THE HISTORY AND ARCHAEOLOGY OF THE LAKE CHAMPLAIN STEAMBOAT *PHOENIX II* (1820-1837)

A Dissertation

by

CAROLYN KENNEDY

Submitted to the Office of Graduate and Professional Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

Chair of Committee,	Kevin J. Crisman
Committee Members,	Donny L. Hamilton
	Cemal Pulak
	Anthony Stranges
Head of Department,	Cynthia Werner

May 2019

Major Subject: Anthropology

ABSTRACT

Steam-propelled vessels transformed North American life in the nineteenth century, but many aspects of the boats still elude us, particularly for the dynamic decades of experimentation and adaptation before 1850. Fortunately, a material record was preserved in the form of wrecks. One of these surviving hulls is *Phoenix II*, built in 1820 for passenger service on Lake Champlain.

The fifth passenger steamboat to operate on the lake, the sidewheel-equipped *Phoenix II* was once known as the fastest boat in the world. Traveling between Saint-Jean-sur-Richelieu, Québec, and Whitehall, New York, for seventeen years, the steamer's career was highlighted by a variety of events, including carrying the first fatal case of cholera into the United States in 1832. In 1837, the old and worn out wooden hull was retired at Vermont's Shelburne Shipyard, where it was scuttled in the shallow harbor.

An archaeological investigation of the hull structure from 2014 to 2016 revealed that only the very bottom of the hull remained intact, but what was left was in a good state of preservation and could tell much about how the vessel was constructed. Excavation of key components of the hull, including the bow, five frame sections, the stern, and the rudder, allowed archaeologists to reconstruct how the boat was built, and interpret what it might have looked like despite the lack of iconographic or historical written evidence. The archaeology revealed that the hull was built much more robustly than necessary for an inland body of water like Lake Champlain. When compared with

contemporary examples of early steamers, its reconstruction shows that the boat resembled those that preceded it more than those that followed, indicating that shipwrights had not yet realized the full potential of hull design as a method of increasing overall speed.

DEDICATION

To Kathy, Joe, and Irene, for getting me to A&M.

To Chris, for making me happy to be here.

ACKNOWLEDGEMENTS

This project had the support of a number of excellent people and organizations with whom I have had the utmost pleasure in working. First and foremost, I would like to thank my committee chair and co-Principal Investigator, Dr. Kevin Crisman, for suggesting this project to me and inviting me to collaborate with him on what was planned as a single field season of work.

I would like to express my gratitude to the rest of my committee, Dr. Donny Hamilton, Dr. Cemal Pulak, and Dr. Anthony Stranges, for their constant support and encouragement, as well as their knowledge and expertise. Their guidance throughout this process is extremely appreciated. Additional thanks are owed to Dr. Donny Hamilton, who has allowed me to make use of the Conservation Research Laboratory's facilities and resources to conserve artifacts recovered from the Shelburne Shipyard site. Thanks also go to the Department of Anthropology, and to Rebekah Luza for her endless hard work facilitating and organizing the financial end of this project.

This project would not have been possible without Christopher Sabick and the Lake Champlain Maritime Museum. Chris is one of my earliest mentors, and I am supremely pleased to be fortunate enough to continue working with him throughout my graduate student years. I hope to continue working with him in the future.

To Arthur B. Cohn, many thanks go for taking me under his wing aboard the *Lois McClure*, and teaching me proper care and respect for our shared cultural heritage resources and the need for public outreach. His devotion to Lake Champlain is inspiring, and I know I would not have gotten to where I am without his taking a chance on me. Since the *Lois McClure* days, the Shelburne Shipyard Steamboat Project and all of its students have benefitted greatly from his dive and safety expertise, and we were incredibly fortunate to have him as our divemaster for two years.

Many thanks go to our three other divemasters, Ron Adams, Dave Potter, and Robert (Ski) Wilczynski. The safe and successful three-year-long dive project is much indebted to their guidance and supervision of operations. A special thanks goes to Dave Potter, assistant divemaster of the 2016 season, who also graciously allowed the project use of his personal air fill station at his home on Shelburne Point. The convenient location greatly decreased transit times to fill tanks, and his sharing of his extensive knowledge regarding dive air safety was greatly appreciated. This project also benefited from the excellent service provided by the Waterfront Diving Center in Burlington, and a special thanks goes to Jonathan Eddy and staff for their support of this project.

I would like to express my sincerest gratitude to Mark Brooks, Charlie Tompkins, Marge Aske, and Connie Porteous for allowing a wild bunch of archaeologists to take over their waterfront properties, use their boats, and mess up their docks every June for three years in a row. Their support and enthusiasm for this project was greatly appreciated, and without it the project would not have been possible. Thanks also to the Shelburne Shipyard Marina for allowing us to use their facilities.

I was extremely fortunate to have fantastic project crews every year, and wish to extend my gratitude to all 34 project participants: Mallissa Barthule, Jean Bélisle, Dane Billman, Dan Bishop, Alex Burford, Lauren Carpenter, Chelsea Cohen, Jenny Craig, Mara Deckinga, Taylor Ehlers, Nathan Gallagher, Paul Gates, Megan Hagseth, Rebecca Ingram, Daniel Israel-Meyer, Stephanie Koenig, Varvara Marmarinou, Rachel Matheny, Maxfield McPhee, Kevin Melia-Teevan, Carrigan Miller, Amber Passen, Kelsey Rooney, George Schwarz, Ed Scollon, Carrie Sowden, Grace Tsai, and Kotaro Yamafune. Thanks also go to Amelia Jordan Hammond for taking on the study of the *Phoenix II* artifacts for her undergraduate thesis.

A great many thanks go to Rudi Vanzin, who was my first friend made in graduate school, and has been a constant source of love, comfort, and cookies as I researched and wrote this very long story about a boat. To Ashley, Caitlin, Brett, and Leo, thanks for the constant reminder that there is a world out there that is bigger than academia.

My deepest and sincerest gratitude go to my parents, Kathy and Joe, for their encouragement, love, and support my whole life. Words will never be enough to thank them for all they have done for me. Simply put, none of this would have been possible without them. I am deeply thankful for the support from my grandparents, Irene and Stan, and inspiration from my sister, Allison.

Finally, to my main editor and favorite colleague, but more importantly, my best friend and partner, Chris – thank you. Your love and support mean the world to me, and I am so lucky to have you.

CONTRIBUTORS AND FUNDING SOURCES

Contributors

This work was supervised by a dissertation committee consisting of Professor Kevin Crisman, committee chair, Professors Donny Hamilton and Cemal Pulak of the Department of Anthropology and Professors Anthony Stranges of the Department of History.

All field work for this dissertation was completed by the student, in collaboration with Kevin Crisman of the Department of Anthropology, leading a team including Ron Adams, Mallissa Barthule, Jean Bélisle, Dane Billman, Dan Bishop, Alex Burford, Lauren Carpenter, Chelsea Cohen, Arthur B. Cohn, Jenny Craig, Mara Deckinga, Taylor Ehlers, Nathan Gallagher, Paul Gates, Megan Hagseth, Rebecca Ingram, Daniel Israel-Meyer, Stephanie Koenig, Varvara Marmarinou, Rachel Matheny, Maxfield McPhee, Kevin Melia-Teevan, Carrigan Miller, Amber Passen, Dave Potter, Kelsey Rooney, Christopher Sabick, George Schwarz, Ed Scollon, Carrie Sowden, Grace Tsai, Robert (Ski) Wilczynski, and Kotaro Yamafune. All other work for the dissertation was completed independently by the student.

Funding Sources

This work was made possible in large part by the Institute of Nautical Archaeology, which provided grant funding all three seasons of the project, including the Claude Duthuit Archaeology Grant in 2016. The 2015 season was made possible by the National Park Service's Maritime Heritage Program Grant under Grant Number 2014-122, grant agreement number 14-MH-018 with the Vermont Division for Historic Preservation. All three seasons were facilitated through additional funding from the Center for Maritime Archaeology and Conservation and Texas A&M University. Permission for archaeological work in 2014-2016 in Vermont's Lake Champlain waters was granted by the Vermont Division for Historic Preservation.

The contents of this work are solely the responsibility of the author and do not necessarily represent the official views of any of the above awarding offices.

NOMENCLATURE

LCSC	Lake Champlain Steamboat Company
LCMM	Lake Champlain Maritime Museum
CTC	Champlain Transportation Company
CMS	Champlain Maritime Society
Phoenix I	First Lake Champlain steamboat named *Phoenix* (1815-1819)
Phoenix II	Second Lake Champlain steamboat named *Phoenix* (1820-1837)
VtDHP	Vermont Division for Historic Preservation
INA	Institute of Nautical Archaeology
CMAC	Center for Maritime Archaeology and Conservation

TABLE OF CONTENTS

LIST OF FIGURES

Page

LIST OF TABLES

Page

CHAPTER I

INTRODUCTION AND LITERATURE REVIEW

The introduction of steamboats as a viable mode of passenger and cargo transportation is often attributed to Robert Fulton's commercial success with his steamer, *Clermont* in 1807. *Clermont*'s inaugural voyage from New York City to Albany along the Hudson River was completed in only 32 hours, a substantial improvement over the average times made by sloops on the river.[1] Fulton's triumphant experiment showed the potential of steam travel: by burning wood or coal to boil water in boilers, engineers could harness the expansive power of steam in an engine and transfer that energy into the rotation of paddlewheels to power a boat. The ability to generate power via fuel suddenly freed nautical transportation from the whims of the weather or the physical limitations of manpower.[2]

This shift in propulsion methods necessitated experimentation in what was a relatively conservative trade: shipbuilding. Although ship design had undergone steady changes throughout the history of seafaring prior to the invention of steam-propelled boats, shipwrights tended to be slow to embrace changes, relying on tried and true methods of shipbuilding and traditional hull design. From the perspective of a shipbuilder, experimentation with hull design could lead to the loss of valuable property and many lives if the experiment was unsuccessful.[3]

---

[1] Bellico 2001, 262; Crisman *Ticonderoga* 2014, 248; Lewis 2015, 1; J. B. Marestier 1957, 5; Renwick 1838, 103; Ross 1997, 23; Schwarz 2012, 3; Stevenson 1859, 70.
[2] Hillstrom and Hillstrom 2005, 1-5.
[3] Steffy 1994, 8.

With the introduction of steam engines, however, traditional sailing ship hull designs were no longer ideal. Sailing ships are designed so that when the wind hits the sails from the side of the boat, the wineglass shape and deep keel of the hull guides the ship forward, preventing the vessel from lateral drift, whichever way the wind is blowing.[4] Steamboats are propelled by paddlewheels, which pull the boat forward by pushing the water backwards. Steamer hulls, particularly those employed on rivers and lakes, did not need deep keels to provide lateral resistance against the wind. With no lateral resistance needed, steamers could be built flat floored, which became advantageous for those designed for inland waterways (seagoing vessels still needed a deeper keel to lower the center of gravity in rolling waves). Flat floors allowed for greater cargo space and shallower drafts, meaning boats could navigate very shallow waters and steam up to docks close to shore, improving passenger boarding efficiency and making the steamboat-travel experience not only much faster, but more pleasant.

As shipwrights sought the ideal steamer hull shape in the first half of the nineteenth century, opportunities for experimentation arose throughout North America. Different bodies of water had different qualities that changed the requirements for engines' power and hull design. As a result, three inland waterway steamboat design categories developed in the early nineteenth century: eastern waterway steamboat design, western river steamboat design, and Great Lakes steamboat design.[5] The earliest group of steamboats were those built in the northeast for the eastern rivers (and smaller

[4] Anderson 2003, 42.
[5] Stevenson 1859, 74.

lakes); these included Fulton's *Clermont*, as well as other Hudson River and Lake Champlain boats. Generally, eastern waterway steamers were built with large, low-pressure, double-acting condensing engines, and the hulls tended to be designed with shallow drafts.[6]

Western river steamboats needed to compete with strong currents, as well as maintain shallow drafts to traverse the shoals and sand bars of the narrow, winding rivers of the west. It was necessary that their engines be more powerful than the eastern waterway steamboats' low-pressure engines to propel them against the currents. These steamers therefore employed high-pressure engines to push upriver and over shallow shoals and snags.[7] Aside from the changes in engine design, the shallow drafts necessary required experimentation with hull design to create large steamboats for maximum cargo capacity that would not constantly run aground.[8]

Steamers on the Great Lakes had fewer restrictions in draft. Rather, boats designed for the Great Lakes could be very deep, which naturally increased cargo and passenger capacity, leading to greater profits.[9] The concern for the Great Lakes, rather, was the fuel it took to power these vessels. The Great Lakes were already well-suited for large sailing ships (unlike the majority of North American inland waterways), so the tradeoff in the cost of fuel for steamers against the capacity of sailing ships delayed their development there. Thousands of boats were built around the lakes in the first half of the

[6] Stevenson 1859, 74.
[7] Ibid, 74.
[8] Crisman *Heroine* 2014, 147.
[9] Stevenson 1859, 74.

century, but most were sailers. The Great Lakes did not rely on steam nearly as much as the Western rivers or Eastern waterways until after the Civil War.[10]

As European settlements in North America expanded westward, settlements typically clustered along waterways as they were the main routes of communication and transportation to the eastern markets since roads were rough or non-existent. These inland waterways were ill-suited for sailing ships on account of their shallow depths and were difficult to navigate by man-powered craft due to their strong currents.[11] The steam revolution changed that. Although the United States made many contributions to the technological advances of the Industrial Revolution, steamboats were "in many ways the most notable achievement of our industrial infancy."[12] They were the solution to a problem specific to nineteenth-century North America: the absence of roads and the massive size of the continent. Although steamboats were influential elsewhere, their impact was greatest in North America where the interconnected inland waterways formed an excellent system of 'highways' whose currents could be overcome by converting heat energy from steam in a boiler to mechanical energy in an engine that turned paddlewheels to propel boats forward.[13]

Despite the profound effect steam transportation had on nineteenth-century North America, the historical record regarding the early years of steamboat hull and engine design is surprisingly sparse. Most steamboats built in the 1810s, 1820s, and 1830s were

---

[10] Lewis, 2015, 369.
[11] Hillstrom and Hillstrom 2005, 196-197; Renwick 1838, 101.
[12] Hunter 1994, 61.
[13] Hillstrom and Hillstrom 2005, 1; Chin et al. 2006, 572.

built through a process of trial and error, and hull and engine plans were either not generated in the first place, or the records were not preserved.[14]

Henry Hall, a special agent for the Department of the Interior remarked on shipwrights' practice of working largely without plans in his *Report on the Ship-Building Industry of the United States.* He writes: "A large number of small builders keep no accounts other than rough memoranda on a board, no copy of which is retained after the boat or vessel in hand is completed, or, at any rate, nothing better than equally rough notes jotted down in a pocket memorandum book, which are not complete when entered, and are almost unintelligible in a year's time."[15] Although Hall's report was written in 1884, the lack of historical documentation tells us that similar practices were common in the earlier part of the nineteenth century.

British engineer David Stevenson provided more insight into the experimental nature of North American steamboat building. He comments on observations made during his visit in 1837, stating:

> [O]n minutely examining the most approved American steamers, I found it impossible to trace any *general* principles which seem to have served as guides for their construction. Every American steamboat-builder holds opinions of his own, which are generally founded, not on theoretical principles, but on deductions drawn from a close examination of the practical effects of the different arrangements and proportions adopted in the construction of different steamboats.[16]

---

[14] Stevenson 1859, 71-72.
[15] Hall 1884, v.
[16] Stevenson 1859, 71-72.

Commenting on the speed of American steamers in the second quarter of the century, he notes,

> They have effected this great increase of speed by constantly making experiments on the form and proportions of their engines and vessels – in short, by a persevering system of *trial and error*, which is still going forward; and the natural consequence is, that, no two steamboats are alike, and few of them have attained the age of six months without undergoing some material alterations.[17]

Not only did steamboat builders not record their designs, but Stevenson calls attention to the fact that even if they did, hulls were often completely reworked months or years after they were launched, making those original plans no longer representative of the actual vessel (an important point to keep in mind when the archaeological remains of boats are found). Photography dating to the latter half of the nineteenth-century can be used to study later steamers, but the dearth of reliable images or plans of steamboats built in the 1810s, 1820s, and 1830s leaves us with little evidence of what the early vessels looked like.

Fortunately, a material record from these decades -- steamboat wrecks -- currently lies beneath many of North America's inland waterways. To date, several have undergone thorough archaeological study, including *Ticonderoga* (1813-1825),[18] *Phoenix I* (1815-1819),[19] *Lady Sherbrooke* (1817-1824),[20] *Heroine* (1832-1838),[21] and *Anthony Wayne* (1836-1850).[22] The archaeological study of the hulls and machinery of

[17] Ibid., 72.
[18] Crisman, *Ticonderoga* 2014.
[19] Schwarz 2012; Schwarz 2016.
[20] Belisle and Lepine 1986; Belisle and Lepine, 1988.
[21] Crisman, *Heroine*, 2014.
[22] Krueger 2012.

these boats have greatly added to our understanding of the propulsion technology and the rapidly-changing architecture of steamers in these first few decades of the nineteenth century. This dissertation seeks to contribute to this record by providing a detailed description of the history and archaeology of another early steamboat, *Phoenix II*, built and operated on Lake Champlain between 1820 and 1837.

Why Lake Champlain?

There are several reasons why Lake Champlain was selected for this study. The first reason was the author's interests to learn more of the history and nautical archaeology of Lake Champlain, stemming from previous employment with the Lake Champlain Maritime Museum. Project co-principal investigator Crisman also had extensive professional experience working with Lake Champlain's submerged cultural heritage resources. Through these experiences, Crisman knew about the Shelburne Shipyard Steamboat Graveyard, and had some idea of its potential for revealing information on early steamboats, having dived on the wrecks himself thirty years prior to this investigation.

Aside from the directors' strong ties to the lake, and the known archaeological remains of four steamboat wrecks in Shelburne Shipyard, Lake Champlain is an ideal location for the study of submerged steamboat wrecks for three main reasons: (1) the cold, dark waters of the lake preserve wooden hulls remarkably well, leaving detailed archaeological evidence to work with; (2) although its waters can be cold for divers, Lake Champlain is an excellent diving location, with little to no current, fair visibility (3 to 10 feet [1 to 3 m] at Shelburne Shipyard), and an active dive community with readily-available dive resources; and (3) lastly, but most importantly, the lake's extensive and well-documented history of steamboat activity (especially during the early years of steam), lasting from 1809 to 1953.

Lake Champlain's Steamboat History

In the months and years following *Clermont*'s inaugural passage up the Hudson River in 1807, Fulton's boat rapidly gained recognition throughout the Hudson Valley as a practical way to travel, encouraging ambitious entrepreneurs to follow suit. Fulton and his partner Chancellor Robert Livingston anticipated these potential competitors and applied for (and were granted) a monopoly over steam transportation on all New York state waters.[23] To circumvent the Fulton-Livingston monopoly on the Hudson River, the brothers James and John Winans launched the world's second commercially-successful steamboat, *Vermont*, on nearby Lake Champlain in 1809.[24]

Lake Champlain was ideally suited for a passenger steamboat venture. Located between the states of New York to the west and Vermont to the east, the lake drains northward into the Canadian province of Québec. Its 120-mile (180-km) length created a nearly-continuous water highway between the St. Lawrence River and the Hudson River (Figure 1-1). This fortuitous geographical position meant that travelers from New York City to Montreal or Québec City (or vice versa) could board the lake's steamboats rather

[23] Renwick 1838, 103; Hemenway 1867, 686.
[24] Hemenway 1867, 686.

than travel the rough, bumpy roads through the region, which at the time did not offer comfortable or speedy traveling. Traveling from the lake's southernmost limit of navigation, Whitehall, New York, to its northern end at Saint-Jean-sur-Richelieu (at that time, known by its English name St. John's), Québec, the 1809 steamboat *Vermont* could make the round-trip journey in a week, averaging 4 miles per hour (6.4 km/h).[25] This time was drastically improved upon by subsequent steamers. In 1820 *Phoenix II* made the trip at double *Vermont*'s speed, paddling at 8 miles per hour (12.9 km/h). By the late 1830s, the steamers *Burlington* and *Whitehall* attained speeds of 16 miles per hour (25 km/h), enabling a one-way trip in only 15 hours.[26] By the 1880s, another 50 years later, Champlain steamers were capable of 20 miles per hour (32 km/h), and finally, by the turn of the century, both *Vermont III* (1903) and *Ticonderoga* (1906) reached 23 miles per hour (37 km/h).[27]Although perhaps less impressive now, these were fast boats for their era, and steamboat passengers on Lake Champlain could generally expect reliable departure and arrival times, a great improvement on the speed and reliability of sailing vessels on the lake.

[25] Ross 1997, 25.
[26] *Plattsburgh* (NY) *Republican* 27 October 1837: 3.
[27] Ross 1997, 143,145.

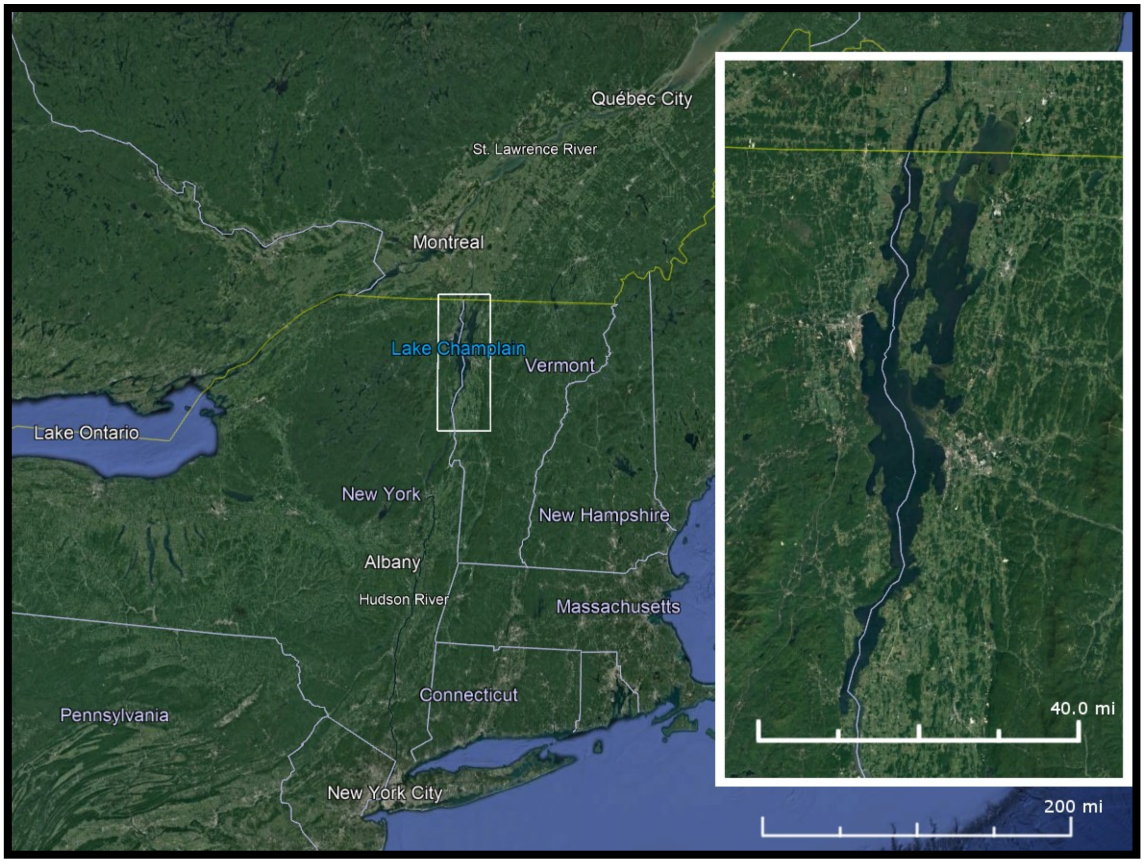


Figure 1-1. Location of Lake Champlain in relation to major waterways and cities. These include the St. Lawrence River (north) and Hudson River (south), and four major cities: Québec City (north east), Montreal (north), Albany (sourth), and New York City (south). (Reprinted from Google Earth, 2018)

Steam transportation in the Champlain and Hudson Valleys was swiftly and enthusiastically welcomed by most of the people living in the northeast. Aside from the loss of business experienced by some owners of sailing craft, the general population benefited greatly from the lake's fleet of steamboats. Steam navigation brought business to the Champlain Valley, and contributed to the growth of both the population and the economy in newly-settled lakeside communities.[28]

[28] Cohn 2003, 26.

Research Objectives and Methods

In 2013, the author and Crisman began their investigation of the scuttled hulls of several steamboats near Lake Champlain's Shelburne Shipyard (located in a small bay in the town of Shelburne, Vermont) (Figures 1-2 and 1-3). The initial objective of this study, planned for the 2014 field season, was to survey and identify the four wrecks in the south end of the bay, an area adjacent to the Aske Marina (Figures 1-4). Once this goal was achieved, the principal research questions subsequently posed by this study were: (1) how did shipwrights adapt traditional shipbuilding methods to the building of vessels suited to steam propulsion; and (2) how can the archaeological remains of early steamers contribute to our understanding of the outfitting and operations of the earliest steamboats?

Figure 1-2. The four steamboat wrecks that were the focus of the Shelburne Shipyard Steamboat Graveyard Project. These include: 1. *A. Williams*, 2. *Phoenix II*, 3. *Burlington*, and 4. *Whitehall*. (Reprinted from Bing Maps, 2013)

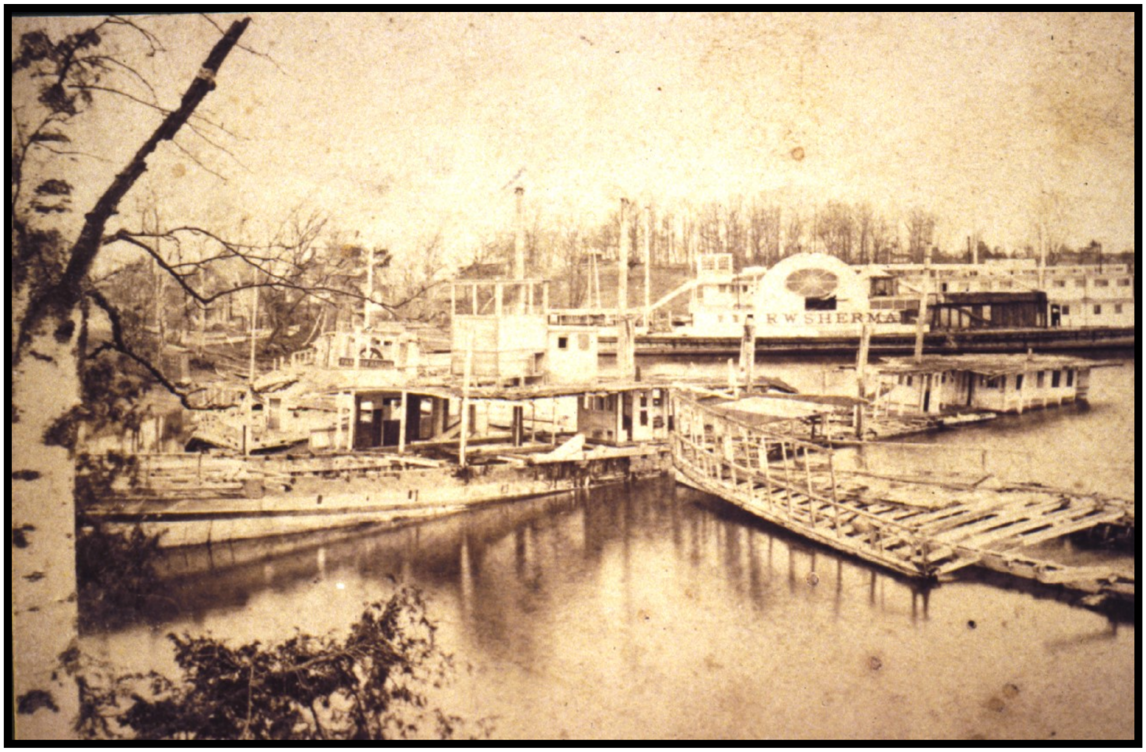


Figure 1-3. Shelburne Shipyard, circa 1858. (Photograph courtesy of K. Crisman, personal collection)

Figure 1-4. Aske Marina and Shelburne Shipyard, 2014. Photograph taken from the same location as Figure 1-3. (Photograph by K. Crisman, 2014)

The 2014 field season was originally intended to be the only season of study at Shelburne Shipyard, but the potential of the site to add to our understanding of early steamboat hull design and technology inspired two more seasons of investigation. Three of the four wrecks, *Burlington* (1837-1854), *Whitehall* (1838-1853), and *A. Williams* (1870-1893), were correctly identified during the first season of fieldwork, but the fourth wreck (provisionally known as Wreck 2) was mistakenly reported in the author's Master's thesis to be *Winooski* (1832-1850).[29] Wreck 2 was believed to be *Winooski* based on its length, 134 feet (40.8 m), matching closely with *Winooski*'s recorded length of 136 feet (41.5 m). In 2015, however, Wreck 2's beam was found to be at least 25 feet 7 ½ inches (7.8 m), much larger than *Winooski*'s beam of 20 feet 6 inches (6.25 m) (See Table 1).[30]

As the 2015 field season came to a close, the identity of Wreck 2 was once again a mystery. It was believed to be that of an early lake steamer as the wreck was heavily framed, a construction style that appeared to pre-date the lighter framing found on the other three wrecks in the shipyard. Wreck 2's larger framing timbers closely resembled the scantlings of the 1815-built *Phoenix I* (Figure 1-5). Despite the clues, none of the length-and-beam combinations from the historical records seemed to match the archaeological remains.

[29] Kennedy 2015.
[30] Ross 1997, 39.

Steamboats on Lake Champlain from 1809 to 1916						
Names	Year Finished	Where Built	Length (ft.)	Breadth (ft.)	Depth (ft.)	Tonnage
Vermont I	1809	Burlington	120	20	8	167
Phoenix I	1815	Vergennes	146	27	9 ½	336
Champlain	1816	Vergennes	90	20	8	128
Congress	1818	Vergennes	108	27	8	209
Phoenix II	1820	Vergennes	150	26	9 ½	343
General Greene	1825	Shelburne	75	22	8	115
Franklin	1827	St. Albans	162	22	9	350
Washington	1827	Essex, NY	92	20 ½	7 ¾	134
MacDonough	1828	St. Albans	89	20 ½	8 ½	138
Winooski	1832	Shelburne	136	20 ½	8 ½	226
Water Witch	1832	Fort Cassin	90	17	8	107
Burlington	1837	Shelburne	190	25	9	405
Whitehall	1838	Whitehall	215	23	9	460
Saranac	1842	Shelburne	166	22	9	375
Francis Saltus	1844	Whitehall	185	26	8 ¾	473
J.H. Hooker	1846	Whitehall	136	23	7	258
United States	1847	Shelburne	240	28 ½	9	648
Ethan Allen	1847	Shelburne	136	27	8 ½	328
Boquet	1848	Essex, NY	80	17	1	111
Boston	1851	Shelburne	127	25	8 ½	284
America (*R.W. Sherman*)	1851	Whitehall	250	31 ½	9 ½	745
Canada	1853	Whitehall	260	33 ½	10	881
Montreal	1855	Whitehall	224	23	9	417
Oliver Bascom	1856	Whitehall	136	27	9 ½	360
Adirondack	1867	Shelburne	251	34	9	1087
Oakes Ames	1868	Marks Bay	258	35	9	1145
A. Williams	1870	Marks Bay	132	22	8	240
Vermont II	1871	Shelburne	262	36 ½	10	1124
Maquam	1881	Swanton	142	25	8	370
Reindeer	1882	Alburgh	168	27	9	498
Chateauguay	1888	Shelburne	205	54	9 ½	742
Vermont III	1903	Shelburne	262	62	10 ½	1195
Ticonderoga	1903	Shelburne	220	57 ½	11 ½	892

Table 1. Lake Champlain steamboats and their sizes, their dates of construction, dimensions, and tonnages. (From Wilkins 1916, 14-15)

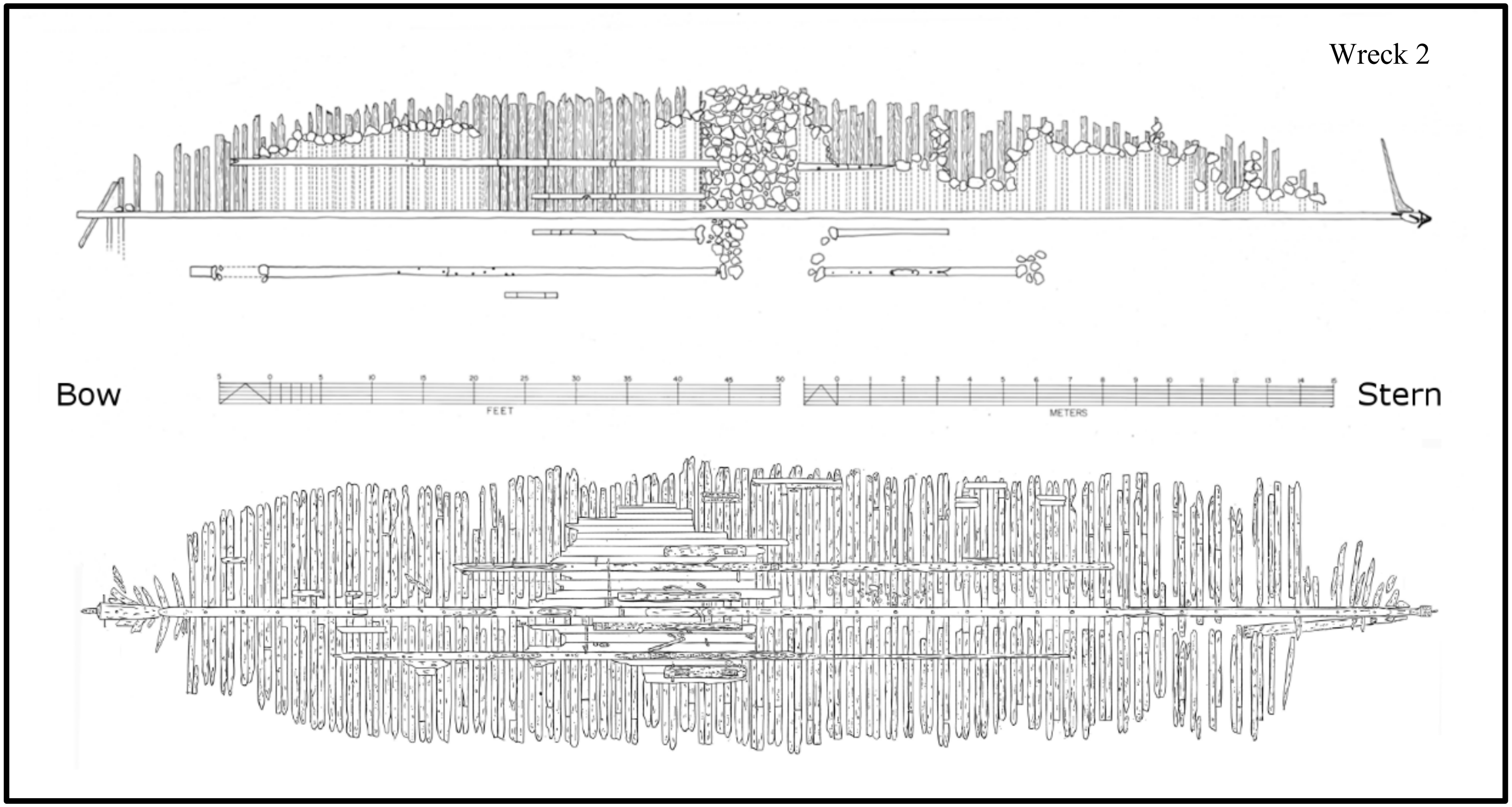
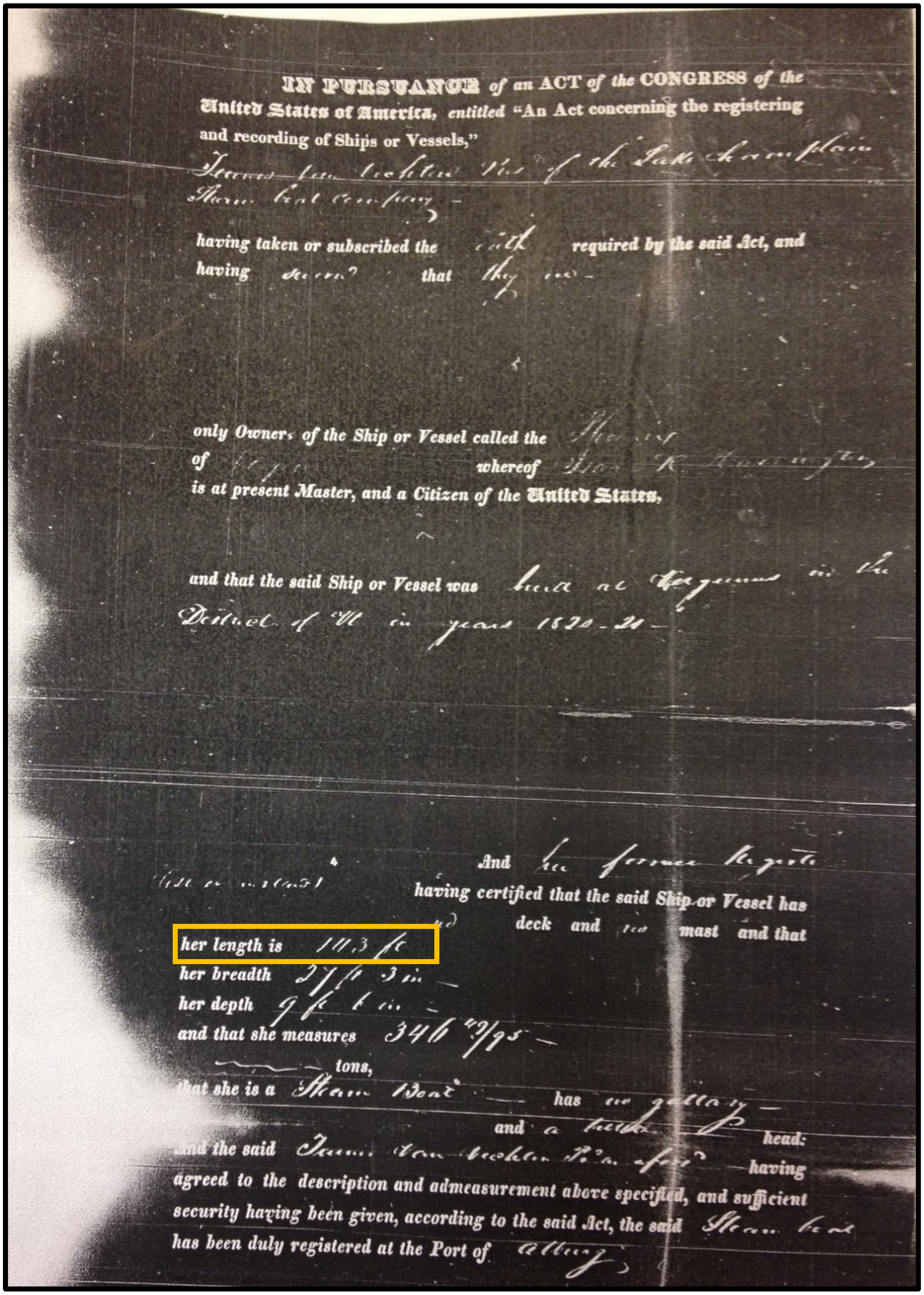


Figure 1-5. Wreck 2 site plan (2014) (above) compared with *Phoenix I* site plan (below). At the same scale, both wrecks are nearly identical in size, number of frames, and position, size and number of engine bed timbers. (Wreck 2 site plan by C. Kennedy, *Phoenix I* site plan reprinted from Schwarz, 2012: 129)

In an effort to solve the mystery, the author located copies of Lake Champlain passenger steamboat ‘Certificates of Registry’ in a collection donated to the Lake Champlain Maritime Museum by historian Peter A. Barranco. These documents revealed that while the passenger steamer *Phoenix II*’s length had been recorded in some secondary sources as 150 feet (45.7 m), its Certificate of Registry length was actually 143 feet (43.6 m) (Figure 1-6).[31] This slight exaggeration in length of 7 feet (2.13 m) had initially put *Phoenix II* out of range as a likely candidate for Wreck 2, but 143 feet (43.6 m) seemed a plausible fit for a 134-foot-long (40.8-m-) wreck. The remaining hull lacked most of its stem and sternpost as well as the upper sternpost and counter structure, accounting for the discrepancy in length measurements.

Based on this rediscovered actual length of *Phoenix II*, the 2016 field season began with the new plausible identification in mind, knowing it was unlikely the wreck’s identity would ever be known for certain. Two weeks into the final season of archaeological investigation, however, a diver recovered a chisel tucked between the engine bed timbers amidships. The letters stamped into both sides of its octagonal shank spelled ‘SBPhoenix,’ (with the ‘S’ stamped backwards) an unexpected and very welcome archaeological corroboration of the historical evidence (Figure 1-7).

[31] Sources citing *Phoenix II*’s length as 150 feet (45.7 m) include Ross 1997, 39; Hemenway 1867, 707; Wilkins 1916, 15-16; Thompson 1853, 215-216; Barranco Papers, LCMM.


IN PURSUANCE of an ACT of the CONGRESS of the United States of America, entitled "An Act concerning the registering and recording of Ships or Vessels,"

having taken or subscribed the oath required by the said Act, and having sworn that they are

only Owners of the Ship or Vessel called the
of whereof
is at present Master, and a Citizen of the United States,

and that the said Ship or Vessel was built at

And
having certified that the said Ship or Vessel has [illegible] deck and mast and that
her length is 114.3 ft
her breadth
her depth
and that she measures
tons,
that she is a has
and a [illegible] head:
and the said having agreed to the description and admeasurement above specified, and sufficient security having been given, according to the said Act, the said has been duly registered at the Port of

Figure 1-6. *Phoenix II*'s Certificate of Registry with the steamer's length outlined in yellow. (Reprinted from Barranco Papers, LCMM)

Figure 1-7. The chisel recovered from between two engine bed timbers amidships, stamped with 'SBPhoenix' in which the 'S' is backwards. The discovery of this chisel confirmed the identity of Wreck 2 as *Phoenix II*. (Photograph reprinted from G. Schwarz, 2016)

This unlikely find of a named tool confirmed the identity of Wreck 2 as *Phoenix II*, since only two steamers ever bore the name "Phoenix" on Lake Champlain, and *Phoenix I* was known to have burned and sunk in another location.[32] The positive identification of the wreck permitted its hull components to be directly compared to those of its direct predecessor, *Phoenix I*, which has also undergone systematic study.

[32] Schwarz 2012, 3.

The fortunate, unexpected discovery and identification of *Phoenix II* helps to fill in the story of early Lake Champlain steamboat construction.

Literature Review

To understand *Phoenix II*'s hull remains fully, and to place its design in historical context, it was necessary to review both historical records and archaeological reports describing contemporary steamboats and their hulls. This research established a baseline for common construction techniques at the time and helped determine which features found on *Phoenix II* could be considered new or experimental, versus those that conformed to common steamboat-building practices of this era.

Historical Sources

Both primary and secondary historical sources were examined to provide the historical context of *Phoenix II*'s operational life. The latter included popular histories written long after *Phoenix II* was scuttled. Two of the most useful were Abby Maria Hemenway's histories of Lake Champlain steamers in *Vermont Historical Gazeteer* (1867), and Ogden Ross' *The Steamboats of Lake Champlain 1809-1930* (1997).

The description of *Phoenix I* in Hemenway's short history noted that, "unlike steamboats of the present day she had no upper deck or stateroom, the main deck being protected from the weather by an awning of canvas." This source also mentioned the "short guards which extended from the bow to about 25 feet [(7.62 m)] abaft of the wheels – where the small boats were suspended – and an accommodation ladder for the purpose of entering the small boats from the deck."[33] These descriptions are helpful for understanding *Phoenix II*, because, as stated later in the same text, the second *Phoenix* was "arranged and finished similar to the first *Phoenix*," except that, "some improvements were afterwards made, and the guards were extended full around."[34]

Ogden Ross wrote his history of Lake Champlain steamboats in 1930 for the Champlain Transportation Company (CTC). His work includes information about all of the passenger steamers on the lake, such as the year each was built, as well as its size, speed, owners, and year of retirement. His book is generally organized in a chronological order, with each chapter devoted to one or two decades of steaming on the lake. While an excellent starting point, Ross' accounts were not always very detailed, nor complete, for example he did not include any information about the retirement of *Phoenix II*. Furthermore, the information he does provide bears striking similarities to Hemenway's history, suggesting that perhaps much of his information was derived from that source.

Unfortunately, Ross and Hemenway did not include sources for their information (which was typical for their time), and both proved to have factual inaccuracies that were misleading. Luckily, contemporary accounts describing *Phoenix II*'s operational history do exist, and could be used to verify the popular sources. These primary sources included a diary kept by one of the boat's captains, Gideon Lathrop, and documents from the steamer's first owners, Isaiah and John Townsend, and later owners, the CTC.[35]

---

[33] Hemenway 1867, 688.
[34] Ibid., 692.
[35] Lathrop 1827-1842; Champlain Transportation Company (CTC) Records, Collection A; Townsend Family Papers (TFP).

Lathrop began his career on board *Phoenix II* in 1823 under the steamer's first captain, Jahaziel Sherman. Lathrop only began keeping a detailed diary in 1826, however, as captain of the Lake Champlain Steamboat Company's (LCSC) *Congress*. Although he was not working on board *Phoenix II* at the time, Lathrop recorded notes pertaining to the operating season and encounters between *Phoenix II* and *Congress* while captain of the latter. One of these notes included mention of *Phoenix II* being hauled out at the end of the 1827 season to be fitted with its new engine. In 1831, Lathrop transferred from *Congress* to *Phoenix II*, but his diary was regrettably less detailed than during his earlier years. Even so, it did include details regarding the sale of the LCSC and its two steamers to Isaiah Townsend. Also of note is Lathrop's entry from 21 August 1832 that stated, "This is the first trip since the 14th of June. We discontinued running there on account of the cholera and the death of [John Larned] who died on board at Whitehall on the 15th of June at 11 o'clock, a.m."[36] This statement led to research in other document collections that confirmed Larned was the first person to die of cholera in the United States, and that he died on board *Phoenix II*.

The Townsend Family Papers include a 55-linear-foot (16.8-m) collection of documents from between the years 1799-1902 that include correspondence, legal contracts, insurance records, and miscellaneous papers belonging to the Townsend Family, especially Isaiah and John Townsend. These two men were directors in the LCSC when it built *Phoenix II*, and were heavily involved in the lake's steamers, as well as steamboat operations on the Hudson River and elsewhere in the northeast. Documents

[36] Lathrop 1827-1842, 29.

discovered in this collection included letters between the Townsends and Jahaziel Sherman, who supervised the building of *Phoenix II*, as well as several from Gideon Lathrop. The author visited this collection in April 2016 where it is currently housed in the Brooke Russell Astor Reading room for Rare Books and Manuscripts at the New York Public Library in New York City.

Similarly, Collection A of the Champlain Transportation Company Records included correspondence and legal contracts concerning Lake Champlain steamers. Since the CTC was not yet founded when *Phoenix II* was built, the documents found in this collection were useful only for the steamer's later years. Of particular relevance was the contract outlining the sale of *Phoenix II*, *Congress*, and the LCSC's Shelburne Shipyard property to the CTC by Isaiah Townsend in 1833. The author made several visits to this collection at the Bailey-Howe Library of the University of Vermont in Burlington in the years 2014, 2015, and 2016.

Along with providing context, these and other historical sources were used to inform the reconstruction of the hull, providing details no longer present among the archaeological remains. One historical document containing information about *Phoenix II* is its aforementioned Certificate of Registry form for registering passenger steamboats with the government, outlining the basic dimensions of the vessel.[37] These dimensions were used to establish the correct length of *Phoenix II,* and provide the parameters for the hull reconstruction (Chapter VI).

---

[37] The copy used for this research was found in the Barranco Papers at the LCMM, but the original is stored in the National Archives, Records of the Bureau of Marine Inspection and Navigation, Record Group 41.4.2, "Records relating to vessel documentation." https://www.archives.gov/research/guide-fed-records/groups/041.html#41.4.2; Gordon 1837, 830.

Although design specifications, hull plans, or similar construction documents for *Phoenix II* were either lost or never existed in the first place, Jean-Baptiste Marestier's *Memoir on Steamboats of the United States of America*, published in 1824, describes hull and engine dimensions, as well as speed and other details of early American steamers, ranging in date from 1807 to 1820.

The most thoroughly documented steamboat in Marestier's study was *Chancellor Livingston*, a Hudson River passenger steamboat built in 1816. Not only was *Chancellor Livingston* built only four years prior to *Phoenix II*, it was also comparable in size.[38] It is reasonable to assume that *Phoenix II* bore some similarities in its design to *Chancellor Livingston*. As such, the lines, interior profile, and section view in Marestier's work are useful to fill in some of the gaps in *Phoenix II*'s reconstruction.

Contemporary Champlain Valley newspapers, including *Burlington Free Press*, *Northern Sentinel*, *Plattsburgh Republican*, *North Star*, *Vermont Aurora*, and several others also proved to be excellent sources of information. These were particularly good for identifying the opening and closing of the navigational seasons, the routes followed by the LCSC and CTC steamers, and the price of passages from year to year.

Archaeological Studies

Along with historical sources, previously-excavated archaeological examples of steamboats and their subsequent reports were used to supplement the analysis and reconstruction of *Phoenix II*. The contemporary North American inland waterway

---

[38] Marestier, 1957.

steamboats that have been discovered and studied archaeologically to date include *Ticonderoga* (1813-1825), *Phoenix I* (1815-1819), *Lady Sherbrooke* (1817-1824), and *Heroine* (1832-1838). Aside from those directly contemporary steamers, *Champlain II* (1868-1875) is a well-documented Lake Champlain passenger steamboat from half a century later.[39] Finally, the preliminary survey and documentation of the three other passenger boats sunk at Shelburne Shipyard, *Burlington* (1837-1854), *Whitehall* (1838-1853), and *A. Williams* (1870-1893), was discussed in the author's Master's thesis.[40]

The best comparative archaeological example was *Phoenix I*, the steamer *Phoenix II* was built specifically to replace. *Phoenix I* was built by the LCSC and provided the passenger service on Lake Champlain from the summer of 1815 until September of 1819, when it caught on fire while under way and burned to the waterline.[41] These steamers were described as similar in both form and function, and their wrecks bore many similarities as well. In fact, one of the first clues to the identity of the *Phoenix II* wreck was its similarity to the wreck of *Phoenix I*. The wreck of the first steamer measured 133 feet 9 inches (40.8 m) long from stem to stern, which was quite close to *Phoenix II*'s 134-foot (40.8 m) wreck length.[42] Furthermore, the number, size, and arrangement of frames on both wrecks were almost identical, as were the number, size, and arrangement of the engine bed timbers, indicating at the very least that they were built to similar or identical specifications. *Phoenix I* was studied by the Champlain Maritime Society (CMS) in 1981 and 1983, and by George Schwarz and

---

[39] Baldwin 1997.
[40] Kennedy 2015.
[41] Schwarz 2012, 1-3.
[42] Schwarz 2012, 178.

nautical archaeologists from the Institute of Nautical Archaeology (INA), Texas A&M University (TAMU), and the Lake Champlain Maritime Museum (LCMM) in 2009 and 2010. The results of these studies are documented in Schwarz's dissertation, in an article in the *International Journal of Nautical Archaeology*, and in a book published by Routledge in 2018.[43]

The archaeological study of the steamboat-turned-schooner *Ticonderoga* took place in 1981, and its reconstruction was completed in 2011 by Kevin Crisman.[44] *Ticonderoga* was originally intended to be the first steamboat of the LCSC (and the second steamboat on Lake Champlain), but the needs of the US Navy during the War of 1812 superseded the need for a passenger steamer. In 1814 Commodore Thomas Macdonough, in charge of the US fleet on Lake Champlain, requisitioned the steamer while it was still on the stocks. Construction had already begun at this point and the hull was intended for steam, but Macdonough decided not to test the new technology and completed the hull as a schooner.[45] Although the vessel was never fitted with a steam engine, the construction and reconstructed lines closely resemble those of early steamboats, and the hull therefore serves as a useful comparison for *Phoenix II*.[46]

Another archaeologically-studied contemporary of *Phoenix II* was the St. Lawrence River steamboat *Lady Sherbrooke*, built in 1817 and operated through 1826.[47] *Lady Sherbrooke* was a passenger steamer on the Molson line that transported travelers

---

[43] Schwarz 2012; Schwarz 2016; Schwarz 2018.
[44] Crisman, *Ticonderoga,* 2014.
[45] Ibid., 251.
[46] Ibid., 268.
[47] Belisle and Lepine 1986; Belisle and Lepine 1988.

between Montreal and Québec City. The Canadian steamer was heavily built to withstand the fierce current and wintertime ice of the river, rather harsher conditions than were typical on the more protected waters of the lake. It was fitted with a single mast, as well as a side-lever engine instead of a crosshead-beam engine, the common British choice for steamboats of the time. The archaeological study of *Lady Sherbrooke* by Jean Bélisle and Marc-André Lepine in the 1980s includes excellent details regarding the construction of the hull, which provides useful comparative information for *Phoenix II*.

Previous Archaeological Study of Shelburne Shipyard

It was not unprecedented to mistake the identities of the hull remains in Shelburne Shipyard. A brief survey of the wrecks along the east shore of Shelburne Point was made in 1983 by the CMS. The survey sought to locate, identify, and assess twelve wrecks included on an anonymously-drawn map of Shelburne Shipyard found in the CTC records, estimated to have been prepared as early as 1880 (Figure 1-8).[48] Of the twelve wrecks identified on the map, the CMS team located only six. The six wrecks that were identified were assigned a letter along with their identification: they identified Wreck A as either *Francis Saltus* or *A. Williams,* Wreck B as *Franklin*, Wreck C as *Burlington*, Wreck D as *Canada*, Wreck E as *United States*, and Wreck F as

[48] Chase 1985, 57. The text beneath the list of wrecks in Figure 1-8 says "From Old Shelburne Shipyard drawing (as early as 1880)," but *A. Williams* was not retired until 1893, so the drawing must have been made later, Ross 1997, 135.

