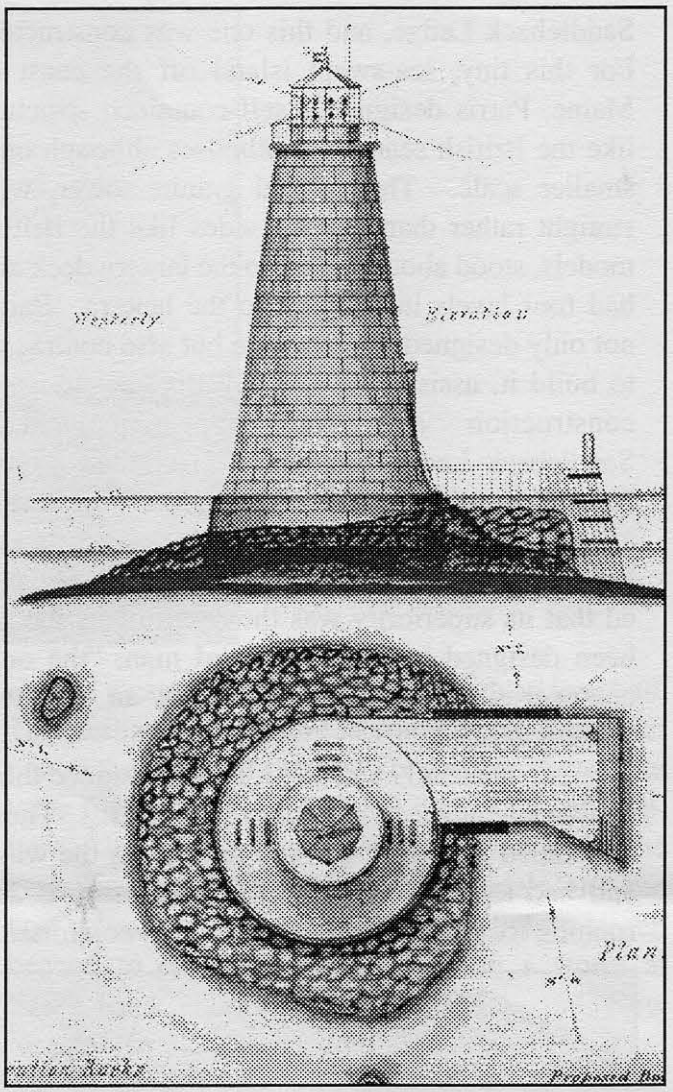
two round, wrought tie rods; the ends of the chords were secured in iron boxes, built into the walls. Iron plates suspended from the top chord carried the timber beams and the iron tie rods, one under each beam. The timber beams then supported the joists for the floor above. While trussed girders consisting of a split beam with a frame between them were used in England in the eighteenth century, the English models were intended simply to keep the girder from sagging; the trussing was not even tied along the bottom. Parris, in contrast, built a complete iron truss for his girder; his adaptation seems to be original.

Lighthouses and beacons

In the late 1830s and 1840s, Parris became involved with the design and construction of lighthouses and beacons. He designed at least eight lighthouses, six of which were built, as well as three unmanned beacons. Three more lighthouses were patterned on his designs. In several cases, he also contracted to build them. Most of Parris's lighthouses were located at unusually remote and challenging sites. He collaborated with Gridley Bryant, the well-known master mason, engineer, and inventor, on several of the projects.

Up to this time, American lighthouses were structurally rudimentary. They came in two general forms: towers, not especially tall (60 feet was the about the tallest), or cottage-style lighthouses, consisting of a tower attached an end wall or poking through the roof of a dwelling. Most were built of wood or of stone. Even the stone lighthouses of this period, for the most, part had rubble walls, which were made of random-sized stones held together with mortar and finished with stucco. Parris's lighthouses were quite different, architecturally and technologically. His towers had walls of dressed granite, meaning that the stones had to be cut, fitted, marked, and assembled in courses in order, rather than piled and parged as in rubble walls. In addition, he designed an all-iron beacon, the first use of iron structurally (apart from the lantern) in lighthouse work.

