A SPATIAL ANALYSIS OF USCG VESSEL *LILAC*:

AN ARCHAEOLOGICAL APPLICATION OF ACCESS ANALYSIS

By

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This thesis examines the relationship between society and space by analyzing the perceptual structure, placement, or arrangement of space (i.e., spatial patterning) onboard *Lilac*, a lighthouse and buoy tender that operated as part of the United States Lighthouse Service (USLS) and the United States Coast Guard (USCG). During an active career spanning from 1933-1972, *Lilac* was responsible for maintaining navigational aids on the Delaware River, the Delaware Bay, and the Delaware Bay's approaches from the Atlantic Ocean. Drawing from Hillier and Hanson's space syntax theory (1984), a method of access analysis will be used to elucidate the spatial patterning on *Lilac* and the social structure which both produced it and was structured by it to maintain a rank-based hierarchy among USLS and USCG servicemembers.

A Spatial Analysis of USCG Vessel *Lilac*: An Archaeological Application of Access Analysis

A Thesis

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CHAPTER 1: INTRODUCTION

Launched in 1933, *Lilac* functioned as a lighthouse and buoy tender for the United States Lighthouse Service (USLS) and United States Coast Guard (USCG) until the vessel's decommissioning in 1972 (Scheina 1982:123). During *Lilac*'s nearly four-decade lifespan, the vessel underwent a series of design changes that affected the internal organization of space onboard. Modifications to the built environment are often interpreted as the materialization of social, economic, or political shifts within populations (Hillier & Hanson 1984:27). With this understanding, this thesis explores how the reconfigurations made to *Lilac*'s design throughout time conceivably mirror societal and cultural changes in USLS and USCG history.

As Hiller and Hanson (1984) assert: "The most far-reaching changes in the evolution of societies have usually involved or led to profound shifts in spatial form and in the relation of society to its spatial milieu; these shifts appear to be not so much a by-product of the social changes, but an intrinsic part of them and even to some extent causative of them" (Hillier & Hanson 1984:27). Spatial analysis in archaeological studies notes the correlation between major changes in society and those found in architecture; demonstrating that these links are not the product of coincidence. Rather, archaeologists determined the "built environment" is often modified to represent changes within a society or culture (Foster 1989; Kent 1990; Bustard 1999; Rotman & Nassaney 1997; Cutting 2003; Brusasco 2004; Johnson 2010:115; Morten et al 2012). The built environment actively serves to create, reproduce, and transform social relations; as such, structures embody social information about their makers (Rotman & Nassaney 1997:42).

Hillier and Hanson's work, *The Social Logic of Space* (1984), was one of the first to not only discuss spatial patterning in connection with social logic, but to develop methods to systematically examine it: "The ordering of space in buildings is really about the ordering of relations between people" (Hillier and Hanson 1984:2). Rather than merely acting as a backdrop or response to certain environmental needs, space is an important element in the development of behavior and culturally meaningful (Fisher 2009:440). The argument of *The Social Logic of Space* (1984) largely centers on Hillier and Hanson's theory of space syntax and the belief that space is both produced by, and in turn produces and reproduces, social relations.

This thesis uses an archaeological application of Hillier and Hanson's space syntax theory (1984), specifically access analysis, to investigate the relationship between spatial order and society represented on *Lilac*. In doing so, this thesis adds to the growing body of literature devoted to spatial analysis and its ability to illuminate social and cultural trends throughout history.

Research Questions

Using access analysis (the graphical manifestation of space syntax theory – a mapping method used to study variants in spatial order) and historical data collected regarding *Lilac* and the USLS and USCG, the following questions will be addressed:

1. What does the spatial patterning onboard *Lilac* suggest in terms of the social logic of its configuration?
2. Does the spatial patterning indicate a hierarchical relationship among USLS and USCG servicemembers? If so, what is the hierarchy based on (e.g., rank)? The stratification of authority is anticipated to be reflected through placement and privacy. Noticeable differences in permeability, control of other spaces, and amount of isolation and privacy could indicate that a hierarchy was present and replicated onboard *Lilac*.
3. If the presence of a hierarchy onboard is observed in the spatial patterning, is there any evidence of resistance to authority as represented in the social logic of *Lilac*'s

structuring? Members of society use space to reinforce and resist relations of power, authority, and inequality (Rotman & Nassaney 1997:42). This is done by organizing space to facilitate the activities and movements of some individuals, while simultaneously constraining others (Rotman & Nassaney 1997:42).