Adirondack.[49] Of those six, the four designated as Wrecks A, B, C, and D in 1983 were re-numbered as Wrecks 1, 2, 3, and 4 for the 2014-2016 archaeological projects.

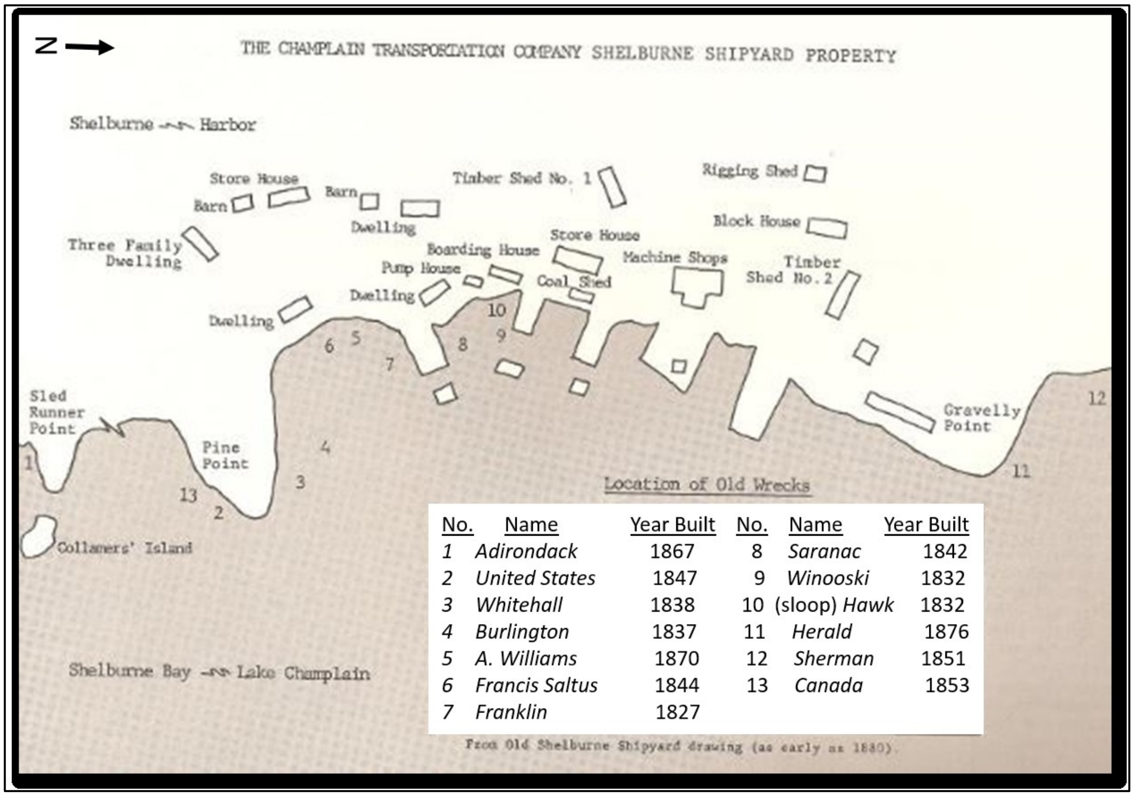


Figure 1-8. Anonymously-drawn map used by the Champlain Maritime Society in 1983 to identify wrecks in Shelburne Harbor. (Reprinted from Chase 1985, 57)

The Shelburne Shipyard map displayed five steamer wrecks in the vicinity of Shelburne Harbor between Pine Point to the south and the current Aske pier to the north, a concrete pier that was present when the map was drawn and is evident on the map (Figure 1-9). Although the map identified five steamboats in that area, only four wrecks

[49] See Kennedy 2015 for the evidence regarding Wrecks 1, 3, and 4's identifications.

were located here by the 1983 CMS and the 2014-2016 INA-TAMU-LCMM investigation.

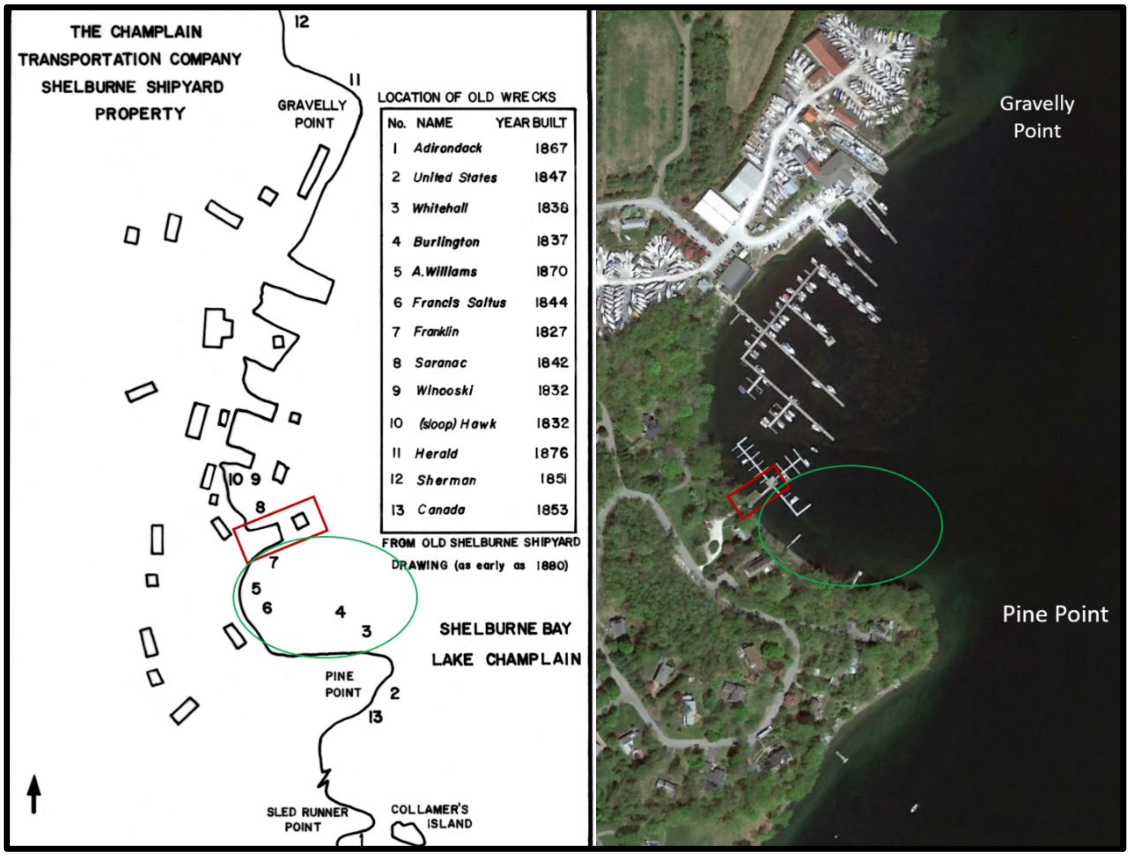


Figure 1-9. Anonymously-drawn map approximately oriented and scaled to the satellite image of Shelburne Shipyard. The Aske pier is outlined in red, and the area of interest to the 2014-2016 project is circled in green on both maps. (Adapted by the author from Chase 1985, 57; satellite reprinted from Google Earth, 2018)

Why and by whom this map was drawn remains a mystery, but it is clear that the mapmaker was mistaken on at least two accounts, leading to confusion for archaeologists. What is particularly curious is that *Phoenix II* was not included at all on this map. In fact, only one source, Walter Hill Crockett's *A History of Lake Champlain*, mentions *Phoenix II*'s final resting place: "An interesting feature in connection with

Lake Champlain navigation is the "graveyard" for outworn ships at Shelburne harbor. Among the craft famous in their day that have been retired to this peaceful haven are the *America, Phoenix, Congress, Franklin, Winooski, Burlington, Whitehall, Saranac, Francis Saltus, Canada, United States, A. Williams, Adirondack, Maquam, and Vermont*."[50]

The retirement of a passenger steamboat like *Phoenix II* that outlived its usefulness and was peacefully sidelined received little notice from contemporary newspapers, and its condemnation was evidently not considered important enough to be worth recording in historical documents. It is unfortunate that Crockett does not include where and how he came by the information that *Phoenix II* ended up at Shelburne, as that fact is not included in any other known source, including the CTC Records and other chronicles of steamboats on Lake Champlain.

To Conclude

Phoenix II's misreported length in Ross, Hemenway, Wilkins, and Thompson, and the lack of information concerning its final resting place reaffirms the need to verify 'known facts' through detailed archaeological investigations. Not only did this archaeological project bring to light where *Phoenix II* ultimately sank, it also corrected its historically-inaccurate length measurement. Although assuredly the world would have continued to spin without these minor revelations, the findings are proof that

[50] Crockett 1909, 313; Ross 1997, 165 failed to mention *Phoenix II*'s retirement in Shelburne.

histories based solely on documents can have many errors, errors that can be corrected via archaeology.

Aside from correcting historical inaccuracies, the archaeology of *Phoenix II* fills gaps in our understanding of the first quarter century of steamboat hull design in the United States. Despite steam's pivotal role in the development and expansion of North America, historical scholarship has thus far failed to fully reveal the changing technologies and designs used in hull and engine construction. The methodological approach taken to answer these questions involved a systematic archaeological study of the hull, analysis of the resulting data, and comparisons of the results to contemporary archaeological and historical examples.

CHAPTER II

THE LAKE CHAMPLAIN STEAMBOAT COMPANY AND THE BUILDING OF *PHOENIX II*

After launching *Clermont*, the world's first commercially-successful steamboat, in 1807, the state of New York awarded a monopoly of steamboat construction and operation on the Hudson River to Robert Fulton and his partner Chancellor Robert Livingston, forcing their competitors to either obtain a permit from the monopoly to operate a boat in New York State waters, or to build steamboats elsewhere.[51] Lake Champlain, just north of the Hudson River, was not only geographically quite close, but was also ideally suited to steamboat transportation due to its protected waters and lack of strong currents, as well its location as a north-to-south water highway between the St. Lawrence River and the Hudson River, connecting the North American ports of Montreal and New York City. In 1809, the brothers James and John Winans entered into the steamboat business by building the lake's first steamer, *Vermont*. It was a modest-sized vessel with a length of 120 feet (36.6 m) and a width of 20 feet (6.1 m). *Vermont* was a commercial success, transporting passengers along the length of the lake, from its northernmost point, Saint-Jean-sur-Richelieu, Québec, to its southernmost point, Whitehall, New York for six years.[52] In 1815, *Vermont*'s engine failed, causing the

[51] Renwick 1838, 103; Hillstrom 2005, 67-69.
[52] Hemenway 1867, 687; Ross 1997, 24.

steamer to sink in Canadian waters just off of Île-aux-Noix near Saint-Jean-sur-Richelieu.[53]

Earlier that year, a group of businessmen from the Albany area came to an agreement with the monopoly created by Fulton, offering to remove themselves from any Hudson River competition and instead establish themselves on Lake Champlain. These men were Tunis Van Vechten, Abram G. Lansing, Isaiah and John Townsend, J. Ellis Winne, Samuel T. Lansing, and Joseph Alexander who, with help from influential Vermont business friends such as Cornelius P. Van Ness, Moses and Guy Catlin, and Amos W. Barnum, founded the Lake Champlain Steamboat Company (LCSC) and established a shipyard at Vergennes, Vermont, at the falls of the Otter Creek, in 1813.[54] Under the management and supervision of Jahaziel Sherman, the LCSC built their first steamer, *Phoenix I,* in 1815.[55] This vessel had a busy and seemingly-profitable four-year career. Its fiery demise in 1819 prompted the LCSC to build a replacement that "should resemble its self-perpetuating mythological predecessor in more than name only," referring to the mythological bird that is fabled to rise from its own ashes.[56]

---

[53] Ross 1997, 26; Hemenway 1867, 687.
[54] Hemenway 1867, 688.
[55] The LCSC did not include the numeral in the original or second *Phoenix*'s names. Because this dissertation is about the *Phoenix II*, both are written with their appropriate numerals to avoid confusion.
[56] Ross 1997, 39.

The Last Steamboat Built at Vergennes

Beginning in late 1819 and extending to November 1820, the LCSC built *Phoenix II* at the Vergennes shipyard on Otter Creek.[57] This was the last steamer to be built in this location before the LCSC moved its operation to Shelburne Shipyard. *Phoenix II* was also the last boat built by the LCSC. Jahaziel Sherman, who supervised the company's operations in Vergennes, hired Jonathan Gorham and Alexander Young to build the steamboat.[58] Gorham built the LCSC's steamer *Congress* at Vergennes only two years earlier, but little is known about him. Young's history prior to his employment by the LCSC is somewhat elusive. He was born in Troy, NY, 13 February 1789, but had settled at Barber's Point in Westport, New York, after marrying his wife, Jerusha Barber.[59] He built at least one 50-ton sailing ship for Lake Champlain in 1810 at what is now known as Young's Bay, north of Barber's Point.[60] After 1821 he worked in Canada building steamboats for the St. Lawrence River.[61]

Few descriptions and no reliable iconographic representations of *Phoenix II* have been found, and there is little historical information regarding the construction of this boat. What methods Young and Gorham used for building can only be guessed. Based on the timeline, however, we know that the process began on 29 October 1819, when

[57] *Plattsburgh* (NY) *Republican*, 11 November 1820; Hemenway erroneously claimed *Phoenix II* was already in operation by 20 July 1820 (1867, 692).
[58] Thompson 1853, 216.
[59] Mackey 2000, 217.
[60] "A search for the names and histories of vessels built at the shipyard of Alexander Young at [Y]oung's [B]ay has been rewarded by one name only, that of the *Emperor*, a sailing boat of fifty tons, "built for H. and A. Ferris, at Barber's Point, by Young," in 1810" (Royce 1902, 607). The source of the quote within Royce's text was not found.
[61] Mackey 2000, 36, 64, 84, 217.

Amos W. Barnum advertised the LCSC's need for good ship timber.[62] The completed hull was launched on 15 November 1820, and since it would have been ill-advised to launch the steamer with its weighty engine, machinery, and boilers on board, the hull was probably empty at that time.[63] The machinery and boilers were fitted over the winter of 1820-1821, and *Phoenix II* began operating as a passenger steamboat in the spring of 1821 under the command of Captain Jahaziel Sherman.

It is difficult to see into the minds of the shipwrights with so little historical documentation of their work, but at the very least their construction had two major considerations: the best types of wood for building the hull, and the engine with which to propel it.

Wood Selection

To begin construction, the LCSC required a large amount of shipbuilding timber. To that end, a newspaper advertisement was taken out by LCSC director Amos W. Barnum on 29 October 1819. The advertisement published in the *Northern Sentinel* 15 November 1819 called for:

> Ship Timber
>
> Wanted at Vergennes
>
> A quantity of White Oak timber, White Pine, White Cedar Futtocks or Knees, Yellow Pine, Red Cedar and other Timber suitable for building a Steam Boat.

---

[62] *Northern Sentinel* (Burlington, VT) 15 November 1819, 3.
[63] "We understand that the large and elegant Steam Boat, now building at Vergennes, is to be launched from the Ship Yard, on Wednesday the 15th inst. at 2 o'clock, P.M." *North Star* (Danville, VT) 11 November 1820, 3; "The Large Steam-Boat, building at Vergennes, will be launched on Wednesday the 15th inst. at two o'clock, afternoon." *Plattsburgh* (NY) *Republican* 11 November 1820, 3.

> Any person desirous of contracting to deliver any part or the whole of said articles, may apply to the Subscriber.[64]

We know from the archaeological remains that at least four different species of wood were used in the construction of *Phoenix II*. Several of the floor timbers, the keel, keelson, stem, sternpost, hull planking and ceiling planking were made from white oak (*Quercus alba*); however, a good number of the floors, and all or most of the futtocks were made from northern cedar (*Thuja occidentalis*) or Atlantic white cedar (*Chamaecyparis thyoides*), and the engine bed timbers were made of eastern white pine (*Pinus strobus*).

Traditionally, white oak was employed for North American shipbuilding during the nineteenth century.[65] It is a hard wood, strong enough for the ship's structure to withstand rough seas, and was fairly resistant to rot. Why did Young and Gorham not build the entire hull out of white oak? There are two possible explanations for the shipbuilders' choice of woods that are by no means mutually exclusive. In 1820 when Young and Gorham began building the steamer, the Champlain Valley's timber industry was at its height, and timber was becoming scarcer and increasingly expensive. Lake Champlain historian Arthur Cohn describes how during the first half of the nineteenth century, "land clearing, log rafting, potash manufacturing, charcoal production, as well as lumbering had cleared the Champlain Valley of every tree worth cutting."[66] The timber trade had shipped great quantities of lumber north to Canada and south to the

---

[64] *Northern Sentinel* (Burlington, VT) 15 November 1819, 3.
[65] Steffy 1994, 258.
[66] Cohn 2003, 27.

towns along the Hudson River via lumber rafts along Lake Champlain and the Champlain Canal. The success of this trade "was such that marketable trees had been virtually eliminated from the Champlain Valley by 1840, and the natives were being forced to import wood" (Figure 2-1).[67] The mass clearing of the forests undoubtedly affected the availability of white oak by 1820, meaning it would have been much more expensive for the LCSC to build an entire ship's hull with this alone. It is therefore likely that the LCSC used other species of wood to alleviate some of the cost.

Figure 2-1. A set of dioramas called "Changes in the Land" show the changing landscapes of Harvard University Forest in Petersham, Massachussetts between the years 1700 (left), 1760 (middle), and 1830 (right). These landscapes depicted here are representative of the changes that were taking place all across New England from European settler activities. (Reprinted with permission from Albers 2000, 99)

Another motivating factor, or possibly a latent function to using cedar for so many of the framing components might have had to do with keeping the hull's weight to a minimum, thereby increasing the steamer's speed. Cedar was a fairly common shipbuilding timber in northeast North-America, and northern white cedar (*Thuja occidentalis*) was both durable and light, with a specific gravity of 0.31 (Atlantic white

[67] Albers 2000, 156.

cedar [*Chamaecyparis thyoides*] is similar, with a specific gravity of 0.32), compared with White oak's specific gravity of 0.68.[68] Furthermore, cedar is rot resistant, so the shipbuilders may have chosen it specifically to prolong the life of the steamer.

The selection of wood called for in Barnum's advertisement and found on the wreck could represent the experimental nature of steamboat construction at this time. The framing timbers found on *Phoenix II* were larger than those present on later steamboat wrecks, including *Burlington* and *Whitehall* lying adjacent to it in Shelburne Shipyard.[69] The shipwrights' decision to use lighter wood may reflect their desire to lessen the weight of the hull but maintain the volume of wood they considered necessary to construct a durable ship.

Construction Sequence

Construction of *Phoenix II* began with the laying of the keel on keel blocks, parallel to the bank of the Otter Creek. The stem and sternpost were subsequently bolted to the ends of the keel. The shipbuilders followed a frame-first, or skeletal construction pattern, (typical of this period) forming the shape of the hull with the frames up to and including the deck beams, and only afterwards adding the 'skin,' or planking, to the exterior of the hull.

---

[68] Bush 2017, 4; "[Cedar is] your go-to wood for a boat hull. It's incredibly lightweight but it has a really high tensile strength which means it floats well, but it's hard to break when you push on it" Offerman, 2018.

[69] Kennedy 2015, 84, 107.

Because of the considerable size of the hull, and its bottom being nearly flat, planking the bottom of the long steamer was a grueling process. Though we can be fairly certain the frames were assembled prior to planking due to the presence of both iron fasteners and treenails securing the floors and futtocks, there is no doubt that the builders had a challenging task in securing the planking to the bottom of the hull, especially near the midship section where it was flattest.

The keel blocks therefore had to be high enough for shipwrights to fit beneath the hull and swing a hammer, but not higher than absolutely necessary. It is likely the construction crew built a platform around the hull to reach the higher sections and continue planking all the way up the sides.

Phoenix II*'s First Engine*

With the hull framed, its deck beams installed, the planking attached inside and out, and the seams caulked, *Phoenix II* was launched into Otter Creek on 15 November, 1820.[70] The entire winter was subsequently spent installing the engine, followed by the completion of the deck and upper structure.[71] The LCSC had recovered *Phoenix I*'s engine prior to the earlier steamer's charred lower hull being lost to the depths of the lake. The engine was built by Robert McQueen of New York City and originally installed in *Phoenix I* in the spring of 1817.[72] McQueen, possibly the earliest steam engine manufacturer to set up shop in New York City, owned Columbian Foundry which

---

[70] *North Star* (Danville, VT) 11 November 1820, 3; *Plattsburgh* (NY) *Republican* 11 November 1820, 3.
[71] Launching the boat with the heavy engine machinery and boilers already installed would unnecessarily strain the hull.
[72] Schwarz 2012, 71, 92; Hemenway 1867, 692; Ross 1997, 41.

produced iron castings at the beginning of the nineteenth century. Beginning in the 1810s and 1820s he transitioned into building engines for steamboats as well.[73] Among McQueen's better-known engines was the one he built in 1818 for Lake Erie's first steamboat, *Walk-in-the-Water*. The cylinder for *Walk-in-the-Water*'s engine was 40 inches (1.02 mm) in diameter with a 4-foot (1.22 m) stroke and was said to resemble a Boulton and Watt square engine.[74] This may be the closest contemporary comparative example for the McQueen engine *Phoenix I* received in the spring of 1817. When this vessel burned in September 1819 the LCSC recovered the engine, returned it to working order, and installed it in *Phoenix II* in 1820-1821.

This low-pressure, crosshead-beam engine had a 3-foot-6-inch (1.07 m) diameter cylinder, a 4-foot (1.22 m) stroke, and was rated at 45 horsepower, giving the boat a maximum speed of 8 miles per hour (12.9 km/h).[75] Because the historical sources reporting this information (namely Ross and Hemenway) have inaccuracies (such as their statement that the length of the boat was 150 feet [45.7 m] when in reality it was only 143 feet [46.3 m]), it is useful to verify these engine characteristics. To do so, the horsepower can be calculated using a formula including the following parameters: pressure (P), area of the piston head (A), length of stroke (L), and revolutions per minute (also known as strokes per minute) (R).[76] In this case, P and R are not provided in historical documents referring to *Phoenix II* specifically, and therefore we look to Jean Baptiste Marestier's *Memoir on Steamboats of the United States of America*. Marestier's

---

[73] Pursell 1969, 36; 50-51; Williams 1830, 159; Koeppel 2001, 92.
[74] Merriam 1861, 239.
[75] Hemenway 1867, 692.
[76] Croft 1922, 76.

memoir documents these parameters for a number of near-contemporary steamers, mentioning that "the mercury in the indicator does not rise more than half a meter [9.7 pounds per square inch] except in a small number of engines."[77] In his detailed descriptions of steamers Marestier describes these parameters in several comparable boats (Table 2).

In those near-contemporary steamers, the most common parameters for pressure (P) and strokes per minute (R) are approximately 7.75 psi and 17 rpm. Using these numbers, we can approximate *Phoenix II*'s engine horsepower as follows:

$$H.P. = \frac{\left((7.75\ lbs/in^2 \times 1385\ in^2) \times \left((4\ feet\ x\ 2)/stroke\ \times 17\ strokes/minute\right)\right)}{33{,}000\ foot - lbs/minute}$$

$$H.P. = \frac{\left((10733.75\ lbs) \times\ (136\ feet/minute)\right)}{33{,}000\ foot - lbs/minute}$$

$$H.P. = 44.24$$

As seen in the above equation, if we assume *Phoenix II*'s engine operated within the parameters of contemporary steamers, the engine output normally had a horsepower of just over 44, closely aligning with Ross and Hemenway's claim of an engine of 45 horsepower.

---

[77] Marestier 1957, 12.

Boat Name	Year Built	Length of Boat	Beam of Boat	Rated Engine HP	P	A	L	R
Chancellor Livingston	1816	154 feet (46.9 m)	33 feet (10.1 m)	60	Not Found	1257 square inch (3 feet 4 inch diameter) (0.81 m^2)	5 feet (1.52 m)	17
Fulton	1813	133 feet (40.5 m)	29 feet (8.84 m)	Not Found	7.8 psi	1017 square inch (3 feet diameter) (0.66 m^2)	4 feet (1.22 m)	18.5
United States	1818	136 feet (41.5 m)	18 feet 11 inches (5.77 m)	Not Found	7.75-8.7 psi	1419 square inch (3 foot 6 ½ inch diameter) (0.92 m^2)	4 feet 9 inch (1.45 m)	16.5-18
Virginia	Unknown	136 feet (41.5 m)	24 feet 10 inches (7.57 m)	44	7.75 psi	855 square inch (2 foot 11 inch diameter) (0.55 m^2)	4 feet (1.22 m)	17.5-18.5
Maryland	1818	137 feet (41.8 m)	26 feet (7.92 m)	60	5.8 – 7.75 psi	1257 square inch (3 foot 4 inch diameter) (0.81 m^2)	4 feet 8 inch (1.42 m)	17
Norfolk	Unknown	134 feet (40.8 m)	25 feet 4 inches (7.72 m)	(similar to *Virginia*)	5.4-9.26 psi	(similar to *Virginia*)	(similar to *Virginia*)	16-17

Table 2. Engine parameters of steamboats contemporary with *Phoenix II*, including pressure (P), area of the piston head (A), length of stroke (L), and revolutions per minute (also known as strokes per minute) (R). (Marestier, 1957)

The information regarding *Phoenix II*'s engine, although minimal, is still more than what we know about its boilers. The sum of our knowledge of *Phoenix II*'s first boiler is contained in a letter from Jahaziel Sherman to Isaiah and John Townsend dated 16 July 1820:

> Gentlemen,
>
> Yours of the 10th Inst. has been Received on the Subject of A Boiler Maker &c –
> You will please to accept of my thanks for your polite attention to our wants and only regret that you did not succeed in geting [*sic*] A man for that Business but presume we shall be able to make the Boiler in time with the help I now have, altho [*sic*] it would have been great relief to me to had A man Master of that [*sic*] [here].[78]

The letter implies one boiler was installed in 1820. Sherman's letter also suggests he was able to design a boiler himself, or someone at Vergennes was able to build one. It seems strange that the LCSC did not hire a professional engineer for the task. However, just as McQueen was one of few North American engine makers at that time, presumably there were few manufacturers who specialized in boilers, and fewer who would be willing to travel to Lake Champlain. Sherman's business records have not yet been found, and no plans for *Phoenix II*'s boilers are known to exist.

A letter from Captain Gideon Lathrop to Isaiah and John Townsend written 7 June 1831, ten years into *Phoenix II*'s life, suggests that at this time the boat had not one, but two boilers: "our Boilers are foul and we cannot clean […] for the want of a

[78] TFP, Box 4, "Letters 1820, Feb 16-29," 16 February 1820.

sufficient hand pump to again fill them."[79] We know that *Phoenix II* received an engine upgrade in 1827, and while no mention is made of a change to the boiler arrangement, it is plausible that the new, more powerful piston demanded the installation of a second boiler.[80] Whether *Phoenix II* came out with two boilers in 1821 or added a second one later, likely it was the first Lake Champlain steamer to be equipped to do so. [81]

A Fire at the Vergennes Shipyard

As the builders, Gorham and Young, neared the launch of the new *Phoenix* in 1820, a fire broke out in the Vergennes shipyard on 5 October, resulting in an estimated $5,000 loss to the LCSC.[82] This was the third major fire experienced by the LCSC in four years, in all of which allegations of arson were made, although never proven. The first fire, on 6 September 1817, saw the company's second steamer, *Champlain* burn to the waterline at its dock in Whitehall. According to some accounts, this was due to imperfections in its boiler, but Captain Jahaziel Sherman concluded "there can be no doubt of its being the work of an incendiary."[83] Who this was he did not say. In 1819, *Phoenix I* burned to the waterline while steaming from Burlington to Plattsburgh. Again,

---

[79] TFP, Box 7, "Correspondence 1827 – June 1833," 7 June 1831.

[80] "The Phoenix [*sic*] having discontinued running, to receive her new engine, the *Congress* [*sic*] will continue her trips the remainder of the season," dated 26 October 1827, published in *Vermont Aurora* (Vergennes, VT) 8 November 1827, 3; "A new and powerful engine has been obtained for the Phoenix." *Vermont Aurora* (Vergennes, VT) 6 December 1827, 3. See Chapter III, "The McQueen Engine is Replaced" for discussion.

[81] Schwarz 2012, 203; Several references by Lathrop to *Congress'* boiler, in a singular form, 15, 16, 17 June 1827 (1827-1842, 6) and 30-31 January: "Mr. Ward will make a boiler for the Congress for $500" and "Measured the place for the boiler and returned for Judge Follett to take the dimensions to Montreal for a boiler" (1827-1842, 10).

[82] *North Star* (Danville, VT) 17 October 1820, 3; Wilkins 1916, 13-16; Thompson 1853, 216.

[83] Hemenway 1867, 692; *Plattsburgh* [NY] *Republican*, 13 September 1817; *Northern Sentinel* (Burlington, VT), 12 September 1817, 2.

the cause of the fire was uncertain, perhaps a candle was left burning in the pantry, or perhaps arson by sailing vessel owners on the lake who did not like competing with a steamboat for passenger traffic.[84] Taken as a whole, these fires are suspicious, but whether they were intentionally set, the result of carelessness, or simply bad luck will never likely be known.

The Move to Shelburne Shipyard

Despite the fire destroying the LCSC shipyard property, *Phoenix II*'s launch was not delayed much, and on Wednesday, 15 November 1820 it became the fifth steamboat on Lake Champlain.[85] All of the LCSC steamers were built at Vergennes.[86] This location was several miles upriver from the mouth of Otter Creek, and because the creek was much shallower than the lake, it froze earlier in the fall and thawed later in the spring, causing the LCSC to lose out on several weeks of profits each year. For this reason, within a year of the launch of *Phoenix II* the LCSC decided to move its shipyard to a more accessible site, Shelburne Point.[87]

The history of the shipyard on Shelburne Point traces back to 1797, when Nathan White purchased one hundred acres of land on Pottier's Point, at the northern end of Shelburne Point, for $900. His sons, Robert and Lavater S., began operating a small shipyard there in subsequent years, and by the 1810s had earned reputations as exceptional shipwrights. In 1820, LCSC stockholder and director Cornelius P. Van Ness

---

[84] Schwarz 2012, 76; Cohn 2003, 22.
[85] *North Star* (Danville, VT) 17 November 1820, 3; *Plattsburgh* (NY) *Republican* 11 November 1820, 3.
[86] Crisman 1987, 16.
[87] Ross 1997, 39; Hemenway 1867, 693; Crisman et al. 2018, 140.

came to an agreement with Robert and Lavater that allowed the steamboat company to base its operations at their shipyard.[88] The company subsequently moved all of its facilities from Vergennes to Shelburne Point. They kept Lavater on as their chief boat builder.

The location was ideal for a shipyard as a peninsula stretching north created Shelburne Bay, and a small inlet on the eastern side of the peninsula near the north end created a small harbor, isolated from the lake's prevailing winds (Figure 2-2). Not only was the harbor well protected, it was also located directly in the middle of Lake Champlain, making it not only easily accessible from most locations on the lake, but one of the last areas to freeze and the earliest to thaw (Figure 2-3).

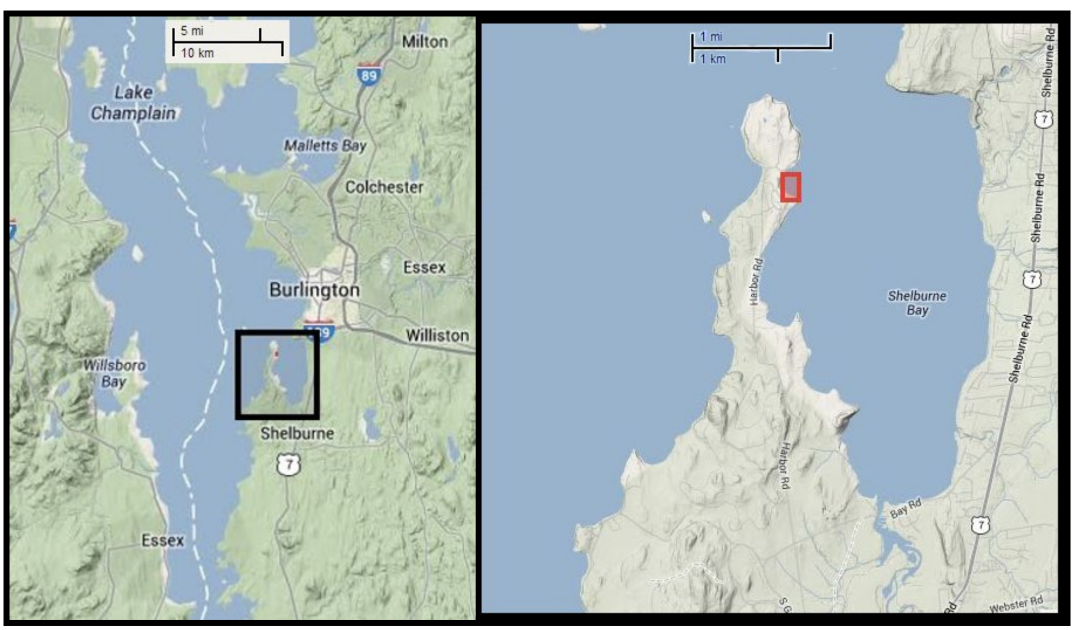


Figure 2-2. Location of Shelburne Shipyard on Lake Champlain. The shipyard is outlined in red, near the northern end of Shelburne Point. Its location was ideal for a shipyard due to its central location and protection from prevailing winds. (Reprinted from Google Maps, 2015)

[88] Aske 2012, 1.

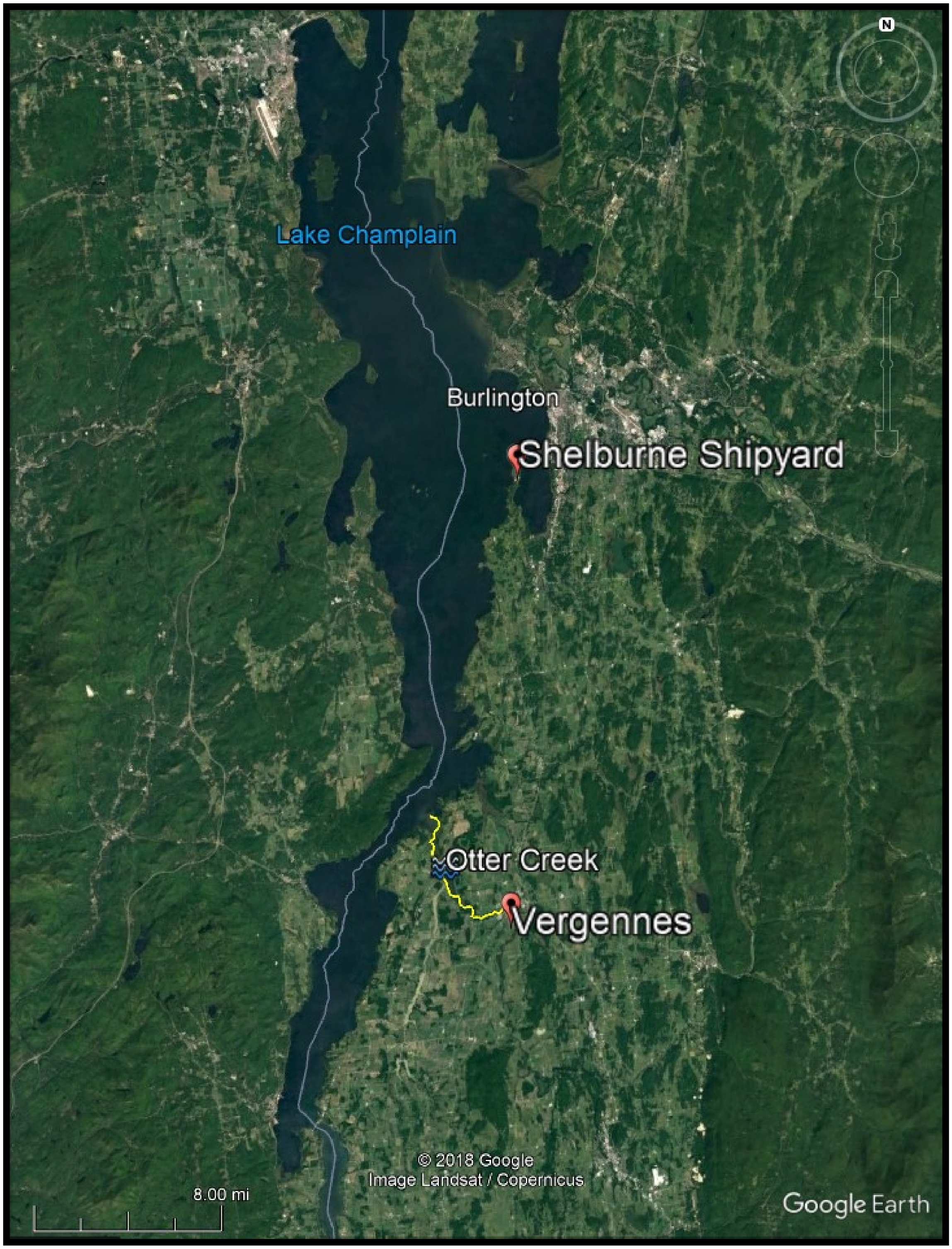


Figure 2-3. The locations of the LCSC's old shipyard at Vergennes, and the new shipyard at Shelburne, demonstrating the central location of the latter. Furthermore, Otter Creek (highlighted in yellow) often froze early and thawed late, limiting the operational season. (Reprinted from Google Earth, 2018)

CHAPTER III

PHOENIX II: OPERATIONS, CHOLERA, DEMISE

Phoenix II entered the lake in the spring of 1821 under the command of Captain Jahaziel Sherman. Since the LCSC moved its base from the Vergennes Shipyard to the Shelburne Shipyard that season, *Phoenix II* was built in Vergennes, but spent its entire career in the new location. For the following 16 years, the vessel worked as a passenger steamer under five different captains, engaged in a number of different schedules and routes, experienced a multitude of breakdowns and engine repairs, was seized for smuggling by Canadian officials, and was directly involved in the spread of cholera from Canada into the United States. Ownership of *Phoenix II* changed twice until the steamer was finally retired in 1837.

Sixteen years, five masters

From 1821 until the end of the 1823 season, *Phoenix II* was commanded by Captain Jahaziel Sherman, former master of *Phoenix I* and the man who oversaw the steamer's construction in Vergennes. Following Sherman was Captain George Burnham for the 1824 and 1825 seasons, then Captain Isaac R. Harrington from 1826 to 1828.[89] In 1829, Cornelius Van Ness and Timothy Follett, board members of the LCSC, personally leased *Phoenix II* and *Congress* from the financially-struggling company, and entered into an agreement with a new rival on the lake, the Champlain Transportation Company

[89] Lathrop 1827-1842, 1; Hemenway 1867, 705-706.

(CTC). Per the agreement, they ran only one of their two boats, *Congress*, and laid up *Phoenix II* for the season.[90] This agreement lasted through 1830, but after Isaiah Townsend purchased all of the LCSC property in July of that year, a new agreement with the CTC was made allowing *Phoenix II* to re-enter regular operating service in 1831. In 1831, Captain Gideon Lathrop took over as master of *Phoenix II*, and remained the boat's captain through the 1834 season. In 1835, Lathrop was succeeded by Captain Dan Lyon, who remained *Phoenix II*'s master until the steamer was finally decommissioned in 1837.[91]

Day-to-Day Operations

During its 16 years in service, *Phoenix II* operated as a passenger steamer along the north-south-oriented Lake Champlain, between Whitehall, NY in the south and Saint-Jean-sur-Richelieu, QC (then known as St. John's of Lower Canada) in the north. Stops along the route included, from north to south: Champlain (NY), Chazy (NY), Plattsburgh (NY), Port Kent (NY), Burlington (VT), Charlotte (VT), Essex (NY), Basin Harbor (VT), Chimney Point (VT) Crown Point (NY), and Ticonderoga (NY) (Figure 3-1). Each year these stops varied slightly, for example in some years the boat stopped at Charlotte, while in others a stop was made at Essex across the lake instead.

---

[90] Lathrop 1827-1842, 1-2.
[91] Ibid.

Figure 3-1. *Phoenix II*'s ports of call between Saint-Jean-sur-Richelieu, QC and Whitehall, NY. (Reprinted from Google Earth, 2018)

Running in the opposite direction on the lake was the steamer *Congress,* built in 1818, which meant that one of the two boats was constantly travelling either north or south. A schedule was advertised every season to inform the public of departure times for the boats. In 1825, for example, one of the two boats left Whitehall every Tuesday, Thursday, and Saturday at 9 o'clock in the morning, and St. Johns every Monday, Wednesday, and Friday at 2 o'clock in the afternoon.[92] The following season, in 1826, the schedule changed slightly so that while the Whitehall departures remained the same, a boat left St. Johns every Monday, Thursday, and Saturday at 8 o'clock in the morning.[93] The public was kept apprised of the docking times through newspaper advertisements, and any variations to the routes or schedules were announced via newspapers as well.

Newspaper advertisements also informed the public when the steamboat passenger service season began each year, and when the boats were laid up for the winter. For the most part, the season began as soon as the lake thawed, which happened sometime between the third week of March and third week of April, and closed when the ice became too thick to be broken up by the boats, usually around the first to third week of December (Table 3).

---

[92] *Northern Sentinel* (Burlington, VT) 15 July 1825, 3.
[93] *Northern Sentinel*, (Burlington, VT) 4 August 1826, 3.

Season	Spring Open	Fall Close
1821	---	---
1822	April 20[94]	---
1823	April 18[95]	---
1824	March 23[96]	---
1825	April 6[97]	December 1[98]
1826	---	Before December 13[99]
1827	April 7[100]	November 27-28[101]
1828	March 30[102]	November 22[103]
1829	April 24[104]	December 8[105]
1830	April 3[106]	December 20[107]
1831	April 8[108]	December 5[109]
1832	April 27[110]	December 2[111]
1833	April 10[112]	November 30[113]
1834	April 1[114]	---
1835	April 20[115]	---
1836	May 2[116]	---

Table 3. Navigational season opening and closing dates of passenger service on Lake Champlain during *Phoenix II*'s operational years. Days varied slightly based on how soon the ice thawed in the spring, and formed in the fall.

---

94 *Rutland* (VT) *Herald* 1 May 1822, 3.
95 *Northern Sentinel* (Burlington, VT) 18 April 1823, 3.
96 *Northern Sentinel* (Burlington, VT) 16 April 1824, 3.
97 *Northern Sentinel* (Burlington, VT) 8 April 1825, 2.
98 *Vermont Aurora* (Vergennes, VT) 1 December 1825, 3.
99 An advertisement for lost articles from *Phoenix II* collected after the close of the season, dated to 13 December 1826, ran in the *Vermont Aurora* (Vergennes, VT) 8 February 1827, 4.
100 *Northern Sentinel* (Burlington, VT) 13 April 1827, 3.
101 Lathrop 1827-1842, 9; advertised by the *Vermont Aurora* (Vergennes, VT) 6 December 1827, 3; *Phoenix II* was removed from the line before 26 October 1827 to be fitted with a new engine, see *Vermont Aurora* (Vergennes, VT) 8 November 1827, 3.
102 Lathrop 1827-1842, 11; see Hemenway 1867, 705 for a list of *Franklin*'s season openings 1828-1837.
103 The steamer *Washington* was laid up 14 December: Lathrop 1827-1842, 16-17.
104 Lathrop 1827-1842, 18.
105 Ibid., 22.
106 Ibid., 23.
107 Ibid., 25.
108 Ibid., 26.
109 Ibid., 28.
110 Ibid., 29.
111 Ibid., 29.
112 Ibid., 30.
113 Timothy Follett wrote to I. & J. Townsend on 1 December 1833: "The Phoenix went into winter quarters yesterday & the Franklin probably will tomorrow," see: TFP, Box 8, "Correspondence July 1833-1838; n.d. [*sic*]"
114 Hemenway 1867, 705.
115 Ibid., 705.
116 Ibid., 705.

Phoenix II was mainly employed in passenger service throughout its career, but was occasionally used for towing or freight service. Passenger transportation was seemingly more pleasant than towing, based on Captain Lathrop's exclamation on 16 July 1827: "This completes the towing for this season and May Heaven [*sic*] grant me a more pleasant livelihood the remainder of my steamboating [*sic*] than that of towing rafts."[117]

Phoenix II was involved in a number of accidents and mishaps over its long career. Incidents in which the steamer was involved included breakdowns, storms, collisions, a legal seizure, and drownings. In order to keep the steamer competitive over its extensive career, the owners invested in at least one engine upgrade and other modifications to its paddlewheels and boilers. These events and periodic overhauls are helpful for understanding steamboat life and daily operations in the 1820s and 1830s. In some cases, details of the upper hull structure or engine are mentioned in the incident descriptions, providing much needed information on the layout of the boat. Several of these events are described in the following pages.

Seizure at St. Johns

In 1823, under Jahaziel Sherman's reign as captain, *Phoenix II* was involved in a smuggling controversy between the Canadian and United States border. The *Plattsburgh Republican* recorded the incident on 31 August 1822:

> The Steam Boat Phoenix was seized in St. Johns, on the 26th inst. for an alleged breach of their Revenue laws. It seems that some person, unbeknown [*sic*] to

[117] Lathrop 1827-1842, 7.

> Capt. Sherman, had secreted a quantity of crapes, to the amount of 10 or 12 hundred dollars, in some part of the boat, with the intention of smuggling them. Information was given to the officers of the customs, and the boat was seized at the moment when she was preparing to leave St. Johns. Capt. Sherman immediately started for Montreal for the purpose of getting the boat released. The crew of the boat 2 hours after the usual hour of departure, managed to secure the two soldiers who were put on board as a guard, cut the fasts, and made the best of their way for the United States. The two soldiers have since been sent back in the Congress. At present the Phoenix goes only to the 45th degree of North Latitude, from whence the Congress takes the passengers into Canada.[118]

The American newspapers were sympathetic towards the esteemed steamboat master, stating: "The seizure of a passage boat, because one of its passengers, without knowledge or privity of the Capt. has illicit articles concealed in his trunk, is peculiarly rigid," and insisting that the "contraband goods, which were put on board, [were] unknown to Captain Sherman."[119] Although the newspapers contributed no blame to Sherman, most likely he was not completely innocent in the smuggling. In fact, the practice of smuggling goods was evidently commonplace, and *Phoenix II* as well as *Congress* most likely smuggled items across the Canadian-US border often. The illegal activity was ignored by both Captain Jahaziel Sherman and his son, Captain Richard Sherman (who commanded *Congress*), or perhaps they were even offered a cut of the profit. Not only did the two captains ignore the illicit dealings of their crew and passengers, but the customs officers at St. Johns were either very unaware, or, more

[118] *Plattsburgh* (NY) *Republican* 31 August 1822, 3.
[119] Ibid; *Northern Sentinel* (Burlington, VT) 30 August 1822, 2.

likely, profiting from the smuggling as well, and were therefore quite lax in their efforts at stopping it.[120]

This illegal smuggling went on unchecked until an honest, diligent man named Bartholomew Tierney became the guager at the port of St. John's in October of 1820.[121] Unlike the other custom officials, Tierney was not willing to overlook cases of smuggling, nor would he accept bribes. Instead, this loyal British subject sought to put an end to the illicit trade of smuggled goods at St. Johns and to enforce the law "with integrity and firmness."[122] During his first two years as guager he made several seizures of smuggled goods from both *Congress* and *Phoenix II*.[123]

In 1822, Tierney learned that it was his right as customs officer to not only seize the contraband goods, but also the boat found guilty of smuggling. On 21 August that year, Tierney was alerted to the smuggling of textiles on board *Phoenix II*, and so when the boat arrived at St. Johns he set out to investigate. He spied the boat's pilot, John Wilson, quietly hauling away bundles of silk, but did not pursue the man.[124] Instead, Tierney gave Sherman the benefit of the doubt and alerted him that his crew and probably some of the passengers were illegally importing goods to Canada. Sherman pleaded ignorance on the matter, but Tierney warned, "should [he] find on any future

---

[120] Crisman et al. 2018, 140-141; "It was impressed upon my attention when I received my commission in Québec, that smuggling, to an almost incredible extent, was carried on via St. Johns," Tierney 1823, iii-iv.
[121] Guager was the nineteenth-century spelling of gauger, referring to the commercial gauger who approved or denied cross-border commercial trade.
[122] Tierney 1823, iii.
[123] Tierney 1823, 7.
[124] John Wilson of Vergennes, VT worked as a Lake Champlain steamboat pilot from 1811 to 1831, Hemenway 1867, 706.

search illegal articles on board, [he] should feel it [his] bounden duty to *seize the Phoenix* [*sic*].”[125]

A mere four days later, 25 August, Tierney again received a tip that Sherman’s boat contained contraband items.[126] This time, Tierney discovered ten bales of crapes and silks secreted beneath a staircase in a locked cabinet that required being broken into. Tierney seized the textiles and placed the steamer under arrest, to be held in the port at St. Johns.[127] Tierney resisted bribes from Sherman and pleas from his fellow customs officers to let the steamer off and followed through with seizing the boat, putting it under the guard of two soldiers. The steamer remained in custody overnight, but the following morning the crew disarmed the two guards and steamed out of the port, reaching the United States and escaping the hold of British officials.[128]

Tierney was initially praised for his actions by the Earl of Dalhousie, Governor General of British North America.[129] Tierney’s coworkers, however, were not helpful in prosecuting the smuggling, and in Tierney’s opinion worked actively against him. The issue was still not resolved by the spring of 1823. According to Tierney, powerful men working on behalf of the LCSC, including Sherman and Barnum, traded letters with people well above Tierney’s head in the Canadian government. Tierney was left largely out of the discussion and the letters he did receive were often ‘accidentally’ delivered

---

[125] Tierney 1823, 8.
[126] Tierney’s informant is never mentioned in his statement. It is possible that, knowing smuggling was rampant, Tierney simply elected to investigate the steamer to attempt to catch the perpetrators in the act.
[127] Crisman, et al. 2018, 141.
[128] Tierney 1823, 8-10.
[129] Tierney 1823, 21.

late, preventing him from acting on the information they contained.[130] The exclusion of *Phoenix II* from Canadian waters negatively affected trade and cross-border visiting, which was not desirable for either the Canadians or Americans. By the end of April, the Canadian government officials were tired of hearing of the case, and the entire affair was quietly and privately dealt with, resulting in Tierney's dismissal from his station. Both *Phoenix II* and *Congress* were officially welcomed to resume business back to St. Johns, and the "unhappy difficulty which existed between the proprietors and his Majesty's custom house officers […] settled."[131]

The event hardly put the public off either *Phoenix II* or the boat's master, though, as evinced in an article published in the *Plattsburgh Republican* shortly following the event:

> This interruption of free communication with St. Johns, is a public inconvenience, and is much to be regreted [*sic*]. No blame can attach to Capt. Sherman – he afforded every facility to the custom house officers to prevent the illicit traffic complained of.[132]

The *Rutland Herald* went even further to defend the captain, by laying blame on British officials for attempting to blacken Sherman's good name:

> The idea that capt. Sherman could have been privy to the shipment of the prohibited articles, by which the boat became forfeited, must not – cannot have a moment's entertainment; and we are happy to observe that the Montreal editors heartly acquit him of all blame.
> We know not that we have sufficient authority to justify suspicion; yet we have but little doubt of this transaction being the result of a deeply laid plot, matured

[130] Tierney 1823, 24, 28
[131] *Northern Intelligencer* (Burlington, VT) 15 April 1823, 2.
[132] *Plattsburgh* (NY) *Republican* 31 August 1822, 3.

> by individuals only, who were base enough to deliberately work the ruin of a most worthy and universally esteemed gentleman.[133]

His colleagues, similarly, were quick to come to Sherman's defense. In a letter to the Chief Justice of Lower Canada, Chief Justice Sewell, Barnum wrote, "I believe your Honour's acquaintance with the public and private character of that gentleman [Sherman] is such, as to render any remarks upon the subject of his integrity useless."[134]

Based on all of this praise, it is hard to imagine the public or the company lost faith in Sherman. However, although he appeared to come through the ordeal unscathed, after finishing up the following 1823 season he moved on from captaining Champlain steamers to other ventures.[135] Whether his transition had anything to do with the smuggling is hard to say, but it may have influenced his decision.

The entire affair was unjust from Tierney's point of view, but from the perspectives of Canadian and American traders and government officials, ten bales of crapes were hardly worth an entire shut down of cross-border trade. The LCSC's passenger service was much more valuable to Canada than the duty and taxes they would have received on the smuggled goods, so *Phoenix II* was welcomed back in 1823 with only three months of service to Canada lost the previous fall.

---

[133] *Rutland* (VT) *Herald* 16 September 1822, 3.
[134] Tierney 1823, 29.
[135] Crisman et al. 2018, 142.

Collision between Phoenix II *and* Congress

On 5 October 1826 the two LCSC steamers were involved in a collision, the particulars of which were reported in local newspapers. Because of the rarity of such an event, by the time the incident was recorded the human tendency to dramatize news severely inflated the severity of the collision. Immediately after the accident occurred, newspapers reported the unverified word-of-mouth stories they heard. One report by the *Northern Spectator*, titled "Shocking Steam-Boat Accident," claimed "Just as our paper was going to press we were verbally informed that the Congress and Phoenix Steam-Boats on Lake Champlain, come in contact a few nights since, and that *seven* [*sic*] persons were killed on board the latter. We have not learnt the particulars of this shocking affair."[136] Similar misinformation was reported by the *Rutland Herald*, which claimed that "two persons [were] instantly killed, and two others so shockingly mangled that they died the next day, and three […] children were missing, who were, without a doubt, swept into the lake."[137] Two weeks later, the *Northern Spectator* recanted its original description of the event, stating "we were misinformed, and the account much exaggerated in our paper before last."[138]

The *Vermont Aurora* commented on the exaggeration, describing how "many reports are in circulation respecting this unfortunate affair, which have no formulation in truth." The paper reported the actual incident thus:

> A serious accident occurred to the *Phoenix* and *Congress* on Thursday night last, the particulars of which are these: The Congress, from St. Johns for Whitehall,

---

[136] *Northern Spectator* (Poultney, VT) 11 October 1826, 2.
[137] *Rutland* (VT) *Herald* 10 October 1826, 3.
[138] *Northern Spectator* (Poultney, VT) 25 October 1826, 2.