Parris's first lighthouse project, in 1838,



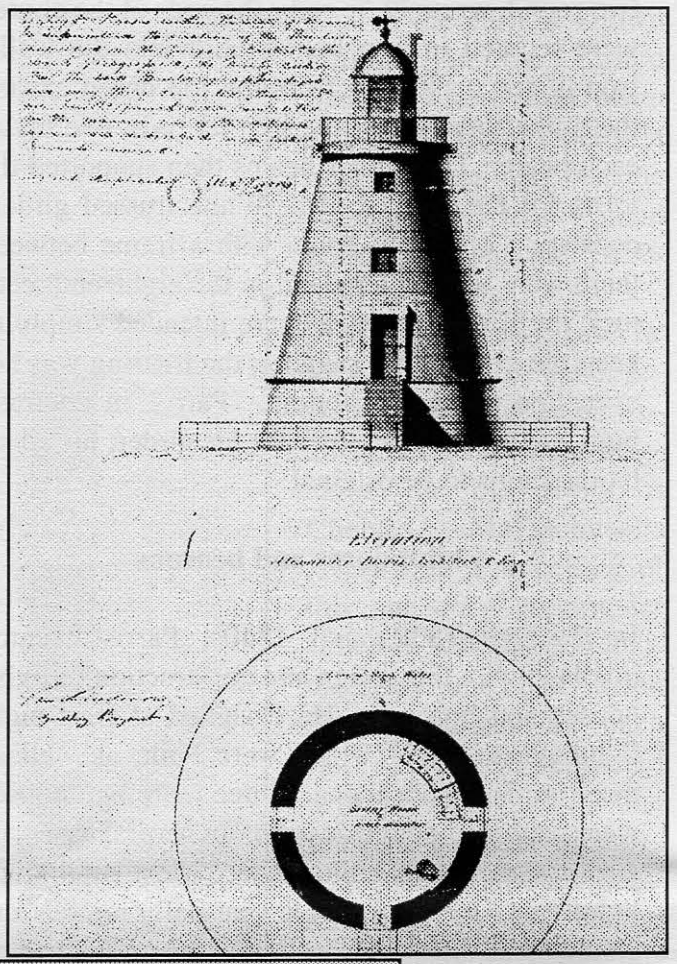
Alexander Parris drawing of the Execution Rocks Lighthouse.

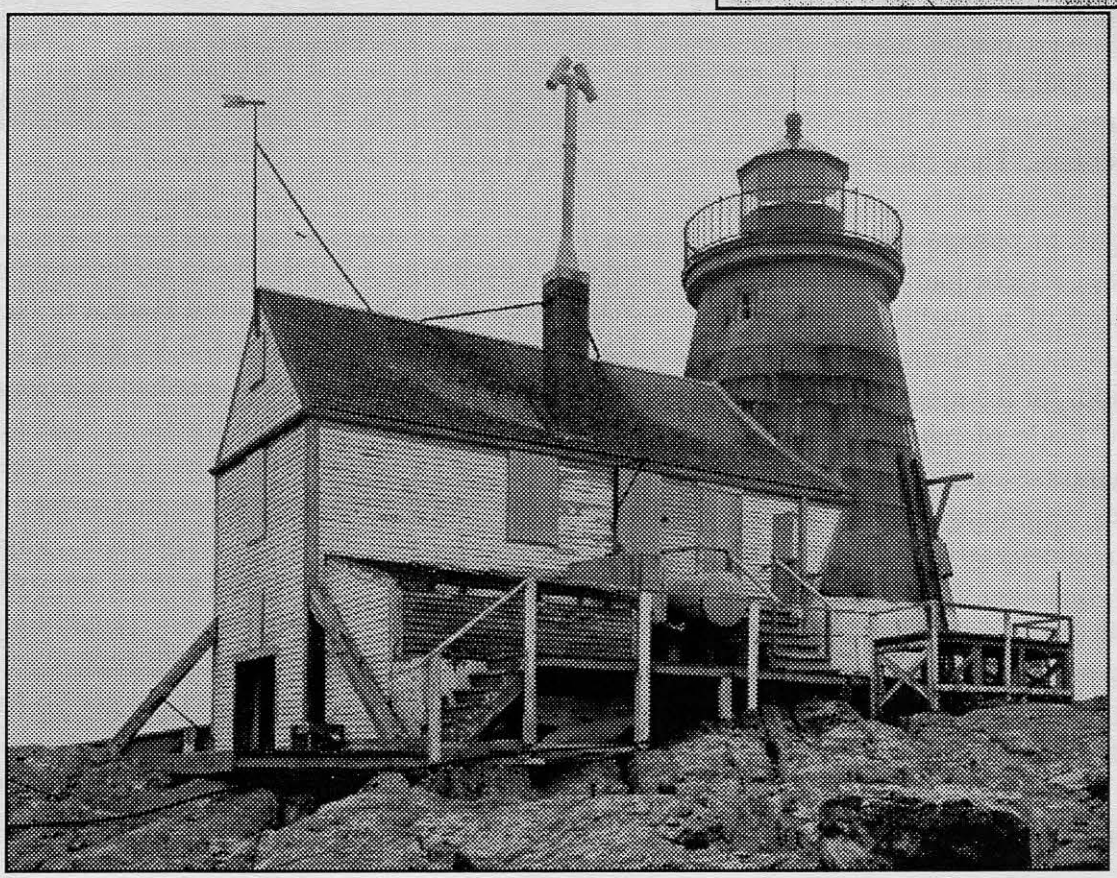
involved designing a lighthouse to replace one on Whaleback Rock near Portsmouth Harbor in New Hampshire. The site was buffeted by waves, and the walls of the existing tower there had deteriorated. Parris proposed replacing it with an elaborate tower, similar to Smeaton's famous Eddystone Lighthouse in England, with sides that curved in like the trunk of an oak tree. The base, which would be submerged at times, was to be solid, made of stones that interlocked horizontally and vertically. Probably because of the high cost – estimated at $75,000 – this project did not go forward.