> was near Port Kent, which place she had just left, and the Phoenix was on her way to St. Johns. The lights of the Congress were distinguished at some distance by the pilot of the Phoenix, who supposed they were the lights at the wharf at Port Kent, and he shaped the course of the boat accordingly. Owing to this mistake, the Phoenix ran foul of the Congress; the bows of the former tore away one of the water-wheels of the latter, destroyed the baggage room, round houses, &c. and swept nearly the whole of the passengers' baggage into the Lake. But, what is more distressing, is the fact that two women (Emigrants from Ireland) were so badly hurt that one expired immediately and the other it was feared would not long survive, but we understand she is likely to recover.[139]

Despite the claim that *Congress* would resume service soon after the report, repairs took until the end of the season.[140] *Phoenix II*, on the other hand, was barely damaged and resumed service immediately, towing the crippled *Congress* to the wharf at Port Kent. Within days, *Congress* was towed to Vergennes for repairs.[141]

The tragedy of the crash was the Irishwoman who was killed by the impact, and the two young teenage daughters she left behind. Several of the passengers present at the crash took it upon themselves to collect donations for the girls, for a total of seventeen dollars (adjusted for inflation, approximately $400 USD today).[142]

Aside from the tragic loss of a life, many of the passengers lost their luggage. In 1886, the *Plattsburgh Republican* published a story titled "Sunken Treasures of Port Kent," referring to the "considerable amount of money" that fell overboard as a result of the collision sixty years earlier. A Mr. G. V. Edwards noted in his diary that over $400

[139] *Vermont Aurora* (Vergennes, VT) 12 October 1826, 2.
[140] Lathrop 1827-1842, 1.
[141] *Vermont Aurora* (Vergennes, VT) 12 October 1826, 2.
[142] *Plattsburgh* (NY) *Republican* 16 October 1886, 1.

was lost, between himself and other passengers.[143] Fortunately for "three beautiful sisters, Jewesses, from Montreal," their trunks containing precious jewelry were found "floating amidst rocks in good condition," ten miles (16 km) away near Plattsburgh.[144]

The McQueen Engine is Replaced

After seven years of operation, the LCSC decided to update *Phoenix II* by replacing its 45-horsepower McQueen engine with a much more powerful engine over the winter of 1827-1828.[145] The decision to upgrade engine likely boiled down to the old McQueen engine wearing down (Captain Gideon Lathrop's journal noted in April 1827: "I have written to Mr. Winne saying the Phoenix had broken her cross head"), as well as the LCSC's desire to compete for passenger service with a newly-formed rival the Champlain Transportation Company (CTC).[146] Although the crosshead was fixed, by this time the McQueen engine had served for a decade on two boats (the first of which burned), and was probably due for retirement.

As for the competition, only two weeks before *Phoenix II* was pulled from the line, the CTC launched its first boat, *Franklin*. By all accounts, *Franklin* was an

[143] *Plattsburgh* (NY) *Republican* 16 October 1886, 1.
[144] *Vermont Aurora* (Vergennes, VT) 9 November 1826, 1.
[145] "The Phoenix having discontinued running, to receive her new engine, the *Congress* will continue her trips the remainder of the season," *Vermont Aurora* (Vergennes, VT) 8 November 1827, 3; "A new and powerful engine has been obtained for the Phoenix." *Vermont Aurora* (Vergennes, VT) 6 December 1827, 3.
[146] Lathrop 1827-1842, 5.

excellent steamer, fast and stylish, and it represented a serious challenge for the LCSC's aging boats.[147]

Phoenix II was fitted with its new engine in time to be a contender the following season. In April of 1828 the LCSC made its first test of the engine, with Lathrop reporting: "The Phoenix made a trip to Pt. Kent and back at the rate of about 9 miles [14.5 km] an hour but we think she will run much faster when properly fitted and packed."[148] Lathrop was correct as, "to allay any fears," the *Vermont Aurora* reported that "there [was] little difference in speed of the boats: both run remarkably fast, the accommodations of both are excellent."[149] Since *Franklin* could make 10 miles per hour (16 km/h), it would seem that *Phoenix II*'s top speed after the new engine was properly outfitted was likely 10 miles per hour (16 km/h) as well.[150]

Unfortunately, other than its probable top speed, little is known about *Phoenix II*'s new engine from December of 1827. Information about where the new engine was made, by whom, and its diameter and length of stroke has not been found. However, an entry in the *New York Annual Register* of 1830 did note that the new engine was capable of generating 90 horsepower.[151] By working backwards using the formula for

---

[147] Hemenway 1867, 694, noted: "No pains were spared to make this boat [*Franklin*] complete, especially in the conveniences for passengers. She was provided with an upper deck throughout, with a ladies' cabin on the main deck, which was the first boat provided in that way. […] The Cham. Trans. Co. was gaining ground with their "splendid steam packet Franklin," while the Cham. Steamboat Co. was losing."
[148] Lathrop, 1827-1842: 12; "Packed" most likely referring to packing used to seal the steam pipe joints and the cylinder head, Crisman, pers. comm.
[149] *Vermont Aurora* (Vergennes, VT) 31 July 1828, 3.
[150] Ross 1997, 53.
[151] Williams 1830, 137.

horsepower described in Chapter II, it is possible to make estimates regarding the size of the cylinder and stroke of the piston.

Assuming the new engine's 90 horsepower rating was accurate, and we retain the pressure (based on the boiler, which is not known to have been replaced in 1827-1828) and strokes per minute (this may have changed, but for the sake of the equation we will assume it did not), we can estimate the size and stroke of the new engine:

$$90 = \frac{\left((7.75 lbs/in^2 \times X in^2) \times \left((Y feet\ x\ 2)/stroke \times 17 strokes/minute\right)\right)}{33{,}000\ foot - lbs/minute}$$

$$90 = \frac{\left((7.75 X lbs) \times (34 Y feet/minute\right))}{33{,}000\ foot - lbs/minute}$$

$$2970000 = 263.5XY$$

$$11271.35 = XY$$

Where: $Cylinder\ diameter\ in\ Feet = 2\sqrt{\left(\frac{X}{\pi}\right)} \div 12$

and $Length\ of\ Stroke\ in\ Feet = Y$

Table 4 shows the possible stroke-length and cylinder-diameter combinations based on the known parameters of *Phoenix II*'s second engine. The most plausible new engine was either a 4-foot-8-inch (1.42-m) diameter cylinder with a 4-foot-6-inch (1.37-m) stroke, or a 4-foot-6-inch (1.37-m) diameter cylinder with a 5-foot (1.52-m) stroke, but unfortunately without more information it is impossible to be sure of either.

Stroke Length	Cylinder Diameter
4 feet (1.22 m)	6 feet (1.83 m)
4 feet 6 inches (1.37 m)	4 feet 8 inches (1.42 m)
5 feet (1.52 m)	4 feet 6 inches (1.37 m)
8 feet (2.44 m)	4 feet 2 inches (1.27 m)

Table 4. The possible stroke length and cylinder diameter combinations based on the known parameters of *Phoenix II*'s second engine.

Deaths and Drownings

Aside from the Irishwoman killed in the collision between *Phoenix II* and *Congress* in 1826, several other deaths and drownings were associated with the *Phoenix II*'s career. While working on the installation of the steamer's new engine, 28-year-old Albert S. Latamer from Middleton, CT, fell through the ice at Shelburne Bay on 23 March 1828. Efforts to save him were for naught, and his body was only retrieved from the water hours later.[152]

On 12 October, 1831, a *Phoenix II* deck hand, Ira Proctor of Burlington, drowned while attempting to "fasten the hooks. The wind blew very hard, the waves rolled high and the night was very dark, the swells dashed into and filled the yawl and the front crane to which he was suspended suddenly gave away and let Proctor drown." Despite search efforts by Captain Lathrop and the crew, the 22-year-old "industrious and faithful hand" was never found.[153] Later that same year, Lathrop noted in his diary the death of

[152] *Northern Sentinel* (Burlington, VT) 28 March 1828: 3.
[153] *Burlington Sentinel* (Burlington, VT) 14 October 1831: 3.

another man who was crushed between the guards of *Phoenix II* and a sloop as the steamer made its way out from the wharf at Whitehall.[154]

Phoenix II*'s Final Upgrade*

In 1830, Isaiah and John Townsend hired Mellen Battle, an engineer from Albany, NY, to make certain modifications to *Phoenix II* to keep the ten-year-old boat competitive with the younger *Franklin*. Although the full scope of his upgrades are unclear, in November of 1830, Timothy Follett wrote to Tunis Van Vechten, describing the work Battle "had directed on board the Phoenix – on Saturday last she was brought out & with a few friends, we made a trip as far as Plattsburgh & back – her water wheel had been diminished one foot by cutting up her buckets 6 inches [(152 mm)], & she made 19 revolutions with ease & yet having a great surplus of steam."[155] Cutting the outer 6 inches [(152 mm)] of the paddlewheel buckets was all that Battle had done in the fall of 1830, but already Follett claimed, "she is now fairly a 10 mile boat [(16 km/h)], & may be forced 11 miles [(17.7 km)]," referring to the new speed of 10 miles per hour (16 km/h), which outpaced their potential competitor's steamer, the CTC's *Franklin*, whose "utmost speed [did] not exceed 9 miles [per hour (14.5 km/h)]." The letter informed Van Vechten that although *Phoenix II*'s modifications made the older boat faster than *Franklin*, it was still in their best interests to "keep cool & avoid competition" by partnering with the CTC. *Phoenix II*'s upgrades meant the potential competitor would

[154] Entry from 4 December 1831: Lathrop 1827-1842, 27.
[155] TFP, Box 7, "Correspondence 1827-June 1833," 17 November 1830.

"have more respect for our present ability & our superiority," giving the older company more bargaining power.[156]

Battle's work on *Phoenix II* continued into 1831, which concerned the boat's new captain, Gideon Lathrop. By 4 March 1831, progress was not advancing satisfactorily according to Lathrop, who wrote to the Townsends:

> I am very sorry Mr. Battle is not here with the Boiler Iron as the Spring is fast approaching and I am afraid we will not be ready – the ice is now breaking up in the Lake and every thing appears like an early spring – nothing would grieve me more than to be behind […] and have people ask Where is the Phoenix? I am sure every thing will be ready on my part by the first of April. We can go without the alteration in the Boilers but I am sure it will save you a great expense to have Mr. Battle's plans completed.[157]

Whatever the holdup was for Battle did not last long, as just over a month later on 10 April, Lathrop wrote the Townsends:

> We have now made three passages the whole distance of the Lake besides a trip from Burlington to St. Johns and several little trials about the Harbor, and I can with much pleasure & confidence say to you she has seemed to run faster every move Mr. Battle has made, and from my own experience and that of others, I can safely say she now runs better than ever before. I am sorry Mr. B.- is obliged to leave us so soon, as we have not had an opportunity of judging accurately the quantity of woods she burns in a passage, as we have had nothing but bad weather since she left the Harbor.[158]

Despite Lathrop's apparent dissatisfaction with the delay in early March, Battle's work evidently proved to be worth the wait. As Lathrop refers to "boiler iron" in his first letter, Battle most likely made some improvements to the boilers. What else he did to

[156] TFP, Box 7, "Correspondence 1827-June 1833," 17 November 1830.
[157] TFP, Box 7, "Correspondence 1827-June 1833," 4 March 1831.
[158] TFP, Box 7, "Correspondence 1827-June 1833," 10 April 1831.

Phoenix II or its machinery is not known, but in the New York Annual Register of 1833, the engine's horsepower was listed as 106, which was higher than the entry in 1830 that listed 90 horsepower, correlating to *Phoenix II*'s second engine.[159] Although no mention is made of a third engine being installed on *Phoenix II*, perhaps Battle's improvements to the boilers managed to eke an extra 16 horsepower out of the engine.

Phoenix II *and the Cholera Epidemics of 1832*

One event in *Phoenix II*'s career had profound consequences for North American history. This was the 15 June 1832 death of John Larned on board the steamer, the first death from cholera in the United States. The event was described in the third volume of the *Bulletin of the New York Academy of Medicine* in 1866:

> In a letter just received, Dr. Long states: "The first fatal case of cholera known to have occurred in any resident of the United States occurred at the Dock, in the village of Whitehall, June 15, 1832, twelve days after the arrival of the pestilence upon the *Carrick* at Québec. The history of that case I will give you in the words of Capt. G. Lathrop, of Columbia Country, N.Y., of the steamboat *Phoenix*, upon which the case occurred. 'Mr. John Larned, of Troy, N.Y., went to Canada on the *Phoenix*, and when going and returning he spoke lightly of the new disease, to which he was exposed in Québec, used opium and stimulants freely to keep off danger. He was seized with the cholera in the night, when going from St. Johns to Whitehall. He died soon after the boat reached her dock, the passengers and every person on board fled, but with the aid of physicians in the village, the corpse was buried on an island in the lake. Immediately the pestilence spread through the village and killed one hundred and thirty-nine of the inhabitants. In 1849 the epidemic reached this place by the same route, and by the same means.[160]

[159] Williams 1833, 268; Williams 1833, 137.
[160] Harris 1866, 107.

Larned was exposed to the disease during a visit to the cholera hospital in Montreal, although what he was doing there to begin with is unknown.[161] To travel back to Troy, he boarded *Phoenix II* at Saint-Jean-sur-Richelieu on 14 June 1832, and the steamer departed at one o'clock in the afternoon. Larned had boasted to his fellow passengers of his opium and stimulants that he had acquired to ward off any cholera attacks, demonstrating his lack of understanding of what caused the disease.[162] Chances are, however, he knew enough about the symptoms that by the time *Phoenix II* left Essex, NY at eight o'clock in the evening, Larned would have started to worry.[163] Symptoms included dehydration, quickened pulse, diarrhea, and aches and pains, all of which victims generally experience approximately two to three days following ingestion of the cholera bacteria. If untreated, the disease can kill its victim through dehydration in 18 hours.[164] Less than 13 hours from his death, Larned must have recognized what was happening to him, or surely felt extremely ill.

By the time *Phoenix II* reached Whitehall the morning of 15 June 1832, the other passengers fled the cholera-infected boat.[165] Larned was left on board, too sick to move, and only Captain Lathrop was brave enough to remain with his passenger. A physician from town, Doctor Wright, was called to attend the patient. At 11 o'clock in the morning, shortly after *Phoenix II* arrived in town, Larned was pronounced dead. Dr.

161 Beck 1833, 353.
162 Harris 1866, 107.
163 *Phoenix's* schedule found in Ross 1997, 38.
164 Kotar and Gessler 2014, 7-8.
165 Harris 1866, 107.

Wright, Captain Lathrop, and several others buried his body on an island just north of the pier on which *Phoenix II* docked.[166]

Larned was the first confirmed cholera fatality in the country, having probably ingested the bacteria while visiting Montreal. In 1832, Larned's passing must have come as something of a shock to many, since most people believed the illness targeted only immigrants. Even the doctors of the time searched for some reason for the disease to target Larned specifically, finally settling on the victim's intemperance as the cause.[167] Many people still believed cholera was a scourge of God, coming to America to eliminate the impure, but Captain Lathrop was more practically minded. After Larned's death, the captain took "great pains to cleanse and purify [his] boat," until he once again felt it was safe for himself and his crew.[168] No more reports of cholera on board *Phoenix II* are known, and Captain Lathrop presumably escaped attack as he survived to write his diary for many years after the incident.[169]

Lathrop was praised locally for his bravery in staying aboard the vessel with his very contagious passenger:

> Capt. Lathrop, of the Whitehall, was long and favorably known as Captain of the Phœnix and other boats that preceded it, and under many trying circumstances acquitted himself with honor, which has not been wholly forgotten or obliterated by his temporary absence from our waters. Well do we remember the presence of mind and devotion to duty exhibited by him on the occasion of the breaking out of that dreadful scourge, the Asiatic Cholera, among us, when stout hearts quailed and the timid shrunk from its presence. The first case that occurred in this vicinity happened on his boat, and proved fatal; the passengers and crew struck

---

[166] Stott 2015, 31.
[167] Beck quoting Dr. W. McLeod in Beck 1833, 353; Harris 1867, 107.
[168] Stott 2015, 32.
[169] Lathrop 1827-1842.

> with consternation and fear, the disease at that time being considered more contagious [*sic*] than it afterwards proved to be. Capt. Lathrop ministered to his wants with his own hands until death terminated his sufferings; when, with a single assistant, he placed the body in a rude coffin, hastily constructed for the purpose, and conveyed it to the shore and gave it a solitary burial. This praiseworthy conduct of the Captain tended much to allay the excitement of the time and strengthen others in the fulfillment of their duty when placed in like circumstances.[170]

The arrival of cholera to North America is generally attributed to *Carrick*, a brig originating from Ireland.[171] One source suggested cholera was brought to North America as early as 28 April 1832, by a ship *Constantia* that came from Limerick, and that previous deaths in the area were simply not recognized as cholera related, since cholera symptoms could be easily confused with dysentery.[172] What is clear is that on 3 June 1832, a confirmed case was reported immediately after the arrival of *Carrick*, in Grosse Isle, Québec. From there, the bacteria was transported by the steamboat *Voyageur* up the St. Lawrence River to Montreal. The first reported case in Montreal occurred 9 June 1832, as a passenger from *Voyageur* fell ill and succumbed to cholera.[173] The outbreak in Montreal quickly escalated to an epidemic, and hospitals swelled with victims of the deadly bacteria.[174]

Due to the multi-day incubation period, and the general ignorance surrounding how cholera spread from person to person, the bacteria was able to spread quickly

---

170 Hemenway 1867, 704
171 Kotar and Gessler 2014, 97; Peters 1885, 16; Harris 1866, 106.
172 Peters 1885, 16.
173 Beck 1833, 352.
174 *Montreal Vindicator*, 19 June 1832: 1.

throughout North America. [175] While undoubtedly the bacteria would have eventually reached all populated corners of the continent one way or another, the swift dispersion of the disease was clearly aided by the speed and regularity of steamboats.[176] The inland waterways on which steamboats navigated were like a circulatory system that connected all of the major cities together, efficiently carrying the deadly bacteria throughout the continent.[177] Lewis Beck, in his 1833 report to New York Governor Enos T. Throop, remarked upon this:

> [It] will be observed that the disease has generally passed from place to place along the main channels of communication. Wherever it has prevailed to any extent, the infected city or village appears to become a centre from which the disease is communicated to different places in the vicinity. Thus from Montreal and Québec, as centres, it gradually spread into various parts of Canada, following the course of emigration.[178]

Following the main water highways, cholera quickly made its way from Montreal in two main directions: south, along Lake Champlain in the direction of New York City, and west, up the St. Lawrence River to the Great Lakes and eventually the Ohio and Mississippi Rivers. Along the southward route, after cholera reached Whitehall via *Phoenix II*, there was no stopping it from traveling down the Champlain Canal to the Hudson River, and on to New York City. It reached Mechanicsville, NY on 18 June, and Albany and Troy officially reported outbreaks on 3 and 4 July, although most likely

[175] Kotar and Gessler 2014, 8.
[176] Stevenson 1859, 74-75.
[177] Kotar and Gessler 2014, 116.
[178] Beck 1833, 356.

cases appeared days earlier. New York City appeared to have cases as early as 24 June, and confirmed deaths on 30 June.[179]

Some of the first preventative efforts were to institute quarantines on ships and steamboats arriving in cities. For example, after Larned's death, the inhabitants of Whitehall would not allow immigrants to land, and required that all steamboat passengers be checked before the steamboat was allowed to dock in their town.[180] They had good reason to enforce this quarantine since as a result of the first wave of cholera brought to the town by *Phoenix II* and Larned, the city lost 139 people in a week.[181] Although it is unclear whether the other Lake Champlain steamers were still operating, Lathrop mentions in his journal on 21 August (over two months after Larned's death), that *Phoenix II* "commenced running from St. Johns. This is the first trip since the 14th of June. We discontinued running there on account of the cholera."[182] This pause in steamboat service may have been voluntary since Lathrop first suggested avoiding St. Johns and Canada all together, in a letter dated 17 June 1832.[183]

New York City also quickly put up quarantine measures. In a proclamation, Mayor Walter Bowne, ordered:

> [F]rom and after the publication of this proclamation, no boat, steamboat, or vessel of any description having on board any person sick with fever, or the disease called Cholera, or any disease resembling it, shall approach any part of the City of New York nearer than three hundred yards, nor shall any person belonging to such vessel, except the master, or some person deputed by him,

[179] Beck 1833, 353.
[180] *American Railroad Journal* (NY) 23 June 1832, 416.
[181] Harris 1866, 107.
[182] *Québec* (QC) *Mercury* 19 June 1832, 1; Lathrop 1827-1842, 29.
[183] *American Railroad Journal* (NY) 23 June 1832, 416.

> (who shall immediately repair to this Office,) be permitted to land from any such vessel, without permission first obtained from this Office.[184]

Of course, in most cases the quarantines were ineffective and the preventive efforts were too late. Immigrants were willing to jump from boats, especially in the canals where shore was close by.[185] When the town of Whitehall prohibited *Franklin* from docking there, the passenger steamboat simply backtracked several miles to drop off its immigrant passengers on an empty stretch of shoreline, meaning these people could easily have found their way to the town on foot.[186]

The quarantines show that people knew cholera was being brought to the city by boat. As a result of this knowledge, steamboat crews were among the first to abandon their jobs. On the St. Lawrence River, "The Agents of the Steamboat Companies, owing to the number of men who have left them through fear, have been obliged to lay up several of their boats, and the only steamers now plying to Québec are the *John Molson*, *Hercules*, *Voyageur*, *St. Lawrence*, and *Lady of the Lake*. The men of the Durham boats and bateaux have objected to taking up emigrants."[187] The steamboat crews could hardly be faulted for leaving their posts as they knew they were the most at risk of contracting cholera. The abandonment of steamboats by their crews was not the most severe preventative measure proposed or employed during the height of the pandemic. The crew of one St. Lawrence River steamer, *John Molson*, received one particularly horrible

[184] *American Railroad Journal* (New York) 23 June 1832, 415.
[185] Rosenburg 2009, 25.
[186] *American Railroad Journal* (New York) 23 June 1832, 416.
[187] *Québec* (QC) *Mercury* 19 June 1832: 1.

instruction: they were told that should any passenger show symptoms of cholera they were to be thrown overboard immediately.[188]

The outbreak of cholera in North America was a catastrophic event that resulted in the deaths of thousands of people. Despite its pivotal role as the conveyor of the first fatal cholera victim in the United States, *Phoenix II* is rarely recognized in historical discussions of cholera. Even Lathrop's journal only barely references this major occurrence. After the steamer resumed service in August, no mention of cholera is found in Lathrop's journal. Passenger service was halted, but evidently not for long. Eventually, the lake steamers resumed their routes, and by the following year (1833) the Townsends and Lathrop had more urgent matters to consider concerning the ownership of the Lake Champlain Steamboat Company.

Selling/Takeover of LCSC

After purchasing the land at Shelburne Shipyard in 1820, the LCSC based its two boats, *Congress* and *Phoenix II* here for the remainder of the company's existence. From here, *Phoenix II* and *Congress* ran the line of the lake, unrivalled, for four years, but in 1824 the Legislature of Vermont granted the Champlain Ferry Company a charter to run passenger steamboats on the lake.[189] Two years later, these two companies were joined by another, the St. Albans Steam Boat Company. In 1827, one year later, Messrs. Henry H. Ross and Charles McNeill, who had operated a horse ferry between Charlotte,

[188] Kotar and Gesler 2014, 100.
[189] Ross 1997, 41; Hemenway 1867, 693.

Vermont and Essex, New York, entered the steamboat business, launching their boat *Washington*. This vessel was originally intended as a ferry in the same place, but later operated as a 'line' boat carrying passengers and freight the length of the lake.

These three new companies, the Champlain Ferry Company, Messrs. Ross and McNeill, and the St. Alban's Steam Boat Company, were modestly successful, but did not reduce the profits brought in by the LCSC's two massive steamers. The other companies' boats ranged from 75 to 92 feet (22.9 to 28 m),[190] not even coming close to *Phoenix II*'s 143 feet (43.6 m)[191] or *Congress*' 108 feet (32.9 m).[192] In addition to being smaller, the other steamers could not beat the 8 miles per hour (12.8 km/h) attained by both of the LCSC steamers, therefore they never posed a real threat to overtake the company's business (Table 5).[193]

Boat	Company	Year Built	Length	Speed
General Greene	Champlain Ferry Company	1825	75 feet (22.9 m)	8 miles per hour (12.8 km/h)
Washington	Messrs. Ross and McNeill	1827	92 feet (28 m)	8 miles per hour (12. 8 km/h)
MacDonough	St. Alban's Steam Boat Company	1828	89 feet (27.1 m)	8 miles per hour (12.8 km/h

Table 5. Steamboats from competing Lake Champlain steamboat companies that were smaller than *Phoenix II*.

[190] Ross 1997, 41, 45, 46; Wilkins 1916, 14-15.
[191] Barranco Papers, LCMM.
[192] Ross 1997, 37.
[193] Ibid., 41, 46.

The real competition for the LCSC started with the inception of the Champlain Transportation Company. This company was founded 26 October 1826, when the Vermont Legislature granted a charter to Ezra Meach, Martin Chittenden, Stephen S. Keyes, Luther Loomis, Roswell Butler and Eleazer H. Deming.[194] In the fall of 1827, the CTC came out with its first steamer, *Franklin*, which was built under the direct supervision of Captain Jahaziel Sherman, former captain of *Phoenix II*.[195]

Sherman and the CTC improved passengers' experiences on board their new steamer by moving the ladies' cabin from below decks to the main deck, including more sleeping quarters that were larger and more comfortable, and adding a covered promenade deck.[196] *Franklin* proved to be very profitable for the new company, while the LCSC's older boats suffered in the 1828 season. Indebted to a number of different creditors, the owners at the time, Cornelius van Ness, Jellis Winne, Timothy Follett, and Tunis Van Vechten, appealed to prominent businessman and founder of the LCSC Isaiah Townsend of Albany for financial aid.

The contract between Isaiah Townsend and Van Ness, Winne, Follett, and company president Van Vechten stated that Townsend would loan the company $6,000, for which the two steamers, *Phoenix II* and *Congress*, and their insurance plans would be used as collateral.[197] The loan was used to pay off the creditors; however, it was not enough to give the old company's steamers an edge over *Franklin*. In 1829, van Ness and Follett stepped in as individuals to lease out the two steamboats and alleviate some

---

[194] Hemenway 1867, 694.
[195] Ibid.
[196] Ross 1997, 53; Hemenway 1867, 694.
[197] TFP, Box 57, "Miscellaneous 1802-1831," 18 August 1828.

of the company's financial woes. Their strategy was to form a partnership with the new and thriving CTC, which mandated that the profits generated by both companies' boats be split between the two companies.[198] Their contract with the CTC was for two years; however, before the end of it, van Ness and Follett ran out of funds and the company sold the boats at auction. Isaiah Townsend bought the two steamers, their insurance plans, all of their outfitting, and the land and workshops at Shelburne on 20 July 1830 for the sum of $18,600.[199] Isaiah's brother, John Townsend, was the official representative of the LCSC in the sale. He listed the advertisement: "Whereas I have advertised for sale at public auction the Steam Boats Phoenix & Congress with their Engines tackle & apparel & all other the [*sic*] property of the Lake Champlain Steam Boat Company to be sold at Whitehall in the County of Washington on the twentieth day of July inst."[200] Both Isaiah and John had been involved with the LCSC from its beginning, and obviously were not willing to let the company dissolve just yet.

Since the cooperative arrangement with the CTC was not yet concluded by July of 1830, after purchasing the old company's assets it became Isaiah Townsend's responsibility to continue the agreement until the end of the season. Townsend must have found the agreement favorable as he renewed the same contract under the same terms the following season, once again for two years.[201] When this contract expired in the beginning of 1833, Townsend and the CTC discussed new possibilities, ultimately resulting in the CTC buying the LCSC's old property. This property included *Phoenix II*

---

[198] Hemenway 1867, 695.
[199] Lathrop 1827-1842, 1.
[200] TFP, Box 57, "Miscellaneous 1802-1831," 18 July 1830.
[201] Hemenway 1867, 695.

and *Congress*, “together with all & singular the engines, boilers, furnaces, tools, compasses, sails, awnings, yard, anchors, cables, ropes, covers, boats, oars, guns, tackle, apparel & furniture” as well as the LCSC’s shipyard property in Shelburne. [202] By signing this document with Tunis Van Vechten and Timothy Follett, who after abandoning the LCSC had taken up with the CTC, Isaiah Townsend was granted equal shares in the CTC stock.

This was the final ownership change for *Phoenix II* and *Congress*. The CTC, however, was only just beginning its reign of passenger steamboat operation on Lake Champlain. After purchasing the LCSC, the company continued to absorb its competitors. The company had already bought the steamer *Washington* in 1829 from Ross and McNeill, leaving three competing enterprises to contend with on the lake. These included the Champlain Ferry Company and the St. Albans Steam Boat Company, as well as Jahaziel Sherman, who in 1832 constructed his own steamboat, *Water Witch*, to provide passenger, freight, and towing service between Whitehall and Vergennes. The CTC did not appreciate this new competition by someone they considered a colleague and former employee, as evident in a letter dated 2 March 1833 from Timothy Follett to Isaiah Townsend, stating “that Old Capt Sherman will hesitate before he takes one farther step in the opposition to our now joint interest,” referring to the recent merging of the old and new companies.

[202] CTC Records, Collection A, Carton 1, Folder 178, “Sale of ‘Phoenix’ and ‘Congress’ to Champlain Trans. Co. February 22, 1833.”

Sherman's rivalry did not last long, nor did the other steamer companies, once the LCSC and CTC joined forces. The consolidated CTC took over all three of its competitors in one fell swoop in a contract written on 27 January 1835:

> Whereas by an arrangement entered into on the 27th day of January 1835 by and between the Champlain Transportation Company of the one part, and the Champlain Ferry Company, the St. Albans Steam boat Company and Jahaziel Sherman of the other part, by which the said parties of the second part, severally, sold to the party of the first part, and executed their deeds of sale of their several and respective steamboats, the Winooski, the Mcdonough and the Water Witch to the party of the first part; and by the payment of the stipulated price of said boats and other property in said deed of sale specified, the said party of the first part issued to the partied of the second part, severally, a certain number of shares of additional stock in said Champlain Transportation Company, and paid certain sums of money, in addition thereto.[203]

The new agreement combined the CTC's 2000 shares with the other companies' 750 shares, to create a consolidated stock of 2750 shares. The arrangement gave Sherman 160 shares of stock and $2,000 for *Water Witch*; the Champlain Ferry Company received 345 shares of stock, and an additional $2,750 to its founder, Peter Comstock, for *Winooski*; and finally the St. Albans Steam Boat Company received 200 shares of stock for *McDonough*.

This agreement resulted in the CTC ownership of the steamboats *Franklin*, *Phoenix II*, *Congress*, *Washington*, *Winooski*, *MacDonough*, and *Water Witch*, along with the "store and work shops […] at Shelburne Point, and a lease at the wharf at Whitehall."[204] Lavater White, previous owner of the land at Shelburne Shipyard and the

[203] CTC Records, Collection A, Carton 1, Folder 241, "Agreement between C. T. C., Champlain Ferry Co., St. Albans Steam Boat Co." 27 January 1835.
[204] Ibid.

LCSC's shipwright, continued with the new steamboat enterprise after that company purchased the Shelburne Shipyard in 1830. His last steamboat, *Vermont II*, was built in 1871.[205]

The Retirement of *Phoenix II*

Phoenix II's 16-year-long career came to an anticlimactic end in 1837 when it was deemed too old for further service and decommissioned.[206] The chronology of events following the company's retirement of the old boat, including the removal of its engines and fittings, and its intentional sinking in Shelburne Shipyard, is undocumented. It is safe to presume that anything of value was first retrieved and repurposed on later boats, stored by the CTC, or sold for a profit. This includes the engine and boiler parts and any furniture the boat contained. All that was left by the shipyard workers was the wooden hull itself and any refuse or forgotten items that slipped into the bilge below.

Historical sources only state that the hull was "condemned," but they do not say why.[207] A 16-year career was an impressive lifespan for a wooden hull in freshwater, and the timbers must have been rotted by the time it was sidelined.[208] Another potential

---

205 Cohn 2003, 90; Aske 2012, 1; Wilkins 1916, 14-15; Hemenway 1867, 693.

206 Thompson 1853, 216; Wilkins 1916, 14-15; Ross (1997, 57-58) states that in 1836, the steamer *Winooski* replaced *Phoenix II* on the line run with *Franklin*, then says the "old *Franklin* was taken out of commission in 1837, sent to Shelburne Harbor and dismantled. It is interesting to note that the hull of this vessel, the first steamboat to be built by The Champlain Transportation Company, lies in Shelburne Harbor a few yards south of the winter berth of the present *Vermont*". Curiously, the Shelburne Shipyard project located the hull of *Phoenix II* in this location, and no evidence of *Franklin*, so perhaps Ross was mistaken, and the old hull sunk here was in fact *Phoenix II*.

207 Thompson 1853, 216; Wilkins 1916, 14-15.

208 The unexposed hull remains appeared in good condition in 2016, but the archaeological investigation did not examine the keel, and only examined selective frames, and may easily have missed areas of rot. Furthermore, areas of rot in 1837 might not be obvious after 175 years on the bottom of Lake Champlain.

reason in addition to rot for its retirement was the heavy construction that kept *Phoenix II* from keeping pace with the newer, faster boats. The CTC owners were constantly striving to have the best boats in the world, and by the mid-1830s a boat as heavy, old, and slow as *Phoenix II* was no longer desirable. By the 1830s speed was a huge factor in the public's ranking of steamboat quality. The same year *Phoenix II* was retired, the new steamer *Burlington* was launched, taking over the passenger service on the north-south line. *Burlington* was able to travel up to 16 miles per hour (25.7 km/h), and at 185 feet (56.4 m) was much longer than *Phoenix II*'s 143 feet (43.6 m). It was altogether more modern and better suited for passengers.[209] Having begun building the impressive new steamboat the previous year, the CTC was able to retire *Phoenix II* to make way for *Burlington*.

One argument in favor of the old steamer's continued soundness and buoyancy is found in the large quantity of rocks deposited into the hull in order to sink it. Of the four wrecks examined in Shelburne Shipyard between 2014 and 2016, only *Phoenix II* was found to have been filled with rocks upon its retirement. These rocks do not represent ballast, as not only would the steamer not need it with its heavy machinery, but they were clearly deposited on top of the ceiling planking and not secured in any way. Furthermore, there are at least three distinct piles, with the largest approximately amidships, which indicate that the rocks were dumped through hatches in the deck. The

[209] *Burlington*'s speed was mentioned in a glowing description from the *Plattsburgh Republican*, copied in the *Burlington* (VT) *Free Press* 10 October 1837, 3); Though Ross 1997 (63), Thompson 1853 (216) and Wilkins 1916 (14-15) list *Burlington*'s length as 190 feet (57.9 m), a letter found in the CTC Records states it was in fact 185 feet (56.4 m) (Collection A, Carton 3, Folder 57, "Miscellaneous Papers October 1-November 11, 1838").

largest pile amidships most likely represents the opening in the deck through which the engine's crosshead framework previously extended.

There were no quarries in the immediate area surrounding Shelburne Shipyard, and depositing the many rocks in the hull was an act that required extra work on the part of the shipyard crew. The empty vessel was most likely towed to a quarry, where rocks were dumped directly in through the hatches, towed back to its current location, and then holes were opened in the bottom of the hull to allow it to sink.

One question that must be asked is: why was the hull sunk alongside the shipyard? It could have scuttled in deeper water to keep the shipyard clear of obstructions. That it was sunk in its current location may indicate some specific intent. Its placement, parallel to shore but out in deeper water, hints that the derelict hull was turned into a working platform. Though only the bottom of the vessel was found intact in 2014, the sides and decks likely remained in place for a few years after 1837. The flattened port and starboard sides of the vessel now lie disarticulated on either side of the hull. When intact, the deck's height of 9 feet 6 inches (3 m) would have been level or slightly above the surface of the lake (it now lies in 6 to 10 feet [1.82 to 3 m] of water). This makeshift dock would have been an excellent location for refueling and maintenance work on subsequent steamers.

Lake Champlain Steamboats after *Phoenix II*

Phoenix II was the last boat built by the LCSC, and could be considered the last of the earliest group of passenger steamboats on Lake Champlain. It was succeeded by a golden age of steam:

> Whereas very little is remembered of some of the older, or some of the later vessels, the records of the four boats of this period – the *Burlington*, *Whitehall*, *Saranac* and *Francis Saltus* – are indelibly stamped in the memories of all old steamboatmen on the lake. Larger boats were built later and more powerful ones, but to none of these was there accorded the admiration and respect enjoyed by these four famous steamboats.[210]

Built by the CTC at the Shelburne Shipyard in 1836-1837, *Burlington* was quickly recognized as the flagship of the company. The larger steamboat *Whitehall*, begun by another owner in the town for which it was named in 1836-1838, was bought early in its construction by the CTC, finished by the company, and subsequently run in tandem with *Burlington*. The two boats were praised highly, not only by locals but by a number of famous historical figures. Among these were Charles Dickens, famous for his disdain of everything American, who said of *Burlington*:

> There is one American boat – the vessel which carried us on Lake Champlain from St. Johns to Whitehall – which I praise very highly, but no more than it deserves, when I say that it is superior even to that in which we went from Queenstown to Toronto, or to that in which we travelled from the latter place to Kingston, or I have no doubt I may add, to any other in the world. The steamboat which is called the *Burlington*, is a perfectly exquisite achievement of neatness, elegance and order. The decks are drawingrooms; the cabins are boudoirs, choicely furnished and adorned with prints, pictures, and musical instruments; every nook and corner of the vessel is a perfect curiosity of graceful comfort and beautiful contrivance.[211]

[210] Ross 1997, 61
[211] Ibid., 67; Dickens 1913, 167-182.

Though *Whitehall* was never regarded with quite the same level of awe as *Burlington*, the steamer was equally as fast and 30 feet (9.14 m) longer. In 1842, the CTC added a third boat, *Saranac*, to operate as a ferry between Burlington and St. Albans.[212]

The company's monopoly was threatened in 1844 by rival Peter Comstock and his new boat *Francis Saltus.* Comstock probably built this steamer with the idea that the company would buy him out, as they had "already decapitated several times the hydra-headed opposition," (namely his previous boats *Winooski* and *Whitehall*).[213] The CTC, however, refused to buy Comstock's third boat, and he sold it instead to three men from Troy, NY, Messrs. Grant, Coffin, and Church.[214] The CTC waged a price war, lowering *Saranac*'s passenger fare to a mere fifty cents and running their steamer at the same time and from the same place as *Francis Saltus*. The company's other two boats *Burlington* and *Whitehall* picked up the slack and ran a night service with three dollar fares, earning enough for the company to maintain such low prices on *Saranac*. The price war worked and *Francis Saltus*' business suffered in 1845 and 1846. In 1847, the last straw came when the CTC launched a new boat, *United States,* which completely outsized and outpaced all of the other steamers on the lake. The launch of this steamer ultimately crushed Grant, Coffin, and Church's service with *Francis Saltus*, and they finally sold their boat to the CTC at the beginning of 1848.[215]

---

212 Hemenway 1867, 696.
213 Hemenway 1867, 696.
214 Ross 1997, 79.
215 Ibid., 75-83.

The boats of this period earned international acclaim, and established Lake Champlain's reputation for having some of the best steamers in the world.[216] The rivalry between *Francis Saltus* and *Burlington*, *Whitehall*, and *Saranac* made them popular among the public, who would bet on their favorites to win daily races down the lake. The price war also had strong favor among the public, as the resulting low prices made steamboat travel cheap and appealing.[217] The competition motivated the CTC to improve its boats' designs, to have the fastest engines, and to provide the best passenger service possible, all of which resulted in some of the finest steamboats to ever operate on Lake Champlain.

The CTC continued its steamboat operations until 1953, when the lake's last steamboat, *Ticonderoga*, was retired, (in 1955 this vessel was moved over land to the Shelburne Museum, where it resides today).[218] The company's record of successful passenger transportation on Lake Champlain continues to this day, as the CTC, now Lake Champlain Transportation, continues ferry operations with large diesel-engine ferry boats between the New York and Vermont shores of the lake.

[216] Hemenway 1867, 701; Ross 1997, 66-69.
[217] Ross 1997, 75.
[218] Strum 1998, 82.

CHAPTER IV

ARCHAEOLOGICAL INVESTIGATION OF THE SHELBURNE SHIPYARD STEAMBOAT GRAVEYARD

The 2014-2016 investigation of the Shelburne Shipyard Steamboat Graveyard generated the archaeological data for both the author's master's thesis and this doctoral dissertation.[219] Preparation for the project began in 2013, when the author and co-Principal Investigator, Kevin Crisman, first considered the site as a potential location for a field school. Over the following three years, several weeks were spent on site each summer, with dive crews collecting data from four wrecks sunk in close proximity to each other and to the Shelburne Shipyard. Beginning in 2015, the wreck identified as Wreck 2, later determined to be the remains of *Phoenix II*, became the focus of the final two field seasons. This wreck was chosen as the subject of this dissertation based on its early construction date; though its identity was unknown until late in the 2015 season, the 2014 survey provided enough data to indicate that it was the oldest of the four steamer wrecks in Shelburne Shipyard.

The three seasons spent working on the site had different goals, crews, and conditions, though the project directors and support of the Lake Champlain Maritime Museum (LCMM), the Institute of Nautical Archaeology, and the Center for Maritime Archaeology and Conservation at Texas A&M University remained the same throughout. The project focused on the scuttled hulls of four steamboats located in the

[219] Kennedy 2015.

south half of a small natural harbor on the east side of Shelburne Point near its northern end. The waterfront property along this part of the harbor is currently owned by the Aske Marina; in 2014 it was owned and managed by Marge Aske; in 2015 and 2016 the Aske Marina was managed by Aske's grandson, Charles Tompkins. Other property owners around the study area included Mark and Kathy Brooks and Connie Porteous. It was thanks to these landowners' generosity that the Shelburne Shipyard Steamboat Graveyard project was able to come to fruition (Figure 4-1). Aske, Tompkins, and the Brooks were especially generous hosts, allowing field crews to stage their dives on their properties over three years, to use their docks for monitoring divers in the water, and to collect wood sample and for artifact recoveries. Mark Brooks graciously loaned his kayak, enabling project crew members to easily place dive flags around the site perimeter every day (Figure 4-2).

Figure 4-1. The project was staged on the privately-owned Brooks waterfront and dock (left) and Aske Marina and dock (right). Brooks' house overlooks the shipyard on the left, and the Aske house on the right. (Photograph reprinted from R. Ingram, 2014)

Figure 4-2. Project crew member Nathan Gallagher returns in Brooks' kayak after placing a dive flag (background, left) at the outer perimeter of the dive area. (Photograph by C. Kennedy, 2014)

Throughout all three seasons, dive crews stayed near the Shipyard in a rental house in North Ferrisburgh (Figure 4-3). This three-bedroom house, owned by Mary Fitzpatrick, accommodated up to 14 people at a time, and allowed the crew to easily commute the 18-mile (29-km), 35-minute drive to and from the site daily. Two or three minivans were rented to convey the crew, gear, and tanks to and from the site every day. Several of the crew's personal vehicles supplemented transportation needs.

Figure 4-3. Ferrisburgh house used by project crew all three years, 2014-2016. (Photograph reprinted from M. Fitzpatrick, 2014)

2014 Field Season

In the fall of 2013, the project directors and Christopher Sabick, the archaeological director of the LCMM, began planning a three-week field school for June 2014. The goals for the first field season were twofold: (1) to develop preliminary site plans for all four wrecks and (2) to establish the identities of each wreck. In addition to the author, Crisman, and Sabick, this first season included one Texas A&M University undergraduate, Varvara Marmarinou; four Nautical Archaeology Program graduate students, Mara Deckinga, Nathan Gallagher, Stephanie Koenig, and Grace Tsai; three program alumnae, Rebecca Ingram, George Schwarz, and Carrie Sowden; one volunteer diver Daniel Bishop; one LCMM staff member, Paul Gates, and two divemasters, Ron Adams and Robert (Ski) Wilczynski (Figure 4-4).

Figure 4-4. Project crew from 2014 examines Wreck 2 beneath Aske's dock. From left to right (front): Stephanie Koenig, Kevin Crisman, George Schwarz, Ron Adams, Varvara Marmarinou, Grace Tsai; (back) Dan Bishop, Carolyn Kennedy, Nathan Gallagher. (Photograph reprinted from R. Ingram, 2014)

Throughout the 2014 season's three weeks on site, between nine and ten divers were in constant rotation, meaning each dive buddy pair (or team) was assigned to one of the four wrecks for the entire three weeks. Wreck 1 was recorded by Koenig, Marmarinou, and Sabick, Wreck 2 by Deckinga and Kennedy, Wreck 3 by Bishop, Ingram, and Sowden, and Wreck 4 by Crisman and Tsai; with Gates acting as photographer for all four wrecks, and divemasters Adams and Wilczynski substituting when further assistance was needed. All four teams produced preliminary site plans depicting hull elements such as longitudinal support timbers, framing timbers, planking, and miscellaneous features throughout the wrecks. Wreck 2 was mostly covered by a layer of limestone rocks, ranging from pebble-sized to some weighing over 100 lbs (45 kg). Because of the rocks, and a slight list to the port side, only the starboard side framing timbers were recorded in full. Wreck 4, though free of rocks, was such a massive hull at 214 feet (65.2 m) in length that it could not be fully recorded in 2014; a preliminary site plan that included frame positions and keelson and engine bed timber information was prepared, however.

The 2014 field season began 9 June with a visit to the site, a discussion of logistics, a lecture on the historical background of Lake Champlain steamers, and a checkout dive at Basin Harbor. The following day, Arthur Cohn, founder and director emeritus of the LCMM, provided a lecture on dive safety, and our divers did a second checkout dive at Basin Harbor to determine necessary equipment and weights for diving in Lake Champlain's cold, fresh water. The first dive on site took place on 11 June, during which divers toured all four wrecks. By the end of the first week each wreck had a baseline tape secured to the centerline, and every fifth frame was numbered with a plastic tag. The tags helped divers to orient themselves on the wreck, and assisted recording by referencing wreck features to the pre-existing grid of exposed keelson and frames.

Due to the large crew size, dive operations required daily, and sometimes twice daily trips to the Waterfront Dive Center in nearby Burlington for tank refills. Divers operated on an alternating one- or two-dive rotations per day; meaning, half the divers (group A) would dive twice one day and the other half (group B) only once that day, so that group A dived first thing in the morning, followed by a rotation of group B, and then group A would dive again in the early afternoon. The following day groups A and B would switch, with group B diving twice and group A only once. This rotation balanced maximum data accumulation with feasible diver stamina, especially with dive times often exceeding two hours. With depths ranging between 4-12 feet (1.2-3.7 m), dive times were generally limited by divers' comfort levels rather than air consumption. The water ranged from 59-66 degrees Fahrenheit (15-19 degrees Celsius), and with most of our divers in wetsuits the most common reason to end a dive was due to getting chilled. Over the 2014 season the project staged a total of 189 dives over 14 dive days. Weekends were not used for diving, and diving was called off in bad weather.

Divers recorded measurements on plastic drafting film (mylar) sheets taped to white-painted Masonite clipboards, using plastic pencils attached with parachute cord. Measuring tools included 'Rhino' brand folding plastic rulers and measuring tapes (Figure 4-5). Digital goniometers, consisting of digital levels encased in watertight housings, were used to record angles and curves, such as the stem of Wreck 2.[220] Measurements were taken using imperial units (feet and inches); the steamers were built using the same system so we concluded that construction patterns would be more easily discernible if our documentation used the same units. The mylar sheets with measurements and sketches were changed daily and (with attribution to the wreck, the

[220] See Cozzi 1998 for a description of the device.

wreck feature, the recorder, and the date) kept as part of the excavation record. Photographs and video were recorded using GoPro Hero 3 and GoPro Hero 3+ cameras and a Nikon DSLR 7100 high-resolution camera. The typical dive day, including all three rotations of divers, lasted from 8 am to 3 pm, including unloading and loading the vans used to transport materials to and from the site daily. After loading the vehicles at the conclusion of the dive portion of the day, a van or truck was sent to the dive shop to drop off empty tanks which would be filled then picked up early the following day.

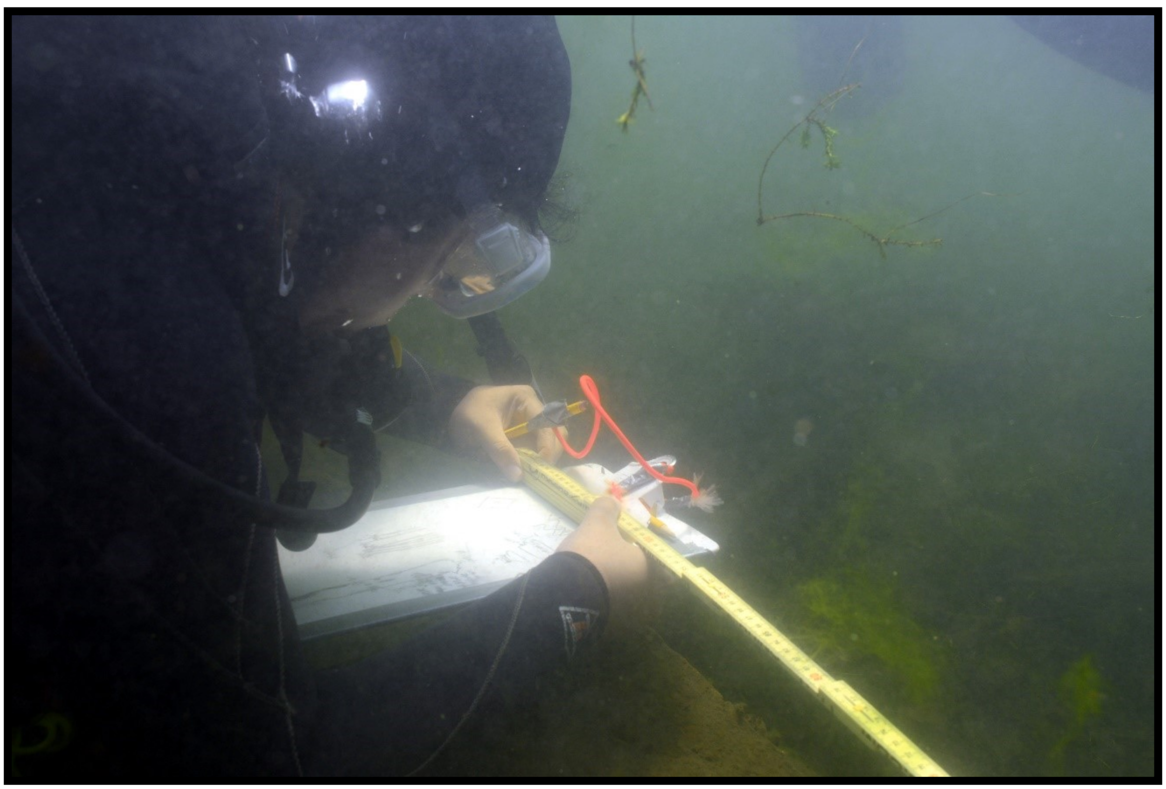


Figure 4-5. Marmarinou holds her clipboard and Rhino Ruler on Wreck 1. (Photograph reprinted from P. Gates, 2014)

When the crew returned to the Ferrisburgh house after diving, gear was hung up to dry (since the lake is freshwater, only occasional rinses were deemed necessary), and divers replaced their used mylar sheets with new ones. The crew spent afternoons and evenings recopying notes taken underwater to more legible paper and pencil notes, and preparing a list of recording tasks for the following day. The crew was given a break from diving on weekends for two reasons: to avoid the heavier weekend boat traffic of summer in Vermont, and to provide them with some recovery time and their ears a chance to dry out fully to reduce their chance of contracting ear infections. Instead of diving, the crew used part of weekends to finish any uncompleted note recopying and develop their preliminary site plans.

2015 Field Season

The 2015 project crew increased greatly in size, thanks to a generous grant from the National Park Service's Maritime Heritage Program (administered through the Vermont Division for Historic Preservation) and additional funding from the Institute of Nautical Archaeology. Aside from the project directors and Sabick, the 2015 crew included undergraduates Mallissa Barthule, Dane Billman, Lauren Carpenter, Taylor Ehlers, Carrigan Miller, and Amber Passen; graduate students Mara Deckinga, Stephanie Koenig, Rachel Matheny, Kevin Melia-Teevan, Grace Tsai, and Kotaro Yamafune; volunteer diver Dan Bishop; volunteer shore support Daniel Israel-Meyer and Jean Belisle; and divemasters Ron Adams and Arthur Cohn (Figure 4-6).

Figure 4-6. Group photograph of the 2015 Shelburne Shipyard Steamboat Graveyard Crew. From left to right, top row: Ron Adams, Carolyn Kennedy, Kevin Melia-Teevan, Grace Tsai, Dan Bishop; middle row: Mara Deckinga, Rachel Matheny, Mallissa Barthule, Stephanie Koenig, Kevin Crisman, Dane Billman, Jean Belisle, Arthur Cohn; bottom row: Kotaro Yamafune, Christopher Sabick, Daniel Israel-Meyer, Lauren Carpenter, Taylor Ehlers, Carrigan Miller, Amber Passen. (Photograph reprinted from K. Yamafune, 2015)

The increase in crew size created minor logistical concerns over tank use. The 2015 field season had usually 20-25 tanks in daily rotation, which used all of the LCMM's extra tanks as well as a number of Waterfront Dive Center rentals. Because the crew's usage neared the limit of available tanks, multiple refill runs were made daily, usually one immediately following the second rotation of dives, and a second at the end of the day. Filled tanks were picked up in the morning. This was a challenge, as traffic in and out of downtown Burlington at these times was generally heavy. In order to alleviate some of the gear transportation issues, Mark Brooks gave the project permission to leave more durable items such as spare tanks, weight belts, and a sun awning on his waterfront property through the duration of the project.