The next year, 1839, Parris received his second lighthouse commission, for a tower on

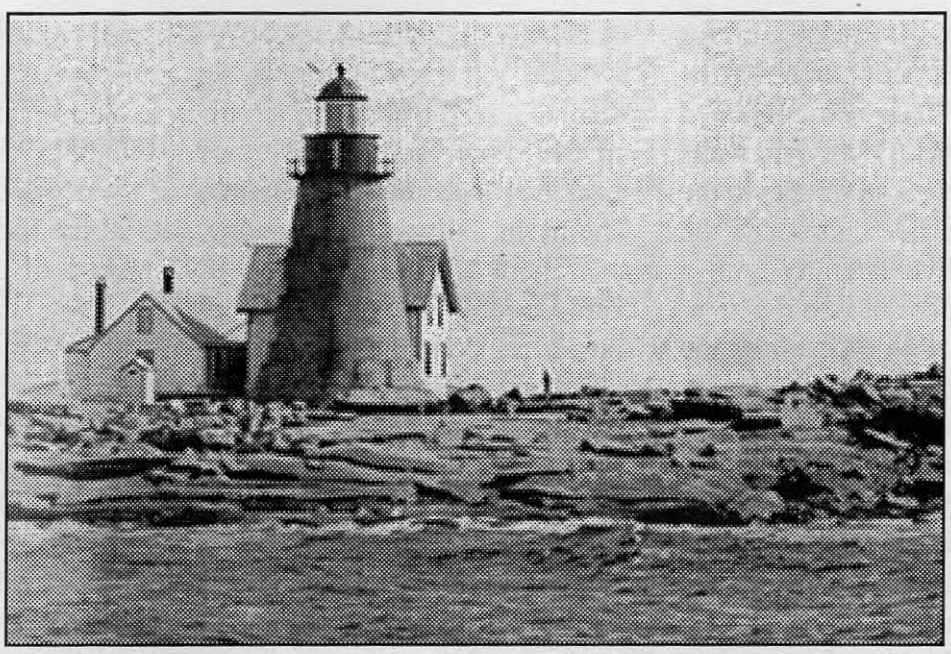
Saddleback Ledge, and this one was constructed. For this tiny, sea-swept island off the coast of Maine, Parris designed a self-contained structure like the British searock lighthouses although on a smaller scale. The conical granite tower, with straight rather than curving sides like the British models, stood about 31 feet to the lantern deck and had four levels in addition to the lantern. Parris not only designed the structure but also contracted to build it, assisted by Gridley Bryant. Its solid construction and fine appearance made Saddleback Ledge lighthouse a standout among New England lighthouses: a lighthouse inspector, after an 1842 tour, described it as the only really well-constructed lighthouse in Maine. He suggested that its superiority was the result of its having been designed by a professional man, "the only one ever erected in New England by an 'architect and engineer.'"