The 2015 season was run as a field school, and therefore several days were devoted to checkout dives for new divers, lectures, and training. Archaeological work on site was impeded by several bad weather days, which were often followed by poor visibility due to the wash of sediments into Shelburne Bay. Two dive days were called off completely due to weather, and three others were shortened or had a reduced dive crew. The lake was cool, with temperatures ranging from 50 degrees Fahrenheit (10 degrees Celsius) to 65 degrees Fahrenheit (18 degrees Celsius). The heavy rain raised the lake level 24 inches (61 cm) over the month of June, but the increased water depth had a negligible impact on dive operations. Despite the various environmental challenges, a total of 275 dives were staged over 17 days.

In 2015, the project was equipped with custom-made plexiglass slates, designed 14 inches long by 11 inches wide (35 by 28 cm), with a handle cut into one side large enough for a gloved hand to fit through. These were useful for easily taping mylar to both sides, providing a large, durable drawing space. Holes were drilled to pass a cord through for pencils. Along with this upgrade in our clipboards, the worn-out goniometers from the first season were replaced with four new digital goniometers and their housings, as well as custom-made 12-inch (30.5-cm) bases (Figure 4-7).

The goals of the 2015 season were threefold: complete Wreck 4's preliminary site plan and add missing details to the plans of Wreck 1 and Wreck 3, continue a more comprehensive investigation of Wreck 2 including removal of the rocks in selected areas to record frame cross sections, and to photogrammetrically document all four wrecks to develop orthophotos and to create a 1:1-scaled 3D digital model of Wreck 2.

Due to the large crew and diverse goals of this season, the dive team tasks varied from day to day. Koenig and Passen were tasked with recording missing details from Wreck 1's rudder during the first week. By the middle of the second week, they began excavating Wreck 2's rudder and sternpost and commenced preliminary recording of those features. Billman and Melia-Teevan recorded an articulated section of frames and planks from Wreck 3 that had broken off from the main portion of the wreck. This structure was not noticed in the previous season as it was already covered by lake flora at the start of the 2014 season. Billman and Melia-Teevan also excavated the bow and frame J of Wreck 2 in preparation for further recording in the 2016 season. Barthule and Carpenter documented the sternpost of Wreck 3, and a 73-foot-long (22.3-m) portion of side planking from Wreck 2's port side. Miller and Tsai recorded a paddlewheel box support frame lying off the starboard side of Wreck 4's stern, then moved on to detailed recording of Wreck 2's keelson and engine bed timbers. Matheny and Sabick were tasked with completing Wreck 4's site plan, and spent the entire season gathering detailed information about Wreck 4's frames. Crisman and Kennedy began recording cross sections of Wreck 2's frames, including the midship frame (frame ꝏ) and a frame slightly abaft amidships (frame 24). Bishop and Yamafune took on the challenge of recording all four hulls photogrammetrically.

Figure 4-7. Digital goniometer in underwater housing, attached to 12-inch (305-mm) base (with handle) (left), and custom-made plexiglass slate with pencil attached by parachute cord and handle cut large enough for gloved diver hand (right). (Photograph by C.Kennedy, 2018 [left], reprinted from K. Yamafune, 2016 [right])

On Wreck 2 the areas surrounding frames Ꝏ and 24 were not fully covered by rocks, so these two locations were selected for detailed study as they required minimal disturbance to comprehensively record the frames. Frame Ꝏ was of particular interest as the construction pattern indicated it was the midship frame (the widest part of the hull). The frame documentation began with the removal of overlying rocks; as noted earlier, the rocks covering Wreck 2 ranged from pebble-sized to over 2 cubic feet (56.6 cm^3). Luckily, at both frame sections selected in 2015 they were small enough to be moved by a single diver. Efforts were made to deposit the rocks off board the wreck, but close enough so they could be returned when finished. The rocks created an excellent sediment trap, so once they were removed a two-inch (5-cm) Honda dredge pump was used to clear the sediment between the exposed frames.

Accessing the full length of frames Ꝏ and 24 also required the cutting of intact ceiling planking starting from the keelson to the outermost strake. This was difficult, tiring work. Once a plank was sawn through on both sides of the frame, it was lifted from the wreck and brought to the shore to recover a small sample for wood analysis. The plank was then returned to its location on site. Once the entire length of the frame was uncovered, its sided and molded dimensions and goniometer angle were recorded every 12 inches (30.5 cm), from the keelson to its outboard end. After all necessary measurements were recorded, the ceiling planking sections were set back in place and weighed down with rocks.

The two-inch (5-cm) pump was also used to remove the sediment covering the stern and the bow, with varying success. The single pump was installed in an aluminum rowboat loaned to the project by the LCMM, and therefore could be moved into position either near the bow, frame Ꝏ, frame 24, or the stern (Figure 4-8). Two crew members attended to the pump whenever it was in operation. Pump tenders wore ear protection and maintained a fire extinguisher nearby in case of emergencies. Despite its relative mobility, moving the rowboat and dredge hoses was a time-consuming task. Though frame Ꝏ and 24 were successfully cleaned of sediment, neither the bow nor stern were completely cleared, and therefore they were not fully recorded in 2015.

Figure 4-8. McPhee and Burford tend to the 2-inch (5-cm) Honda dredge pump in the LCMM aluminum tender. (Photograph by C. Kennedy, 2016)

Wood samples of key features were taken from both Wreck 2 and Wreck 4 in the 2015 season. Fifty samples were taken from Wreck 2, including samples from frames A-1 and 24, their surrounding ceiling planking, engine bed timbers, and from the keel and keelson. Thirteen samples were taken from Wreck 4, including samples from the keel, sternpost, deadwood, engine bed timbers, floors and futtocks, planking, and the keelson. Samples were taken using a saw to cut out 1-2 inch (2.5-5 cm) cubes. Wood analyses were performed by Dr. Leslie Bush at the Macrobotanical Analysis Laboratory of Manchaca, TX in the fall of 2015.

Photogrammetric Procedure

Photogrammetric recording was a second project goal for the 2015 season. The photography and processing was carried out by Kotaro Yamafune, assisted by Daniel Bishop, using a Nikon D7100 DSLR camera in an underwater housing including an 8-inch (20.3-cm) hemispheric dome and two strobe lights.[221] The methodology for each wreck differed slightly, with the most attention given to Wreck 2. The process for Wreck 2 began by laying unfixed underwater coded targets throughout the wreck. The targets were generated by Agisoft *PhotoScan* software, and worked as barcodes that allowed the program to knit the photographs together into a 3D model. For this underwater project, barcodes were printed on mylar using a laser printer and attached to white tiles with white duct tape so they would stand out in photographs (Figure 4-9). These unfixed targets were used only to create a preliminary orthophoto of the wreck in order to plan where to place permanent coded targets as control and reference points (Figure 4-10). The control points were programmed in *PhotoScan* as permanent points and the reference points were used to make trilateration measurements in order to scale the 3D model. Control points were affixed permanently to the wreck using staple guns and, around the perimeter, with numbered tennis balls covering the top end of steel reinforcement bars (rebar) for identification (Figure 4-11). Crew members created perimeter targets by installing rebar into cement-filled plastic milk jugs. Reference points were also stapled to the wreck. Altogether this created 22 control points and 19 reference points around the wreck.

[221] Yamafune 2016, 19.

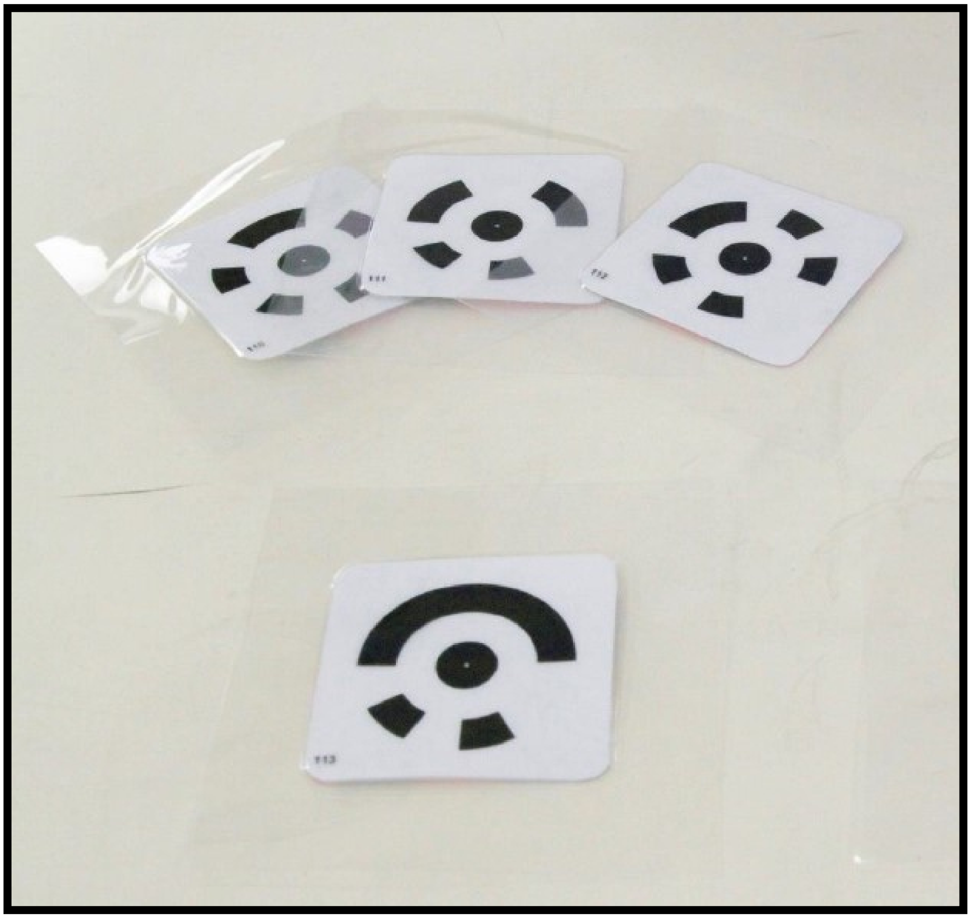


Figure 4-9. Coded targets provided by Agisoft *Photoscan* software. These targets are used in the photogrammetry process as a type of barcode that the software recognizes. (Photograph reprinted from Yamafune 2016, 22)

C1-C2		C2-C13		C11-C17		C3-C14		C4-C16		C17-18	
-C13		-C14		-C15		-C16		-C18		-11	
-C12		-C3		-C12		-C4		-5		-11	
-C14		C2-R1		C11-R9		C3-R5		C4-R7		C18-C10	
C1-R1		-R2		-R6		-R7		-R8		-C19	
-R2		-R3		-R4		-R8		-R10		C18-R11	
-R3		-R5		C15-C13				-R13		-R10	
		C12-C15		-C14				C16-C14		-R8	
		-C13		-C12				-C18			
		C12-R4									
		-R1									
		-R2									

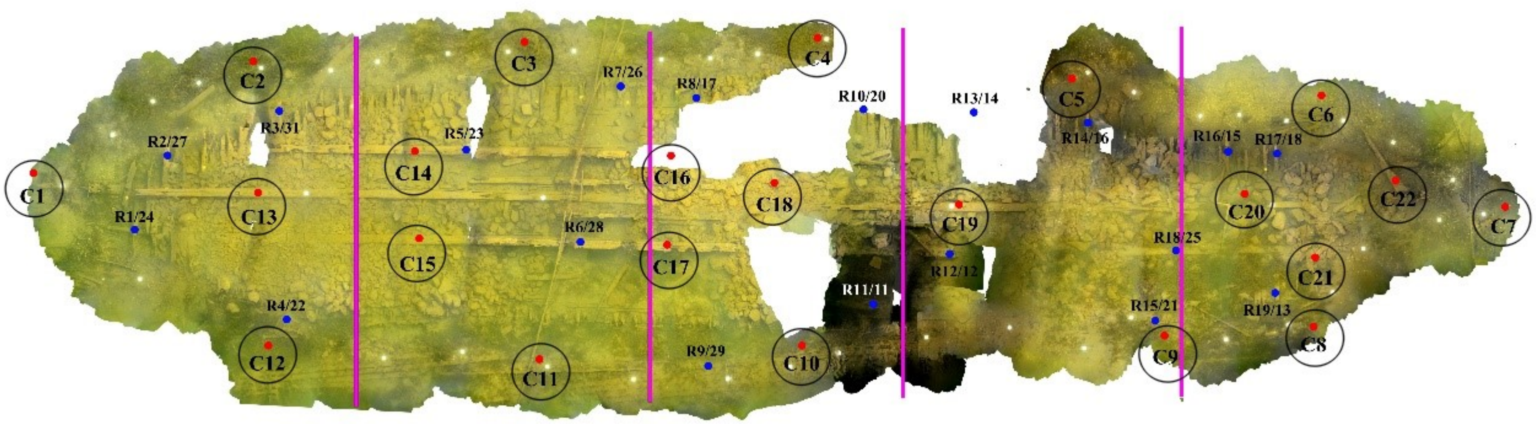


Figure 4-10. The preliminary photogrammetric orthophoto with planned control (C) points and reference (R) points placed throughout the wreck. The chart above the image indicates the measurements to be taken between points. (Image reprinted from K. Yamafune, 2015)

Figure 4-11. Bishop paints perimeter control points for better visibility. Perimeter control points were made of gallon jugs filled with cement holding rebar in place with numbered tennis balls attached to their upper ends. (Photograph reprinted from K. Yamafune, 2015)

To create a scale-constrained model, three measurements were taken from each control and reference point to other nearby points, totaling 109 measurements. This task required two teams of three divers: two to hold the measuring tape as taut as possible at both ends and one to check for line tautness and record the measurements. This task took several dives, but ultimately resulted in a model that was accurate to within 5.0 cm (1.97 inches). After the scale-constraining measurements were taken, the wreck was divided into five sections (A-E) that were each photographed in a single, long dive. Along with the permanent control and reference points, temporary unfixed coded targets on tiles were positioned in each of the five sections spaced approximately 1 m (3.28 feet) apart from each other, prior to that section being recorded. Each section was processed separately using Agisoft *PhotoScan* and later pieced together in Adobe *Photoshop* in order to reduce the processing time and decrease the likelihood of the field computers crashing during processing. The resulting model of Wreck 2 included nearly 20,000 photographs scaled to within 5-cm (1.97-inch) accuracy. Though the model was scaled and no problems were detected in the software, some problems in aligning the five sections to each other prohibit it from being relied on totally. As one of the first photogrammetric models of a shipwreck, and the first of such a large wreck, the model was used mainly as a visual aid, and only as a crosscheck for traditional archaeological recording methods (Figure 4-12).

The other three wrecks were also recorded photogrammetrically, but were not scale constrained using triangulation. Wreck 1 was recorded using photographs from a Nikon DSLR D7100 camera taken in two dives, but the sheer sizes of Wrecks 3 and 4 were too great for divers to take a sufficient number of photos within the allotted field school time. Yamafune opted instead to record the two wrecks using video and later extract still photos to process with *PhotoScan*. This reduced the amount of time divers needed to record the wrecks. The resulting photogrammetric orthophotos of Wrecks 1, 3, and 4 are nice visual aids; however, they are not to scale and cannot be used for scientific data collection (Figure 4-13).

Figure 4-12. Photogrammetric orthophoto of *Phoenix II* from the 1:1-scaled 3D model. (Image reprinted from K. Yamafune, 2015)

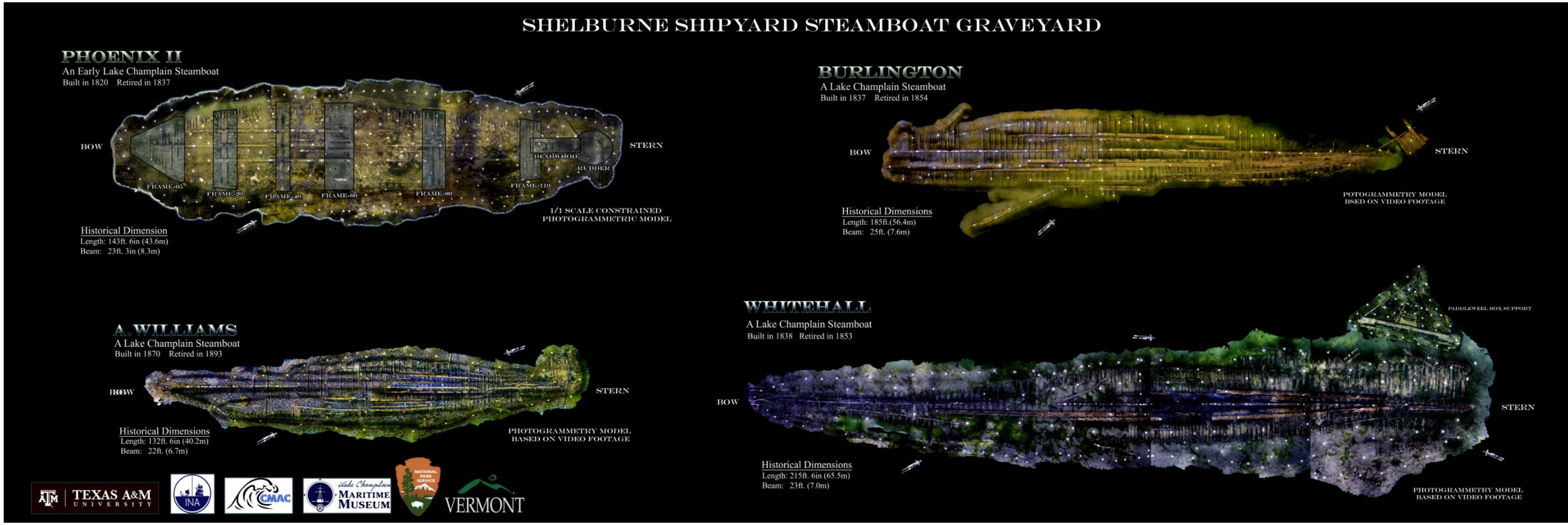


Figure 4-13. Photogrammetric orthophotos of all four Shelburne Shipyard Wrecks. (Image reprinted from K. Yamafune and D. Bishop, 2016)

2016 Field Season

The final, 2016 project was funded by the Institute of Nautical Archaeology's Claude Duthuit Archaeology Grant, as well as Dr. Kevin Crisman's Institute of Nautical Archaeology-Texas A&M research fellowship. Crew members included undergraduate Alex Burford, graduate students Chelsea Cohen, Megan Hagseth, Kelsey Rooney; Nautical Archaeology Program alumni, Kotaro Yamafune; volunteer divers Daniel Bishop, Jennifer Craig, and Ed Scollon; volunteer shore support Maxfield McPhee; and divemasters Art Cohn and Dave Potter. Though this was a smaller crew than the previous year, the removal of the field school component from the program and the boon of excellent weather throughout the three-week season resulted in a very productive project. The small but efficient 2016 crew was able to complete 201 dives over 14 days.

The goal for the 2016 season was to finish recording the main structural features of Wreck 2, including the bow, stern, and five frame cross sections at frames R, J, ⊗, 24, and 39 (Figure 4-14). The addition of two extra volunteer divers permitted an additional goal, which was to remove some of the heavy rocks in the amidships area of the hull (near frame 10) to determine if any engine machinery remained. As this season was intended to be the final year on the site, time was reserved in the final week to rebury any uncovered parts of the wreck, and to remove traces of disturbance to the site.

Figure 4-14. Photogrammetric orthophoto of *Phoenix II* showing excavated areas. Excavated areas from left to right: Bow to frame R (labelled frame-05), frame J (labelled frame-20), ꝏ (labelled frame 40), frame 7-10 area (labelled frame 60), frame 24 (labelled frame 80), frame 39 frame (labelled frame 110), deadwood, and stern area. (Image reprinted from K. Yamafune, 2016)

Dive teams were again designated certain tasks. Hagseth and Craig were tasked with recording a profile and plan view of the bow and frame R, Kennedy and Crisman once again worked to complete cross sections, including finishing frame 24, frame J, and Crisman recorded the stern deadwood assembly. Cohen and Rooney recorded frame 39, while Sabick excavated and recorded the sternpost assembly and rudder. Bishop and Scollon worked on clearing and recording a plan view of the area between frames 7 and 10, and helped with the sawing of ceiling planking. Divemasters Cohn and Potter substituted where needed and helped non-diving project crew members Burford and McPhee operate the dredge pumps.

As in 2015, the ceiling planks covering the frame sections were removed in order to inspect the framing timbers beneath. Funding for the 2016 season allowed the crew to purchase a second dredge pump which, with permission from Charlie Tompkins, was positioned on one of the Aske Marina docks directly above the stern area of Wreck 2. With two dredges, it became much easier to organize dive teams working in the areas that needed the pumps, and one dredge was able to be used constantly near the stern almost the entire three weeks. This was necessary as the sternpost descended further beneath the lake floor than anticipated, almost 5 feet (1.5 m) deep. Though the stern area was not completely uncovered, divers successfully reached the keel on the port side by the final days of the project. The bow area, on the other hand, was completely recorded on the starboard side to the after end of the apron.

Frames R, J, ꝏ, 24, and 39 were all completely uncovered, recorded, and recovered. The challenging task of removing the rocks from the area around frame 10 was completed within the first two weeks of the 2016 season. There were more rocks in this area than initially anticipated, and volunteer diver Ed Scollon moved some that weighed well over 60 lbs (27 kg). Once the rocks were removed, sediment was pumped off the wreck with the dredge. Due to the limited time available, the ceiling planking was not removed from this area. Instead, the curve of the inside of the hull was taken, and the various features present above the ceiling planking were recorded.

The 2016 field season greatly benefited from the addition of divemaster Potter, not only for his superior dive skills, but also for his gracious offer to fill tanks at his own personal tank filling station at his house conveniently located five minutes down the road on Shelburne Point. Potter filled all of the tanks used on site for the 2016 season on his own time, and instructed the entire dive crew in correct air management of their own tanks.

Artifact Recovery

Though divers had come across various artifacts during the recording process in the 2014 and 2015 seasons, these artifacts were not disturbed or recovered for two reasons: first, the focus of the project was the hull's construction, therefore the artifacts added little to answering the research question, and two, we did not apply for an artifact recovery permit from the Vermont Division for Historic Preservation in those first two years, and therefore any removal of the artifacts would have been prohibited.

In the 2016 field season, however, circumstances regarding the significance of the artifacts changed when Bishop discovered the chisel with "SB Phoenix" stamped into its shaft. This singular artifact validated the research the author had invested in identifying the wreck, and confirmed the identity of the hull, thereby adding significantly to the discussion regarding the research questions. Knowing the identity of the hull with a high level of certainty allowed for more detailed interpretation of its construction placed within the known dates of its build, launch, operation, and retirement. Furthermore, the discovery of the chisel attracted the attention of local and regional media, necessitating some action to be taken in order to prevent future looting of the site. To that end, the author applied for an artifact recovery permit from the Vermont Division for Historic Preservation, upon the terms that the project co-directors would be responsible for the conservation of recovered artifacts and their eventual return to the LCMM for permanent storage or exhibition.

Upon reception of the permit, the project crew recovered artifacts that had the potential to add to our understanding of the hull's construction or shipboard life aboard the steamer. These artifacts were catalogued and kept in containers filled with lake water so as not to be allowed to dry out or become damaged. Field observations, measurements, and sketches were made of the 215 recovered artifacts, after which they were securely stored in watertight containers and transported to Texas A&M University.

Since their arrival in College Station in late summer of 2016, the iron and glass artifacts were completely conserved by the author under the supervision and authorization of Drs. Christopher Dostal and Donny Hamilton. At the time of the writing of this dissertation (spring, 2018), the wood artifacts were undergoing silicone oil conservation treatment as part of an undergraduate thesis by Amelia Hammond.

Hammond has worked with Dr. Helen De Wolf at the Conservation Research Laboratory at Texas A&M University to ensure the proper treatment and care of those artifacts, with the permission of Dr. Donny Hamilton. The treatment of the wood is expected to be completed in the spring of 2019. Hammond is also conserving the ceramic items through mechanical cleaning, and conducting the research and documentation on both wood and ceramic pieces. Her thesis will be completed by May 2019.

To Conclude

Three field seasons were spent at Shelburne Shipyard investigating four steamboat wrecks. Divers included 34 total student and professional archaeologists. With resources like Potter's dive tank fill station, the LCMM staff, the Waterfront Dive Center, experienced divemaster and dive safety advocate Arthur Cohn, a community invested in the welfare of its natural and cultural resources, and a fairly large city with all possibly necessary amenities located within an hour's drive, the Shelburne Shipyard was one of the best possible locations to stage a field school. The site was ideally suited to include divers and archaeologists of all skill levels, as the abundance of archaeological material made for a fascinating project for experienced crew, while the logistically-easy staging and site location, as well as the shallow depth helped ease beginner divers into underwater archaeology. All three seasons on the site accumulated hundreds of pages of notes, and detailed recording of Wreck 2, or *Phoenix II*. These archaeological findings are presented in the following section.

CHAPTER V

ARCHAEOLOGY AND CONSTRUCTION OF *PHOENIX II*

The following description of the construction of *Phoenix II* relies on the archaeological findings from the 2014-2016 investigation of the wreck in Shelburne Shipyard. This chapter is organized following the order in which *Phoenix II* was assembled at the Vergennes, VT shipyard in 1820. Although the hull was studied over the course of ten weeks and 665 dives, the sheer size of the steamer would require many more years of study to fully document every detail. Not only was its size a factor, but as the entirety of the wreck was covered with rocks, a much larger excavation project would be necessary to reveal obscured features.

In the limited amount of time spent studying the wreck, archaeologists focused on recording key structural features that add to the overall understanding of the construction of early steamboats. Key structural features included the keel, bow assembly, stern and deadwood assembly, floors, futtocks, keelson, engine bed timbers, ceiling planking, hull planking, rudder, and engine machinery remnants. Though not all floors and futtocks were examined in detail, nor all of the planking, those selected for study revealed many of the patterns followed by the shipwrights. Finally, because the wreck only survives to the turn of the bilge, the upper parts of this vessel, including sides, decks, and engine machinery, were not present for study and therefore archaeologically-based speculation and contemporary examples must be relied upon to answer questions about those features (Figure 5-1).

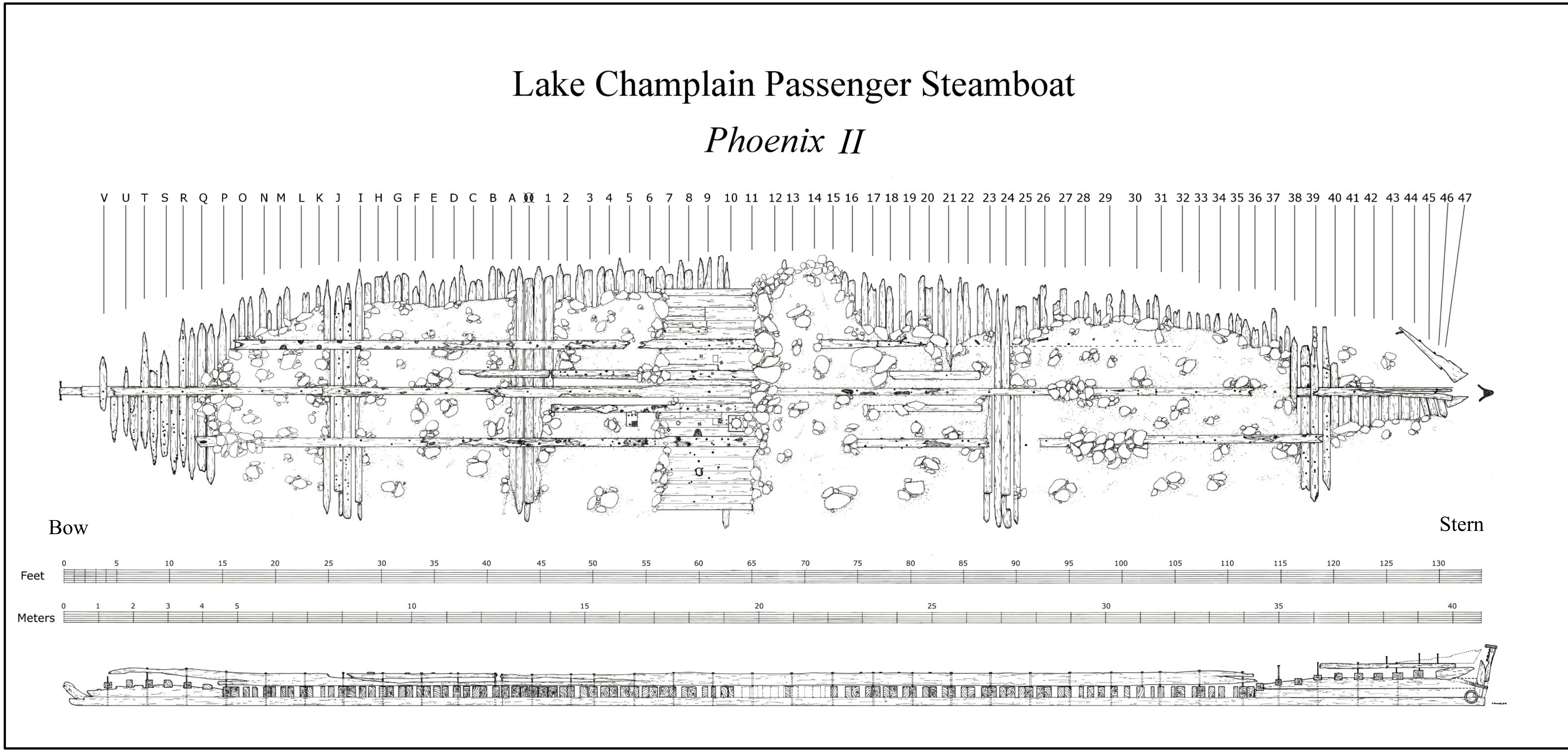


Figure 5-1. *Phoenix II*'s archaeological site plan and profile. (Drawing by C. Kennedy, 2017)

Keel

Samples of the keel taken at the bow and at frame 24 show that *Phoenix II*'s keel was cut from white oak (*Quercus alba*), the generally-preferred shipbuilding timber, especially in North America in the nineteenth century.[222] The keel is believed to be intact over the entire length of the hull, though with the rocks, frames, and planking in the way, access to the keel was not possible in most places. The rock piles also obstructed the tape measures extended from stem to stern, making the precise total length of the keel difficult to determine. The keel's maximum length was 132 feet (40.2 m), with an estimated margin of error of 2 feet (609.6 mm).[223] Unfortunately no scarfs were detected in any of the areas where divers were able to examine the keel, and so information about those is unknown.

The keel was found to average 12 ½ inches (318 mm) sided and 9 inches (229 mm) molded, though the molded dimension was only recorded at the bow and stern. Towards the bow, the keel narrowed to 10 inches (254 mm) sided, and the molded dimension reduced as the bottom of the keel was rounded up and forward, most likely to follow the curve of the stem, so that the forward end of the keel was a mere 4 inches (102 mm) molded. At the stern the keel was 9 inches (229 mm) molded (Table 6). A rabbet ran the length of the keel 2 inches (508 mm) below its upper surface, and based on the garboard thickness of 2 inches (508 mm), likely was 2 inches (508 mm) deep. The forwardmost 18 ½ inches (470 mm) of the keel's upper surface was recessed, decreasing

[222] Bush, L., 2017; Steffy, 1994: 258.
[223] The keel was present at both ends, but the measuring tape could not be stretched taut along the centerline of the wreck due to the presence of the large piles of rocks. For this reason, it is likely the keel was slightly shorter than what was recorded by measuring tape.

the molded dimension from 9 ½ inches (241 mm) to 7 ½ inches (191 mm). This cut was shaped to receive the after end of the stem in a boxing joint. The forward 11 inches (279 mm) of the keel curved upwards, decreasing the molded dimension even more to only 4 inches (102 mm) at its forward face, which was cut flat, and trapezoidal in section: 5 inches (127 mm) sided along the bottom and 7 inches (178 mm) along the top (Figure 5-2).

Location	Sided Dimension	Molded Dimension
Forward End	Bottom: 5 inches (127 mm) Top: 7 inches (178 mm)	4 inches (102 mm)
Frame V	10 inches (254 mm)	9 ½ inches (241 mm)
Frame R	12 ¼ inches (311 mm)	N/A
Frame J	13 inches (330 mm)	N/A
Frame Ꝏ	12 inches (305 mm)	N/A
Frame 24	13 inches (330 mm)	N/A
Frame 39	12 inches (305 mm)	N/A
Stern	N/A	9 inches (229 mm)

Table 6. Keel measurements throughout the hull. The molded dimensions were only accessible at the bow and stern.

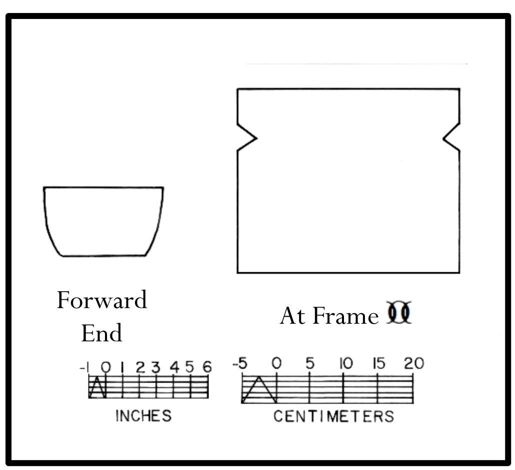


Figure 5-2. Cross-section view of the forward end of the keel (left), and a section based on the keel's shape at frame Ꝏ. (Drawing by C. Kennedy, 2018)

Bow Assembly

The bow assembly was quite eroded, and only a small portion of stem remained (Figure 5-3). A section of deteriorated lower stem approximately 2 feet 6 inches (762 mm) in length remained attached to the forward end of the keel. This remaining piece had a sided dimension of 9 inches (229 mm), and molded dimension of 4 ½ inches (114 mm). Made of white oak (*Quercus alba*), the heel of the stem reached only 1 foot 4 inches (406 mm) above the top of the keel, its upper end at an upward and forward angle of 60 degrees from the top surface of the keel. The boxing joint between the stem and keel contained two stopwaters each of 1 inch (25 mm) diameter. The first stopwater was located 11 inches (279 mm) abaft the forward cut end of the keel, and the second was in the corner of keel created by the boxing joint, 18 ½ inches (470 mm) abaft the forward cut end. The gap between the bottom of the stem and top of the keel widened ahead of the forwardmost stopwater. This gap was either a result of the eroding stem, or was where a cutwater or gripe fit, but has since eroded away. An iron bolt protruding forward and downwards at an approximate 45 degree angle from the top of the remaining stem further indicates that an additional timber, like a cutwater, was originally fastened forward of the stem. Another iron bolt attached to the highest point of the remaining stem and extending athwartships protruded 5 inches (127 mm) on the starboard side, and 7 inches (177.8 mm) on the port side. The bolt was damaged, both bent and rusted, but most likely originally fastened the plank hood ends to the stem rabbets.

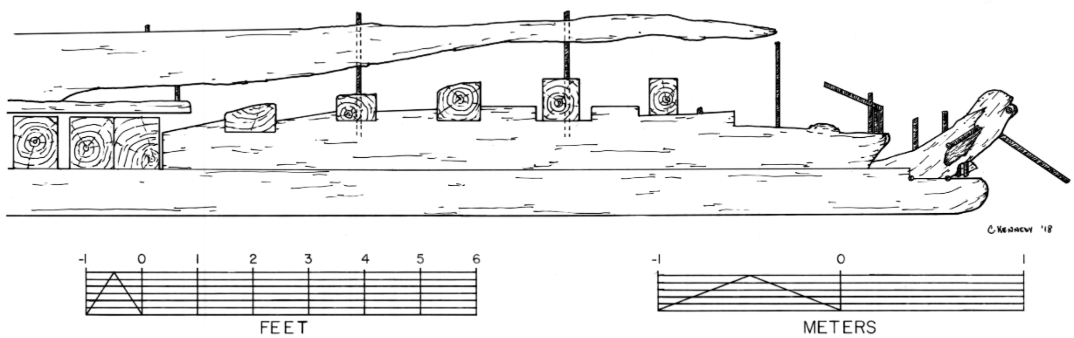


Figure 5-3. Profile of *Phoenix II*'s bow from starboard side looking to port. (Drawing by C. Kennedy, 2018)

Overlapping the after end of the stem was an apron timber, 11 feet 6 inches (3.5 m) long, cut from white oak (*Quercus alba*). Just forward of this, the upper surface of the stem had four vertical bolts extending 4-6 inches (102-152 mm). These fastened the lower end of the upper apron (now missing). Though the lower apron's forward end was badly eroded, its after end was well preserved under the frames, rocks, and sediment. The top surface of the apron was notched 2-4 inches (51-102 mm) deep to fit the floors, up to and including floor Q, whereas the forwardmost six futtocks abutted the side of the apron. In between and beneath the floor and futtock timbers were heavy chocks. The after face of the apron abutted the forward face of floor P. At its forward end, the apron timber was 9 ½ inches (241 mm) molded. The maximum molded dimension was 13 ½ inches (343 mm), between floors U and R (between notches). Abaft frame R the molded dimension reduced to 10 inches (254 mm), and at its after end, just forward of floor P, the molded dimension was 8 inches (203 mm). The sided dimension of the apron's upper surface was consistent throughout at 12 inches (309 mm) (Figure 5-4).

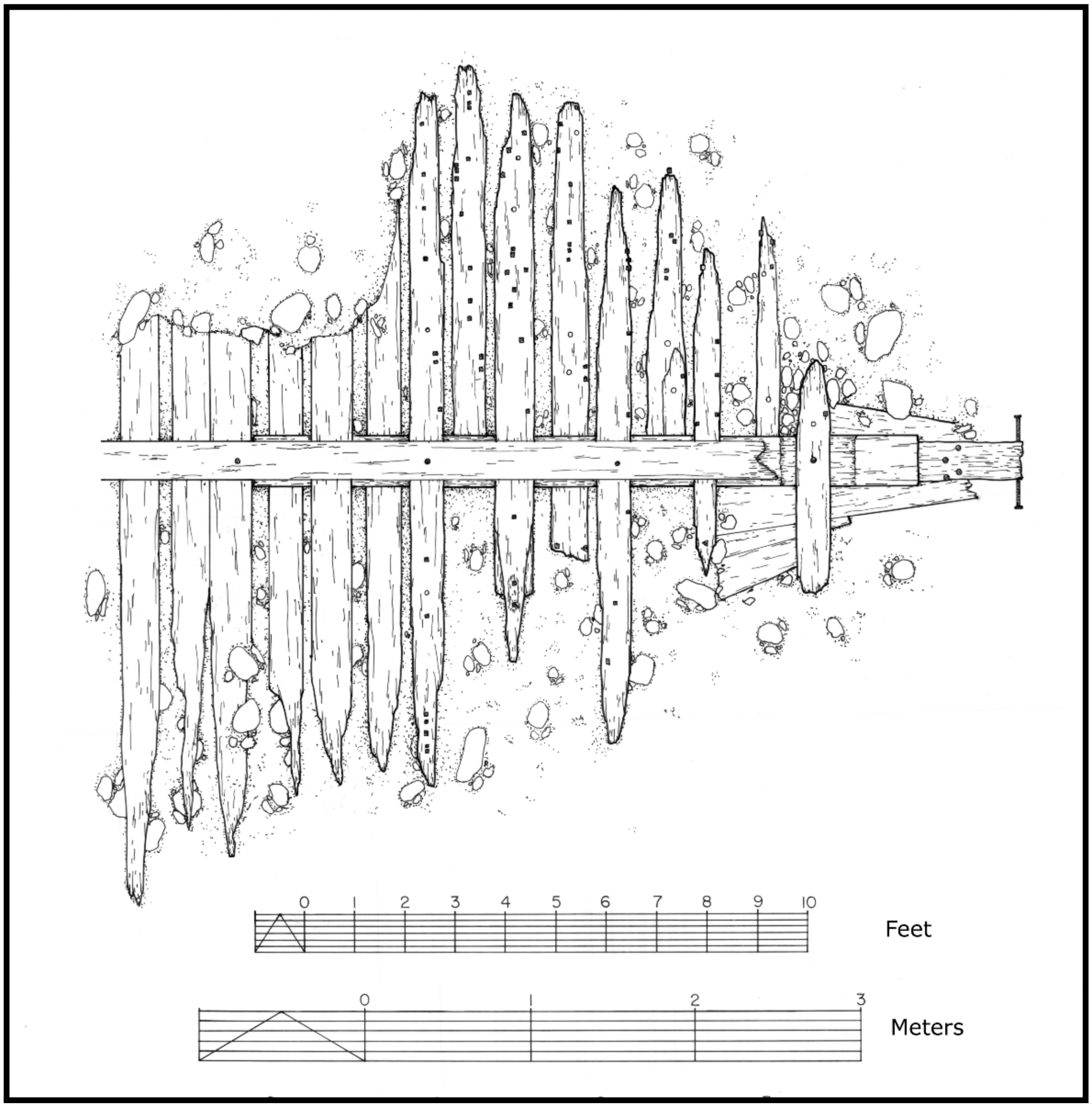


Figure 5-4. Plan view of *Phoenix II*'s bow. (Drawing by C. Kennedy, 2017, based on notes from M. Hagseth and J. Craig, 2016)

Stern

Phoenix II's stern assembly consisted of four parts: the sternpost, inner sternpost, deadwood, and stern knee. As noted in the previous chapter, the stern assembly was the most difficult for divers to access as the structure was largely intact, covered by rocks and sediment above and outside the hull, and was buried nearly 5 feet (1.5 m) beneath the lake sediment. After weeks of employing a dredge pump following the port side of the main sternpost towards the bottom of the hull in 2016, divers were able to feel the bottom of the keel. At no point were divers able to visibly observe the keel at the stern due to the loose sediment within the hole, but photographs taken for photogrammetry were able to capture this area, and through the process of photogrammetric modeling, a usable image was produced (Figure 5-5).[224] Additionally, divers were able to feel and measure the various features hidden by floating sediment, and so accurate measurements of the stern assembly were attained. Unfortunately, the rudder angled to port in such a way as to make it impossible to see the after face of the lower portion of sternpost or after end of the keel, so these features were not recorded.

[224] See Dostal's discussion of the archaeological accuracy of photogrammetry: Dostal 2017, 175-193.

Figure 5-5. Captured image of *Phoenix II*'s stern profile view from photogrammetric 3D model. The image shows the stern assembly features much more clearly than was visible to divers. (Image by C. Kennedy, 2016, photogrammetric model by K. Yamafune, 2016)

Without fully excavating and disassembling the hull, it is impossible to know whether the sternpost was indeed fitted with a tenon that fit into a mortise in the keel; however, this is expected to be the case as it was a common method of securing the two structural components.[225] The connection between the sternpost and the keel was secured externally on the port (and likely starboard) side by a circular iron band, 15 inches (381

[225] "[*Ticonderoga*'s] sternpost […] was fastened to the top of the keel by a 4-inch (10.2 cm) square wooden tenon and a pair of iron dovetail plates," Crisman, *Ticonderoga,* 2014, 264; Though neither Schwarz (2012) nor Belisle and Lepine (1986, 1988) mention a stern mortise and tenon joint on *Phoenix I* or *Lady Sherbrooke*, they likewise would have needed to disassemble the wreck to verify this. That said, the arrangement was common, as evident by Steffy's (1994, 280) glossary which defines "sternpost" as "A vertical or upward-curving timber or assembly of timbers stepped into, or scarfed to, the after end of the keel or heel," the "step" referring to the mortise into which the stern tenon fit.

mm) in outside diameter and 2 inches (51 mm) wide (for a 13 inch [330 mm] interior diameter), that fit flush with the sternpost, keel, and garboard (the band's thickness is unknown) (Figure 5-6). The circular band was located 3 inches (76 mm) above the bottom of the 9-inch-molded (229-mm) keel, and covered 4 ½ inches (114.3 mm) of the sternpost, so that the very top of the circle was 3 inches (76 mm) forward of the sternpost. How it was attached to the wood is uncertain due to corrosion buildup on the iron and the poor visibility in this area, though divers reported feeling small nail heads on the surface of the iron. A 3-inch-wide (76-mm-) straight iron band was noted 5 ½ inches (139.7 mm) above the circle. This was likely the port side arm of the lower rudder gudgeon. The forward and after ends of this gudgeon were not uncovered due to the lack of time and the difficulties of excavating this area. Immediately abaft the circle divers uncovered the top of what is likely a dovetail plate.[226] Since the majority of the plate was obscured by the rudder, measurements of the dovetail plate were unattainable.

[226] Dovetail plates were also found securing the sternpost to the keel of *Ticonderoga*, but were not evident on either *Phoenix I* or *Lady Sherbrooke* (Crisman, *Ticonderoga*, 2014, 264; Schwarz 2012, 144; Belisle pers. comm.).

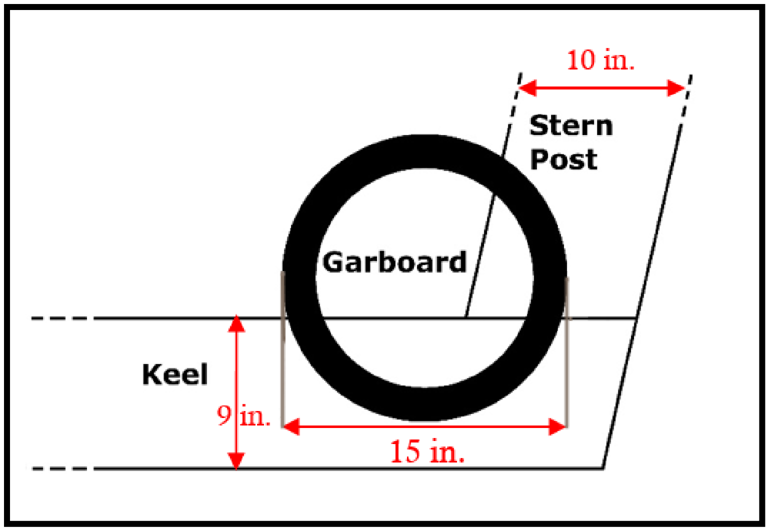


Figure 5-6. Schematic of *Phoenix II*'s keel and sternpost iron circle fastener. (Image by C. Kennedy, 2016)

The white oak (*Quercus alba*) main sternpost was 10 inches (254 mm) molded and had a total height of 4 feet 5 inches (1.35 m). At 18 inches (457 mm) above the iron band fastener the post tapered to 7 inches (177.8 mm) molded. The outer sternpost was in poor condition; the bottom was missing, and the entire white oak (*Quercus alba*) timber appeared to have lost all of its original surfaces. It was likely close to 8 inches (203 mm) sided based on the width of the upper gudgeon, and the best preserved wood measured 8 inches (203 mm) molded. The shape of the upper gudgeon indicates the post was trapezoidal in section (Figure 5-7).

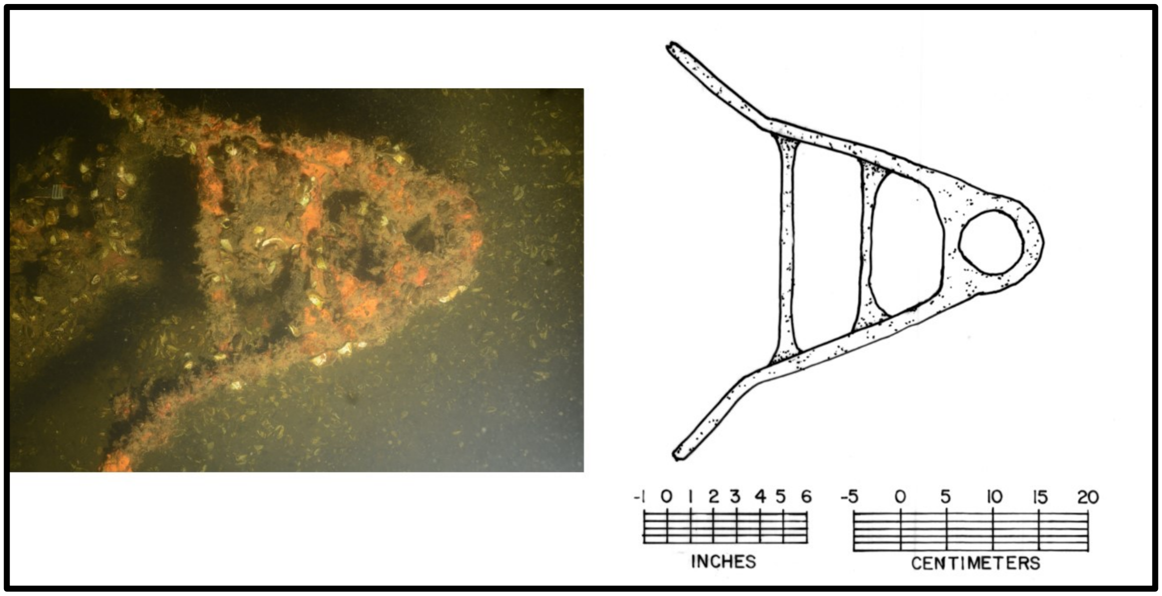


Figure 5-7. Plan view photograph (left) and drawing (right) of *Phoenix II*'s upper gudgeon. (Photograph reprinted from P. Gates, 2014, drawing by C. Kennedy, 2018)

The stern deadwood was made up of (at a minimum) a stern knee and three pieces, labelled A-C on Figure 5-8. Deadwood C's position beneath the floors and the rock coverage prohibited divers from locating its exact forward end, but at frame 39 it was 11 inches (279 mm) sided and 9 inches (229 mm) molded. The forward end of deadwood B began at least 20 feet (6 m) forward of the sternpost, but its exact forward end was not found beneath the rocks, sediment, and frames. Deadwood B was 11 inches (279 mm) sided and 10 inches (254 mm) molded at frame 39.

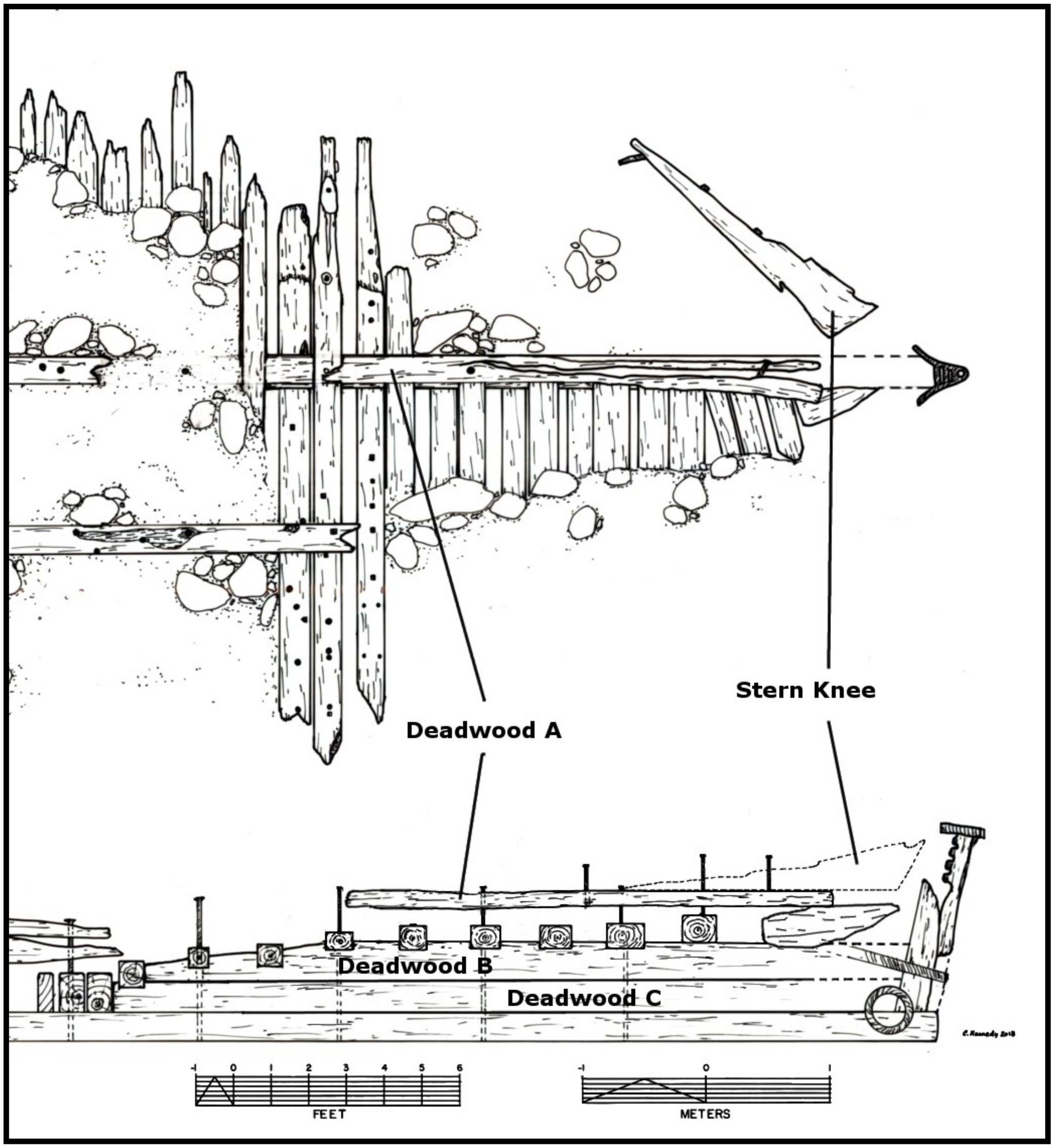


Figure 5-8. *Phoenix II*'s stern and deadwood assembly, plan (top) and profile (bottom) views. (Drawing by C. Kennedy, 2018, based on notes by K. Crisman, C. Kennedy, S. Koenig, C. Sabick, 2015-2016)

Deadwood A passed over the top of the floor timbers for a total length of 13 feet 11 inches (4.24 m), though with some damage to its forward end. Its forward end was located above frame 39, 15 feet 8 inches (4.78 m) forward of the sternpost. Its after end did not extend the full length of the deadwood, but ended 1 foot 9 inches (0.53 m) forward of the sternpost. Deadwood A's molded dimension ranged from 5-5 ½ inches (127-139.7 mm), but because of a gap between deadwood A and B, it increased the height of the deadwood by 7 ½ inches (190.5 mm) over frame 44, and up to 11 ½ inches (292.1 mm) over frame 39. Iron bolts ¾ inches (19.1 mm) in diameter extended above the upper surface of deadwood A by 8 ¼ inches (209.6 mm) at futtock 43 and 12 ½ inches (317.5 mm) over floor 44; these bolts originally attached the stern knee to deadwood A.

The stern knee was found disarticulated, lying on the starboard side of the deadwood, but was identified as the knee due to its shape and location adjacent to the sternpost. The knee was made of one solid, triangular-shaped timber that had a base length of 7 feet 6 inches (2.29 m). Its angled after face measured 18 inches (457 mm) in length, which, when accounting for the angle to match the rake of the sternpost, gave the knee a total height of 15 inches (381 mm). The slight angle gave the timber a maximum length of 7 feet 11 ½ inches (2.43 m). The timber tapered in its molded dimension from 15 inches (381 mm) aft to 1/4 inch (6.35 mm) at its forward tip (Figure 5-9). The extremely small molded dimension at this end may be the result of the timber eroding, and splintering when it was detached. Remains of splintered timbers running alongside the articulated deadwood structure supports this idea.

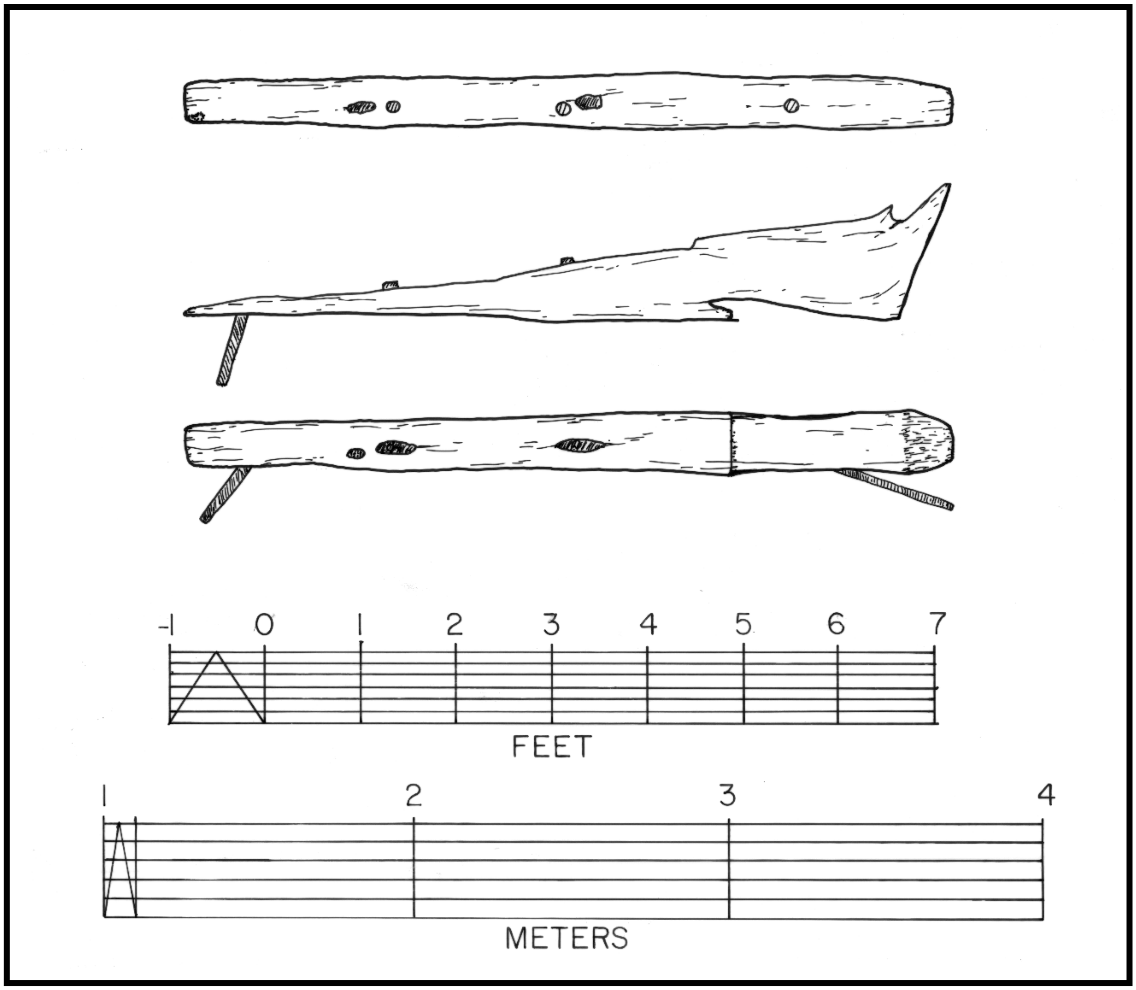


Figure 5-9. *Phoenix II*'s stern knee was found disarticulated from the hull but adjacent to the stern assembly. The holes depicted in the drawing align with the bolts protruding from deadwood A, pictured in Figure 5-5. (Drawing by C. Kennedy, 2017, based on notes by C. Cohen, 2016)

Two bolt holes running through the knee from the top face through its base were found to align with bolts still in place along the deadwood timber. The forwardmost of these was 2 feet 1 inch (635 mm) abaft its forward end, and the next was 1 foot 9 inches (533 mm) abaft the first hole. The bolt on the deadwood that aligned with the forwardmost hole protruded 12 inches (305 mm) above the deadwood timber. If correctly placed, the part of the knee at this bolt location was only 3 inches (76 mm) molded, indicating there was likely some missing upper part. The aftmost bolt was bent over to one side, and its overall length was not recorded.

Frames

Phoenix II had a total of 66 frame pairs: 22 forward of the midship frame and 44 abaft the midship frame, along with three half frames at the stern. The average sided dimension of the floors was 9 inches (229 mm) and of the futtocks was 8 inches (203 mm). The middle frame timbers, J, ⊗, and 24, averaged 10 ½ inches (267 cm) molded in the throat, 12 inches (254 mm) molded at the rabbet, and 6 ½ inches (165 mm) molded at their heads. Frames R and 39 averaged 5 inches (127 mm) molded in the throat, 7 ½ inches (191 mm) molded at the rabbet line, and 6 ½ inches (165 mm) molded at their heads. Both floors and futtocks were notched 2 inches (51 mm) to fit over the keel. The notches were 6 inches (152 mm) wider than the keel's sided dimension to leave 3-inch-wide (76-mm) limber holes on either side of the keel. Frame centers were 22.5 inches (572 mm) on average, with a driftbolt driven through the top of the keelson to the keel only every second floor, or 3 feet 9 inches (1.14 m) apart. The remaining floors were presumably fastened to only the keel, with a bolt driven from the top of the floor, though this could not be observed due to the keelson being intact over its entire length.

As the hull listed slightly to port on the lake floor, the port side frames were buried beneath the lake sediment over time, and the rocks used to scuttle the vessel shifted to cover more of the port side than the starboard side. As a result, the outboard ends of the frames on the port side were mostly buried, and therefore (regretfully) left largely unrecorded. Furthermore, the poor visibility of Lake Champlain and the rocks and sediment covering the frames from made it difficult to connect exposed port frame ends with their starboard counterparts. As a result, only the lengths of a few selected port frames were recorded.

The lengths of all starboard frames were recorded, however the frames here were not as well preserved as on the port side, and many did not survive to the turn of the bilge. The longest starboard frame (frame 9) was 12 feet 8 inches (3.86 m) from the center of the keelson. Of the five port frames whose lengths were recorded, the longest (frame 24) was 12 feet 11 ½ inches (3.95 m). On both frames 9 and 24, the futtocks were eroded so that they did not complete the turn of the bilge, meaning the original frame lengths must have been at least slightly longer, thereby necessitating that the full breadth must have been greater than 25 feet 11 inches (7.9 m). This fits well with *Phoenix II*'s historically-recorded maximum beam of 27 feet 3 inches (8.31 m).

Forward of the midship frame, the futtocks were positioned abaft the floors, and abaft the midship frame the futtocks were positioned forward of the floors. The futtocks were laterally fastened to the floors with both treenails and iron spikes. The futtock heels abutted on the centerline of the hull beneath the keelson and above the keel, fully overlapping the entire lengths of each floor. The result of the fully-overlapped futtocks and floors was a heavily-framed hull that made for a heavy, but structurally very strong boat.

The only floor to have no associated futtock was the midship frame, located one third of the length of the hull abaft the bow (Figures 5-1 and 5-10). The midship floor measured 21 feet 3 inches (6.47 m) long, and was 10 ¼ inches (260 mm) sided its entire length. Beneath the keelson, the midship floor measured 12 inches (305 mm) molded, which tapered to 7 inches (178 mm) molded at its ends. The tapering resulted in a 1.5 degree deadrise of the hull at this flattest section. The midship floor was the largest in cross section, and the wood was also visibly darker than the surrounding floors and futtocks. Analysis revealed that it was cut from white oak (*Quercus alba*), while its surrounding floors and futtocks were cut from Northern white cedar (*Thuja occidentalis*), accounting for the color differences.

Abutting the midship floor head was the midship frame's second futtock, a 1-foot-9-inch (533-mm), badly-eroded timber cut from Northern white cedar (*Thuja occidentalis*), which aligned with the forward side of the midship floor but was only 6 inches (152. 4 mm) sided instead of 10 inches (254 mm). A small part of the turn of the bilge was preserved on the port side of the midship frame made up by the second futtock, but its end was broken and so the full curve of the turn of the bilge no longer remains.

In addition to the midship frame (ꝏ), four other frames were selected for detailed study: R, J, 24, and 40 (see Figure 5-1 for locations on the site plan). These five frame sections were chosen based on their accessibility (all of them were mostly free of rocks) and their placement throughout the hull, which included one near the bow (R), three fairly evenly spaced throughout the middle (J, ꝏ, 24), and one near the stern (40). The ceiling planking at each of these areas was recorded and subsequently removed to access the floors and futtocks beneath in order to record section views of each frame (Figure 5-11).

The frame sections showed that the steamer was nearly flat-floored for most of its length (Figure 5-12). The 1.5 degree deadrise observed at the midship frame increased to 2.25 degrees at frame J, and 2.5 degrees at frame 24. The deadrise became much steeper at frame R, at 15 degrees, and again at frame 40, with a 25 degree deadrise.

Though wood samples were only taken from a selection of frames (see Table 7), a visual comparison of the frames showed that the floors of frames V, T, B, ꝏ, 2, 4, 38, 43, 44, and 45 were much darker than others, and had a visible grain pattern. Most likely these floors were made of oak, as confirmed with ꝏ, while the remaining floors were made from Northern white cedar (Figure 5-13).

A 73-foot (22.2-m) section of hull planking was found lying disarticulated to the port side of the wreck. This planking retained eroded fragments of the upper futtocks. These port side futtocks averaged 5 inches (127 mm) sided, though based on the level of erosion this number would have originally been 6 inches (152.4 mm) or greater, and had a maximum molded dimension of 6 ½ inches (165 mm).

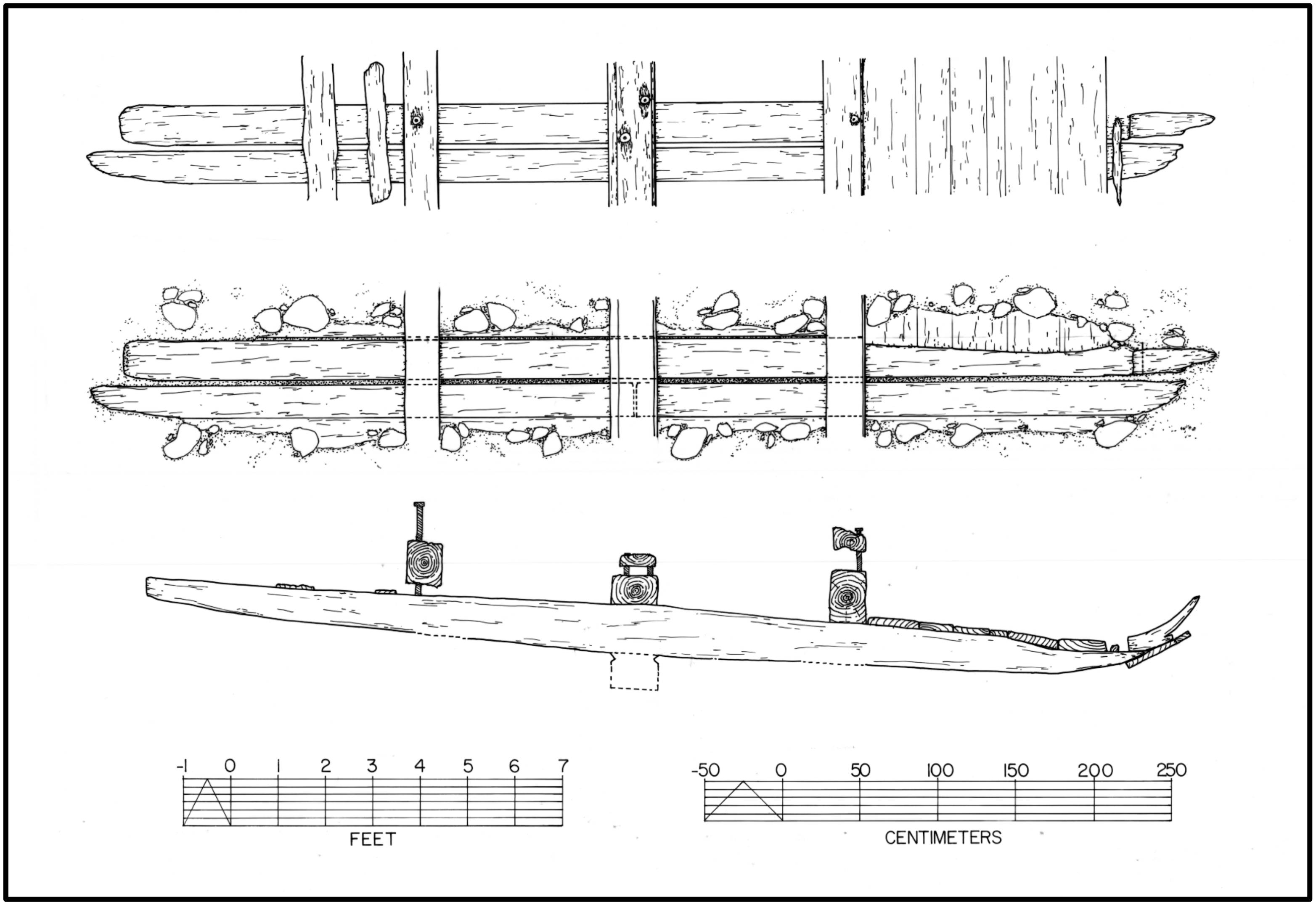


Figure 5-10. Two plan views and section view of *Phoenix II*'s midship frame. The top image shows the frame plan view with the ceiling planking as found in 2014, the middle image shows the plan view with the ceiling planking cut away, and the lower image shows a section view looking aft. (Drawing by C. Kennedy, 2017)

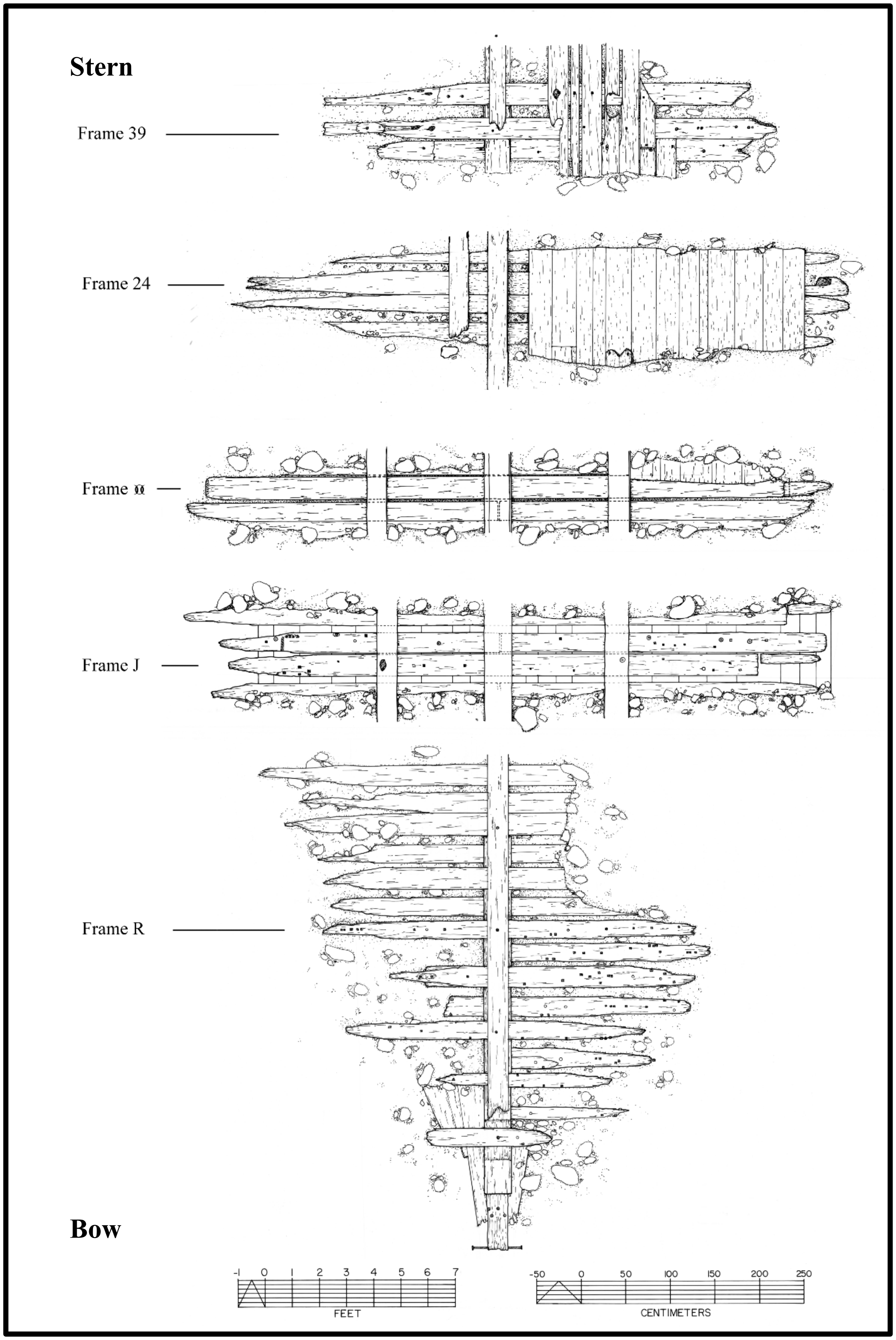


Figure 5-11. Plan views of frames R, J, ꝏ, 24, and 39. Frames R, J, and ꝏ are shown with the ceiling planking removed, frames 24 and 39 are shown with the ceiling planking in place. (Drawing by C. Kennedy, 2018)

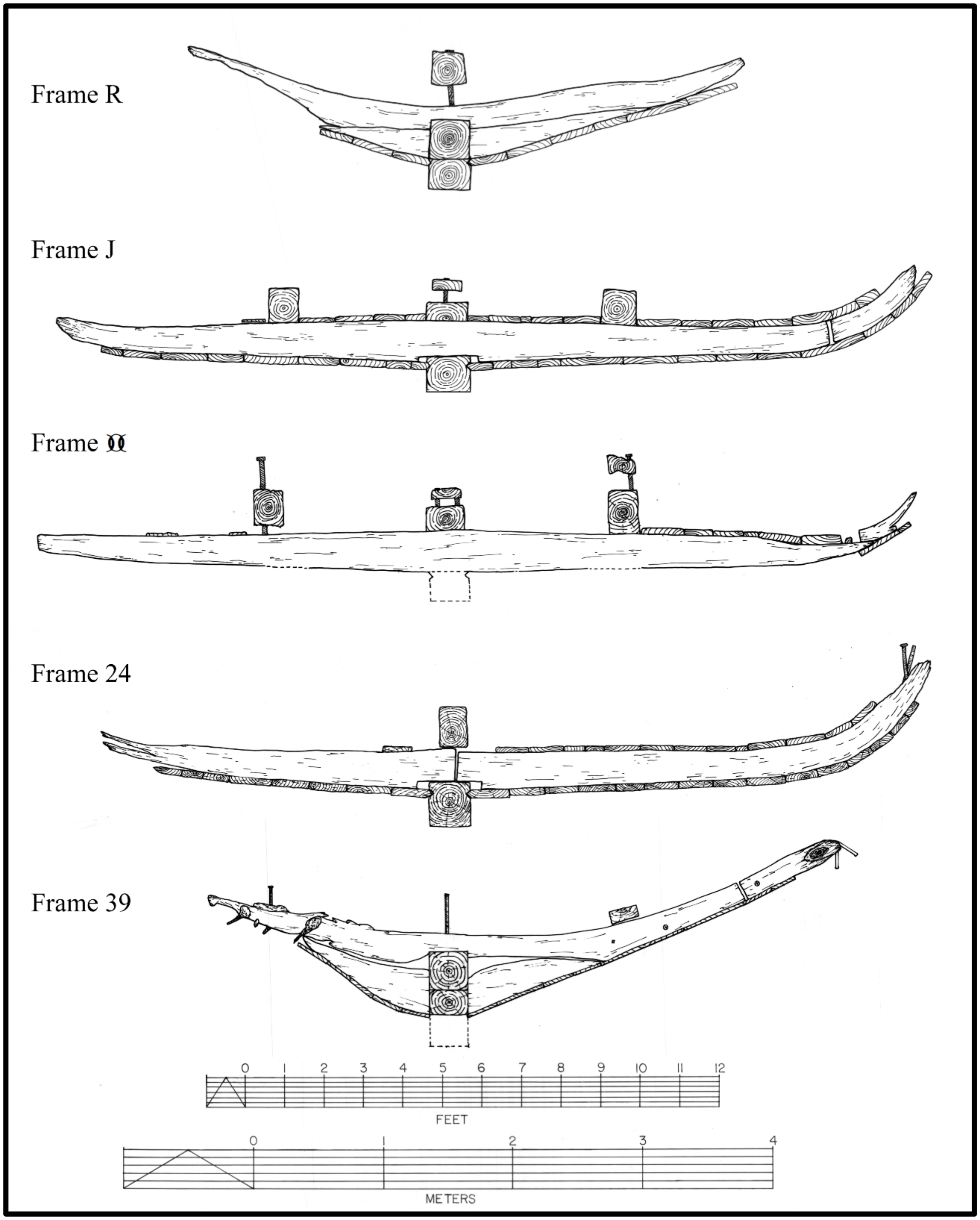


Figure 5-12. Section views of frames R, J, ⅩⅩ, 24, and 39. All views facing aft. (Drawings by C.Kennedy, 2017, K. Rooney and C. Cohen, 2016)

Frame	Timber	Wood Type
R	Floor	Atlantic white cedar (*Chamaecyparis thyoides*)
	Chock (beneath floor)	Atlantic white cedar (*Chamaecyparis thyoides*)
J	Floor	White cedar (*Chamaecyparis/Thuja*)
	First Futtock, Starboard	Northern white cedar (*Thuja occidentalis*)
	First Futtock, Port	White cedar (*Chamaecyparis/Thuja*)
	Second Futtock, Port	White cedar (*Chamaecyparis/Thuja*)
A	Floor	Atlantic white cedar (*Chamaecyparis thyoides*)
	First Futtock, Starboard	Atlantic white cedar (*Chamaecyparis thyoides*)
ꝏ	Floor	White oak (*Quercus alba*)
	Second futtock, Port	Northern white cedar (*Thuja occidentalis*)
1	Floor	Northern white cedar (*Thuja occidentalis*)
	First futtock, Starboard	Northern white cedar (*Thuja occidentalis*)
22	Floor	Northern white cedar (*Thuja occidentalis*)
23	Floor	Northern white cedar (*Thuja occidentalis*)
	First Futtock, starboard	Northern white cedar (*Thuja occidentalis*)
24	Floor	Northern white cedar (*Thuja occidentalis*)
	First Futtock, starboard	Northern white cedar (*Thuja occidentalis*)
	First Futtock, port	Northern white cedar (*Thuja occidentalis*)
39	Floor	White cedar (*Chamaecyparis/Thuja*)
	First Futtock, starboard	Northern white cedar (*Thuja occidentalis*)
	First Futtock, port	Northern white cedar (*Thuja occidentalis*)
40	Floor	White cedar (*Chamaecyparis/Thuja*)
	First Futtock, starboard	White cedar (*Chamaecyparis/Thuja*)
	First Futtock, port	Northern white cedar (*Thuja occidentalis*)
41	Floor	Atlantic white cedar (*Chamaecyparis thyoides*)
42	Floor	Atlantic white cedar (*Chamaecyparis thyoides*)
	First Futtock, port	Atlantic white cedar (*Chamaecyparis thyoides*)
43	Floor	White oak (*Quercus alba*)
	First Futtock, port	Atlantic white cedar (*Chamaecyparis thyoides*)
44	Floor	Oak family (*Fagaceae* sp.)
	First Futtock, port	Atlantic white cedar (*Chamaecyparis thyoides*)
45	Floor	White oak (*Quercus alba*)
	First Futtock, port	Northern white cedar (*Thuja occidentalis*)
46	Half-Frame	White oak (*Quercus alba*)
47	Half-Frame	White oak (*Quercus alba*)
48	Half-Frame	White cedar (*Chamaecyparis/Thuja*)

Table 7. Framing timbers selected for wood species analysis and the results.

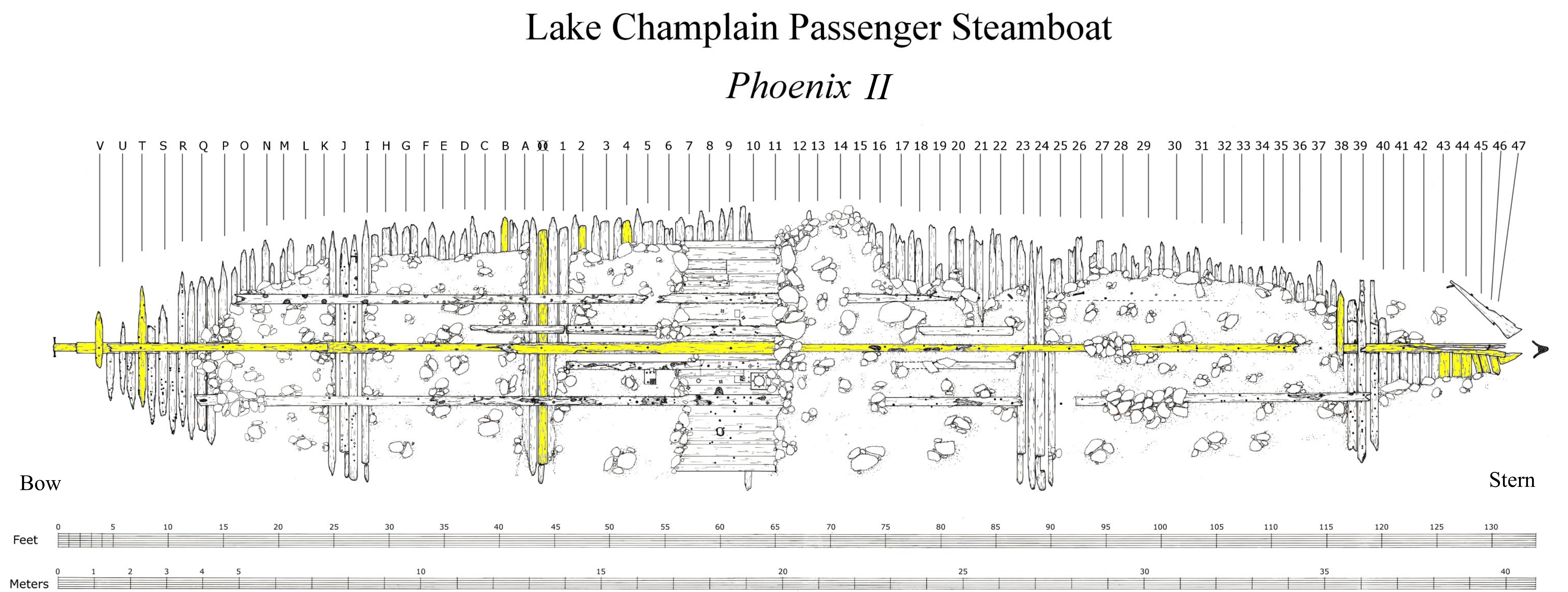


Figure 5-13. *Phoenix II*'s archaeological site plan with white oak (*Quercus alba*) timbers highlighted in yellow. Highlighting includes both those verified as white oak by wood analyses, and those suspected of being white oak based on visual analysis. (Drawing by C. Kennedy, 2017)

Keelson

Phoenix II's white oak (*Quercus alba*) keelson measured 108 feet 5 inches (33 m), slightly less than its original length (see Figure 5-1). Its forward end was eroded and its after end was broken off forward of frame 37. The majority of the keelson was completely buried below rocks and could not be recorded. A scarf was identified at frame J (the length of the scarf was not recorded), with the after timber overlying the forward timber. The keelson was not square in section, but rather had a narrower upper portion measuring 9 inches (229 mm) sided and wider bottom portion measuring 11 inches (305 mm) sided, with a molded dimension of 12 to 13 inches (305 to 330 mm) (Figure 5-14). It is unclear whether this irregular shape was achieved by stacking two timbers of different sizes or if it was one single timber shaped this way. Between frames 16 and 19, the upper face of the keelson had four eroded holes, each approximately 12-inches (305 mm) long. The holes may be related to the engine's placement, but the combination of erosion, damage, and the rock coverage make it impossible to be certain.

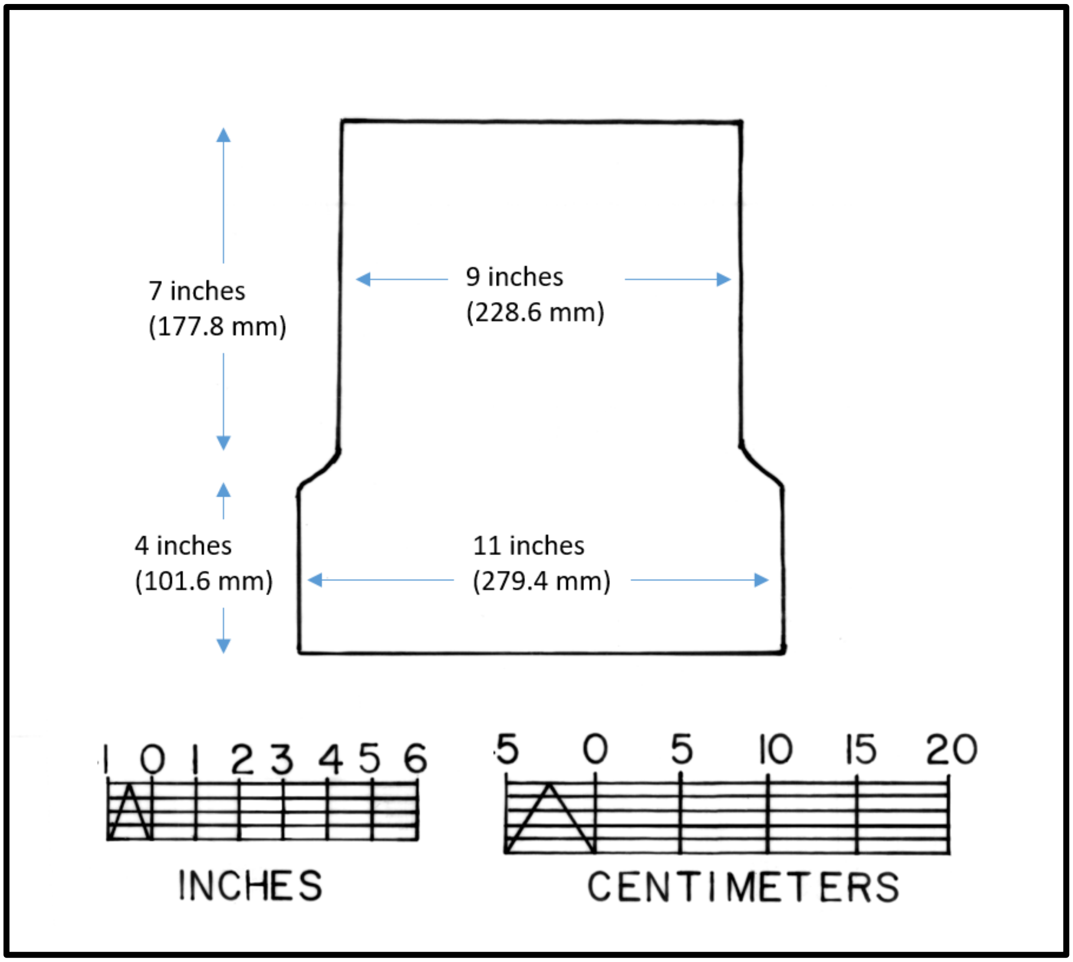


Figure 5-14. Keelson cross section. (Drawing by C. Kennedy, 2018)

A pattern of bolts was observed along the upper surface of the keelson with bolts driven in from above every 3 feet 9 inches (1.14 m), a distance that coincided with every second floor. The pattern was consistent except at frames 2 and 3, which were both fastened through their floors with bolts positioned only 1 foot 10 inches (0.56 m) apart, although the 3-foot-9-inch (1.14-m) spacing resumed on either side.[227] The keelson was not notched to fit atop the frames.

[227] The same bolting pattern was evident on *Phoenix I*'s keelson, see Schwarz 2016, 130.

Engine Bed Timbers

On either side of the keelson two longitudinal timbers, the engine bed timbers, supported the heavy engine machinery (see Figure 5-1). The innermost pair SBT1 (starboard) and PBT1 (port) were located 14 inches (356 mm) outboard of the keelson, and the longer extant starboard side timber ran from frame D to 23 for a total length of 40 feet 10 inches (12.45 m). PBT1 also ended at frame 23, parallel with SBT1, but began at frame 1, 8 feet (2.44 m) abaft the forward end of SBT1. PBT1's forward end was located parallel with a 2-inch (51-mm) vertical gap in bed timber SBT1.

SBT1 and PBT1 were cut from a soft pine group (*Pinus* subgenus *Strobus*), and at several points along their lengths were made of two timbers stacked on top of each other. At their ends, the inner bed timbers' molded dimensions were 8 inches (203 mm) (where it was one single timber), and at their tallest (at frame 10) 23 inches (584 mm) (where the second timber was stacked on top of the first timber). The sided dimension reached a maximum of 10 inches (254 mm) around frame 10 where they had been protected from erosion by sediment and rocks, but in most places the upper timbers were 6 inches (152 mm) sided. Also at frame 10, additional longitudinal timbers, 6 ½ inches (165 mm) sided and 14 inches (356 mm) molded, were fitted outboard and alongside SBT1 and PBT1. The additional timbers were fastened transversely to the inboard engine bed timber by 1-inch-diameter (25-mm-) iron fasteners. The total lengths of these timbers are unknown (their forward ends were not uncovered in 2016).

The outboard pair of engine bed timbers, SBT2 and PBT2, were positioned 4 feet 6 inches (1.37 m) from the sides of the keelson at their forward ends, but angled towards the centerline slightly, so that their after ends were 4 feet (1.22 m) outboard from the keelson (see Figure 5-1). This pair of bed timbers was much longer than the other, spanning nearly the entire length of the hull. PBT2 was the better preserved of the two, although its ends were eroded and damaged. The timber ran from frame R to 41, for a total preserved length of 107 feet (32.6 m). Though only 65 feet 9 inches (20 m) of SBT2 exists from frame P to 20, bolts extending up from frames abaft frame 20 and impressions on the frame surfaces show the timber's original length was equal to that of PBT2.

Like the inboard engine bed timbers, the outboard engine bed timbers were composed of single pieces and stacked double members in certain sections. At frame J both SBT2 and PBT2 were a single timber each, SBT2 measuring 9 inches (229 mm) sided and 10 ½ inches (267 mm) molded, and PBT2 measuring 10 ½ inches (267 mm) square. SBT2's second timber was laid atop the bottom timber 36 feet (11 m) abaft the bow, at frame E, but bolts up to 2 feet (0.61 m) forward of this point indicate that this second timber originally began further forward. The doubled timber continued to frame A, and resumed at frame 2, but bolts protruding high above the lower SBT2 timber's surface indicate the doubling originally continued unbroken until at least frame 17. On PBT2 the second timber began at frame D and continued to frame 20. PBT2 was missing between frame 23 and 26, and therefore was not visible in the section view of frame 24 (see Figure 5-12). When doubled, SBT2 and PBT2's maximum molded dimension was 25 inches (0.64 m).

Neither of the inboard or outboard engine bed timber pairs showed any obvious or consistent bolting patterns over their lengths, though the forward end of SBT2 had an alternating port-to-starboard bolting pattern through every floor for the first seven floors. It is possible a similar pattern was attempted on PBT2, though rocks covered much of the surface impeding documentation of any such pattern. Break patterns in both pairs of timbers do appear largely symmetrical. The most obvious symmetrical break is in the outboard pair of bed timbers between frames 5 and 6. On both SBT2 and PBT2, a 12-inch (305 mm) gap in the upper timber is present at this location, corresponding to breaks in SBT1 and PBT1 only slightly behind them. This location was slightly forward of where the engine cylinder was mounted, and probably represents the location where the forward legs of the crosshead beam's supporting A-frame fit into mortises cut into the outboard bed timbers.

Ceiling Planking

The ceiling planking was cut exclusively from white oak (*Quercus alba*). In areas of sediment and rock coverage the ceiling planking was often incredibly well preserved, so much so that finding the seams between strakes became difficult. At frame J, for example, the 13 port side strakes were still tight. In general, the ceiling planking was best preserved on the port side. Strake widths ranged from 6 inches (152 mm) to 13 ½ inches (343 mm). The majority of the ceiling planking was 2 inches (51 mm) thick, but from the floor heads up around the turn of the bilge plank thickness increased to 2 ¾ inches (70 mm).

At frame J the ceiling plank directly adjacent to the starboard side of the keelson had a 5-inch-long (127-mm-) by 2-inch-wide (51-mm-) cutout on the edge next to the keelson, only 6 inches (152 mm) forward of the butt end of the plank. Though the plank's forward end was not observed, this cut out may represent the handhold of a limber board used to access the bilge. No matching cut was found on the port side limber board.

Ceiling planking was fastened to the floors and futtocks using ½-inch (13-mm) square iron spikes along the flat surface. Around the turn of the bilge, 1 ½-inch (38-mm) diameter iron bolts fastened the thicker planks, though some of the smaller spikes were used as well. Treenails measuring 1 inch (25 mm) in diameter were also used to fasten ceiling planking to the framing timbers throughout the hull.

Hull Planking

It was difficult to examine the hull planking due to the closely-spaced frames and relatively-intact ceiling planking. The hull planking widths were measured through the narrow gaps between frames where frame sections were recorded. Wood samples taken at the turns of the bilge indicated that the hull planking, like the ceiling planking, was cut from white oak (*Quercus alba*). Plank strakes were approximately 2 inches (51 mm) thick at the turns of the bilge. The seams between the strakes were, like those between ceiling planks, remarkably tight. Two planking strakes at frame J were recorded with widths of 20 inches (508 mm) and 29 inches (737 mm), which seems unlikely; each was probably composed of two planks with an invisible seam between them. Otherwise strakes ranged from 6 to 14 inches (152 to 356 mm) thick. The hull planking at frame ꝏ was left unrecorded as the gaps between floor ꝏ and futtocks A and 1 were less than 1 inch (25 mm) each, and the molded dimension of floor ꝏ was 12 inches (305 mm), making it impossible to see or feel outer hull planking seams.

The disarticulated portside section was made up of eight hull planking strakes over a length of 73 feet (22.2 m). The strakes were labelled A-H starting from the strake closest to the hull, which would have been the lowest strake when intact. The strakes ranged from 3 to 7 inches (76 to 178 mm) wide, and varied in thickness: strakes C, D, E, and F were 1 ¾ inches (44 mm) thick, strake G was 3 inches (76 mm) thick, and strake B was 3 ½ inches (89 mm) (strakes A and H's thicknesses were not recorded).

Frames 7-10 and Evidence of Machinery

A section of hull amidships at frames 7, 8, 9, and 10, located at the forward end of the largest pile of rocks on the wreck, was selected for excavation with the intent of recording a frame section. The rocks in this location proved to be much more challenging to remove than anticipated, however, and therefore a full section recording was not taken. Instead, documentation was carried out to permit the preparation of a plan view and cross section above the ceiling planking. This area proved to be incredibly rich with archaeological data, not only for the yield of artifacts such as the wreck-identifying 'SB PHOENIX' chisel, but also for clues to the placement of the engine and boiler.

Since the area was well covered with rocks prior to excavation, the preservation of the wood and hull fasteners was excellent. It was in this area that the maximum heights of the engine bed timbers were found (25 inches [635 mm]), and also the best-preserved section of keelson with clean-cut corners. On the port side, two holes appeared to have been out of the ceiling planking, possibly hacked away at by the shipyard workers to remove valuable piping that originally passed through the ceiling planking to the bilge, or outboard completely. Also on the port side, located between PBT1 and PBT2 and 21 inches (533 mm) from the port side of the keelson, a 16-inch-square (406-mm) wooden block was found, with an 11-inch-diameter (279-mm), perfectly circular hole in its center. The hole through this block was not open to the bilge area, but rather seemed to travel through to the outside of the hull. Another smaller hole, 4 ¼ inches (108 mm) in diameter, was located 5 feet 9 inches (1.75 m) forward of the block. This smaller hole was cut into the ceiling planking, and unlike the other two holes in the ceiling planking that were clearly roughly hewn, this hole was uniform in shape (Figure 5-16 and 5-17).

Figure 5-15. Photogrammetric orthophoto of the frame 7-10 area. The arrows point to holes cut into the ceiling planking, and the engine anchor-bolt mounts are circled. The hole near the top of the image was housed in a wooden block. (Orthophoto reprinted from K. Yamafune, 2016)

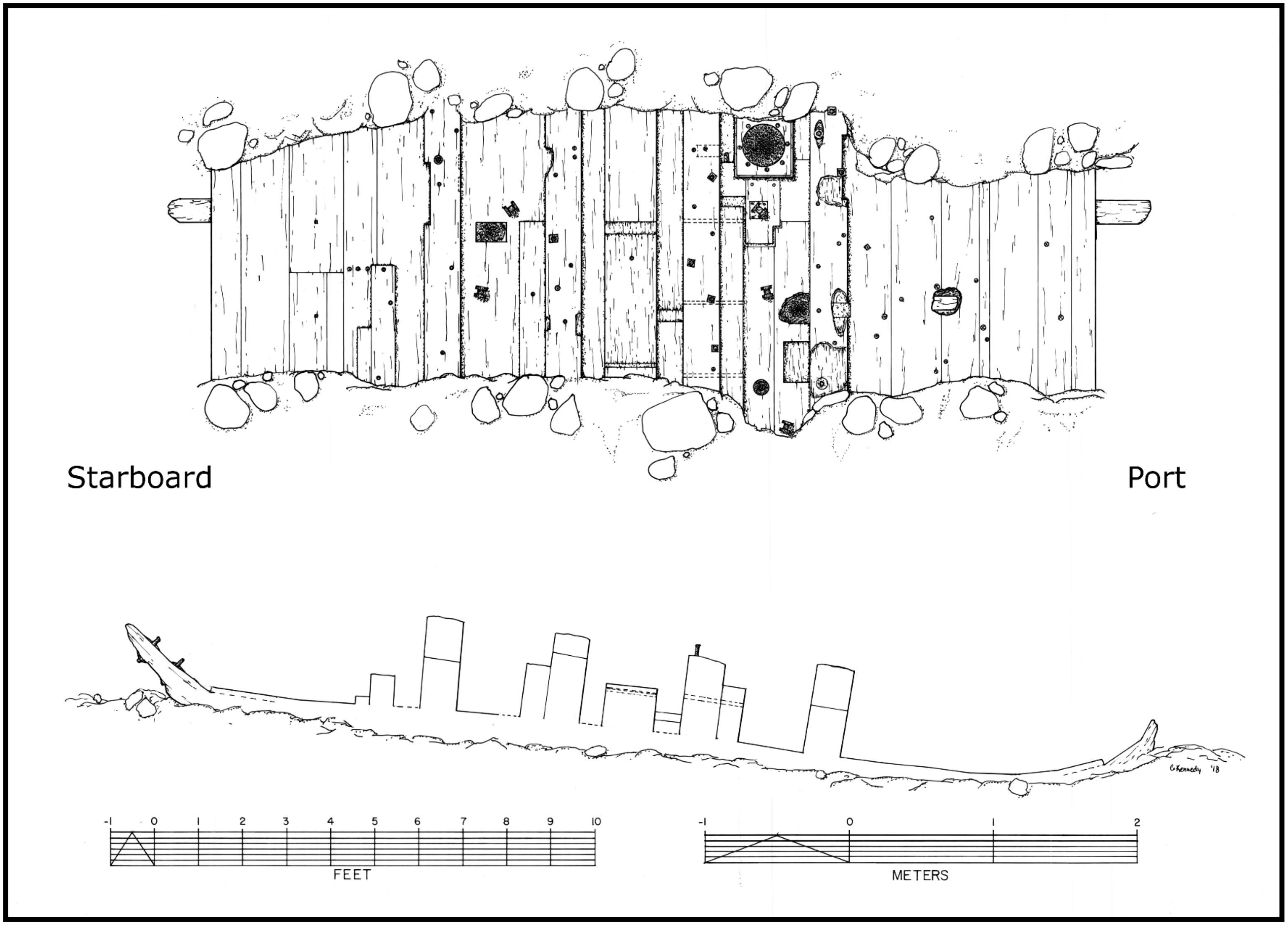


Figure 5-16. Plan view and cross section of the frame 7-10 area. (Drawing by C. Kennedy, 2018, based on notes by D. Bishop, 2016)

Five engine anchor-bolt mounts were found fastened to the ceiling planking 2 feet (0.61 m) to 2 feet 6 inches (0.76 m) outboard of both sides of the keelson. Two were located on the starboard side and three on the port side. Each mount was made up of a pair of iron rings, 3 inches (76 mm) wide with a 1 inch (25 mm) hole through the center, measuring 4 ½ inches (114 mm) above the ceiling planking. The cylinder linking the two sides of the mount was 1 ¾ inches (45 mm) long, for a total length of 3 inches (76 mm), with rings on either side (Figure 5-18). On the port side, the three mounts were in line with one another, 1 foot 9 inches (0.53 m) apart. On the starboard side, the two mounts were slightly offset, the forward one 2 feet 8 inches (0.81 m) to outboard of the keelson, and the aft mount 2 feet (0.61 m) from the keelson, though they were parallel to the port side pair, 1 foot 9 inches (533 mm) apart. These mounts likely anchored, with chains or wrought-iron rods, some tall, heavy feature that needed added support for its height, very likely the engine cylinder.

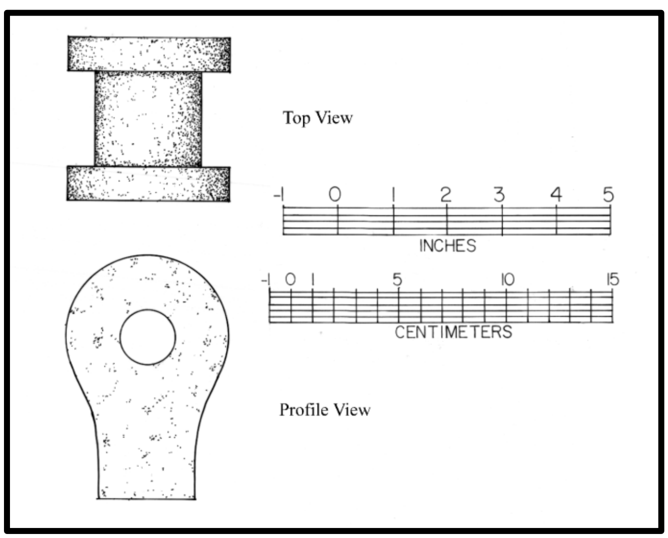


Figure 5-17. Scaled drawing of the engine anchor-bolt mounts found in the area between frames 7 and 10. (Drawing by C. Kennedy, 2018)

Rudder

Phoenix II's rudder was located directly adjacent to the port side of the sternpost. It was mostly intact except for the missing upper half of the rudder post and damage to the top of the rudder horn. The rudder was made up of six vertically-oriented timbers 6 feet 6 inches (1.98 m) high (not including the rudder horn). The forwardmost timber, which formed the rudder post, was broken off at the top and was only 44 inches (1.12 m) tall. From the rudder post to the horn, the six timbers were 8 inches (203 mm), 8 ½ inches (216 mm), 13 ½ inches (343 mm), 13 ½ inches (343 mm), 13 ¼ inches (337 mm) and 10 ½ inches (267 mm) wide, creating an overall width of 4 feet 11 ½ inches (1.51 m). The six timbers were edge-fastened together by a series of cylindrical iron bolts driven through holes drilled through the width of the rudder blade. The ends of two of the bolts were visible at the top of the rudder, but the total number of bolts was not determined. The entire rudder was 4 inches (102 mm) thick (Figure 5-15).

Wood samples were not taken, but excavators noted that the bottom half of the rudder post and its adjacent timber, as well as the aftermost rudder timber (its upper end included the rudder horn), were all made of dark, dense wood, while the three central timbers were of a lighter wood. Most likely the end timbers were of oak and the middle three timbers were of cedar.

Two 3 ½-inch-long (89-mm), 2 ½-inch-diameter (64-mm) pintles were mounted on the rudder, although the lower pintle, which was in line with the shoe, was difficult to record due to visibility. The upper pintle was fastened to the rudder by 3-inch-wide (76-mm), 36 ½-inch-long (0.93-m) iron straps. The straps were parallel with the top of the rudder blade, and located 17 inches (432 mm) below it. The after end of the port side strap was bent and lifted away from the rudder timbers.

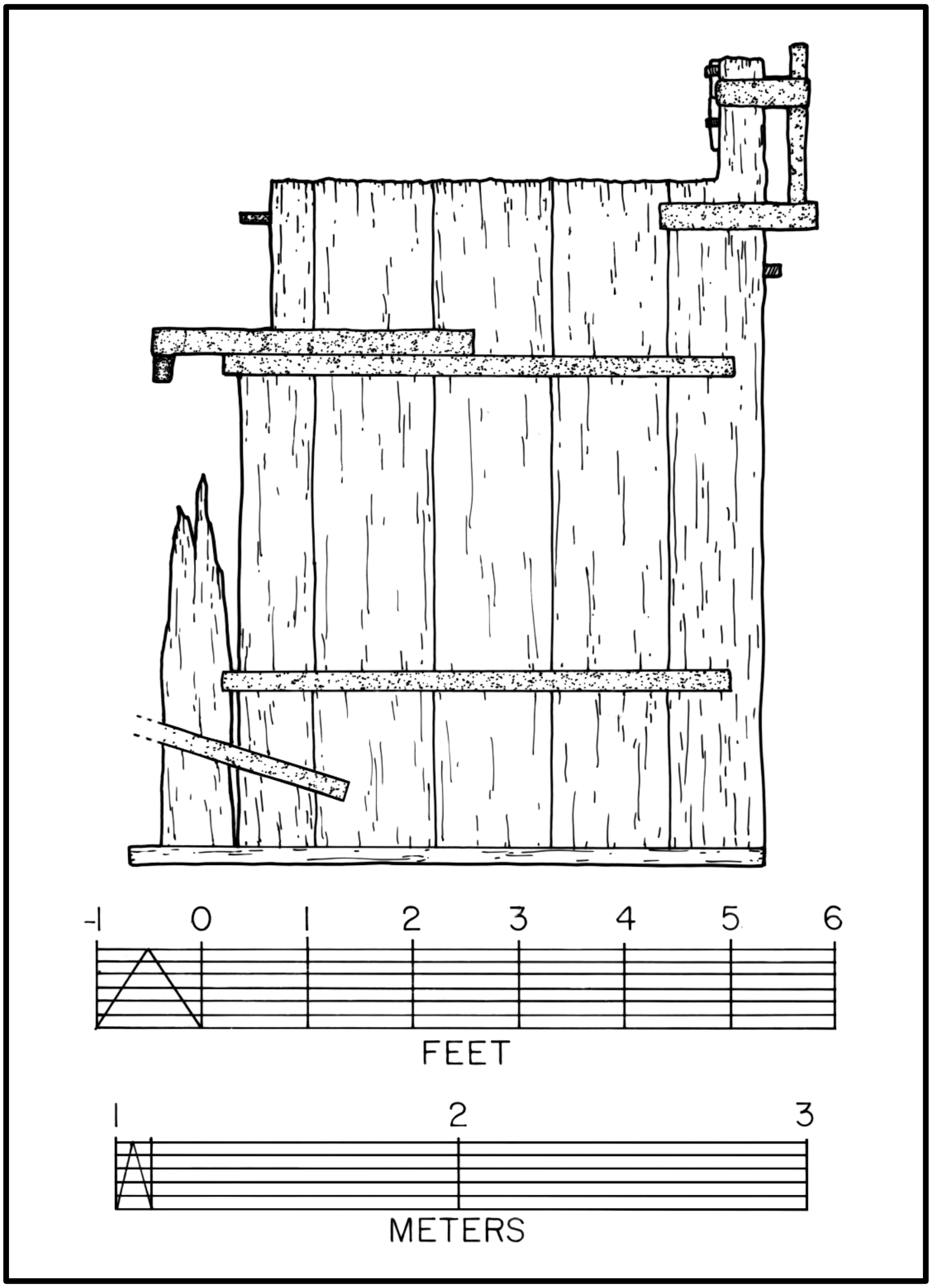


Figure 5-18. Profile view of *Phoenix II*'s rudder. (Drawing by C. Kennedy, 2017, based on notes by C. Sabick, 2016)

Aside from their bolted edges, the timbers were fastened together on each side of the rudder blade by two 2 ¼ inch-thick (57-mm), 58-inch-long (1.47-m) iron bands. The bands spanned five of the rudder timbers (not including the rudder post), and were positioned 32 inches (0.81 m) apart. The upper band was located 20 inches (508 mm) from the top of the rudder, and the lower band 20 inches (508 mm) from the bottom of the rudder. A 2-inch-thick (51-mm) shoe, also made of dark wood, covered the bottom of the rudder. Another iron strap was found 6 inches (152 mm) below the lower band. Its after end was pulled away from the rudder, leaving an impression along the vertical rudder timbers showing its original placement. Its forward end was obscured by the sediment immediately abaft the sternpost, but it is undoubtedly the lower pintle still mounted in the gudgeon. The twisted, hard-to-port position of the rudder indicates that the hull slid backward as it sank, wrenching the rudder to port and pulling on the lower pintle so that its straps detached from the rudder. The damage to the upper pintle and missing upper post are also explained by this scenario (see Figure 5-5).