Between 1839 and 1843, Parris designed three beacons, two of which were built. These unmanned structures marked hazards in the water and had to withstand pummeling by storms and running ice in the spring. Parris's first commission





The c. 1839 Saddleback Ledge Lighthouse: above, the Alexander Parris drawing, and a photograph to the left.



The Mount Desert Rock Lighthouse.

was for a beacon on York Ledge, near the harbor at York, Maine. He used this opportunity to build what was for the United States a groundbreaking structure: an iron skeleton. For this partly submerged reef, Parris designed a prefabricated iron structure could be erected quickly once the foundations had been prepared. His model was a beacon on Carr Rock in Scotland, designed by Robert Stevenson and built in 1821. Manufactured in Portland, Maine, the superstructure stood about 34 feet high and consisted of six hollow, iron legs in a pyramid, which carried another hollow tube topped with a 3-foot diameter iron ball. To secure the structure to the ledge, the holes for the legs, and for the center plate that held the diagonal braces, were drilled directly into the rock, at the site. This was difficult and dangerous work, but the project was a success. Parris wrote that these methods could be used at other dangerous rocks. And indeed, iron skeleton lighthouses and beacons began to be erected on American shores with similar methods later in the 1840s, although not by Parris.

Parris's next two designs for beacons used traditional stone for the most part. His 1841 design for Round Shoal beacon, at the entrance to the Connecticut River, consisted of a cone with curving sides. The structure stood about 33 _ feet to the top, with a 19-foot tall masonry section that carried a cast iron column topped with an iron ball. To stabilize the structure laterally, Parris had holes cut on the edges of the first six courses stones that were filled with "joggles" – 8-inch cubes of granite. All the work was to be laid in hydraulic cement. Two years later, Parris made plans and cost estimates for a similar, though slightly larger, beacon to replace one destroyed in a storm at Black Rock Harbor in Long Island Sound, New York. This design was not implemented

In 1844, Parris was let go from the Boston Navy Yard. The next year, he designed a lighthouse for Minot's Ledge, near Cohasset, Massachusetts, but it was not constructed. By 1846 he must have wanted work badly, because he wrote to the federal official who oversaw the lighthouse service offering to superintend any planned lighthouses. He got the commission to build a lighthouse on Matinicus Rock, another remote outcropping on the Maine coast. The structure Parris designed – a dwelling with towers at each end – resembled the earlier lighthouse there, except the new one was made of hammered granite. From late fall to spring, 1846-47, Parris and Bryant built the dwelling and towers and they also improved the island's harbor so boats could land more easily.

In 1847, Congress passed a major lighthouse bill, and Parris was commissioned to design two of

the lighthouses: for Execution Rocks and for Mount Desert Rock in Maine. Both were barren rocks surrounded by water. The self-contained lighthouse at Mount Desert Rock (1848) had walls of hammered granite and stood about 42 feet to the underside of the gallery. The five courses of the base (for 10 feet) were secured laterally with a band of stone that fit in a groove cut into the adjacent layer. It had four levels, with a cistern in the cellar for the keeper's water supply, and a staircase of cantilevered stone. Parris designed another conical granite tower for Execution Rocks in the approach to the East River, in Long Island Sound, New York. To build on this uneven collection of rocks, he used a cofferdam and, working inside, leveled the rocks to make a foundation. The base of the structure, which would be submerged in high water, was made solid and reinforced laterally with stone joggles. It was completed in 1849 (lighted in 1850).

Parris had a hand in building several other lighthouses in this period, but they were less complicated from an engineering standpoint.

Portsmouth Navy Yard and the floating dry dock

In April 1847, after finishing plans for Mount Desert and Execution Rocks lighthouses, Parris was offered a salaried position as engineer with the Portsmouth Navy Yard in Kittery, Maine, and there he superintended the construction of a stone wharf and other projects. Parris's first association with the Portsmouth Yard was in 1839, when he directed the reconstruction of a quay wall that had collapsed. The wall was in deep water and work was done from a cast iron diving bell. Parris went down in the bell to train the men in how to work from it.

Parris's arrival in 1847 was the start of an active period in development at the Portsmouth Navy Yard. His first projects included building a stone wharf, quay wall, and various buildings. The Yard needed a dry dock, and finally in 1848, Congress authorized funds to build one. The type selected was a patented Balance Floating Dry Dock, and its inventor and an associate contracted to build it. Parris designed and built a granite basin to hold the dock and a railway to haul vessels up the shore; and put in various buildings and machines needed for the operation of the dry dock. The basin, railway, and floating gate to the basin cost about $300,000. In his 1892 history of the Yard, George Henry Preble, U.S.N., wrote that Parris had complete control of this work, which took place during two building seasons, and noted that "during that time the engineer descended in the diving bell daily" to make inspections and direct the workmen. Parris worked on other buildings and improvements at the Yard during his time there, most notably another solid masonry powder magazine, known as Building 32 (1848-49).

Conclusion

One wonders how Parris felt about his two professions – whether he preferred architecture to engineering or vice versa. He had actively sought engineering positions. For example, in 1835, he went to Washington to seek work, carrying a letter of introduction from Loammi Baldwin. Baldwin rated Parris's abilities highly, stating, "Mr. Parris has acquired from reading and long experience much scientific knowledge important in various departments of construction, which is wholly unknown to common carpenters, and ordinary house builders. I have often witnessed the value of his acquaintance of this nature, which must necessarily add great confidence to the stability, and usefulness of constructions erected under his guidance." He suggested that Parris be appointed Superintendent of Public Buildings for the navy yards. But this did not come to pass; rather, Parris continued to work at the Boston Navy Yard on a project-by-project basis. But Parris also sought architectural commissions. He designed a few buildings between 1835 and 1837, and in this latter year, entered the design competition for a new customhouse in Boston, but lost out to Ammi Burnham Young. In 1844, having been let go from Boston Navy Yard, he applied for the superintendent position for the construction of a dry dock in

New York, but apparently did not get the job. Then, feeling "too much advanced in age to again enter the strife and competition for private employment," he moved to a farm he owned in Pembroke, Massachusetts. But his retirement did not last long.

While the civil engineer position in Portsmouth allowed Parris to continue his record of accomplishment to the last days of his life, one can imagine that he would have preferred architecture to engineering, simply because it was less physically demanding. After a life filled with the usual discomforts and hardships of the times, his lighthouse work sometimes required Parris to live on desolate islands in Maine while putting up the structures. At age sixty-six, he spent the fall and part of the winter on Matinicus Rock, rebuilding the lighthouse. At age seventy he apparently was descending "daily" in a diving bell. The possibility of working indoors must have had great appeal; nevertheless, he continued doing strenuous work. In his last years, his family stayed in Pembroke, and Parris traveled from there to Portsmouth as needed. In the federal census of 1850, Parris identified his occupation simply as civil engineer. He worked until illness brought him down two years later, and died at the age of seventy-one.

Parris contributed to the development of civil engineering in several ways. He successfully implemented novel structures, adapting ideas that he learned about in books or devised on his own solutions. Parris was one of the first Americans to use iron structurally in a large way. In addition, and very importantly, he trained many architects and engineers, including Gridley J. F. Bryant, son of Gridley Bryant, and Richard Upjohn, both of whom became prominent architects; and Calvin Brown, Benjamin Chandler, and Charles Hastings, who became civil engineers. Parris also passed on the architect-engineer tradition. Luther Briggs, Jr. (1822-1905) worked as a draftsman in Parris's office as a young man and then for Gridley J. F. Bryant. On the bookplate Briggs made to label his books, he identified himself as an "Architect and Engineer."

Sara E. Wermiel, PhD

[Ed. note: Sara E. Wermiel is writing a book about the work of architect-engineers in the nineteenth century. This article draws on her research, which was partly funded by the National Science Foundation. Her book on lighthouses, part of the Norton/Library of Congress Visual Sourcebooks series, will be available in 2006.

An archive of Parris documents is now available online through the Alexander Parris Digital Project: http://www.parrisproject.org/.]

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