At the after end of the rudder was the rudder horn, which was a modification typical to steamboat rudders that allowed them to be longer and shallower. Tackle arrangements for the wheel ropes attached to this after extremity provided greater control over the long rudder, and may have eliminated the need for a tiller.[228] *Phoenix II*'s rudder horn was formed by the top of the aftermost rudder timber. It was 5 inches (127 mm) wide and extended 15 inches (381 mm) higher than the main blade of the rudder. Two 12-inch-long (305-mm) iron bolts passed through the rudder horn driven

---

[228] Stevenson 1859, 81.

from forward to aft. The lower bolt was 6 inches (152 mm) above the top of the rudder blade, and the second was 12 inches (152 mm) above the rudder blade. A 3-inch-wide (76-mm), 9-inch-long (229-mm) strap was found 4 inches (102 mm) from below the top of the rudder horn. This strap held a 2-inch-thick (51-mm) parallel metal rod to the after side of the wooden horn. The metal rod was also held to the main face of the rudder by another 3-inch-wide (76-mm), 18-inch-long (457-mm) iron strap located just below the top of the main face of the rudder. This rod reinforced the rudder horn extension, which would have been a natural weak point prone to breaking.

Discussion of Significant Construction Features

What did *Phoenix II* have in common with contemporary steamers? What features in its design or construction are seen in boats that come before it and after it? Was it typical of its time? These questions are best answered by comparing the hull data with other archaeologically-investigated contemporary steamboats (see Chapter 1 for a listing of comparative examples of steamboat wrecks).

The study of *Phoenix II*'s hull components and their assembly revealed a heavily-constructed steamboat with several unexpected features. The heavy construction by itself was surprising; a boat built for passenger transportation on an inland lake did not need such large framing timbers as those found on *Phoenix II*. The frames were not only large, but the location of the first futtock heels, butting along the centerline of the hull under the keelson, added unnecessary weight to the hull. The average distance between the sides of the keel and futtock heels on *Phoenix I*, for example, was 12 ½ inches (318 mm), and on *Ticonderoga* approximately 12 inches (305 mm).[229] Why then did builders Young and Gorham follow building practices that ultimately increased the tonnage and decreased the speed of their steamer?

The builders' choice of timbers with large molded and sided dimensions contrasts even more greatly with the framing of the 1830s steamers, *Burlington* (1837-1854) and *Whitehall* (1838-1853). Built less than two decades after *Phoenix II*, these later boats exhibited much framing timbers that are much smaller in cross section. *Burlington*'s frames were 5 inches (127 mm) sided and 16 inches (406 mm) molded, making for deep but narrow frames. *Whitehall*'s frames were slightly larger overall, but similarly proportioned: 5 to 6 inches (127 to 152 mm) sided and 20 inches (508 mm) molded. By shaping the frames with this rectangular section, the builders were capitalizing on the strength of the timber where it was necessary (at the turn of the bilge), while reducing the overall volume of the timbers and thereby reducing the weight of the hull. By eliminating unnecessary floor and futtock weight, the much larger hulls of *Burlington* and *Whitehall* were proportionately much lighter (and ultimately faster) than *Phoenix II*.

One potential explanation for the large, overlapping frames of *Phoenix II* might be the builders' use of cedar for frame timbers instead of the more traditional white oak. Though not much is known about Alexander Young's history, he reportedly built at least one 50-ton sailing ship for Lake Champlain in 1810.[230] Jonathan Gorham built *Congress*

---

[229] Schwarz 2016, 128; Crisman, *Ticonderoga*, 2014, 265.

[230] "A search for the names and histories of vessels built at the shipyard of Alexander Young at Young's bay [sic] has been rewarded by one name only, that of the *Emperor*, a sailing boat of fifty tons, 'built for H. and A. Ferris, at Barber's Point, by Young,' in 1810," from Royce 1902, 607.

for the LCSC two years prior to building *Phoenix II*.[231] Perhaps between the two experienced shipwrights, the idea of using the weaker cedar instead of oak made them nervous about the structural strength of the large boat, and they compensated by overlapping the floors along their entire lengths.[232] That said, *Phoenix I* also relied on Northern white cedar for its frames, as well as the even softer yellow pine, meaning that the use of these non-conventional wood species was not completely new to shipwrights hired by the LCSC.[233] Opting for cedar framing timbers could indicate that the LCSC was going for rot-resistance and durability over strength; *Ticonderoga*, built entirely of oak, rotted beyond repair in only five years, whereas *Phoenix II* survived almost two decades.[234]

One unexpected feature on the wreck was the circular iron band that secured the sternpost to the keel and garboard. Neither *Ticonderoga* nor *Phoenix I*, the other early Champlain steamer hulls, had circular iron bands at their stem or stern joints; iron dovetail plates secured those assemblies. *Lady Sherbrooke* had neither dovetail plates nor circular iron bands, but seems to only have used bolts and possibly mortise-and-tenon joints to secure the stem and stern joints.[235] The only other known archaeological example of circular plates comes from the wreck of the Royal Navy's War of 1812 frigate *Burlington* (originally called *Princess Charlotte*), where plates reinforced the

[231] Thompson 1853, 216.
[232] The specific gravity of white oak is 0.68 whereas the specific gravities of Northern and Atlantic cedar are 0.31 and 0.32 respectively (see Appendix A: Bush 2017: 3-4).
[233] Schwarz 2012, 131.
[234] Crisman, *Ticonderoga*, 2014, 256.
[235] Belisle, pers. comm.

stem (but not the stern) (Figure 5-19).[236] Another, more common fastener for reinforcing these typical weak points in the hull construction were horseshoe plates, similar to the circular plate but not connected at the top.[237] What influenced Young and Gorham to select a circular plate, departing from the previously-seen dovetail plates, is difficult to say since their histories are largely unknown. With so much cross-border influence, either one of these shipwrights may have worked with the Royal Navy during the War of 1812, or worked with Royal Navy shipwrights afterwards, and picked up ideas or preferences through those connections.

[236] Moore 2014, 208-210; Walker 2006.
[237] Moore 2014, 208.

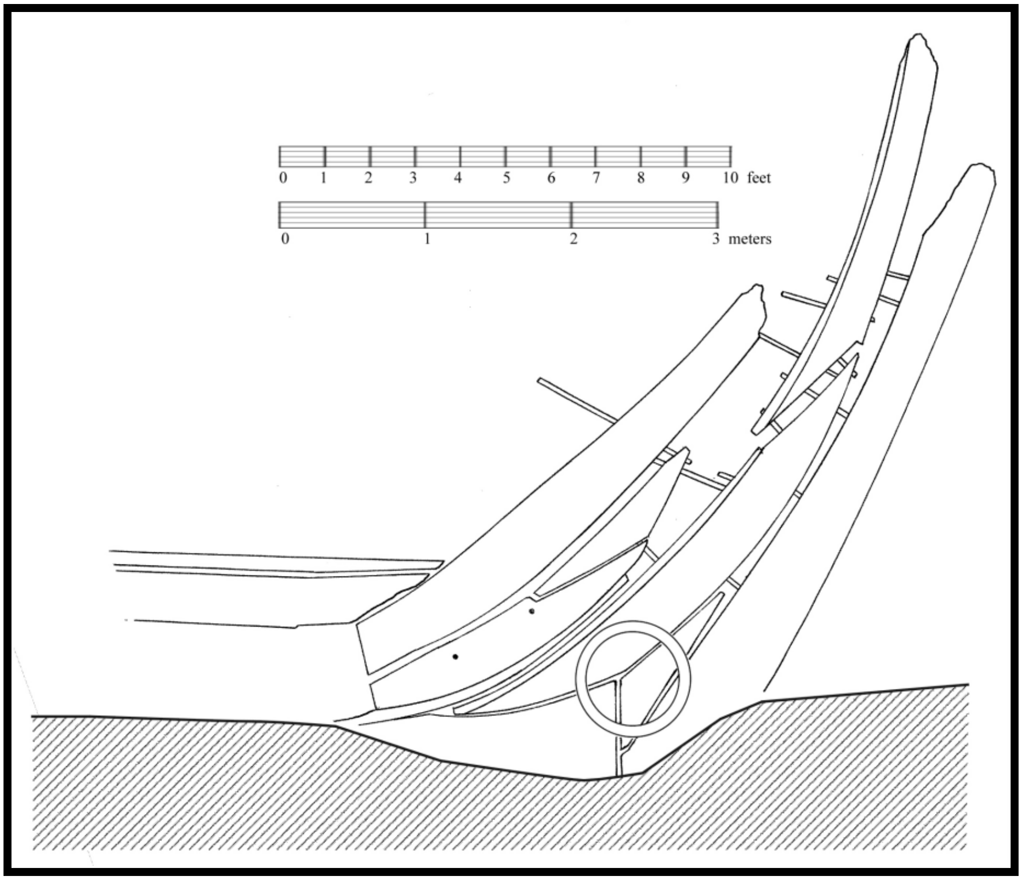


Figure 5-19. Stem assembly of Wreck Baker (Royal Navy ship *Princess Charlotte*, later called *Burlington*). (Drawing by D. Walker, reprinted from Walker 2006, 60)

The large frame dimensions, the abutting futtock heels, and the circular iron fastener are all departures from construction patterns found on the earlier steamer hulls, *Ticonderoga*, *Phoenix I*, and *Lady Sherbrooke*. These changes move in the opposite direction from what would be expected, that is to say a lighter, faster hull. Creating a lighter hull was clearly central to the design and assembly of the later 1830s *Burlington* and *Whitehall*, as well as the general desire by steamboat companies for fast boats. The 1820-built *Phoenix II* in fact shows a heavier, slightly beamier hull than its predecessors, which would not have improved speed at all. That said, the increased bulk may have seemed necessary if *Phoenix II* was the first Champlain steamer to be equipped with two boilers (to be discussed in Chapter VII). Whether or not that is the case, when compared to steamers that were built the years before and after it, namely the 1810s, 1820s, and 1830s, *Phoenix II*'s hull very well demonstrates the experimental nature of steamboat construction during this time.

To Conclude

Though the wreck of *Phoenix II* was only preserved to the turn of the bilge at best, what remains beneath rocks and sediment was well preserved. Efforts to remove the rocks covering the majority of the hull were limited to the bow, stern, and six separate areas in between. These locations were selected for practical reasons; on the one hand, the areas selected were chosen based on lighter rock coverage than other areas, or they were selected based on their key locations throughout the hull with the intention of informing a reconstruction of the hull. The information from the bow, stern, five frame sections, and the area around frames 7-10 were compiled into a lines reconstruction of the hull, and also served to inform the internal layout of the steamer. This reconstruction is discussed in Chapter VII.

CHAPTER VI

HULL RECONSTRUCTION OF *PHOENIX II*

A reconstruction of *Phoenix II* based on archaeological evidence promises to fill several significant gaps in our understanding of the development and diversification of steam technology. To date, only one other early nineteenth-century Lake Champlain steamboat, *Phoenix I* (1815), has undergone systematic study and attempted reconstruction. Following in the wake of its predecessor, *Phoenix II*'s hull remains demonstrate what designs were adopted and maintained in the early development of steamboat construction. On a wider scale, *Phoenix II* can also explain how early shipwrights adapted their vessels to different bodies of water.

If construction plans or lines drawings for *Phoenix II* were ever created, they are now lost. Even if they did exist, ship plans were notoriously idealized and rarely did the actual, as-built ships match the drawings very closely.[238] Even if *Phoenix II* was built precisely to the original plans, it is possible that the hull was drastically altered during its operational years.[239] Furthermore, having resided for nearly 200 years on the bottom at Shelburne Shipyard, the archaeological remains have suffered much damage, frames have sagged underneath the weight of the rocks deposited on top of them, while exposed

[238] "Hull lines drawn by the nautical archaeologist cannot adhere precisely to the methods followed by naval architects. The architect designs; we interpret. Architects' lines show perfection – the hull as they hope it will be built. Ours show something less – the hull as it actually turned out," fom Steffy 1994, 15.
[239] "The original construction of most of these vessels has […] been materially changed. […] in America it is no uncommon thing to alter steamboats by cutting them through the middle, and either increasing or diminishing their dimensions as the occasion may require," from Stevenson 1859, 73, written in 1837 (the year *Phoenix II* retired).

timbers have eroded. Given that the hull as it exists today is not a perfect representation of what it looked like during its working life, original, idealized ship lines for *Phoenix II*, if found, may not closely resemble the lines produced by this archaeological study.

It is helpful to keep in mind that this historic vessel is not old by archaeological standards; 1820 is really not that long ago, relatively speaking. It is therefore surprising how little information is available in the way of historical documentation to inform the reconstruction. Retired in 1837, *Phoenix II* predates the introduction of photography by two years, and iconographic evidence of the steamer's appearance is limited to woodcuts that were typically generic representations of steamboats interchangeably used for different vessels.[240] For example, one woodcut used to represent *Phoenix II* in 1823 was also used to represent *Congress* in 1819, the St. Lawrence River steamer *La Prairie* in 1822, and *General Greene* in 1825. A second woodcut was used to represent *Congress* in 1824, and both *Congress* and *Phoenix II* in 1825 and 1826. A third steamboat representation of *Phoenix II* was used on a poster in 1834, but in 1836 *Franklin* was represented by the same image, with only the name on the side changed from "*Phoenix*" to "*Franklin*" (Figure 6-1).[241] Unfortunately, no eyewitnesses, sketches, or paintings of *Phoenix II* have been located.

[240] Hacking 2012, 18.
[241] Ross 1997, 38, 52.

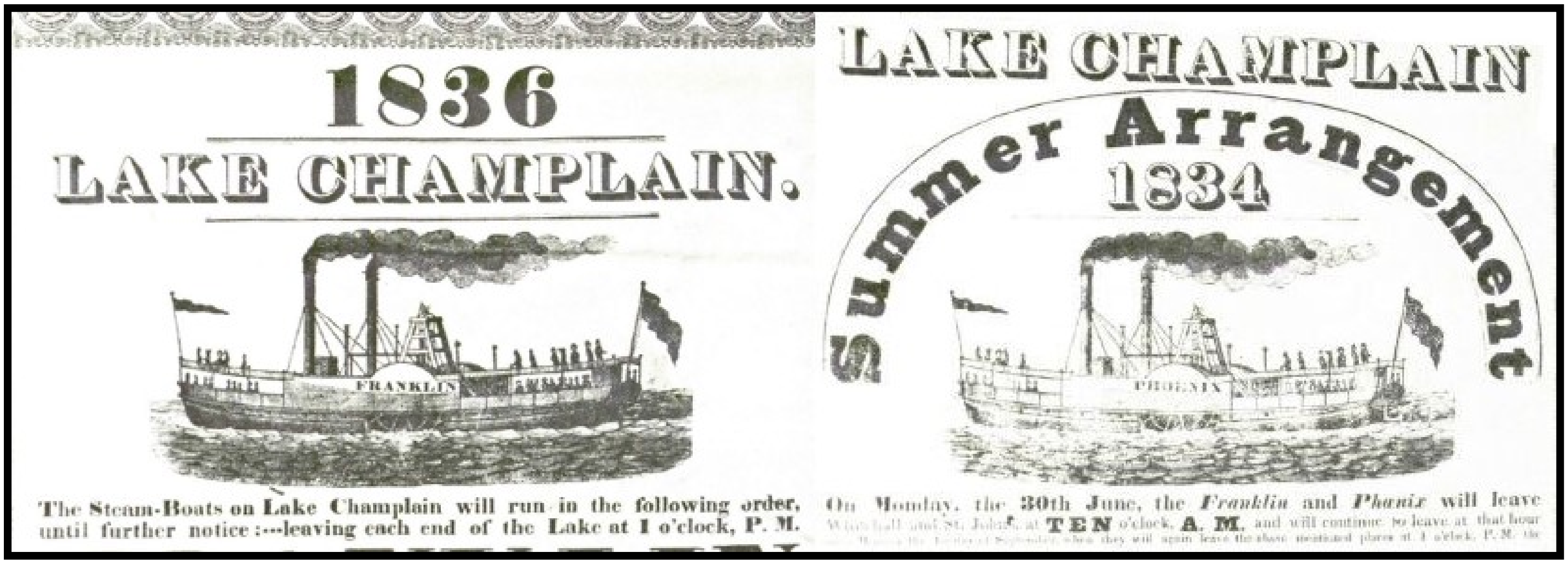


Figure 6-1. Champlain Transportation Company posters from two separate years, showing the names “Franklin” and “Phoenix” on identical generic steamboat images. (Reprinted from Ross 1997, 52, 38)

With so little in the way of iconographic or descriptive information from historical sources, the key to understanding the construction and operation of *Phoenix II* lies in the archaeological evidence obtained during the three field seasons. While Chapter V described the physical remains of the steamer, this chapter is essentially a hypothetical reconstruction of the ship's appearance based on those remains; unfortunately, without more information, this hypothesis somewhat defies rigorous testing. That said, this interpretation is based on physical evidence, not solely on conjecture, and is therefore valuable in better understanding *Phoenix II*.

Sources for the Reconstruction

The sources available for reconstructing *Phoenix II* came in three forms: archaeological data from the wreck, described in detail in Chapter V, historical documents describing the steamer, and contemporary examples of similar vessels (both described in Chapter I). Though these sources have allowed for a plausible reconstructed set of lines for this early steamboat, it is worthwhile to point out what is not available as a resource for the reconstruction. As mentioned in the previous chapter, the archaeological remains are only extant to the turn of the bilge, meaning only the bottom of the hull was available to inform a reconstruction.

Also missing are contemporary construction plans and ship lines for *Phoenix II*. Whether they once existed and have now been lost, or were never created in the first place is unknown. Original ship plans for Lake Champlain steamboats are non-existent for this period (this author is unaware of any made prior to 1850). It is highly likely that

Phoenix II was never planned out on paper, and the shipwrights, Jonathan Gorham and Alexander Young, relied on the image inside their heads (and past experience) to build the steamer. If they did at some point prepare plans for a boat, such plans were likely destroyed when their supervisor Jahaziel Sherman's office burned 6 July 1828.[242] Many documents relating to the steamboats Sherman built and commanded for the LCSC, including *Phoenix II*, were probably housed in that office and burned in that same fire, in which case any plans, notes, or sketches regarding the boat's construction were lost.

Archaeological Remains

The bow and stern profile views, and the five cross sections recorded and discussed in Chapter V were used to guide the lines reconstruction. The ceiling planking and hull planking of sections J and 24 were used to inform the planking of the midship frame reconstruction, as was the side hull planking found disarticulated to the port side. Disarticulated second futtocks were still fastened to parts of this disarticulated hull planking, so these were used to inform the molded dimensions of the sides of the midship frame reconstruction.

Historical Documents

The main historical document consulted for this reconstruction was *Phoenix II*'s Certificate of Registry. This document included key measurements such as the boat's

[242] *Baltimore* (MD) *Gazette* 22 July 1828; *Hampshire Gazette* (Northampton, MA) 23 July 1828; *The Watchman* (Montpelier, VT) 15 July 1828; *Woodstock* (VT) *Observer* 9 July 1828.

length (143 feet [43.6 m]); beam (27 feet 3 inches [8.31 m]); depth (9 feet 6 inches [2.9 m]); number of masts (none); and number of decks (one). The length refers to the distance between perpendiculars, meaning between the stem and sternpost. The beam would have been taken at the widest point of the vessel – the midship frame. The depth describes the depth of hold, meaning the distance from the limber boards to the deck beams, also at the midship frame. This information provided the basic parameters to begin the reconstruction.

Shedding further light on the arrangement of the vessel, Captain Gideon Lathrop of the *Phoenix II* wrote to owner Isaiah Townsend on 7 June 1831, "we have not a rug of awning to protect the passengers from the burning sun – and the deck forward is now crowded with emigrants who have not had any protection from the sun this day and are now huddling together to screen themselves from the night air – do believe me Gentlemen, this is not right they pay us an immensity of money and are treated no better than cattle […] I can get the awning and other articles here at short notice if you will allow me to do so." Same letter, continuation "I have just found the promenade deck awning and if I have the forward awning for deck passengers I should be well off."[243] Lathrop's description of the awnings indicate there were no decks or permanent fixtures above the main deck with which to shield the passengers from the elements. Furthermore, it implies that there was a distinction between the promenade deck and the forward deck, meaning the deck in the after part of the vessel was reserved for higher-fare cabin passengers, whereas the forward deck was used for deck passengers.

[243] TFP, Box 7, "Correspondence 1827 – June 1833," 7 June 1831.

Contemporary Examples

Clues derived from contemporary examples of steamboats, both in the form of historical ship lines and the publications on other archaeologically-investigated steamboats from this period, helped to inform *Phoenix II*'s reconstruction. These included *Ticonderoga* (1813-1825), *Phoenix I* (1815-1819), *Chancellor Livingston*, *Lady Sherbrooke* (1817-1826), and *Heroine* (1832-1838).[244]

The advantages and disadvantages of using these contemporary examples varied depending upon the steamboat. As the earliest example of an archaeological steamer hull to draw upon, *Ticonderoga* faced many of the same issues as *Phoenix II* for its lines reconstruction. Reconstructed by Kevin J. Crisman in 1981, the steamer-turned-17-gun-schooner only exists in the form of the bottom of the hull. The turn of the bilge no longer survived on the starboard side, and was only extant on the occasional frame on the port side, leaving very little archaeological material to go on for a lines reconstruction. As such, Crisman recorded six sections, similarly located to the sections recorded on *Phoenix II*. The middle section of *Ticonderoga*'s hull was boxy, indicating the vessel's "steamboat origins," and also removing the need to record numerous sections in that area as they would have been very similar.[245]

Phoenix I undoubtedly shared the most similarities with *Phoenix II*, as both Hemenway and Ross proffer that the second boat was built and laid out in a similar manner to the first.[246] The wreck of *Phoenix I* was studied by a team of nautical

---

[244] Crisman, *Ticonderoga*, 2014; Schwarz 2012; Belisle and Lepine 1986 and Belisle and Lepine 1988; Crisman, *Heroine*, 2014.
[245] Crisman, *Ticonderoga*, 2014, 268.
[246] Ross 1997, 39; Hemenway 1867, 692.

archaeologists led by George Schwarz in 2009 and 2010, the results of which were published in Schwarz' dissertation in 2012. Though the earlier Champlain steamer was also lacking in historical construction plans, it was much better preserved where it sank in a deep part of Lake Champlain, and therefore most of its frames are extant well above the turn of the bilge. Schwarz and team were able to take goniometer recordings of 18 frames, 13 more than were recorded on *Phoenix II*, providing much more frame section detail overall.[247] Unfortunately, the upperworks, including the deck beams and knees, no longer exist, and analogous information was looked for elsewhere.

Since no historical ship lines for *Phoenix I* were ever located, Schwarz relied heavily on Jean-Baptiste Marestier's lines of *Chancellor Livingston*, whose lines drawings and construction plans were deemed to be the most relevant contemporary source available. Built in 1816, only four years prior to *Phoenix II*, *Chancellor Livingston*'s design was also relevant to the later boat.[248] Generally, steamboat innovations appeared first on the Hudson River steamboats, like *Chancellor Livingston*, and made their way north to Lake Champlain within a couple of years. Evidence for this can be seen by the arrival of the first steamboats themselves to these areas, just as *North River Steamboat Clermont* appeared on the Hudson River in 1807 and was followed by the second operational passenger steamboat, *Vermont*, on Lake Champlain in 1809.[249] In the 1820s, the first walking-beam engines were adopted on the Hudson River, and Lake

[247] Schwarz 2012, 182.
[248] Marestier 1824, 51.
[249] Ross 1997, 23; Hemenway 1867, 686; Thompson 1853, 215.

Champlain shipbuilders followed suit with *Burlington* (1837-1854) in the 1830s.[250] Similarly, with *Chancellor Livingston* having been built for the Hudson River in 1816, the innovations present in that hull could have easily made their way north to Lake Champlain in the following four years. That said, the two contemporary steamers were built by different builders, with potentially differing ideas of how to build a successful steamboat. Therefore, the lines and construction of *Chancellor Livingston* were merely looked at for guidance, prioritizing reliance on the archaeological evidence.

Additionally, *Lady Sherbrooke*, built for the St. Lawrence River, and *Heroine*, built for the western rivers, were consulted as potential sources of comparison. Although the *Lady Sherbrooke* was built only three years earlier than *Phoenix II*, and geographically was quite close on the St. Lawrence River, it was built with a side-lever engine, it included a mast, and its frames had more deadrise than those of *Phoenix II.* Most likely these design choices were deemed necessary due to the St. Lawrence's strong current and sea-like conditions near the Québec City end of *Lady Sherbrooke*'s route. *Heroine*, on the other hand, was built twelve years later for the shallow, fast-running Ohio and Mississippi Rivers, and was narrow and very flat-floored. Though neither boat resembled *Phoenix II* identically, with so few archaeological examples to choose from, *Lady Sherbrooke* and *Heroine* were useful comparative examples.

[250] The exact date of the first successful walking-beam engine is contested, but was introduced at least by 1822, see Lewis 1997, 6.

Reconstructing *Phoenix II*'s Ship Lines

The lines reconstruction represented in Figure 6-2 combined several aspects of the archaeological evidence, historical documents, and contemporary examples. The method followed by the author, including observations made throughout the process of recreating *Phoenix II*'s lines, will be outlined here.

As the port side of the vessel was best preserved, this side is shown in the reconstruction despite the naval architect's convention of showing the starboard side.[251] The length, beam, and depth taken from *Phoenix II*'s Certificate of Registry set the boundaries for this reconstruction, so that between perpendiculars the total length was 143 feet, meaning the transom extended slightly beyond this.[252] The beam, as seen in the body and half-breadth plans, was 27 feet 3 inches (8.3 m). The depth of hold at 9 feet 6 inches (3 m) would have been measured from the upper surface of the limber boards to the bottom of the main deck beams at the midship frame, giving a height of 11 feet 4 ½ inches (3.47 m) from the bottom of the keel to the bottom of the main deck beams. Assuming that the deck beams were 9 inches (229 mm) by 9 inches (229 mm), based on

[251] "While traditional and modern methods, such as showing hulls with their bows to the right of the drawing or using certain numbering systems for stations, serve their intended purposes quite well, they may not be compatible with the artifact you are about to illustrate. If your hull was best preserved on the port side and most of the results of research came from that side, then your drawings should show the port side on all three views (bow to the left on the sheer and half-breadth plans, after half of the hull to the left of the centerline on the body plan)" from Steffy 1994, 244-245.
[252] Though it is possible that the 143-foot length indicated in the Certificate of Registry included the entire length of the deck, to the end of the transom, this reconstruction interpreted the length as to the top of the sternpost (extrapolated from the archaeological remains). This method was chosen for two reasons: (1) since the transom reconstruction is conjectural, if it extended the deck abaft the sternpost (which it is assumed to have done) there is no way to know how far; and (2) the frame of *Chancellor Livingston*'s lines drawings indicates it was constrained to the top of the rabbet line along the sternpost, not the deck along the transom; Crisman's reconstructed lines of *Ticonderoga* follow this assumption as well. See Marestier 1957, 73: Plate I: fig. 2 and 5; Crisman, *Ticonderoga*, 2014, 268.

the heavy proportions of the framing timbers and Schwarz's estimate for *Phoenix I*, and allowing for deck planking 1 ½ inches (38 mm) thick to match the ceiling planking, this placed the sheer line 12 feet 3 inches (3.73 m) above the bottom of the keel.

The reconstruction illustrates a sheer that increases 8 inches (203 mm) in height at the bow and 6 inches (152 mm) at the stern.[253] This slight upward sloping of either end would have helped prevent the long steamboat hull from hogging. The keel's molded dimension was only measurable at the bow and the stern, but was unlikely to have increased or decreased throughout, so a 9-inch (229-mm) molded keel was drawn on both the sheer and body plans. Since the keel's sided dimension did vary throughout, tapering from 13 inches (330 mm) amidships at sections J, ꝏ, and 24, to 7 inches at the bow and 8 inches (203 mm) at the stern, this was reflected in the half-breadth plan. On the body plan the keel is represented at its widest, 13 inches (330 mm).

[253] Estimates based on *Heroine* models (Glenn Grieco, pers. comm.).

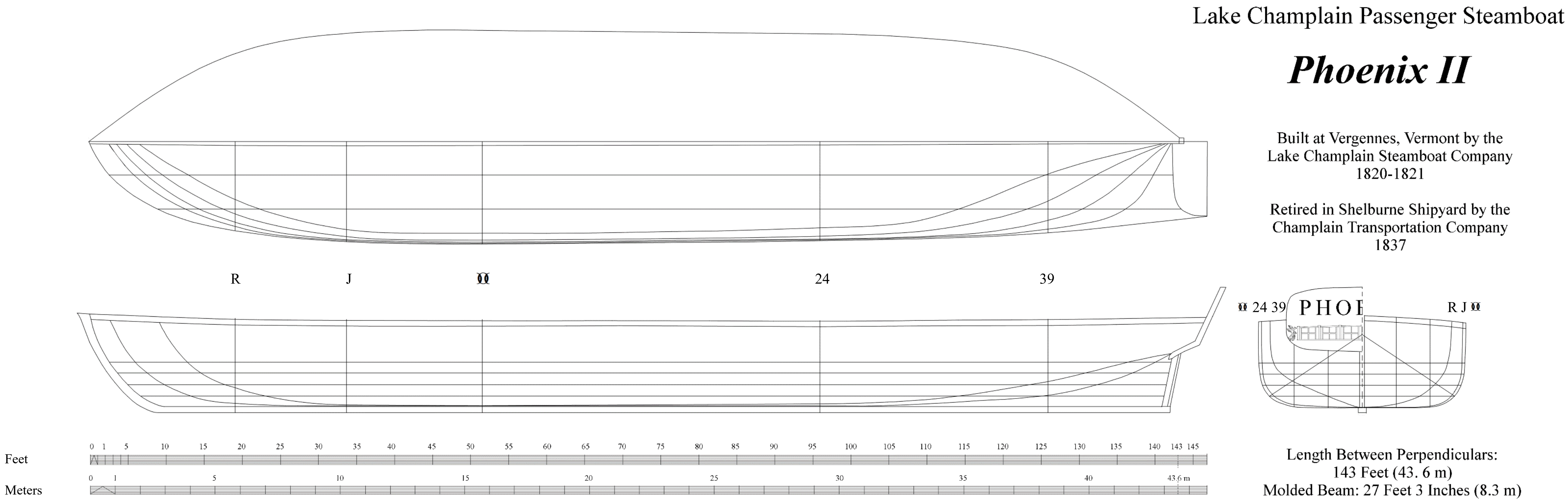


Figure 6-2. Reconstructed lines of *Phoenix II*. (Drawing by C. Kennedy, 2018)

The stem and sternpost were informed by the archaeology as well as the length dictated by the Certificate of Registry. The profile plan of the wreck was laid beneath the tracing paper in order to guide the lines based on the physical evidence. As the sternpost was preserved well enough in order to record the angle at which it raked, this was extrapolated to the height of the deck, which, as previously mentioned, would have been 6 inches (152 mm) higher at the stern than at the midships frame due to the sheer of the deck. From the forward face of the sternpost, the top of the stem was placed 143 feet (43.6 m) forward. With not much to go on from the badly-eroded archaeological remains of the stem, a long, raking curve was drawn upwards to create a deck length of 143 feet (43.6 m) between perpendiculars.

A short transom would have increased the overall deck surface area, and would have projected out over the rudder, allowing for improved control over the after end of the long, barn-door style rudder. Unfortunately, with no archaeological remains to guide it, the transom reconstruction was largely conjectural. Its shape and size was based on the transom of the *Chancellor Livingston* and *Ticonderoga*. The transom extended past the sternpost 3 feet 9 inches (1.14 m), and had a 3-foot-6-inch (1.07-m) angled aft side, where most likely the shipwrights would have included windows to provide light to the cabins below deck, as illustrated on the body plan. The transom was reconstructed to extend 4 feet (1.22 m) above the deck, providing a high railing/wall at the stern of the boat. Both the *Chancellor Livingston* and the 1813-built *Washington*'s transoms were drawn extending to 4 feet (1.22 m) above deck as well.[254]

[254] Marestier 1957.

The body plan was informed directly by the archaeologically-recorded sections of frames R, J, ꝏ, 24, and 39. The five sections were drawn at 1 inch =1 foot, or 1:12 scale, and all were drawn from a view facing aft. In order to use the archaeological sections to inform the body plan, the five illustrated sections were overlaid in *GIMP 2.0*, an open-source photo editing software that allowed for easy manipulation of the separate archaeological drawings. Once they were rotated so that the keel and keelson in each separate section were levelled (eliminating the port list that currently affects the wreck and is illustrated in the archaeological section drawings), sections 24 and 39 were mirrored, based on the premise that ships' hulls are symmetrical. Since the port side of the hull was best preserved, the body plan showed the stern sections (24 and 39) on the left and the bow sections (J and R) on the right. The scale of the lines drawing, ½ inch = 1 foot, or 1:24, required that the 1:12-scale archaeological sections be halved in size within the *GIMP 2.0* software to match. The separate sections were color-coded in order to differentiate the different sections, and the final product was printed, ensuring the scale was not altered (Figure 6-3).

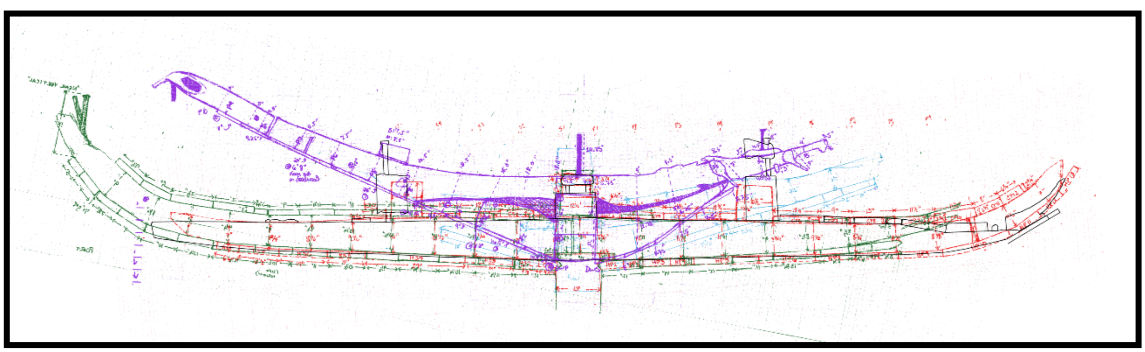


Figure 6-3. Five frame sections, R, J, ꝏ, 24, and 39, color coded and overlaid to assist with body plan lines reconstruction. Frame sections 24 and 39 were mirrored so as to show the stern port side on the left, and the bow port side on the right. (Drawings and image by C. Kennedy, 2017)

Once printed, the curves of each section were traced along the outer edge of the frame, inside of the hull planking. The midship section was extrapolated into fair curves, symmetrically, that turned into nearly-vertical sides that fit the beam as dictated by the Certificate of Registry. The other sections were traced and extrapolated (on their appropriate sides) as naturally as a fair curve allowed, also with nearly-vertical sides (Figure 6-4).

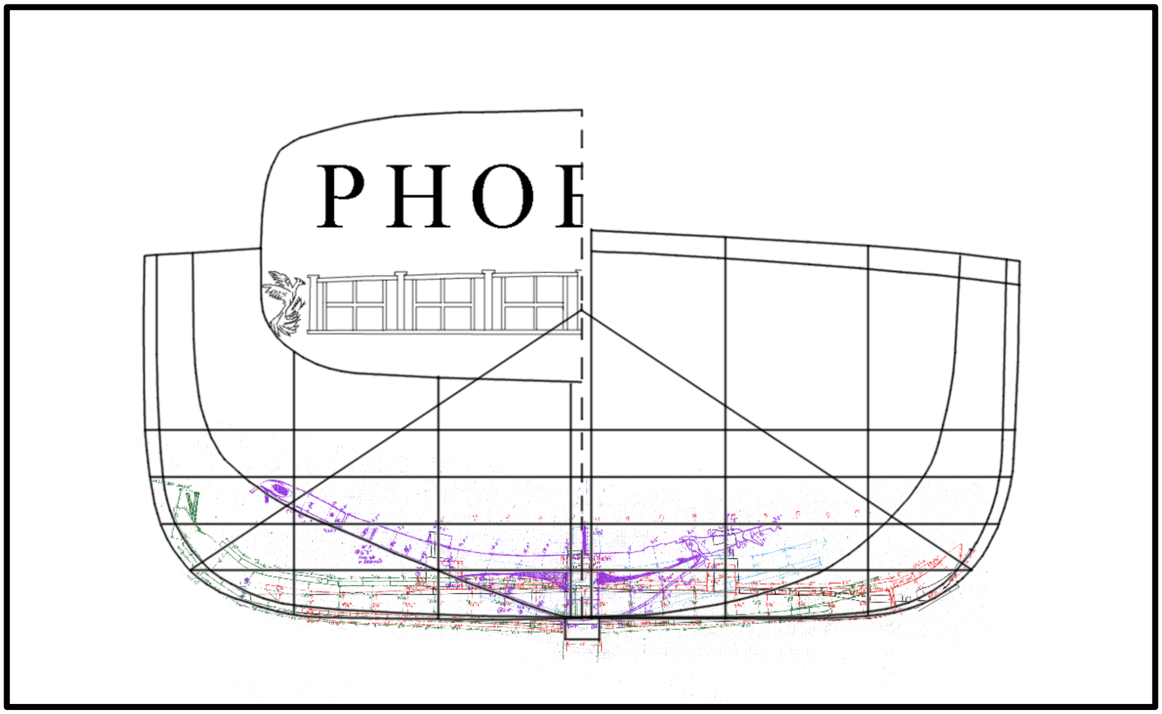


Figure 6-4. Body plan showing the curves created by extrapolating the sections taken directly from the archaeological remains. (Drawing by C. Kennedy, 2018)

Once the section lines were drafted on all three views, four waterlines were added, spaced at 1-foot-6-inch (0.46-m) intervals from the keel up to the highest extent of the archaeological remains (which occurred only on frame section 39). The lowest waterline shows a narrow entry at the bow and a distinct narrowing towards the stern; however, the entire middle of the hull is boxy and wide. Waterlines 2, 3, and 4 closely mimic the curve at the bow, and at the stern show a gradual widening of the hull at each level. Two buttock lines served to correct the waterlines and section lines. These mimicked the curve of the bow on the sheer plan, and sloped up slightly at the stern to converge directly beneath the transom.

Through the process of continuously fairing all three sets of lines, the section curve for frame R required more adjusting than the others. The need to correct this line is believed to be due to an original error in rotating the archaeological section drawing to level (from the wreck's portside list). Additionally, since the forward end of the wreck was most exposed, it is possible that the heaviest structural timbers here were damaged, splayed, and warped. This warping altered the angles of the floors in relation to the centerline timbers, which made levelling the section based on the keel and keelson particularly difficult. Aside from frame R's slight need for adjustment, the faired lines conformed closely to the archaeological remains.

Interpreting ***Phoenix II***'s Hull Lines

The reconstructed lines of *Phoenix II* show a long, raft-like boat, and beamy hull sections with fairly rounded turns of the bilge (see Figure 6-2). These lines can be compared to historical and archaeological examples to determine in what ways these lines resembled other contemporary steamers.

In contrast to *Phoenix II*'s round bilges, *Ticonderoga*'s reconstructed lines display a sharp turn of the bilge, at least at the midship frame section (Figure 6-5). *Phoenix II* was built seven years later than *Ticonderoga*, showing that the development in steamboat hull designs favored more natural-looking lines than in the earliest steamers that were built with sharp angles, as can be seen in the reconstruction of *Ticonderoga*'s midship frame section (Figure 6-6).[255] Otherwise, *Phoenix II*'s reconstructed lines are quite similar to *Ticonderoga*'s reconstructed lines. The waterlines and buttock lines align very closely, and though *Ticonderoga* was smaller, the length-to-beam ratios of both were similar, 1:5.25 for *Phoenix II* and 1:5 for *Ticonderoga*.

Not surprisingly, *Phoenix II*'s lines appear very similar to Schwarz's reconstructed lines of *Phoenix I* (Figure 6-7). The length-to-beam ratios are similar, though the earlier of the two was slightly longer and narrower, with a length-to-beam ratio of 1:5.41 compared with *Phoenix II*'s 1:5.25.[256]

---

[255] "The first boats built under Mr. Fulton's direction were flat bottomed […] the sides had little curvature and were nearly vertical. The *Fulton*, a boat built in 1813 to navigate Long Island Sound, is the first boat where the angles of the cross section were rounded, and where the ends of the decks were raised. This experiment having succeeded, the boats built since that time have differed less from an ordinary boat which has a very flat bottom and more or less sharp ends," from Marestier 1957, 7; Similar curves were generated by Schwarz for *Phoenix I* (2012, 179).
[256] Schwarz 2012, 179.

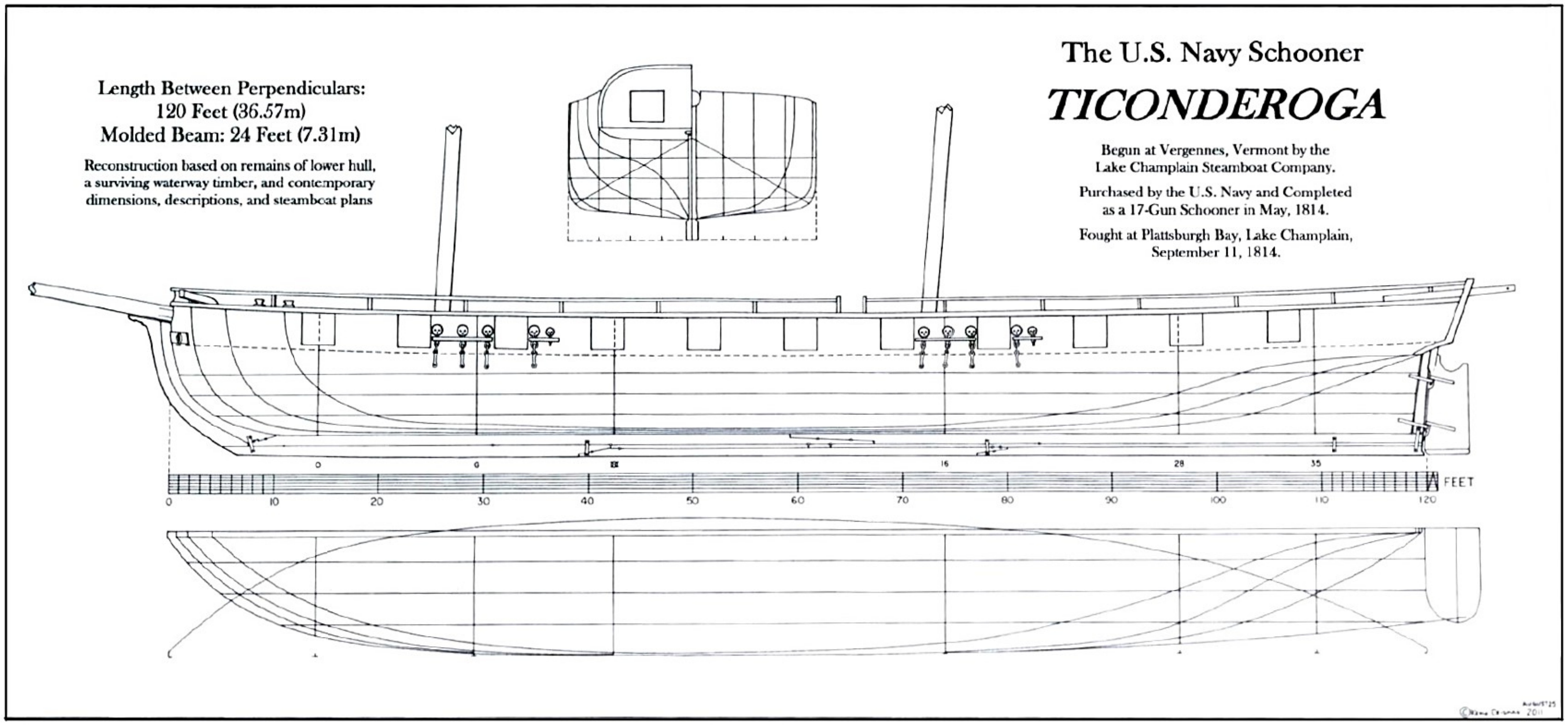


Figure 6-5. Reconstructed lines of *Ticonderoga*. In Crisman's reconstructed body plan (top), the turn of the bilge is quite angular compared to that of *Phoenix II.* (Drawing by K. Crisman, reprinted from Crisman, *Ticonderoga*, 2014, 268)

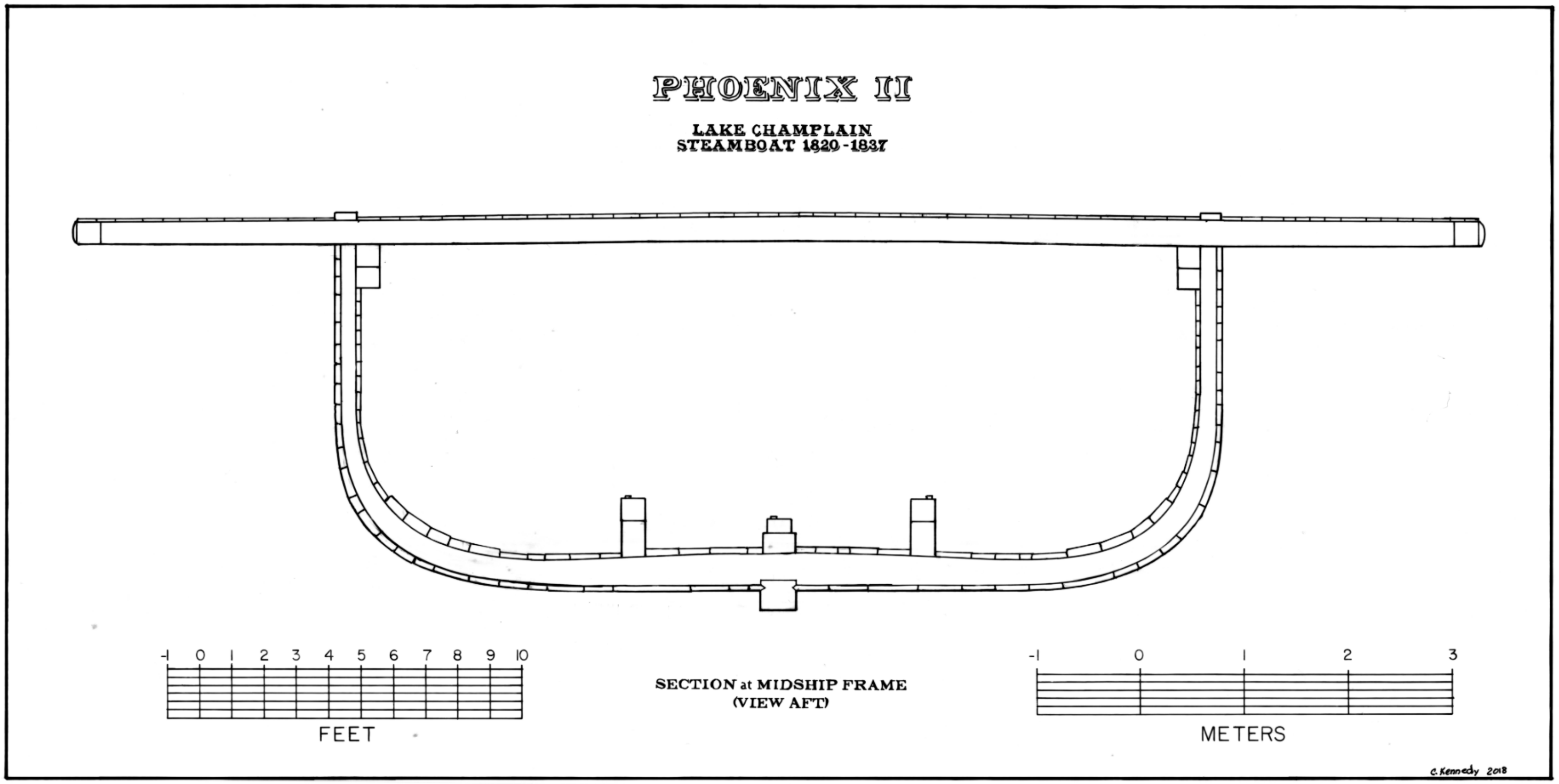


Figure 6-6. Midship reconstruction of *Phoenix II*. The round turn of the bilge differs greatly from that of *Ticonderoga*. (Drawing by C. Kennedy, 2018)

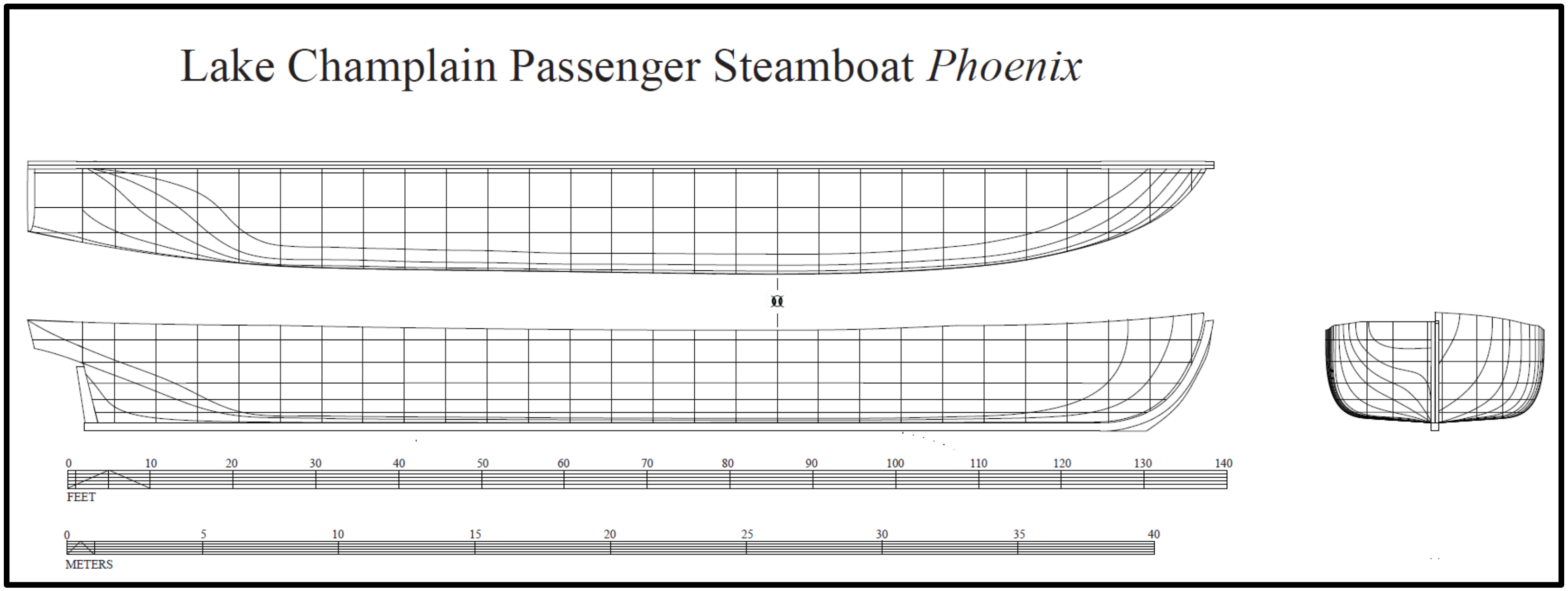


Figure 6-7. Reconstructed lines of *Phoenix I.* The bow is much narrower than *Phoenix II*'s bow. (Drawing by G. Schwarz, reprinted from Schwarz 2012, 179)

Compared with the Hudson-River steamer *Chancellor Livingston*'s lines, *Phoenix II*'s lines show a much fuller bow and stern on the breadth plan. In fact, Marestier's drawing of *Chancellor Livingston*'s bow lines appears unrealisticly narrow with excessive hollow in the waterlines (Figure 6-8). In a comparison of body plans, *Phoenix II*'s turn of the bilge was more rounded than *Chancellor Livingston*'s, which conforms with the trend towards more rounded lines in later designs.[257] Aditionally, *Phoenix II*'s depth from the bottom of the keel to the bottom of the deck was 11 feet 6 inches (3.51 m), whereas *Chancellor Livingston* measured 11 feet (3.35 m) from bottom of keel to bottom of deck, making the 1820-built lake boat slightly deeper and wider, but shorter in length than the earlier, 1816-built river boat.[258]

[257] Marestier 1957, 7.
[258] Principal Dimensions included found on Pl. I, Marestier 1824.

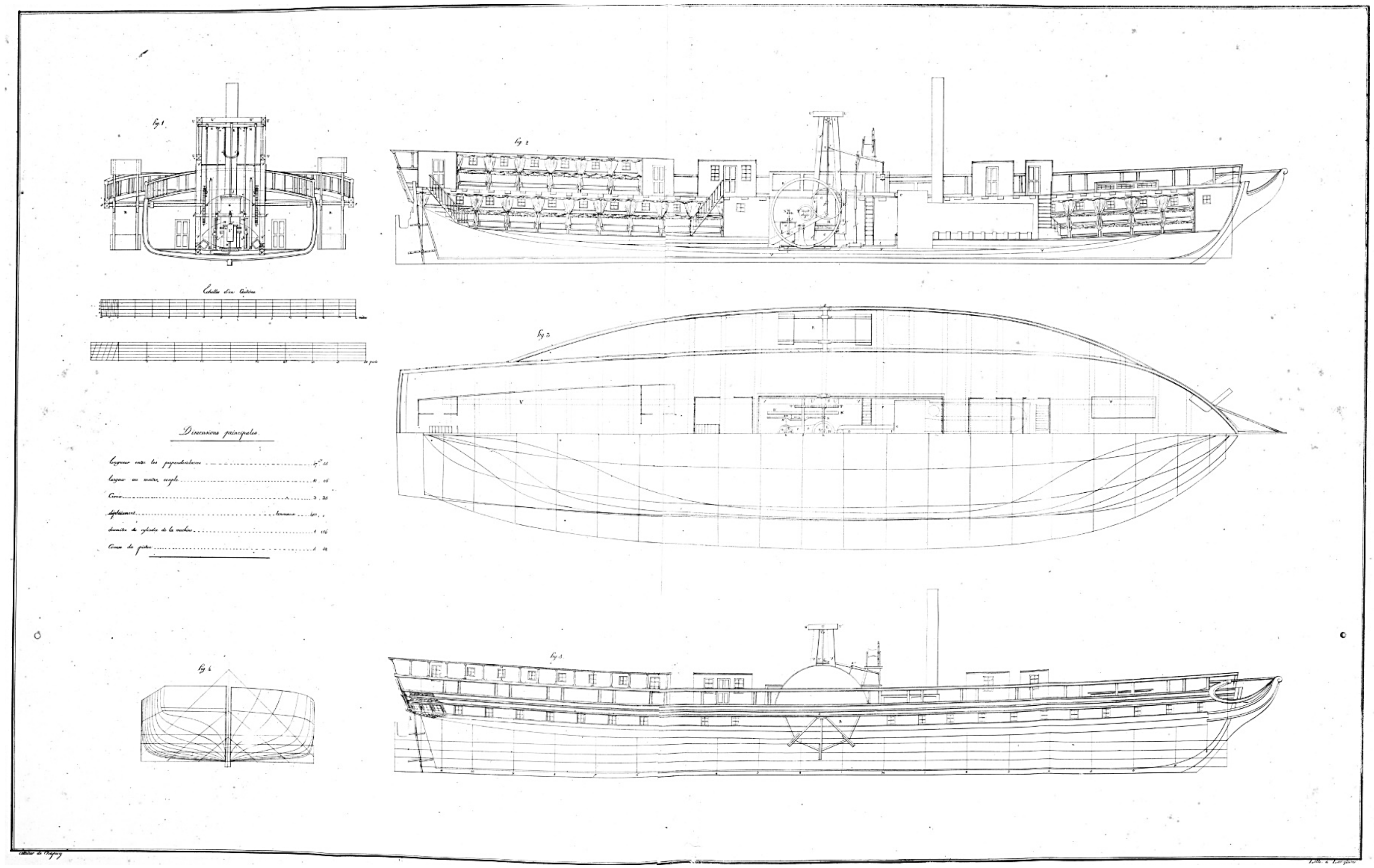


Figure 6-8. Marestier's plans of *Chancellor* Livingston. The breadth plan (fig. 2 - middle) shows an unrealistically-narrow bow entry, differing greatly from *Phoenix II*'s rounded bow. (Reprinted from Marestier 1824, Pl. I)

Phoenix II's lines are also quite similar to those of the western river steamer *Heroine*, with a couple of exceptions. Though overall the lines of both boats show a long, narrow hull, the exceptions include the differences in depths, which on *Heroine* was 6 feet 6 inches (1.98 m) from the top of the keel to the main deck, whereas *Phoenix II* was 11 feet 6 inches (3.51 m) from the top of the keel to the deck, a difference of 5 feet (1.52 m).[259] This is representative of one of the major differences between eastern river (and Lake Champlain) steamers and western river steamers; since the lake boats were not nearly as restricted in their drafts, they could be built with deep hulls, whereas the western river boats necessitated very shallow drafts to traverse the shallow rivers. Another striking difference was the strange transom of *Heroine*, which was no more than a couple of planks jutting out over the sternpost to provide leverage with which to help control the rudder, whereas *Phoenix II*'s transom included windows below deck, and extended 4 feet (1.22 m) above deck to create a railing at the stern.

[259] Crisman, *Heroine*, 2014, 148.

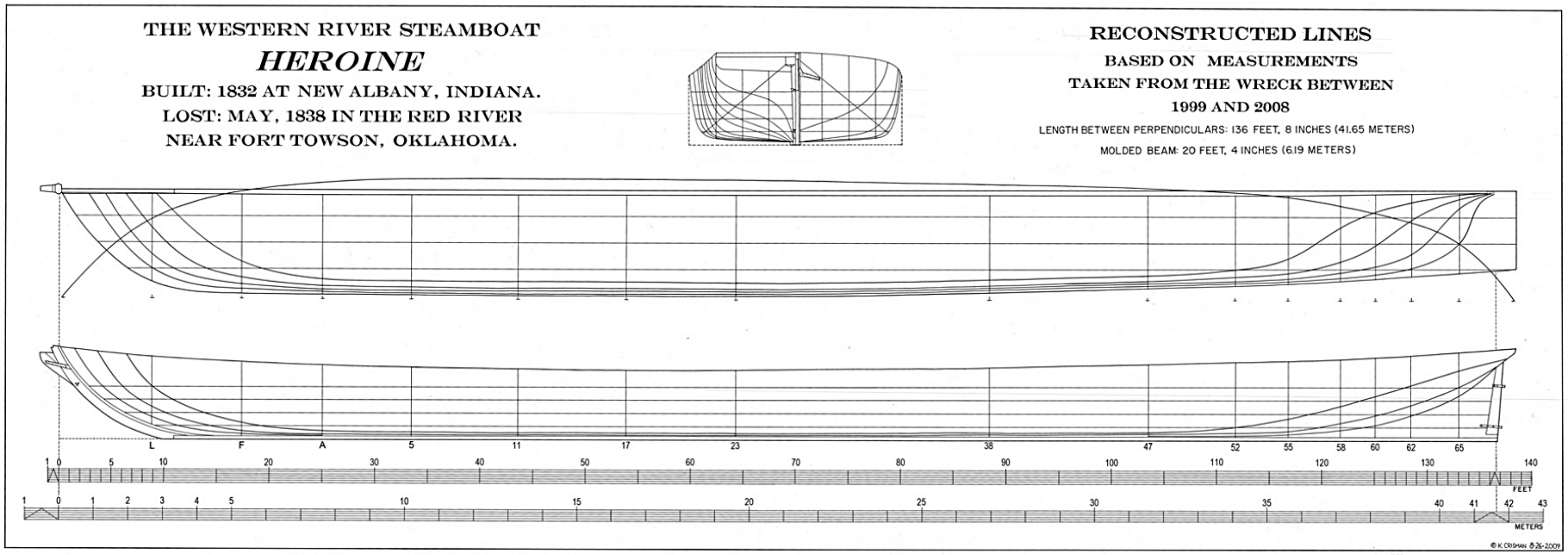


Figure 6-9. Reconstructed lines of *Heroine*. The western river steamer had a much shallower draft than *Phoenix II*, and its transom was much smaller. (Drawing by K. Crisman, 2009, reprinted from Crisman, *Heroine*, 2014, 149)

Overall, the lines of North American inland waterway steamboats in the 1810s, 1820s, and 1830s, were similar. Long, narrow boats, with fairly shallow drafts, with nearly flat bottoms and somewhat sharp turns of the bilge. The boats all widen fairly quickly at the bow, and their midship bends extend as far as possible to create ample room for engine machinery, boilers, saloons, and passenger cabins. The greater the room available on board for passenger cabins, the greater profit the boats could make for their owners. The nearly flat bottoms are a reflection of this need, as having a flat-floored vessel allowed for this extra room in the hold. Lateral resistance was not much of a concern: unlike sailing ships, these steamboats did not have the wind in their sails pushing them sideways. Furthermore, a flat-floored boat meant reduced drafts, allowing passenger boats to steam right up to near-shore docks, streamlining passenger access and reducing travel times. *Phoenix II*'s beamier design may have been intended to accommodate more passengers, as well as the two boilers it carried. It also had a deeper depth of hold than its predecessor, *Phoenix I*, even though it was shorter in length.

Shallow draft was a useful feature for approaching near-shore areas, but in many cases the lack of shoreside infrastructure, such as docks, likely made shallow draft irrelevant. During *Phoenix II*'s career steamers were still using small boats to ferry passengers to and from many landings, as evident from the writings of British traveler Basil Hall. One of Hall's journal entries from September 1827 mentioned "the rattle and bustle of lowering down the boat [that] was sure to banish all remaining chance of sleep" during his night passage aboard an unidentified Lake Champlain steamboat.[260]

[260] Hall 1974, 5.

Although there are no lines drawings available to date, the historical information and archaeological data collected from the hulls of *Burlington* (1837-1854) and *Whitehall* (1838-1853) indicate that by the 1830s the trends in steamboat design on Lake Champlain were geared towards longer, narrower, shallower boats. *Burlington* was 185 feet (56.4 m) long and 25 feet (7.62 m) wide, with a depth of hold of 9 feet (2.74 m), and *Whitehall* was 215 feet long (65.5 m), 23 feet (7.01 m) wide, also with a depth of hold of 9 feet (2.74 m), both much longer than *Phoenix II*, but with reduced beams and depths of hold.[261] If this is what followed, it seems apparent that *Phoenix II*'s design fit more closely with the earlier class of steamers that directly followed in the wake of Fulton's first boats.

[261] Ross states *Burlington*'s length was 190 feet (57.9 m) (1997, 63, 65), but the CTC Records showed the boat was 185 feet (56.4 m) long, see CTC Records, Collection A, Carton 3, Folder 57, "Miscellaneous Papers October 1-November 11, 1838."

CHAPTER VII

ENGINE AND BOILER PLACEMENT AND RECONSTRUCTION

Phoenix II's engine and boilers were recovered from the hull by the Champlain Transportation Company before the steamer was sunk in Shelburne Shipyard so as to repurpose the valuable machinery, either as a functioning engine in a new boat, or as dismantled parts to repair other engines. Historical sources include only very general descriptions of the engine, or small clues to its details at best, and iconographic sources claiming to show *Phoenix II* are unreliable. With no reliable historical or iconographic evidence of *Phoenix II* to illustrate the placement or makeup of its engine, and without the actual engine and boilers themselves available for study, clues to their designs must be sought from contemporary examples, like the plans for *Chancellor Livingston* (as it was documented by Marestier), the plans for St. Lawrence River steamers from Boulton and Watt, and the scant archaeological evidence for machinery within the hull of *Phoenix II*.

A thorough understanding of how these engines work can be found in contemporary texts such as Thomas Tredgold's posthumously-published three-volume work: *The Steam Engine: Its Invention and Progressive Improvement.*[262] Similarly, in addition to Marestier's excellent plates and figures, the French engineer also described in detail the working parts of contemporary steamer *Chancellor Livingston*'s engine in his

[262] Tredgold 1838.

Mémoire sur les bateaux à vapeur des États-Unis d'Amérique.[263] Combining the information on crosshead-beam engines and their constituent parts from these historical sources with the clues derived from the hull of *Phoenix II* allows for a plausible reconstruction of the engine and its placement within the hull.

Crosshead-Beam Engines

Phoenix II was equipped with a crosshead-beam, double-acting (or expansive), condensing steam engine, because that was the only style of engine in use at this time on Lake Champlain.[264] The double-acting condensing engine was famously designed in the 1770s by James Watt, who introduced the concept of a condenser being separate from the cylinder to allow the cylinder to remain heated and therefore lose less energy than the engine designs that continuously heated and cooled the cylinder. The double-acting aspect of the design used the expansive power of steam in two directions, which was an improvement over using expanding steam in only one direction, and allowed the vacuum created by condensed steam to move the piston in the other direction.[265] A crosshead-

---

[263] Marestier 1824. Note that this is the original French version; the translated 1957 edition unfortunately does not include the detailed description of *Chancellor Livingston*'s engine.

[264] For a discussion of double-acting or expansive condensing engines, see Tredgold, 1838: 28. The walking-beam engine only became popular in the 1830s, see Lewis 1997, 5-6; *Burlington* (1837-1854) was the first Lake Champlain steamer with a walking-beam engine, as evident by a letter from engine makers, Ward & Co., to CTC agent Philo Doolittle: "Something has been said about an open beam for the engine which was not contemplated in the contract. Is it to be understood that we furnish one […]?" with the response sent 10 December 1836: "In the contract for the last engine which we made with you we did not make provision for a wrought iron beam. Our people are all so decidedly in favor of them, that we shall also have to have one of that description for the last engine," from CTC Records, Collection A, Carton 3, Folder 20, "Miscellaneous Papers, October 17-November 3, 1836," 29 October 1836. The open beam in these letters describes the contract for the first walking-beam engine on Lake Champlain.

[265] Tredgold 1838, 27-28; also, "The double acting engine, in general construction, resembles the single one described in the preceding article. (Art. 386.) It differs in having a passage from the boiler both to the top and the bottom of the cylinder, and a similar passage from both to the condenser […] The force of the steam impels the piston in both directions," see Tredgold, 1838: 185.

beam engine is made up of seven major working components: the cylinder, the piston, the crosshead beam, the connecting rod, the side lever, the crank arm, and the crankshaft. The crankshaft is what connects to the paddle wheels to the engine, just as an axle works in a car.[266]

Double-acting engines work by directing steam from the boilers alternatingly into the top and bottom of the cylinder by a series of steam valves. To begin the motion of the piston inside of a cylinder, assuming the piston was positioned at the top of the cylinder, steam generated from the boiler was first directed into the top of the cylinder by the steam valve chest, forcing the piston downward. As the piston neared the bottom of the cylinder, a series of valves and cocks within the steam valve chest would be opened or closed as necessary to redirect steam from the boiler into the bottom of the cylinder, which would act expansively to move the piston upward again. The steam that was previously directed into the upper end of the cylinder was forced out, back into the steam valve chest, where it was directed to the bottom of the steam valve chest. Meanwhile, a new supply of steam from the boiler was again directed into the top of the cylinder, forcing the piston down again. This recurring distribution of steam to the top and bottom of the cylinder moved the piston up and down.

After having pushed the piston down and then up again, the steam begins to lose its expansive power as it cools. A fresh supply of steam from the boiler entering the top of the cylinder forced the exhausted steam out of the bottom of the cylinder and into the

[266] The term crankshaft is used by Tredgold (1838, 243) to describe what Stevenson (1859, 95) calls the "paddle-wheel axle," and what Crisman terms the "main shaft" (2014, *Heroine*, 140). The terms are interchangeable and describe the one or two shafts that connect the energy from the piston to the rotation of the paddle wheels via a crank arm.

condenser, where it was hit with a blast of cold water from an injection pipe running through the hull of the boat to the lake. The cold water cooled the used steam, condensing it back into water. The condensing process created a vacuum, which pulled the used steam from the cylinder and steam valve chest into the condenser, constantly repeating that process.

Meanwhile, the piston in the cylinder was connected to the center of the crosshead beam, positioned high above the cylinder and running transversely across the hull within a sturdy wooden frame. The up-and-down motion of the piston (known as the stroke) forced the crosshead beam up and down as well. Also fitted to the crosshead beam, and therefore subject to the same motion as directed by the piston, were two pairs of arms. One of these pairs of arm were connected to side levers (one on either side of the cylinder), which operated the air pump and pump for the hot water cistern.

The arrangements of the levers and connecting rods to operate the air pump and hot water cistern varied based on the design of the engine. For example, Marestier shows *Chancellor Livingston* with two separate levers: one lever was connected to a weight that serves to balance out the gravitational force on the piston inside the cylinder. As the motion of the lever moved its ends up and down, it powered a small piston connected to a pump fitted between the hot water cistern and boiler, which forced water collected in the former to return back to the latter. The other beam was supported by a pedestal on the bottom of the hull, and connected to the piston within the air pump. On the upward motion of the air pump piston, a vacuum would form, pulling water from the condenser into the air pump, which would subsequently be collected into the hot water cistern (Figure 7-1).[267]

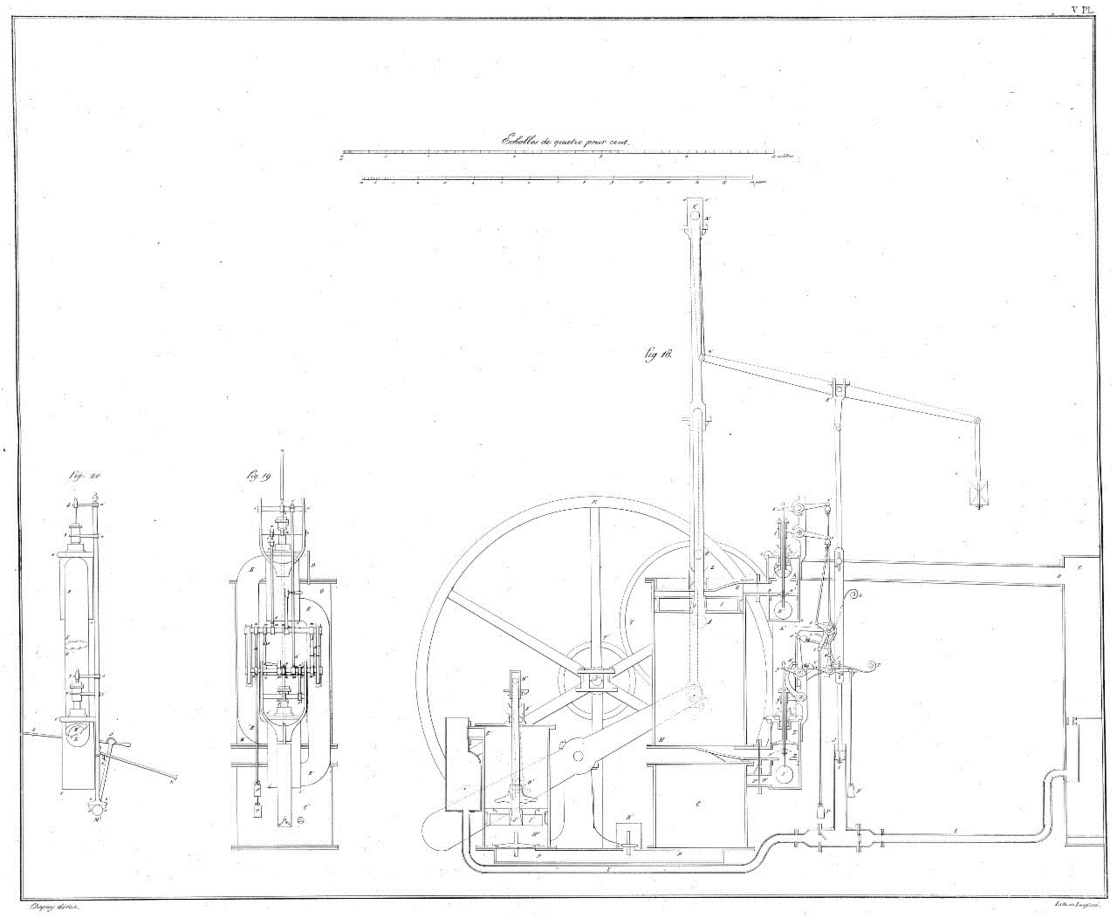


Figure 7-1. Marestier's plan of *Chancellor Livingston*'s engine. (Reprinted from Marestier 1824, Pl. V)

In Boulton and Watt’s design, on the other hand, one pair of levers were connected transversely by three separate shafts, each attached to three separate pistons. Along one shaft was a connecting rod to the piston in the air pump, which served to

[267] Marestier 1824, Pl. V.

create the vacuum necessary to pull the water from the condenser. A second shaft was connected to a piston inside the hot water cistern, directing water both out of the boat as waste, and also back into the water pump, which was housed separately from the cistern. In the water pump, the third shaft connected to a third piston pumped the collected water back to the boiler. Therefore, the motion of the lever created by the cylinder piston served to operate three other pistons at once (Figure 7-2).

In both designs, as the large crosshead beam moved up and down, the motion of the beam was transferred to pistons inside the air pump, the pump or piston in the hot water cistern, and the pump that sent water either back to the boilers or outboard. This allowed the air pump to pull the water from the condenser by means of a vacuum, which was then transferred to the hot water cistern through one-way valves. The chosen arrangement of pistons then pumped some of that water from the hot water cistern through a pipe running beneath the entire engine arrangement back to the boilers, where the hot water was reheated to create more steam. This allowed for the boiler to save energy by not having to rely solely on supplying itself with water from the lake, which is cold to begin with and requires more energy to heat than the already-hot water being recycled from the hot water cistern. Excess water that collected in the hot water cistern was pumped out of the boat back into the lake. Though there is some energy loss through the process, the overall effect of having a condenser, air pump, hot water cistern, and water pump creates a more efficient engine-and-boiler arrangement than if the boiler was only supplied by water coming directly from the lake.

Returning to the crosshead beam, another pair of arms, called connecting rods, connected the crosshead beam to the crank arm. Through the connecting rods, the up-and-down motion of the crosshead beam was transferred to a circular motion for the crank arm, which turned the crank shaft (paddle wheel shaft) in a circle, rotating the paddle wheels. On the earliest steam engines, like the double-acting engine employed on *Phoenix II*, engineers included flywheels in the design. The crankshaft, in these cases, was fitted with a large circular gear, which served to turn another gear that was connected by a short shaft to a flywheel. The flywheel's entire purpose was to alleviate the irregular motion created by the engine: "irregularity in motion is naturally very great in engines in which steam is allowed to expand. The pressure at the beginning of the piston stroke, which is equal to 8 or 10 times atmospheric pressure, is reduced, toward the end of the stroke, to one or two times that pressure. A fairly heavy flywheel is therefore necessary if reasonably uniform motion is to be obtained."[268] Since flywheels were necessarily heavy, they were often fairly large, like *Chancellor Livingston*'s 12-foot-8-inch (3.86-m) flywheel, but there was no rule for exactly how large a flywheel had to be in proportion to the rest of the engine.

[268] Marestier 1957, 26; "La roue dentée T engrène avec une autre plus petite T*'* placée sur l'arbre d'un volant double R*'* destine à entretenir et à régulariser le jeu de la machine," from Marestier 1824, 85. Flywheels were phased out of designs in the 1830s, as "the paddle-wheels, from their large diameter, become good generators of momentum, and act in the same way as the fly-wheels of land engines in regulating their motion," see Stevenson 1859, 84.

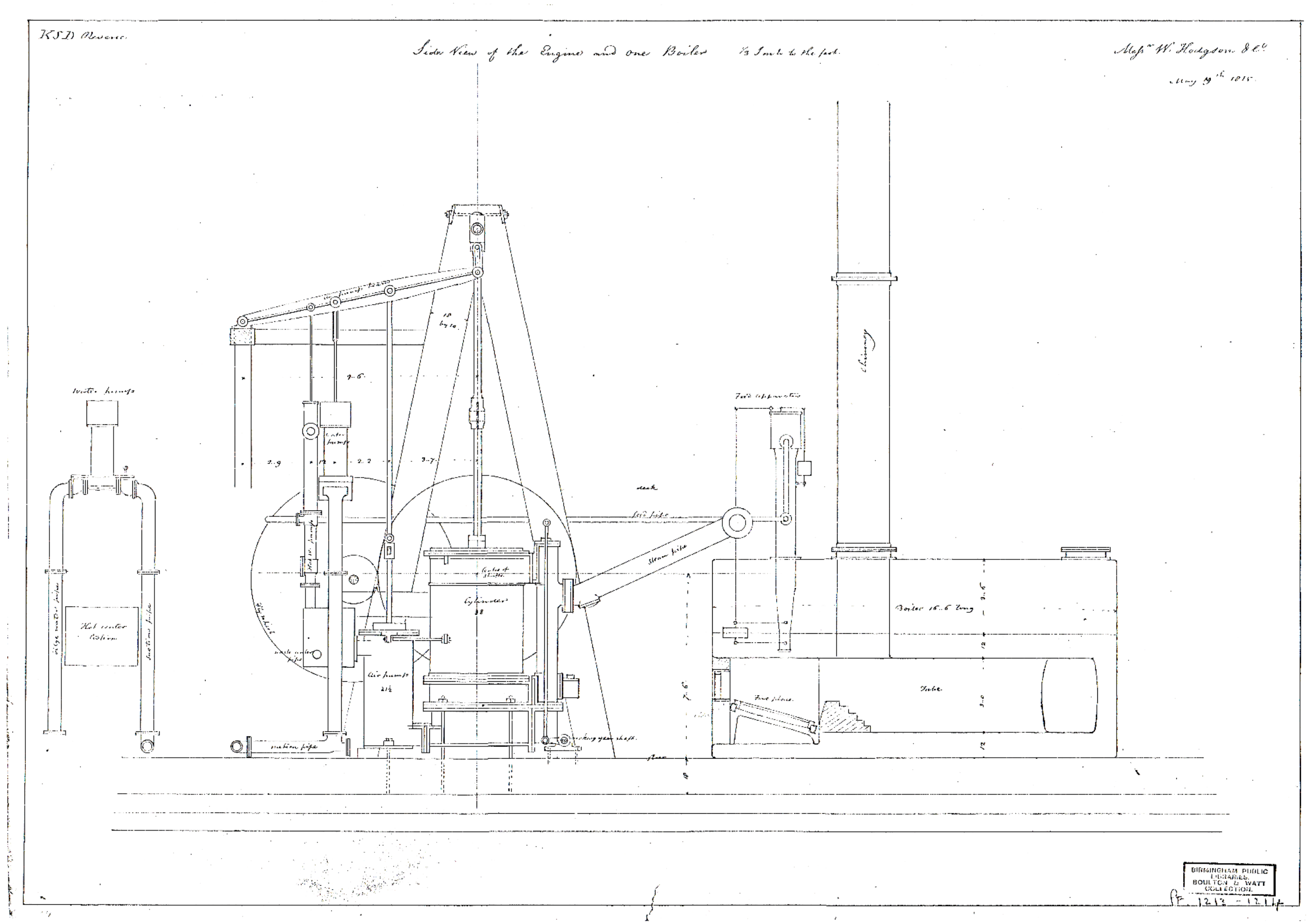


Figure 7-2. Boulton and Watt's engine design for Messrs. W. Hodgson & Co., May 19th 1815. (Reprinted from Birmingham Public Library, Boulton & Watt Collection)

Phoenix II's Reconstructed Engine

Phoenix II's first engine, the one built by McQueen, is what will be discussed here since the details of the second engine are unknown. The McQueen engine, salvaged from the hull of *Phoenix I* soon after it wrecked, had a 42-inch (1.07-m) cylinder and a four-foot (1.22-m) stroke.[269] These two measurements were used to reconstruct the entire engine with some degree of plausibility, as they dictated the power to be generated. Some engine components were informed by the engine diameter and stroke, while others could have been built in a variety of different ways, specific to the engineer's personal preferences (Figure 7-3).

[269] See Chapter II: *Phoenix II*'s First Engine for details.

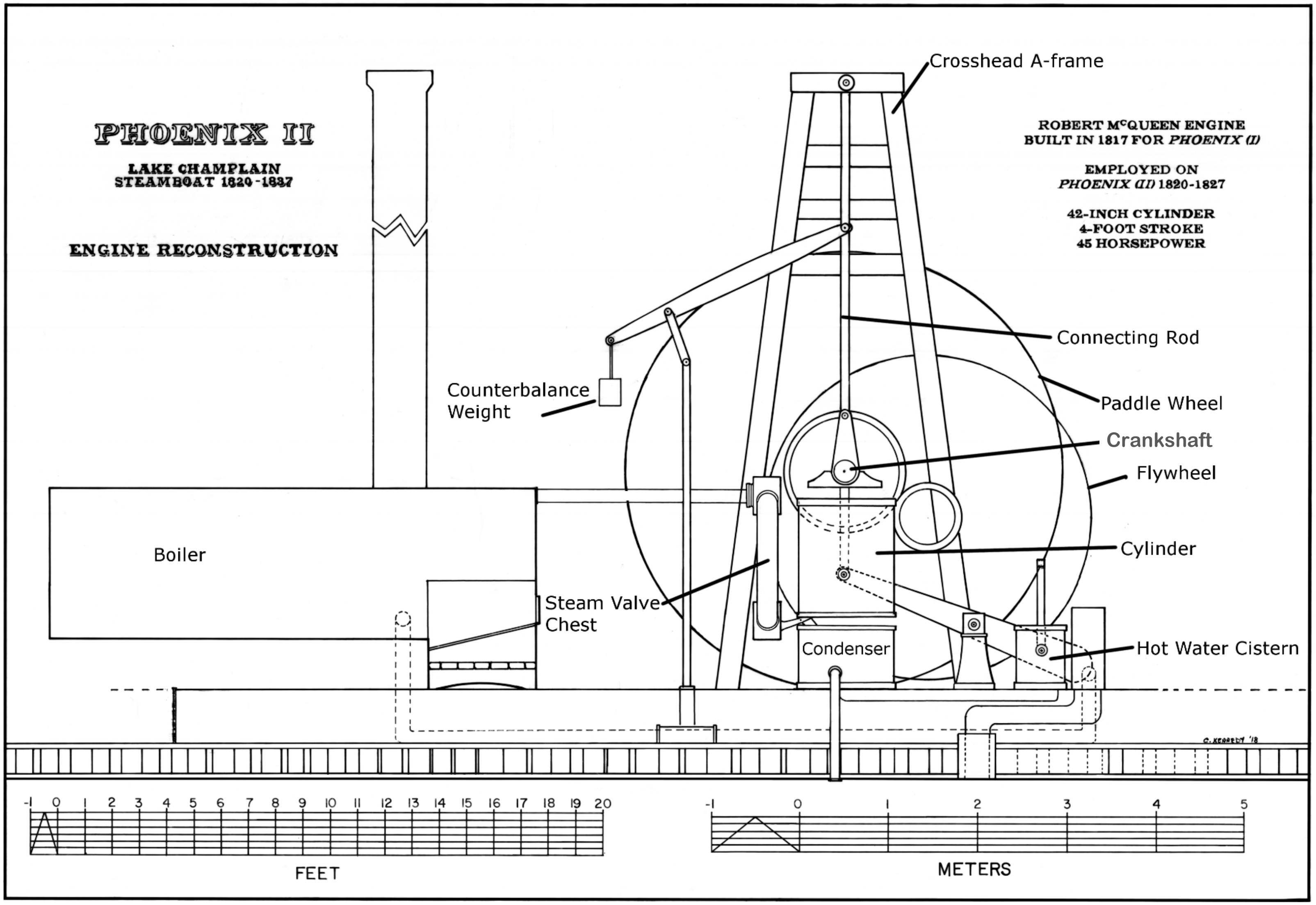


Figure 7-3. *Phoenix II*'s reconstructed engine. (Drawing by C. Kennedy, 2018)

The cylinder, therefore, if observed from a profile view, was 3 feet 6 inches (1.07 m) wide and 4 feet (1.22 m) tall. The typical arrangement, as seen in Marestier's *Chancellor Livingston* and *Washington* plans, Boulton and Watt's plans, and Tredgold's plan, was to place the cylinder above the condenser, leaving some room for pipes connecting the two. Tredgold stated that the "air pump should be 1/8th of the capacity of the cylinder, or ½ the diameter and ½ the length of the stroke of the cylinder […] and the condenser should be of the same capacity." Renwick amended Tredgold's statement for American steamers, describing how based on Fulton's engine design, "the cold water cistern of Watt's engine was dispensed with, and in order to supply its place the diameter of the condenser was doubled; its capacity thus became half that of the cylinder, instead of one-eighth, as had before been customary."[270] As such, if *Phoenix II*'s cylinder was 3 feet 6 inches (1.07 m) wide and 4 feet (1.22 m) tall, its condenser was also 3 feet 6 inches (1.07 m) wide, but only 2 feet (0.61 m) tall. It is impossible to say how much space was left between the bottom of the cylinder and the top of the condenser, so a gap of 4 inches (102 mm) is depicted in the reconstruction, as this would have been wide enough to allow the pipes to pass between the cylinder, condenser, and steam valve chest effectively. The entire arrangement totaled a height of 7 feet (2.13 m), including 8 additional inches (203 mm) accounting for the cylinder heads enclosing the tops and bottoms of the cylinder and condenser.

Conforming to Tredgold's rule, the air pump should have been half of the diameter and half of the height of the cylinder, so it was reconstructed as 1 foot 9 inches

[270] Renwick 1838, 102.

wide (0.53 m) and 2 feet (0.61 m) tall. This was perhaps not a very strict rule, as neither Marestier's drawing of *Chancellor Livingston* nor Boulton and Watt's 1816 engine design show the air pumps to be 1/8th the size of their respective cylinders (see figures 7-1 and 7-2). That said, with no evidence for the size of the air pump on *Phoenix II*, Tredgold's rule is probably the best estimate.

The reconstruction represents *Phoenix II*'s A-frame (the wooden structure that supported the crosshead beam) as having a total height of 22 feet (6.7 m) when measured from the bottom of the cylinder (i.e. on top of the engine bed timbers). Since there are no known rules for the height of the crosshead beam based on the cylinder measurements, the estimate was based on the height of *Chancellor Livingston*'s A-frame, which was 24 feet 6 inches (7.47 m), but accounted for the earlier boat's longer stroke of 5 feet (1.52 m). With a 1-foot longer stroke, the combined height of *Chancellor Livingston*'s cylinder and condenser was 9 feet 9 inches (2.97 m), compared with *Phoenix II*'s reconstructed cylinder and condenser's height of 7 feet (2.13 m).[271] All that is required of the crosshead is that it is tall enough to allow for the full motion of the piston, as well as the full motion of the crank arm, and to operate the levers to work the pumps. Twenty-two feet (6.7 m) provides sufficient room for all of these actions, without being unnecessarily tall.

The crank arms were required to be half the length of the stroke, so that as the piston reached the top of the cylinder, the connecting rods (attached via a shaft high above the condenser) pulled the crank arms to their highest height, and when the piston

[271] Marestier 1824, Pl. I: Fig. 1, 2.

was pushed down again, the crank arms rotated in a semi-circle around the crankshaft to its lowest point, completing one full revolution with each stroke of the engine.[272] The required length of the crank arms, therefore, was 2 feet (0.61 m) long. The crankshaft itself was drawn with a diameter of 10 inches (254 mm), based on *Heroine*'s crankshaft size (Figure 7-4), and was positioned at deck level, based on Marestier's claim that "the wheel shaft does not generally pass under the deck."[273]

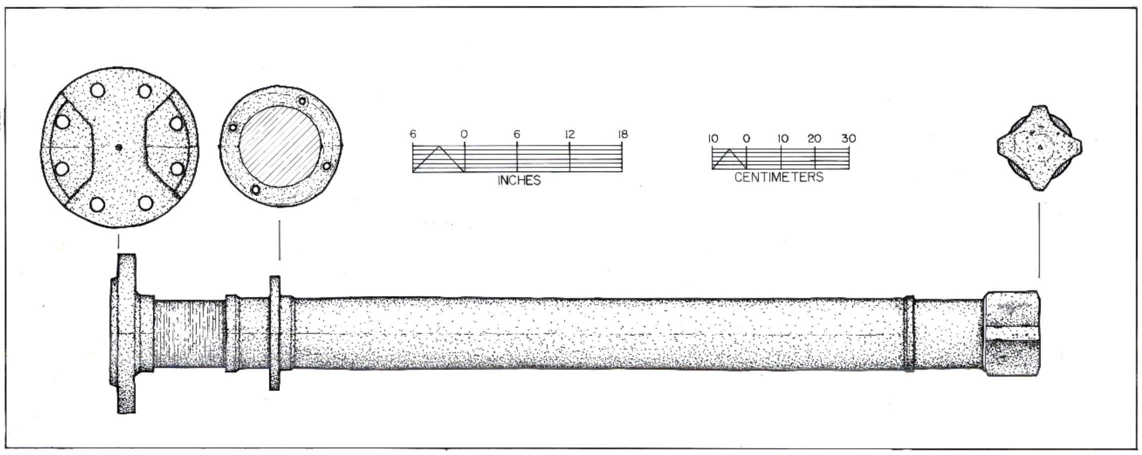


Figure 7-4. *Heroine*'s starboard crankshaft (main shaft). The shaft diameter measured 10 inches (254 mm). This measurement was used to inform *Phoenix II*'s reconstructed crank shaft. (Drawing by C. Kennedy, 2014, reprinted with permission from Crisman and Grieco 2015, 188)

This same measurement informed the reconstruction of the flywheel. The gear turned by a connecting rod from the crosshead was reconstructed with a diameter of 2 feet (0.61 m), turning a second, smaller gear attached to the flywheel shaft, which was reconstructed at 1 foot (305 mm) in diameter. The flywheel was drawn with a diameter

[272] Crankshaft is also known as the main shaft.
[273] Marestier 1957, 10.

of 12 feet (3.66 m), scaled back only slightly from *Chancellor Livingston*'s 12-foot-6-inch-diameter (3.81-m) flywheel to reflect *Phoenix II*'s smaller engine size. The paddlewheel itself was drawn with a diameter of 16 feet (4.88 m), scaled back somewhat more from *Chancellor Livingston*'s 18-feet-diameter (5.5-m) paddlewheels.[274]

Without historical or archaeological information that could inform the reconstruction of the levers operating the air pump and water pump pistons, they were also modeled after Marestier's *Chancellor Livingston*'s style of levers, rather than Boulton and Watt's style. The choice to reconstruct *Phoenix II*'s levers after the Hudson River boat over the St. Lawrence River boat was due to the fact that McQueen was based in New York, and was described as a "protégé of Robert Fulton," meaning his engine design would much more likely be based on Fulton's designs in New York, like *Chancellor Livingston*, than the imported Boulton and Watt designs used in Canada.[275]

Similarly, the steam valve chest was informed mainly by Marestier's plans, in which it is shown as 9 inches (229 mm) wide, the same diameter used in this reconstruction of *Phoenix II*'s steam valve chest. Marestier showed *Chancellor Livingston*'s steam valve chest to be 9 feet 5 inches (2.87 m) tall, and therefore *Phoenix II*'s reconstructed steam valve chest was drawn as 6 feet (1.83 m) to reflect the shorter cylinder and condenser.

---

[274] Marestier 1824, 66.
[275] Koeppel 2001, 92.

Engine Placement in Hull

The engine reconstruction described above was informed not only by historical comparisons and the reported size of *Phoenix II*'s cylinder, but also by archaeological clues in the hull itself. As described in Chapter V, the area of the hull between frames 7 and 10 included evidence of engine machinery. A total of five holes were found cut into the bottom of the hull, most likely once housing pipes for water coming to and from the engine or boiler. Two of these holes appeared to be uniformly shaped, probably as they were designed, while the other three had been roughly hacked at, most likely done to remove the valuable metal pipe fittings upon the boat's retirement.

The larger of the uniformly-shaped holes was housed in a square block of wood, 16 inches by 16 inches (406 mm by 406 mm), with an 11 inch (279 mm) diameter hole in its center. The block stood 3 inches (76 mm) proud of the ceiling planking, between the port side engine bed timbers. The large size of the hole and the fact that it continued through the hull to the lake indicates that it was likely where waste water was flushed out of the engine. The smaller circular hole was only 4 inches (102 mm) in diameter, and had no housing, but was simply cut into the ceiling planking. Though its size made it difficult for divers to verify its depth, it is believed to have likewise passed through to the lake beneath. This hole is thought to be the intake pipe for the cold water injected into the condenser.

Apart from the holes cut into the ceiling planking, five iron engine anchor-bolt mounts were attached to the ceiling planking.[276] Of the five mounts, three were fastened to the ceiling planking between the two port engine bed timbers, and the other two between the starboard engine bed timbers. The starboard side of the frame 7-10 area was not cleared as extensively as the port side, so the rocks likely concealed a third mount on the starboard side. Their locations and the distances between them match the size and proposed height of the *Phoenix II* engine condenser and cylinder. Since the cylinder sitting atop the condenser would have been quite tall and unstable with the constant motion of the piston, these mounts probably anchored wrought iron rods that tightened with turnbuckles to secure the tall cylinder to the hull and stabilize it.

The condenser and cylinder likely sat atop an iron foundation plate. To prevent the movement of the engine from affecting the integrity of the hull, and vice-versa, the foundation plate was fastened to the engine bed timbers above the keelson to avoid pressure on that essential structural member. The inner engine bed timbers in the frame 7-10 area were 25 inches (635 mm) tall, a full 11 inches (279 mm) above the keelson, and their outboard edges were 4 feet (1.22 m) apart, making them the perfect size to support a foundation large enough for a 3-feet-6-inch (1.07-m) diameter condenser.[277] Additional longitudinal timbers were fastened to the outboard sides of these inner engine bed timbers to strengthen the area supporting the engine weight. At the same location

[276] What these were actually called is not certain, but they appear to have been mounts for anchoring wrought iron rods that were tightened down with turnbuckles, and so have been dubbed "engine anchor-bolt mounts" for the sake of this dissertation. See Chapter V for detailed measurements.
[277] Though the measurement for the diameter of the cylinder describes the interior of the cylinder, cylinder walls would not exceed 1-inch (25-mm) thick, and likely not more than ½-inch (13-mm) thick, therefore the exterior diameter of the cylinder would be no more than 1 or 2 inches (25 or 50 mm) wider.

that these additional longitudinal timbers were added to the inner engine bed timbers, the keelson's upper surface was notched, reducing its molded dimension by 2 inches (51 mm) for an undetermined length (since the forward end was obscured by rocks, the length of the notch remains unknown).

The positioning of the engine anchor-bolt mounts, the height and spacing of the inner engine bed timbers, the additional longitudinal timbers added in this discrete area, and the reduced height of the keelson all clearly indicate that the condenser and cylinder tower were originally placed in this cleared-off area. Clues to the location of the crosshead beam's A-frame legs were also found here. Beginning approximately 3 inches (76 mm) abaft the depression in the keelson and the after end of the additional longitudinal timbers, mortises 1 ½ inches (38.1 mm) deep and 17 inches (431.8 mm) long were cut into the outboard sides of the outer port and starboard engine bed timbers. Damage was observed on both the port and starboard engine bed timbers' upper surfaces, likely representing large U-bolts that secured the legs of the A frame to the timbers within the grooves that were pulled out.

Finding precisely where the cylinder and condenser were located during the 2016 project was fortuitous. Less fortunate is the fact that this area was only excavated near the end of the field project, meaning time constraints limited further investigation. Potential clues to the positioning of other engine features such as the boilers, the air pump, hot water cistern, water pump, and lever supports are likely still hidden beneath the rock piles directly forward and abaft the frame 7-10 area.

Boiler Placement in Hull

Historical sources are not very helpful when it comes to determining the position of the boilers in relation to the engine. In Marestier's drawing of *Chancellor Livingston*, the boilers are located forward of the cylinder, but in his drawings of *Fulton* and *Washington* (both built in 1813) they are abaft the cylinder (Figure 7-5).[278] Boulton and Watt's plans do not include the orientation of an associated hull, but only the engine and boiler plans themselves.

Other iconographic evidence from this time period is equally unhelpful for determining the placement of the boilers. *Phoenix II* had such a long career that the generic woodcuts the steamboat companies used to represent it in advertisements changed over the years. Furthermore, as discussed in Chapter VI, these advertisement images were rarely a true representation of one specific boat. Of the multiple representations of *Phoenix II*, both boiler-placement options are shown: the earlier woodcuts from 1823 and 1826 show the boilers abaft the engine, whereas the poster from 1836 shows the boilers forward of the engine (Figure 7-6).

[278] Marestier 1957, 13.

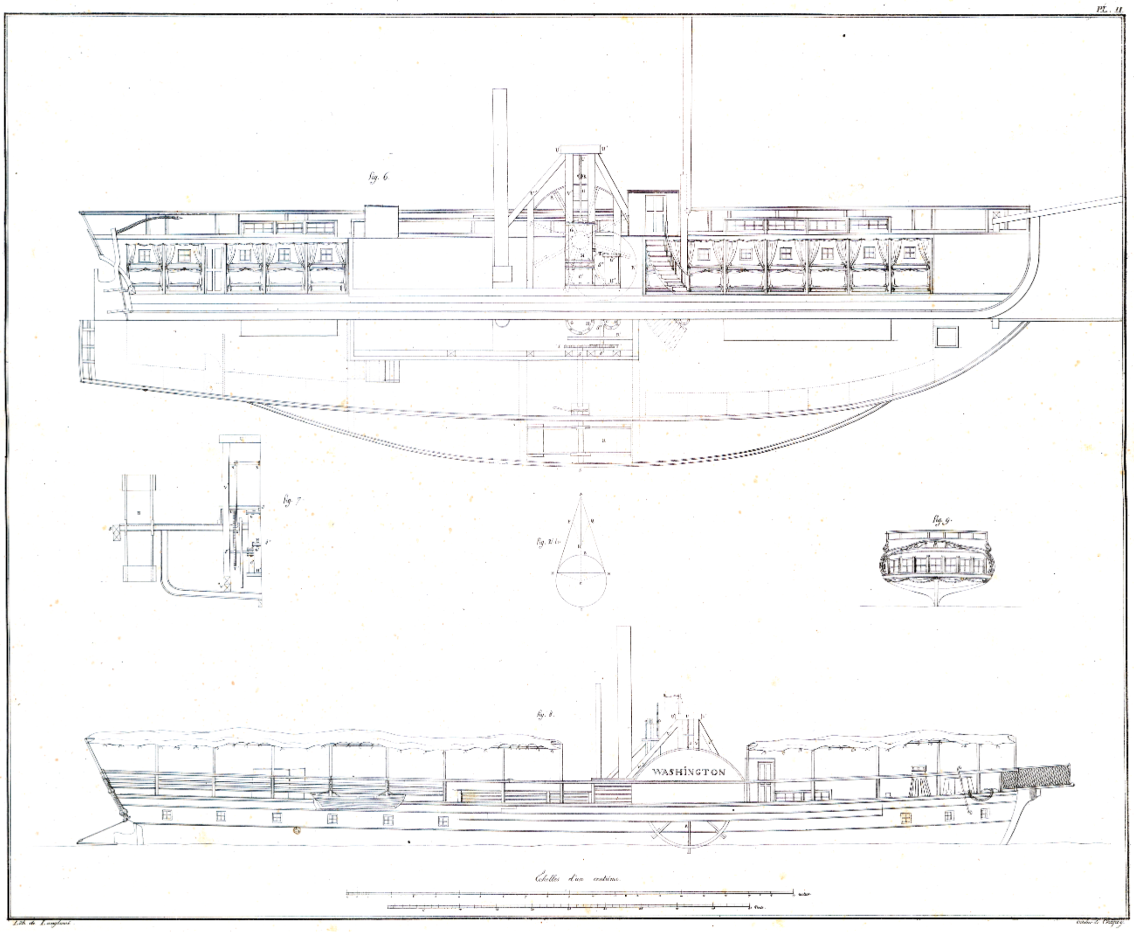


Figure 7-5. *Fulton* (top) and *Washington* (bottom) are both shown with their boilers placed abaft the engine. (Repinted from Marestier 1824, Pl. II)

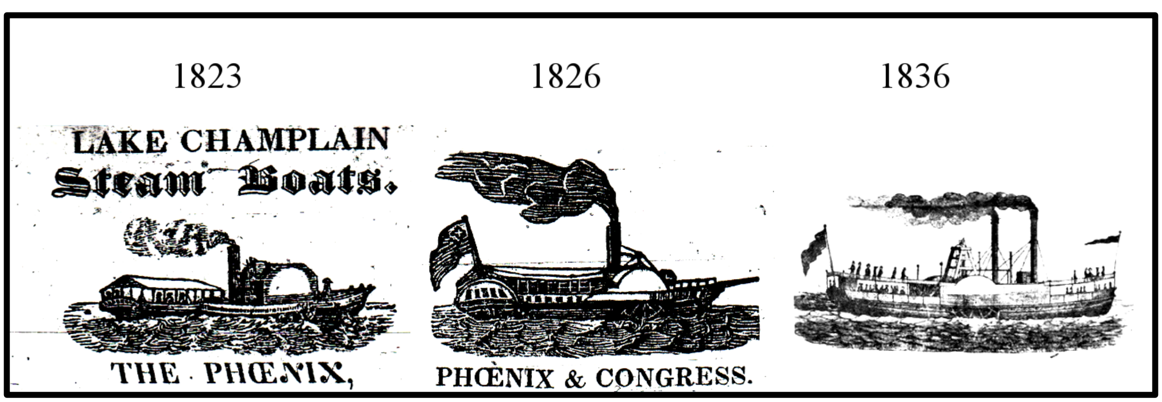


Figure 7-6. Three different woodcuts used to represent *Phoenix II*. The 1823 and 1826 woodcuts show the steamboats' boilers placed abaft their engines, but the 1836 woodcut shows the boilers placed forward of the engine. (Reprinted from *Northern Sentinel* (Burlington, VT) 27 June 1823, 4; *Northern Sentinel* (Burlington, VT) 8 April 1826, 3; Ross 1997,

Looking at archaeological examples, Schwarz concludes that *Phoenix I*'s boilers would have been placed abaft the engine; however, his discussion mentions "the positioning of the boilers is a matter of interpretation," and that "evidence from the archaeological data […] suggest that the boiler might have been positioned forward on *Phoenix* [I]."[279] Essentially, Schwarz describes evidence supporting theories of the boilers being positioned forward and abaft the engine, but ultimately concludes the engines were positioned aft, though he states "concrete evidence for the position of *Phoenix*'s boiler has not yet been discovered."[280] So, while Schwarz represents the boilers as abaft the engine in his reconstruction, he was evidently not fully confident in his interpretation, meaning this should not necessarily influence *Phoenix II*'s reconstruction.

Furthermore, since *Phoenix II* differs from *Phoenix I* in at least one major aspect, namely the absence of a mast, there is no reason that even if Schwarz's interpretation was correct that *Phoenix II* would have followed the same rule. It is possible that a mast step forward of the engine would have necessitated *Phoenix I*'s boilers being placed further aft, while its absence on *Phoenix II* freed up this space forward of the engine room.

Bélisle and Lepine were more fortunate than Schwarz in finding archaeological evidence indicating the location of *Lady Sherbrooke*'s boilers. Pipes running through the side of the hull were determined to be the water intake pipes for the boilers, and these

[279] Schwarz 2012, 197, 200.
[280] Schwarz 2012, 204.

were located abaft where the archaeological evidence placed the engine machinery.[281] It is worth noting that *Lady Sherbrooke*, like *Phoenix I*, also had a mast, potentially affecting where the boilers were positioned in the hull.

Similar to *Phoenix I*'s wreck, scant evidence pointing to the location of the boilers was found on *Phoenix II*'s hull. Since the historical records, iconographic evidence, and archaeological evidence of our closest contemporary examples show boilers placed both before and abaft the engine, those cannot definitively provide the answer for the placement of *Phoenix II*'s boilers. Unfortunately, the areas immediately adjacent to the frame 7 to 10 area with the engine machinery were covered in rocks, so potential clues to boiler machinery were not found. The decision was ultimately made to reconstruct the steamer with the boilers placed forward of the engine.

The primary reason for choosing to place the boilers forward of the engine pertains to the space distribution on board. Since the engine was found almost exactly amidships, if the boilers were placed abaft the engine, this would leave little room for passenger cabins, which were typically found in the stern of passenger steamboats.[282] More room for passengers could be attained by placing the boilers forward of the engine, in which case the LCSC could sell more tickets and make more profit. Furthermore, *Phoenix II* evidently had two boilers, as indicated in a 1831 letter from Captain Gideon Lathrop to Isaiah and John Townsend, in which he claims, "our boilers are foul and we cannot clean and let out the water for the want of a sufficient hand pump to again fill

[281] Belisle and Lepine 1988, 16; Belisle and Lepine 1986, 44-48.
[282] Marestier 1957, 10.

them."[283] Lathrop uses the plural "boilers" and "them," denoting that there were two boilers on board in this letter, but as captain of *Congress* in 1827, he mentions only a single boiler.[284] Evidently, *Phoenix II* was the first Lake Champlain steamer to benefit from the extra power of two boilers, instead of relying on a single boiler. The two boilers needed to be placed in a wide part of the hull, and with the engine mounted amidships, the wider midship area was forward. Two boilers also would have required a sufficiently strong hull to bear their weight, and since the frames in the midship area are largest and also closest together, this would have added additional support to the hull beneath the heavy boilers and smoke stacks.

Three clues, one each historical, iconographic, and archaeological, support the decision to place the boilers forward. The historical clue comes from an entry in Lathrop's journal from 5 July 1831, when he was captain of *Phoenix II*, in which he describes an incident of running aground on a shoal north of Chazy, NY. He writes:

> We were hard on our bows out about 18 inches [(457 mm)]. After carrying the wood aft and making many unsuccessful attempts to back off I sent [Durfey] to get a vessel of some kind to help us. He returned about 7 a.m. with the sloop Boker. We sunk the sloop under our bows, fastened her by boring through the stem and fastening planks from the bitts to her masts. Carried our anchors astern and by bailing out the sloop and heaving on the anchors we at last succeeded in getting her afloat and under weigh at half past 5 p.m.[285]

---

[283] TFP, Box 7, "Correspondence 1827-June1833, 7 June 1831. Though this letter was written 10 years after *Phoenix II* was built, no evidence has been found indicating a second boiler was added during the boats operational years. Installing a second boiler was would be very difficult as it would require changing the location of the first boiler to balance the weight of a second boiler,

[284] "Come to at Long Point to repair leak in boiler […] Wrote to Judge Follett wishing advise on account of our boiler," 16 June 1827; "Another attempt to stop the leak in the boiler," 17 June 1827; "Mr. Ward will make a boiler for Congress [*sic*] for $500," 30 January 1828, from Lathrop 1827-1842, 6, 10.

[285] Lathrop 1827-1842, 5 July 1831, 27; the transcribed diary entry says Lathrop sent "Duffy (?) [*sic*]" to get help; most likely this was actually Phineas Durfey, who was a Lake Champlain steamer pilot from 1825-1840, see Hemenway 1867, 706.

Lathrop indicates in this entry that the wood was stored forward on *Phoenix II*, and since it made sense to store the wood near the boilers, this tends to support the decision to place the boilers forward of the engine in the reconstruction.

An iconographic clue comes from images of *Walk-in-the-Water*, the 1818-built steamer equipped with the only other known McQueen engine. Logically, two engines built within a year of each other by the same person would share the same configuration. All of the depictions of *Walk-in-the-Water* show that its boiler was mounted forward of the engine, which suggest that *Phoenix II*'s boilers were also forward (Figure 7-7).

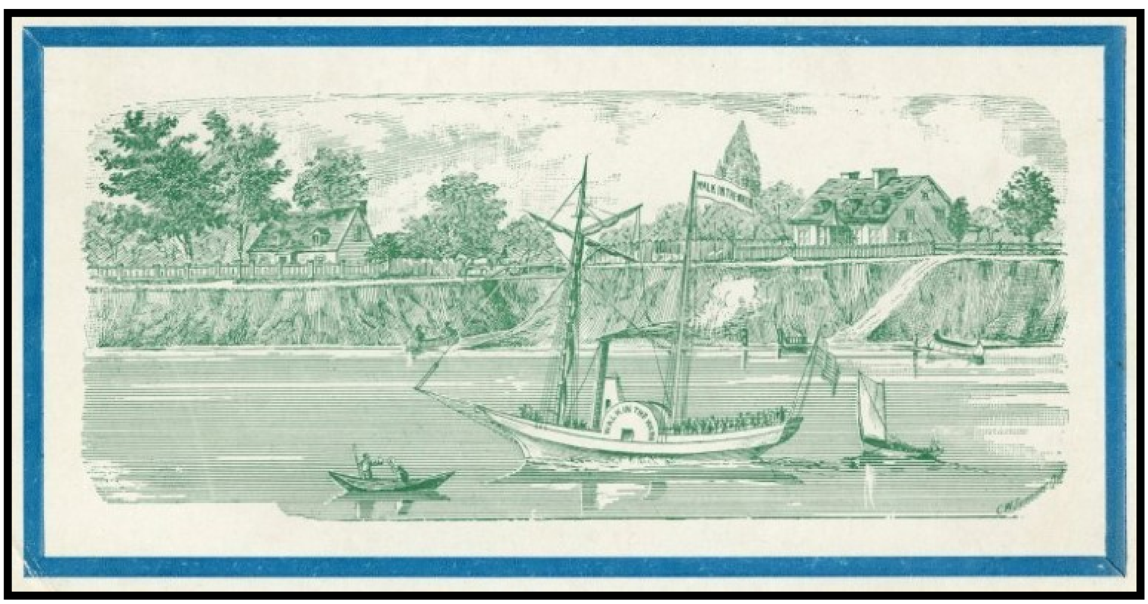


Figure 7-7. Lake Erie steamer *Walk-in-the-Water*. The boiler is positioned forward of the engine. (Reproduction of drawing from "Detroit River Front of Jones and Cass Farms in 1819," reprinted with permission from Detroit Historical Society)

Further evidence for the boilers' placement forward of the engine was based on an archaeological clue, a timber found outboard of the outer port engine bed timber, between the midship frame and frame 2. The 62-inch-long (1.57-m) timber was 8 inches (203 mm) tall in its middle, with 15 inches (381 mm) on either end having been cut down to 6 inches (152 mm) tall. Running transversely through the timber were four 4-inch-diameter (102-mm) holes. These holes appear to have been cut into the timber, most likely for pipes to run through. The boiler required a number of pipes for water intake and waste water, and as seen on *Lady Sherbrooke*, those pipes ran through the side of the hull rather than the bottom. This timber probably represents a similar arrangement. Its placement forward of the engine machinery supports the forward boiler theory.

Working against this theory is the arrangement of the engine bed timbers. While the outer engine bed timbers extend almost all the way from stem to stern, the inner engine bed timbers only extend approximately 20 feet (6.1 m) forward of the engine cylinder location. Assuming an engine room approximately 8 feet (2.44 m) long, that leaves a mere 12 feet (3.66 m) of engine bed timber to support the heavy boiler.[286] At a minimum, boilers in contemporary sources were found to be 16 feet 6 inches (5.03 m) long, and *Chancellor Livingston*'s boilers were 25 feet 3 inches (7.7 m) long.[287] That said, in both Marestier's profile of *Chancellor Livingston* and *Fire Fly*, one end of the boiler rests on the engine bed timbers, like the cylinder, but the other end is supported by

[286] Engine room on *Fulton* was only 8 feet (2.44 m) long, Marestier 1824, Pl. II: fig. 6.
[287] Boulton and Watt's design from 19 May 1815 shows a boiler 16 feet 6 inches (5.03 m) long (see figure 7-2), Birmingham Public Library Boulton & Watt Collection; *Lady Sherbrooke*'s boilers were estimated as close to 18 feet (5.49 m) long, Belisle, pers. comm., 2014.

some other means.[288] If *Phoenix II*'s boilers' forward ends were supported by some other means, perhaps they would not have required the engine bed timbers to be as long.

Though it is possible that *Phoenix II*'s boilers were located abaft the engine, the evidence appears to favor a forward placement, despite the exception of the engine bed timber placement. It made sense financially to fit the boilers in the forward end of the hull if the profit was gained through passengers, whose cabins were located in the stern end. Furthermore, two boilers required significant transverse space to fit side by side, which would have necessitated placing them in a beamier section of hull, preferably with more structural support, like around the midship frame. Based on these factors, the provisional conclusion is that boilers were likely placed forward of the engine.

[288] Marestier 1824, Pl. I: fig. 2; Pl. VIII: fig. 38.

CHAPTER VIII

CONCLUSIONS

The hull of *Phoenix II* was studied during the three-season-long Shelburne Shipyard Steamboat Graveyard Project, co-directed by the author and Dr. Kevin Crisman. The goals of this project were to discover how early steamboat builders on Lake Champlain were adapting traditional shipbuilding methods to build vessels best-suited to steam propulsion in the 1810s, 1820s, and 1830s, and what could be learned from the archaeological remains of a steamboat that was absent from historical records. Shelburne Shipyard was selected for archaeological investigation due to the known presence of four steamer wrecks in its waters, with suspicions that they were built during those first three decades of steamboat construction on the lake. This proved true for three of the four: three of the steamboats were identified as *Phoenix II*, *Burlington*, and *Whitehall*. The fourth steamer hull was the later, 1870-built *A. Williams.* The earliest of these, *Phoenix II*, was selected for comprehensive study.

Phoenix II was built at Vergennes, VT in 1820-1821, by the Lake Champlain Steamboat Company (LCSC), but as soon as it was launched the company moved their operations to Shelburne Shipyard in Shelburne, VT. *Phoenix II* spent its 16 working years as a passenger steamer based out of the shipyard, until 1837 when it was condemned and retired in the harbor.

The archaeological investigation of *Phoenix II* focused on recording key elements of its structure in order to understand its builders' construction and design decisions. Since the wreck was covered in rocks and partially buried beneath the sediment, divers targeted specific locations to gain the maximum information within the time and resource constraints of the project. Areas that received close inspection included the bow to frame R, frame J, the midship frame ꝏ, the area between frames 7 and 10, frame 24, frame 39, and the stern and rudder. These areas exhibited a heavily-constructed assembly, more than was necessary for an inland lake steamer. Its respectably-long 16-year career testifies to durable construction. Its heavy build showed that by 1820 steamboat builders were not yet prioritizing lightweight hulls in order to achieve the fastest speeds possible, but were still more concerned with the structural strength and the vessel's ability to support heavy engine and boiler machinery.

The findings from the archaeological investigation were used to reconstruct the hull lines of the ship. The reconstruction was assisted by relevant historical information, as well as examples of contemporary steamers, both historical and archaeological. Basic information about the vessel was found on *Phoenix II*'s Certificate of Registry, including its length of 143 feet (43.6 m), breadth of 27 feet 3 inches (8.3 m), depth of hold of 9 feet 6 inches (2.3 m), and its tonnage of 346 49/95 tons, along with the clear statement that the steamer had no mast and only one deck. That deck was covered with a canvas awning to protect deck passengers from the elements.

The reconstructed lines of *Phoenix II* are similar to reconstructed lines of *Ticonderoga*, *Phoenix I*, and even the western river steamer *Heroine*, though with some marked differences. Compared to *Heroine*, *Phoenix II* had a markedly lower length-to-breadth ratio and a deeper depth of hold, since it was not restricted by shallow depths like *Heroine* was on the western rivers. Compared with *Ticonderoga*, *Phoenix II*'s turn of the bilge was more rounded, which followed the trend of the time that was moving away from the earliest boats' sharp turns of the bilge. The lines of *Phoenix II* were very similar to those reconstructed from *Phoenix I*, which is to be expected since the two steamers were so similar in size and purpose, and built only four years apart from each other.

Though historical sources describe the second *Phoenix* as similar to the first, the later steamer was built with at least two major differences: the lack of a mast and the addition of a second boiler.[289] The archaeological evidence was not conclusive as to the location of the boilers, but historical sources show that *Phoenix II* was the first Lake Champlain steamer to employ two boilers, so they were probably positioned forward of the engine in order to give them ample room to fit side by side, and so as not to reduce the space for passenger cabins in the after end of the boat.

Despite the lack of evidence as to the location of the boilers, a fortuitous choice to remove rocks in the area between frames 7 and 10 revealed evidence pointing to the location of the engine condenser and cylinder, as well as for the A-frame for the crosshead beam. A plausible engine reconstruction can be shown within the hull based on historical sources describing the size of *Phoenix II*'s first engine, 3 feet 6 inches (1.07 m) in diameter with a 4-foot (1.22-m) stroke and the archaeological evidence for its location.

[289] Hemenway 1867, 692; Ross 1997, 41.

The reconstructed lines drawing and engine provide an idea of what *Phoenix II* looked like during its working years. Comparing these reconstructions to steamboats built slightly earlier and a few years later, we can begin to see how *Phoenix II* fits into the scheme of early steamboat design. Overall, the steamer shows a much closer resemblance to those preceding it than to those built in the following decade, namely *Burlington* and *Whitehall*. In fact, *Phoenix II*'s building style shows what could be considered as a step backward in eastern-river-and-lake-steamboat construction: its large framing timbers and the futtocks abutting beneath the keelson, overlapping the entire length of the floors, and the greatest breadth measurement known to a Lake Champlain passenger steamer. Perhaps because the LCSC was unchallenged on the lake in 1820 they were not desperate for every advantage of speed. Or maybe Young and Gorham were concerned about using cedar framing over the preferable oak or wanted to strengthen the hull to support two boilers. Whatever the case, *Phoenix II*'s considerable structural strength no doubt contributed to its long life.

Why Young and Gorham chose to design such a heavy hull remains a mystery, but preconceived ideas that hulls were being made lighter and slimmer every year on the eastern rivers and lakes in order to be faster was clearly not true, or at least had not yet become true in 1820. Steamboat builders were still unsure of how to build an efficient steamer hull when *Phoenix II* was built, and some tweaks to its design would surely have allowed it to travel much faster. That said, *Phoenix II* was more than adequate for its time and purpose. With speeds of 8 miles per hour (12.9 km/h) in 1821, increasing to 10 miles per hour (16.1 km/h) by 1830, the Lake Champlain steamer was widely regarded (at least in the Champlain Valley) as a fast boat. Though it is difficult to know for sure how high a priority speed was considered during its construction, historical evidence shows it at least became a much more important issue once competing steamboat companies began operations on the lake.

The Shelburne Shipyard Steamboat Graveyard Project spent a total of ten weeks working on the site and generated an enormous amount of archaeological data on *Phoenix II*. Despite that wealth of data presented here, the large wreck of *Phoenix II* could be investigated for several more years and still retain many of its secrets. Its size and the large amount of rocks impeding access to many of the hull components were two major obstacles preventing the retrieval of more information. To fully document the wreck, a massive excavation of its entire hull would be necessary. The benefits of such a large-scale undertaking currently do not outweigh the costs (in both money and time), which would have to include a conservation plan for the 134-foot-long (43.6-m) wreck. A more realistic future study might focus on targeting specific areas that are likely to reveal key pieces of missing information, like looking for evidence of the boiler placement, further uncovering of the area between frames 7 and 10 for additional insight into the engine configuration, and a more in-depth excavation and study of the stern and deadwood assembly. In the meantime, a study of the artifacts recovered from the wreck is currently underway at the time of the writing of this dissertation. Investigation of these artifacts falls outside of the scope of this dissertation, but may reveal information regarding shipboard life aboard the steamer. The results of this study are expected in the spring of 2019.

The information presented in this dissertation, including the historical background, the archaeological details, the reconstructed ship lines, and the engine reconstruction of *Phoenix II* contributes to the growing record of archaeological data concerning early nineteenth-century steamboats built for the inland waterways of North America. The early decades of steamboat construction, specifically the 1810s, 1820s, and 1830s, were largely experimental years. Early steamboat shipwrights sought to design and build wooden hulls that could both support heavy machinery and also move swiftly through the water. To that end, many steamboat owners were experimenting with hull designs, which was something that was fairly risky in the shipbuilding trade since a failed experiment could be disastrous.

The eastern rivers and lakes of North America were home to the earliest steamboats, and during the first three decades of passenger-steamboat design shipwrights working on those waterways were often at the forefront of experimentation. They used trial and error to achieve the desired hull shape and would often make alterations throughout the steamboats' lifetime. *Phoenix II* was as large and as heavy as Lake Champlain boats that preceded it, but boats following in its wake were refined in their design. The hulls of *Burlington* and *Whitehall*, for example, show intent by the shipwrights to create longer, lighter, faster steamers that could transport more passengers and earn their owners more profit. Though boats like that were in Lake Champlain's future when *Phoenix II* was built, steamboat design had not yet prioritized speed over hull strength. Its hull features place *Phoenix II* into the early class of steamboats, along with *Ticonderoga*, *Phoenix I*, and *Lady Sherbrooke*. The use of heavy structural timbers in this early class of steamboats shows that shipwrights were not yet willing to abandon more traditional shipbuilding styles, but their flat floors and shallow drafts show how steamboat builders were learning to build hulls best-suited to housing large engines and boiler machinery, and be propelled by paddle wheels rather than sails.

While historical sources were essential in the reconstruction and understanding of *Phoenix II*, they fail to provide insights into many details such as the accurate length of the hull, clues to its engine placement within the hull, or what the steamer looked like when it was a functioning passenger steamboat. Archaeological investigation is vital to our understanding of these and other details about this boat. Now that these details have been reported in this dissertation, they can be used to inform future studies of steamboat building in the first half of the nineteenth century.

REFERENCES

Albers, Jan. 2000. *Hands on the Land: A History of the Vermont Landscape.* Cambridge, MA: MIT Press.

American Railroad Journal (New York), 23 June 1832: 401-416.

Anderson, Bryon D. 2003. *The Physics of Sailing Explained.* Dobbs Ferry, NY: Sheridan House Inc.

Aske, Jerry Jr. 2012. *From Steamboats to Subchasers: A History of the Shelburne Shipyard.* Shelburne, VT: Red Barn Books.

Baldwin, Elizabeth. 1997. "The Reconstruction of the Lake Champlain Sidewheel Steamer Champlain II." Master's Thesis, Anthropology, Texas A&M University, College Station.

Baltimore (MD) *Gazette,* 22 July 1828.

Barranco Papers, "*Phoenix II* Certificate of Registry," Lake Champlain Maritime Museum.

Beck, Lewis C. 1833. "Report on Cholera." *Medical Society of the State of New York Transactions, Volume 1.* Boston, MA: Harvard University. 348-372.

Belisle, Jean and Andre Lepine. 1986. "Rapport Preliminaire de la Troisieme Campagne de Fouilles (1986)." Preliminary Report, Comite d'Histoire et d'Archeologie Subaquatique du Québec Inc., Montreal.

Belisle, Jean and Andre Lepine. 1988. "Le Project Molson 1." Preliminary Report, Comite d'Histoire et d'Archeologie Subaquatique du Québec Inc., Montreal.

Bellico, Russel P. 2001. *Sails and Steam in the Mountains: A maritime and military history of Lake George and Lake Champlain.* Fleischmanns, NY: Purple Mountain Press.

Burlington (VT) *Free Press,* 10 October 1837.

Burlington (VT) *Sentinel,* 14 October 1831.

Bush, L. 2017. "Wood from the *Phoenix II*, Shelburne Shipyard, Lake Champlain, Vermont, USA." Unpublished Report: Wood Sample Analysis, Macrobotanical Analysis, Manchaca, TX.

Champlain Transportation Company (CTC) Records from the University of Vermont Special Collections & University Archives, Collection A, Carton 1, Folder 178, “The Sale of ‘Phoenix’ and ‘Congress’ to Champlain Trans. Co., February 22, 1833.”

CTC Records, Collection A, Carton 1, Folder 241, “Agreement between C.T.C., Champlain Ferry Co., St. Albans Steam Boat Co.” 27 January 1835.

CTC Records, Collection A, Carton 3, Folder 20, "Miscellaneous Papers October 17-November 3, 1836," 29 October 1836.

CTC Records, Collection A, Carton 3, Folder 57, “Miscellaneous Papers October 1-November 11, 1838.” "Return of Steamboats on Lake Champlain NY in October 1838" Compiled by J. H. Morrison. 17 February 1910.

Chase, Jack. 1985. "Shelburne Bay Project." In *A Report on the Nautical Archaeology of Lake Champlain: Results of the 1983 field season of the Champlain Maritime Society*, edited by R. Montgomery Fischer, 54-61. Burlington, VT: Champlain Maritime Society.

Chin, Aimee, Chinhui Juhn, and Peter Thompson. 2006. "Technical Chance and the Demand for Skills During the Second Industrial Revolution: Evidence from the Merchant Marine, 1891-1912." *The Review of Economics and Statistics* 88 (3): 572-578.

Cohn, Arthur. 2003. *Lake Champlain Sailing Canal Boats.* Basin Harbor, VT: Lake Champlain Maritime Museum.

Cohn, Arthur. 2013. "The Official Blog of LCMM: Sharing the history & archaeology of Lake Champlain." *Lake Champlain Maritime Museum.* January 9. Accessed 2018. https://lcmm.wordpress.com/2013/01/09/vergennes-1812-welcome-home/.

Cozzi, J. 1998. "The Goniometer: an improved device for recording submerged shipwreck timbers." *International Journal of Nautical Archaeology* 27 (1): 64-80.

Crisman, Kevin J. 1987. *The Eagle: An American Brig on Lake Champlain during the War of 1812*. Annapolis, MD: The Naval Institute Press.

Crisman, Kevin J. 2014. "The Western River Steamboat *Heroine,* 1832-1838, Oklahoma USA: Construction." *International Journal of Nautical Archaeology* 43 (1): 128-150.

Crisman, Kevin J. 2014. "US Schooner *Ticonderoga.*" In *Coffins of the Brave: Lake Warships of the War of 1812*, edited by Kevin J. Crisman, 247-270. College Station, TX: Texas A&M University Press.

Crisman, Kevin and Glenn Grieco. 2015. "The Western River Steamboat *Heroine*, 1832-1838, Oklahoma, USA: propulsion machinery." *International Journal of Nautical Archaeology* 44 (1): 173-195.

Crisman, Kevin, Carolyn Kennedy, and George Schwarz. 2018. "Vermont's Steamboat Pioneer: Captain Jahaziel Sherman of Vergennes." *Vermont History* 86 (2) 125-161.

Crockett, Walter Hill. 1909. *A History of Lake Champlain: The Record of Three Centuries.* Burlington, VT: Hobart J. Shanley & Co.

Croft, Terrell. 1922. *Steam-engine Principles and Practice.* New York: McGraw-Hill.

Dickens, Charles. 1913. *American Notes and Pictures from Italy.* London: Chapman & Hall.

Dostal, Christopher. 2017. "Laser Scanning as a Methodology for the 3-D Digitization of Archaeological Ship Timber: A Case Study Using the World Trade Center Shipwreck." Doctoral Dissertation, Department of Anthropology, Texas A&M University, College Station, TX.

Gordon, Thomas Francis. 1837. *A Digest of the Laws of the United States; including an abstract of the judicial decisions relating to the Constitutional and Statutory Law.* Philadelphia.

Hacking, Juliet. 2012. *Photography: The Whole History.* New York: Prestel Publishing.

Hall, Basil. 1974. *Travels in North America.* New York: Arno Press.

Hall, Henry. 1884. *Report on the Ship-Building Industry of the United States.* Census Office, Department of the Interior, Washington: Government Printing Office.

Hampshire Gazette (Northampton, MA), 23 July 1828.

Harris, Elisha. 1866. "Report on Sanitary Police Measures Applied to the Prevention and Control of Epidemic Cholera." *Bulletin of the New York Academy of Medicine*, 101-122.

Hemenway, Abby Maria, editor. 1867. "Lake Champlain." *Vermont Historical Gazeteer* 1: 685-707.

Hillstrom, Kevin and Laurie Collier Hillstrom. 2005. *The Industrial Revolution in America: Steam Shipping.* Vol. 3. 3 vols. Santa Barbara, CA: ABC-CLIO.

Hunter, Louis C. 1994. *Steamboats on the Western Rivers.* Mineola, NY: Dover Publications.

Kennedy, Carolyn. 2015. "Shelburne Shipyard Steamboat Graveyard: Archaeological Investigation of Four Steamboat Wrecks." Master's Thesis, Anthropology, Texas A&M University, College Station, TX.

Koeppel, Gerard T. 2001. *Water for Gotham: A History.* Princeton: Princeton University Press.

Kotar, S.L., and J.E. Gessler. 2014. *Cholera: A Worldwide History.* Jefferson, NC: MacFarland & Company.

Krueger, Bradley. 2012. "Anthony Wayne: The History and Archaeology of an Early Great Lakes Steaamboat." Master's Thesis, Department of Anthropology, Texas A&M University, College Station, TX.

Lathrop, Gideon. 1827-1842. "Gideon Lathrop Diary." Kinderhook, NY: Columbia County Historical Society.

Lewis, Walter. 1997. "The First Generation of Marine Engines in Central Canadian Steamers." *Northern Mariner* 7 (2): 1-30.

Lewis, Walter. 2015. "Transition from Sail to Steam on the Great Lakes in the Nineteenth Century." *The Northern Mariner* 25 (4): 345-374.

Mackey, Frank. 2000. *Steamboat Connections: Montreal to Upper Canada 1816-1843.* Montreal: McGill University Press.

Marestier, Jean-Baptiste. 1824. *Memoire sur les bateaux a vapeur des Etats-Unis d'Amerique.* Digitized by Google. Paris: l'Imprimerie Royal. https://archive.org/stream/bub_gb_1K9bAAAAQAAJ#page/n3/mode/2up.

Marestier, Jean Baptiste. 1957. *Memoir on Steamboats of the United States of America.* Translated by Sidney Withington. Mystic, CT: The Marine Historical Association, Inc.

Merriam, John C. 1861. "Steam." In *Eighty years progress of the United States: Showing the various channels of industry and education… with a large amount of statistical information…* (vol. II) by James T. Hodge, Thomas P. Kettell, and John C. Merriam, 227-273. New York: Stebbins.

Montreal Vindicator, 19 June 1832.

Moore, Jonathan. 2014. "Frontier Frigates and a Three-Decker: Wrecks of the Royal Navy's Lake Ontario Squadron." In *Coffins of the Brave: Lake Warships of the War of 1812*, edited by Kevin J. Crisman, 187-218. College Station, TX: Texas A&M University Press.

North Star (Danville, VT), 17 October 1820, 17 November 1820.

Northern Intelligencer (Burlington, VT), 15 April 1823.

Northern Sentinel (Burlington, VT), 12 September 1817, 15 November 1819, 30 August 1822, 18 April 1823, 27 June 1823, 16 April 1824, 23 April 1824, 8 April 1825, 15 July 1825, 8 April 1826, 4 August 1826, 13 April 1827, 28 March 1828.

Northern Spectator (Poultney, VT), 11 October 1826, 25 October 1826.

Offerman, Nick and Amy Poehler. 2018. *Making It - Amy and Nick Play "Smell That Wood!" (Digital Exclusive)*. Produced by NBC.

Peters, John Charles. 1885. *A Treatise on Asiatic Cholera.* New York: William Wood and Company.

Plattsburgh (NY) *Republican,* 13 September 1817, 11 November 1820, 31 August 1822, 27 October 1837, 16 October 1886.

Pursell, Carroll W. 1969. *Early Stationary Steam Engines in America.* Washington: Smithsonian Institute Press.

Québec (QC) *Mercury*, 19 June 1832.

Renwick, James. 1838. "On the Steam Boats of the United States of America." Appendix in *The Steam Engine: Its Invention and Progressive Improvement*, by Thomas Tredgold, 101-116. London: John Weale.

Rosenburg, Charles E. 2009. *The Cholera Years: The United States in 1832, 1849, and 1866.* Chicago: University of Chicago Press.

Ross, Ogden. 1997. *The Steamboats of Lake Champlain 1809-1930.* Burlington, VT: Vermont Heritage Press.

Royce, Caroline Halstead Barton. 1902. *Bessboro: A History of Westport, Essex Co., N.Y.* Westport, NY: C.H. Royce.

Rutland (VT) *Herald*, 1 May 1822, 16 September 1822, 10 October 1826.

Schwarz, George. 2012. "The Passenger Steamboat *Phoenix*: An Archaeological Study of Early Steam Propulsion in North America." Doctoral Dissertation, Anthropology, Texas A&M University, College Station, TX.

Schwarz, George. 2016. "Archaeology of the Early 19th-Century American Steamboat Phoenix." *International Journal of Nautical Archaeology* 45 (1): 119-140. doi:10.1111/1095-9270.12119.

Schwarz, George. 2018. *The Steamboat* Phoenix *and the Archaeology of Early Steam Navigation in North America*. New York: Routledge.

Steffy, J. Richard. 1994. *Wooden Ship Building and the Interpretation of Shipwrecks.* College Station, TX: Texas A&M University Press.

Stevenson, David. 1859. "Steam Navigation." In *Sketch of the Civil Engineering of North America*, by David Stevenson, 69-103. London: John Weale.

Stott, Peter. 2015. "Portrait of Gideon Lathrop (1805-1877)." *Columbia County History & Heritage* 14 (1): 30-38.

Strum, Richard M. 1998. *Ticonderoga: Lake Champlain Steamboat.* Shelburne, VT: Shelburne Museum.

Thompson, Zadock. 1853. *Part II: Civil History of Vermont.* Vol. II, in *History of Vermont, Natural, Civil and Statistical, in Three Parts*, by Zadock Thompson. Burlington, VT.

Tierney, Bartholomew. 1823. *A Statement of the Case of Bartholomew Tierney, Late Guager at Port St. Johns, Lower Canada, Respectfully Addressed to the Public.* Montreal, QC: James Lane.

Townsend Family Papers (TFP), Manuscripts and Archives Division, The New York Public Library, Astor, Lenox, and Tilden Foundations, Box 4, "Letters 1820, Feb 16-19," 16 February 1820.
TFP, Box 7, "Correspondence 1827-June 1833," 17 November 1830.
TFP, Box 7, "Correspondence 1827-June 1833," 4 March 1831.
TFP, Box 7, "Correspondence 1827-June 1833," 10 April 1831.
TFP, Box 7, "Correspondence 1827-June 1833," 7 June 1831.
TFP, Box 8, "Correspondence July 1833-1838; n.d.," 1 December 1833.
TRP, Box 57, "Miscellaneous 1802-1831," 18 August 1828.
TRP, Box 57, "Miscellaneous 1802-1831," 18 July 1830.

Tredgold, Thomas. 1838. *The Steam Engine: Its Invention and Progressive Improvement, an Investigation of Its Principles, and Its Application to Navigation, Manufacturers, and Railways.* London: John Weale.

Vermont Aurora (Vergennes, VT), 1 December 1825, 12 October 1826, 9 November 1826, 8 February 1827, 8 November 1827, 6 December 1827, 31 July 1828.

Walker, Daniel R. 2006. "The Identity and Construction of Wreck Baker A War of 1812 Era Royal Navy Frigate." Master's Thesis, Department of Anthropology, Texas A&M University, College Station, TX.

The Watchman (Montpelier, VT), 15 July 1828.

Wilkins, F. H. 1916. "Lake Champlain Steamers." *The Vermonter* 21 (1): 13-16.

Williams, Edwin. 1833. *The New York Annual Register.* New York: Peter-Hill.

Williams, Edwin. 1830. *The New-York Annual Register For the Year of Our Lord 1830.* New York: J. Leavitt.

Woodstock (VT) *Observer*, 9 July 1828.

Yamafune, Kotaro. 2016. "Using Computer Vision Photogrammetry (Agisoft Photoscan) to Record and Analyze Underwater Shipwreck Sites." Doctoral Dissertation, Department of Anthropology, Texas A&M University, College Station,TX.

APPENDIX A

RESEARCH PERMITS

VERMONT

State of Vermont
Division for Historic Preservation
One National Life Drive, Floor 6
Montpelier, VT 05620-0501
www.HistoricVermont.org

[phone] 802-828-3211
[division fax] 802-828-3206

Agency of Commerce and Community Development

PERMIT NO. 2014- 1

STATE OF VERMONT
DIVISION FOR HISTORIC PRESERVATION

PERMIT

FOR
FIELD INVESTIGATION
AND/OR
DATA RECOVERY

In accordance with Title 22 of Vermont Statutes Annotated, Subchapter 9, Section 782, permission is hereby granted to the **Department of Anthropology, Texas A&M University** (Texas A&M), MS 4352 TAMU, College Station, TX 77843-4352 and **Lake Champlain Maritime Museum (LCMM),** 4472 Basin Harbor Road, Vergennes, Vermont to carry out archaeological investigations and underwater survey as described in a permit application dated May 20, 2014. The work covered under this permit will generally consist of an underwater reconnaissance survey of four or more steamboat wrecks located in shallow water adjacent to the Aske Marina and Shelburne Shipyard near the tip of Shelburne Point in Shelburne, Vermont. The wrecks may include remnants of the *Burlington*, *Whitehall*, *Franklin*, *Francis Saltus*, and *Saranac* steamboats, all constructed between 1827 and 1844. In addition to basic documentation, the survey will contribute to a broader research initiative documenting early steamboat use in North America. The project will be funded by the Institute of Nautical Archaeology and the Center for Maritime Archaeology and Conservation.

This permit is subject to the Special conditions specified on Page 2 of this permit, and to the General conditions sent as a separate document and agreed to by the applicant on May 28, 2014 in the permit application.

Effective Date: June 6, 2014
Expiration Date: December 31, 2014

STATE OF VERMONT
DIVISION FOR HISTORIC PRESERVATION
By: [signature]
Laura V. Treischmann
State Historic Preservation Officer

Date: June 6, 2014

VERMONT

State of Vermont
Division for Historic Preservation
Deane C. Davis Building, 6th Floor
One National Life Drive, Montpelier, VT 05620-0501
www.accd.vermont.gov/strong_communities/preservation/

[phone] 802-828-3540

Agency of Commerce and Community Development

Archaeology Permit No. 2016-2

In accordance with Title 22 of Vermont Statutes Annotated, Subchapter 9, Section 782, permission is hereby granted to the **Department of Anthropology, Texas A&M University** (Texas A&M), MS 4352 TAMU, College Station, TX 77843-4352 and **Lake Champlain Maritime Museum (LCMM)**, 4472 Basin Harbor Road, Vergennes, Vermont to carry out archaeological investigations and underwater survey as described in a permit application dated May 26, 2016. The work covered under this permit will generally consist of an underwater reconnaissance and documentation survey of three or more steamboat wrecks located in shallow water adjacent to the Aske Marina and Shelburne Shipyard near the tip of Shelburne Point in Shelburne, Vermont. The investigation is a continuation of work begun in a field school initiated in 2014 and continued in 2015 with funding from a National Park Service Maritime Heritage Grant. The 2016 work will focus on the remains of the 1820 Phoenix II steamboat which, prior to the 2015 fieldwork, had been tentatively identified as the wreck of the Winooski (1832). The 2016 field work will include additional 2D and 3D photogrammetry complementing data collected in 2015, and the overall effort will also include additional documentation of adjacent steamboat wrecks. The 3-year project will contribute to a broader research initiative documenting early steamboat use in North America.

This permit is subject to the special conditions specified on Page 2, and to the general conditions sent as a separate document and agreed to by the applicant on May 26, 2016 in the 2016 permit application.

Effective Date: May 31, 2016

Expiration Date: December 31, 2016

By: e-Signed by Jess Robinson on 2016-05-31 17:02:10 GMT

Jess Robinson, PhD.

Vermont State Archaeologist

APPENDIX B

PHOENIX II WOOD SAMPLE IDENTIFICATION & REPORT

WOOD FROM TWO SHIPWRECKS IN LAKE CHAMPLAIN, VERMONT, USA

February 17, 2016

Prepared for:
Carolyn Kennedy
Nautical Archaeology Program
Department of Anthropology
Texas A&M University
College Station, Texas 77843

Prepared by:
Leslie L. Bush, Ph.D., R.P.A.
Macrobotanical Analysis
12308 Twin Creeks Rd., B-104
Manchaca, Texas 78652

Sixty-four wood samples from two shipwrecks at Shelburne Shipyard, Lake Champlain, Vermont were submitted for identification. Thirteen samples were labeled "Whitehall" and 51 were labeled "TE".

METHODS

Wood samples were received in individual bags of water contained in plastic tubs. For identification, wood samples were removed from bags one at at time, and clean anatomical sections were cut with razor blades. The sections were placed on glass microscope slides, moistened with boiled tap water and covered with a glass slip before being examined at 75-400 X magnification using a Spencer American Optics compound binocular microscope. Transverse, radial, and tangential sections were cut and examined for all softwoods. Samples that appeared to be hardwood (oak) on initial inspection were examined in transverse and tangential section under a 4 X magnifying light and only transverse sections cut and examined under the microscope to confirm the identification. After identification, sections cut from each sample were washed into a 2" x 2" ziplock bag with a few drops of water. The identification (and sample control number, when present) was written on Tyvek with a Sharpie marker. Section bags and identification labels were placed in the original bag with the remainder of the sample.

Woods were identified to the lowest possible taxonomic level by comparison to materials in the Macrobotanical Analysis comparative collection and through the use of standard reference works (e.g., Core et al. 1979; Hoadley 1990; InsideWood 2004-onwards; Panshin and de Zeeuw 1980; Wheeler 2011). Plant nomenclature follows the PLANTS database (USDA, NRCS 2016).

RESULTS

As shown in Tables 1 and 2, four types of wood were identified from the two shipwrecks. Properties of the woods identified and distribution of the tree species is discussed below.

Shipwrecks

Ten of the thirteen samples from the **Whitehall** wreck were oak of the white group. The two samples labeled "stringers" were soft pine, and the remaining sample, "Futtock Frame 85, port" was northern white-cedar.

Twenty-nine samples from the "**TE**" wreck were oak of the white group. These samples included pieces associated with the ceiling and keel as well as the frame. The eleven samples identified as northern white-cedar all appear to have come from various parts of the frame. Nine samples were soft pine, including several labeled "stringers". A fourth type of wood, eastern white-cedar, was present only as "Frame 38 in board" and "Frame 39 starboard".

Woods

White group oak (*Quercus* sect. *Quercus*). Samples of this type were heavy, dark in color, and in good condition. The ring-porous structure and large, multi-seriate rays could usually be seen without magnification after the transverse section was cleaned. Clean sections examined under the microscope revealed abundant tyloses and small latewood pores arranged in dendritic patterns, indicating an oak of the white group (Hoadley 1990:103). These and other anatomical characteristics are illustrated in Figure 1. White group oaks are present in Europe, Asia, and North Africa as well as North America. Of the North American oaks in this group, white oak *(Quercus alba*) and bur oak (*Quercus macrocarpa*) are the most common in the northeastern United States (Elias 1980:317-351). The tyloses that occlude the large vessels of white group oaks make them relatively impermeable and well-suited to use in shipbuilding and tight cooperage (Panshin and de Zeeuw 1980:571-2). White group oak wood is hard and resists abrasion. Its high specific gravity (average 0.68) makes it durable but also heavy, a characteristic that can be a liability in transportation applications (Hoadley 1990:103).

Soft pine (*Pinus* subgenus *Strobus*). Soft pines were identified by the preponderance of tracheids, large resin canals, gradual transition from earlywood to latewood, fenestriform cross-field pitting, and presence of smooth-walled ray tracheids. Some of these anatomical characteristics are illustrated in Figure 2. The relatively fine texture of the pine wood from both wrecks suggests the specimens represent eastern white pine, (*Pinus strobus)* (Hoadley 1990:144-5). This is the only pine of the soft pine timber group that grows in the northeastern United States (Elias 1980:37-49). Its range is shown in Figure 3. Soft pines also occur in Europe, Asia, Central America and other parts of North America, however. As indicated above, soft pine, probably eastern white pine, appears to be the preferred wood for stingers in these ships. Eastern white pine is valued for its uniform texture, ease of cutting in any direction, and minimal shrinkage and swelling (Panshin and de Zeeuw 1980:441). Its specific gravity averages about 0.35 (Hoadley 1990:145).

Northern white-cedar (*Thuja occidentalis*) was identified by the preponderance of tracheids, absence of resin canals, gradual transition from earlywood to latewood, taxodioid cross-field pitting, absence of ray tracheids, and scarcity or absence of longitudinal parenchyma. Some of these anatomical characteristics are illustrated in Figure 4. The finer texture and more gradual transition from earlywood to latewood in the wood from these wrecks indicates an identification of northern white-cedar rather than western redcedar (*Thuja plicata*), the other member of the genus in North America (Hoadley 1990:159-160; Panshin and de Zeeuw 1980:483). The range of northern white-cedar is shown in Figure 5. Trees of the genus *Thuja* also occur in Japan, Korea, and China. Northern white-cedar is noted for its durability in contact with the ground, and it is frequently used in boatbuilding, especially for canoe ribs (Panshin and de Zeeuw 1980:483). At 0.31 its specific gravity is slightly lighter than eastern white pine (Hoadley 1990:159).

Eastern white-cedar (*Chamaecyparis thyoides*). Only two samples were identified as eastern white-cedar. As shown in Figure 6, they were distinguished from northern white-cedar by the presence of cupressoid cross-field pitting (Hoadley 1990:159). The wood was distinguished from the western members of the genus by the lesser abundance of longitudinal parenchyma and apparently smooth longitudinal parenchyma end walls. The range of this tree is shown in Figure 7. At 0.32, its specific gravity is similar to northern white-cedar, and it is also used in boat construction (Panshin and de Zeeuw 1980:490).

References Cited

Core, H. A., W. A. Cote and A. C. Day
1979 *Wood Structure and Identification*. 2nd ed. Syracuse University Press, Syracuse, New York.

Elias, Thomas S.
1980 *The Complete Trees of North America: Field Guide and Natural History*. Outdoor Life/Nature Books. Van Nostrand Reinhold Company, New York.

Hoadley, R. Bruce
1990 *Identifying Wood: Accurate Results with Simple Tools*. The Taunton Press, Newtown, Connecticut.

InsideWood
2004 onwards Published on the Internet. http://insidewood.lib.ncsu.edu/search. Accessed 2/12/16.

Panshin, A. J. and Carol de Zeeuw
1980 *Textbook of Wood Technology: Structure, Identification, Properties, and Uses of the Commercial Woods of the United States and Canada*. 4th ed. McGraw-Hill Book Company, New York.

USDA, NRCS (United States Department of Agriculture, Natural Resources Conservation Service)
2016 The PLANTS Database. United States Department of Agriculture, Natural Resources Conservation Service, National Plant Data Team, Greensboro, NC 27401-4901. http://plants.usda.gov. Accessed 2/12/16.

Wheeler, Elizabeth A.
2011 InsideWood - A Web Resource for Hardwood Anatomy. *IAWA Journal* 32(2):199-211.

Control #	Context	Botanical name	Common name	Ship Feature
02-033	1st ceiling strake out from keelson P180	*Quercus* section *Quercus*	White group oak	Ceiling
02-034	Ceiling plank port side of keel P2 80	*Quercus* section *Quercus*	White group oak	Ceiling
02-034	Frame 75 starboard	*Thuja occidentalis*	Northern white-cedar	Futtock
02-036	Ceiling plank outboard of stringer 1	*Quercus* section *Quercus*	White group oak	Ceiling
02-037	P3 ceiling plank	*Quercus* section *Quercus*	White group oak	Ceiling
02-038	Frame 76 starboard	*Thuja occidentalis*	Northern white-cedar	Floor
02-039	Frame 78 starboard	*Thuja occidentalis*	Northern white-cedar	Floor
02-040	79 starboard frame	*Thuja occidentalis*	Northern white-cedar	Futtock
02-041	Frame 80 starboard	*Thuja occidentalis*	Northern white-cedar	Floor
02-042	77 starboard side	*Thuja occidentalis*	Northern white-cedar	Futtock
02-044	Frame keelson 75 & 77	*Quercus* section *Quercus*	White group oak	Keelson
02-045	Port side stringer/upper	*Pinus* subgenus *Strobus*	Soft pine group	Engine Bed Timber
02-047	Limber board starboard	*Pinus* subgenus *Strobus*	Soft pine group	Ceiling
02-048	Keel abaft Frame 78	*Quercus* section *Quercus*	White group oak	Keel
02-049	Port side stringer 1 lower	*Pinus* subgenus *Strobus*	Soft pine group	Engine Bed Timber
02-052	Portside stringer 1	*Pinus* subgenus *Strobus*	Soft pine group	Engine Bed Timber
02-053	Frame P5	*Quercus* section *Quercus*	White group oak	Ceiling
02-055	Planking starboard b/w 76 & 77	*Quercus* section *Quercus*	White group oak	Ceiling
02-056	Frame P8	*Quercus* section *Quercus*	White group oak	Ceiling
02-057	Frame P7	*Quercus* section *Quercus*	White group oak	Ceiliing
02-058	Frame 42 starboard side	*Thuja occidentalis*	Northern white-cedar	Floor
02-059	Frame 41 starboard	*Thuja occidentalis*	Northern white-cedar	Futtock
02-060	Frame 40 starboard	*Quercus* section *Quercus*	White group oak	Midship Floor
02-061	Frame 39 starboard	*Chamaecyparis thyoides*	Atlantic white-cedar	Futtock
02-062	Frame 38 delta outboard	*Thuja occidentalis*	Northern white-cedar	Second Futtock

02-063	Frame 38 in board	*Chamaecyparis thyoides*	Atlantic white-cedar	Floor
02-064	Frame ceiling plank 6-P	*Quercus* section *Quercus*	White group oak	Ceiling
02-071	Starboard frame 40	*Quercus* section *Quercus*	White group oak	Floor
02-072	Frame 39 ceiling plank 1 starboard	*Quercus* section *Quercus*	White group oak	Ceiling
02-073	Frame ceiling plank 5 outboard	*Quercus* section *Quercus*	White group oak	Ceiling
02-074	Frame ceiling plank 4 outboard port side	*Quercus* section *Quercus*	White group oak	Ceiling
02-075	Frame ceiling plank 3, port side	*Quercus* section *Quercus*	White group oak	Ceiling
02-076	Frame ceiling plank 1, starboard	*Quercus* section *Quercus*	White group oak	Ceiling
02-077	Plank starboard limber board, frame 40	*Quercus* section *Quercus*	White group oak	Ceiling
02-078	Frame 2 D2, Port Frame 39	*Quercus* section *Quercus*	White group oak	Ceiling
02-079	Frame 39 ceiling plank 1 port	*Quercus* section *Quercus*	White group oak	Ceiling
02-080	Upper port stringer 2	*Quercus* section *Quercus*	White group oak	Engine Bed Timber
02-081	Frame 40 lower port stringer 2	*Quercus* section *Quercus*	White group oak	Engine Bed Timber
02-083	Frame 40, upper stringer 1, starboard	*Pinus* subgenus *Strobus*	Soft pine group	Engine Bed Timber
02-084	Frame 40, upper starboard stringer 2	*Quercus* section *Quercus*	White group oak	Engine Bed Timber
02-085	Frame 40, Lower starboard stringer	*Pinus* subgenus *Strobus*	Soft pine group	Engine Bed Timber
02-086	Stringer 2 lower starboard	*Quercus* section *Quercus*	White group oak	Engine Bed Timber
02-087	Lower keelson, Frame 40	*Quercus* section *Quercus*	White group oak	Keelson
02-088	Frame 40 upper keelson	*Quercus* section *Quercus*	White group oak	Keelson
02-089	Frame 40 port side stringer 3	*Quercus* section *Quercus*	White group oak	Unidentified member possibly related to boiler activity (see page 209)
02-090	Floor Frame 40 port	*Quercus* section *Quercus*	White group oak	Floor
02-091	Futtock Frame 40	*Thuja occidentalis*	Northern white-cedar	Second Futtock
02-092	Frame 40 lower P1	*Pinus* subgenus *Strobus*	Soft pine group	Engine Bed Timber
02-093	Frame 40, upper port side, stringer 1	*Pinus* subgenus *Strobus*	Soft pine group	Engine Bed Timber

02-093	Frame 40 stringer 1, upper port side	*Pinus* subgenus *Strobus*	Soft pine group	Engine Bed Timber
02-106	Frame 79, 1st futtock, port	*Thuja occidentalis*	Northern white-cedar	Futtock

Table 1. Wood samples retrieved in 2015 from Lake Champlain Wreck 2. (Results by Dr. L. Bush)

Control #	**Provenience**	**Botanical name**	**Common name**	**Ship Part (alpha sort)**
02-113	Frame 20, ceiling plank 5, starboard	*Quercus* section *Quercus*	Oak, white group	Ceiling
02-119	Frame 20, ceiling plank 3, starboard	*Quercus* section *Quercus*	Oak, white group	Ceiling
02-120	Frame 20, ceiling plank 4, starboard	*Quercus* section *Quercus*	Oak, white group	Ceiling
02-121	Frame 80, ceiling plank 9, port	*Quercus* section *Quercus*	Oak, white group	Ceiling
02-124	Frame 80 ceiling plank 12 W5	*Quercus* section *Quercus*	Oak, white group	Ceiling
02-126	Frame 80, ceiling plank 10 (P11B)	*Quercus* section *Quercus*	Oak, white group	Ceiling
02-127	Frame 80, ceiling plank 10	*Quercus* section *Quercus*	Oak, white group	Ceiling
02-154	Frame 80 ceiling plank P11a	*Quercus* section *Quercus*	Oak, white group	Ceiling
02-178	Frame 20, ceiling plank 1	*Quercus* section *Quercus*	Oak, white group	Ceiling
02-179	Frame 20 ceiling plank 3	*Quercus* section *Quercus*	Oak, white group	Ceiling
02-180	Frame 20 ceiling plank 11	*Quercus* section *Quercus*	Oak, white group	Ceiling
02-182	Frame 20 ceiling plank 12	*Quercus* section *Quercus*	Oak, white group	Ceiling
02-186	Frame 20 ceiling plank p2	*Quercus* section *Quercus*	Oak, white group	Ceiling
02-196	Frame 20, ceiling plank - P10	*Quercus* section *Quercus*	Oak, white group	Ceiling
02-197	Frame 20, ceiling plank - P9	*Quercus* section *Quercus*	Oak, white group	Ceiling
02-198	Frame 20, ceiling plank - P4	*Quercus* section *Quercus*	Oak, white group	Ceiling

02-208	Frame 20, ceiling plank P5	*Quercus* section *Quercus*	Oak, white group	Ceiling
02-209	Frame 110 Portside	*Quercus* section *Quercus*	Oak, white group	Floor
02-221	Frame 20, ceiling plank - P6	*Quercus* section *Quercus*	Oak, white group	Ceiling
02-222	Frame 80, second futtock treenail, port	*Quercus* section *Quercus*	Oak, white group	Treenail
02-223	Frame 80, second futtock, port	*Thuja occidentalis*	White cedar, northern	Futtock
02-225	Frame 20 ceiling plank 15	*Quercus* section *Quercus*	Oak, white group	Ceiling
02-226	Frame 80 treenail attaching first futtock to ceiling plank 12, port	*Chamaecyparis thyoides*	White cedar, Atlantic	Treenail
02-235	Frame 80 Keel	*Quercus* section *Quercus*	Oak, white group	Keel
02-247	Frame 20 ceiling plank P7	*Quercus* section *Quercus*	Oak, white group	Ceiling
02-248	Frame 20 ceiling plank P8	*Quercus* section *Quercus*	Oak, white group	Ceiling
02-257	Frame 5 ceiling plank 1	*Quercus* section *Quercus*	Oak, white group	Ceiling
02-258	Frame 5 ceiling plank 2	*Quercus* section *Quercus*	Oak, white group	Ceiling
02-266	Frame 5 ceiling plank P3	*Quercus* section *Quercus*	Oak, white group	Ceiling
02-267	Frame 5 ceiling plank P4	*Quercus* section *Quercus*	Oak, white group	Ceiling
02-268	Frame 5 ceiling plank P5	*Pinus* subgenus *Strobus*	Pine, soft group	Ceiling
02-308	Frame 20-21 starboard 1st futtock	*Thuja occidentalis*	White cedar, northern	Futtock
02-313	Frame 20-21 port first futtock	*Chamaecyparis/Thuja*	White cedar	Futtock
02-314	Frame 20 port stringer	*Pinus* subgenus *Strobus*	Pine, soft group	Engine Bed Timber
02-315	Frame 20 floor	*Chamaecyparis/Thuja*	White cedar	Floor
02-316	Frame 20 starboard stringer	*Pinus* subgenus *Strobus*	Pine, soft group	Engine Bed Timber
02-317	Frame 5 apron	*Quercus* section *Quercus*	Oak, white group	Apron
02-318	Frame 20 second	*Chamaecyparis/Thuja*	White cedar	Second

	futtock			Futtock
02-321	Garboard port side frame 5-bow	*Quercus* section *Quercus*	Oak, white group	Garboard
02-322	Stem	*Quercus* section *Quercus*	Oak, white group	Stem
02-324	Frame 5 starboard	*Chamaecyparis thyoides*	White cedar, Atlantic	Floor
02-327	Port futtock, frame 107	*Thuja occidentalis*	White cedar, northern	Futtock
02-328	Starboard futtock frame 107	*Thuja occidentalis*	White cedar, northern	Futtock
02-329	Floor frame 108	*Chamaecyparis thyoides*	White cedar, Atlantic	Floor
02-330	Frame 5 starboard chock	*Chamaecyparis thyoides*	White cedar, Atlantic	Chock
02-331	Frame 5, keel	*Quercus* section *Quercus*	Oak, white group	Keel
02-332	Frame 110 floor	*Chamaecyparis/Thuja*	White cedar	Floor
02-333	Frame 7 Port stringer	*Pinus* subgenus *Strobus*	Pine, soft group	Stringer
02-334	Frame 110 Port stringer	*Pinus* subgenus *Pinus*	Pine, hard group	Stringer
02-335	Frame 20 keelson, bow side of Scarf	*Quercus* section *Quercus*	Oak, white group	Keelson
02-336	Frame 110 port futtock	*Thuja occidentalis*	White cedar, northern	Futtock
02-349	Frame 110 1st futtock starboard	*Chamaecyparis/Thuja*	White cedar	Futtock
02-355	Frame 60 port stringer 1-1	*Pinus* subgenus *Strobus*	Pine, soft group	Stringer
02-359	Frame 112 Port floor	*Chamaecyparis thyoides*	White cedar, Atlantic	Floor
02-360	Frame 118 Port floor	Fagaceae	Oak family	Floor
02-361	Frame 113 Port floor	*Chamaecyparis thyoides*	White cedar, Atlantic	Floor
02-362	Upper deadwood Frame 117 Port	*Quercus* section *Quercus*	Oak, white group	Deadwood
02-363	Lower deadwood frame 110	*Pinus* subgenus *Strobus*	Pine, soft group	Deadwood
02-364	Frame 119 Port	*Thuja occidentalis*	White cedar, northern	Futtock
02-365	Stern knee	*Quercus* section *Quercus*	Oak, white group	Knee

02-366	Frame 117 Port	*Chamaecyparis thyoides*	White cedar, Atlantic	Futtock
02-367	Stern lower chock	*Chamaecyparis thyoides*	White cedar, Atlantic	Chock
02-368	Frame 111 Port	*Thuja occidentalis*	White cedar, northern	Futtock
02-369	Frame 115 Port	*Chamaecyparis thyoides*	White cedar, Atlantic	Futtock
02-370	Frame 116 Port floor	*Quercus* section *Quercus*	Oak, white group	Floor
02-371	Frame 20 ceiling plank 2 starboard	*Quercus* section *Quercus*	Oak, white group	Ceiling
02-372	Frame 120 Port floor	*Quercus* section *Quercus*	Oak, white group	Floor
02-373	Frame 114 Port floor	*Chamaecyparis thyoides*	White cedar, Atlantic	Floor
02-374	Frame 20, ceiling plank 2, Port	*Quercus* section *Quercus*	Oak, white group	Ceiling
02-375	Sternpost	*Quercus* section *Quercus*	Oak, white group	Sternpost
02-376	Outer sternpost	*Quercus* section *Quercus*	Oak, white group	Sternpost
02-381	Half frame 122 port	*Chamaecyparis thyoides*	White cedar, Atlantic	Half Frame
02-382	Half frame 121 Port	*Chamaecyparis thyoides*	White cedar, Atlantic	Half Frame
02-383	Stern upper chock port	*Chamaecyparis thyoides*	White cedar, Atlantic	Chock
02-384	Half frame 123 port	*Chamaecyparis/Thuja*	White cedar	Half Frame

Table 2. Wood samples retrieved in 2016 from Lake Champlain Wreck 2. (Results by Dr. L. Bush)