Thesis Structure

This thesis is organized to, first, provide the historical context for the issues addressed; second, present a theoretical and methodological foundation; and, finally, draw together the results from both the historical and archaeological analyses to address the stated research questions. In order to accomplish these aims, this study is organized into seven chapters. Chapter 2, titled "Historical Perspectives," describes *Lilac*'s construction, service as part of the USLS and USCG (1933-1972), and the period following the vessel's decommissioning to present-day (1972-2020).

Chapter 3, "Theoretical Approach," examines spatial archaeological theory, specifically Hillier and Hanson's (1984) access analysis method (the graphical manifestation of space syntax theory), and its applications. The application of access analysis particularly suits this study because it highlights *Lilac*'s changing spatial patterns, while simultaneously illuminating the role space played in the structuring and reinforcement of societal norms onboard.

The purpose of Chapter 4, titled "Methodology," is to outline the methodology used to collect and synthesize data throughout this study. This thesis uses several research methodologies that were developed based on available data, and this section describes how and why they were used. The ultimate purpose of this section is to explain how Hillier and Hanson's (1984) theory of spatial analysis is applied in this study. In doing so, this thesis can hopefully act as a framework for further studies utilizing spatial archaeological methods in maritime contexts.

The fifth chapter, "Results of Archaeological Investigation," focuses on the outcomes of the archaeological investigation and describes the complete design of *Lilac*'s 1933 original configuration, and the subsequent changes and additions made to the described spaces in the years that followed the vessel's launch up to present day (1933-2020). This section focuses on the specific design features of *Lilac*'s 1933, 1942, 1958, and 2020 design configurations and provides readers with vital information regarding *Lilac*'s component spaces and key design changes. This information is then built on in the subsequent chapter (Chapter 6) where it is analyzed through the lens of access analysis.

Chapter 6, titled "Access Analysis Diagramed and Interpreted," examines the observed changes in *Lilac*'s spatial organization over time through the paradigm of Hillier and Hanson's (1984) access analysis, to elucidate the societal norms which both influenced *Lilac*'s spatial patterning and was in return influenced by it to maintain a rank-based social hierarchy among individuals serving onboard the vessel. Along with documentary evidence, access diagrams (the visual manifestation of access analysis) are used throughout this chapter to measure the permeability of rooms and areas onboard *Lilac* to illuminate social patterns.

The final chapter, Chapter 7, synthesizes the information presented in this study, finding that *Lilac*'s design reflects important USLS and USCG cultural changes and that the vessel's configuration in turn reinforced USLS and USCG social norms among servicemembers. This chapter also discusses the limitations of this study and concludes with suggestions for additional research. These suggestions include the wider application of spatial analysis to other archaeological maritime contexts.

One of the goals of this thesis is to demonstrate that spatial archaeological theory and methods, like access analysis, can and should be applied to maritime contexts. Space plays a multi-faceted role in the construction and reinforcement of maritime culture onboard vessels. There exist complex relationships between space and society, which cannot be fully understood through an examination of the historical record alone. Rather, by examining a vessel using access analysis, in conjunction to studying the historical record, researchers can yield an understanding of space's social logic. Access analysis represents a relatively untapped resource in terms of theoretical approaches to maritime archaeological practice. Future archaeological applications of access analysis in maritime contexts would prove fruitful.

CHAPTER 2: HISTORICAL PERSPECTIVES

Introduction

In order to conduct a thorough analysis of the social logic behind *Lilac*'s spatial patterning, an understanding of the vessel's history and role in the United States Lighthouse Service (USLS) and United States Coast Guard (USCG) is required. A historical study of the USLS and USCG alongside an examination of its social structure will result in a better comprehension of life onboard *Lilac*. This perspective will form the foundation for the primary historical analysis, which relates more directly to *Lilac*, as it will center on the vessel's specific history in conjunction to its role in the USLS and USCG.

There are a number of historical focal points pertaining to *Lilac*'s spatial patterning. The first will establish the origins of the USCG and USLS and its history up to 1972 (the *Lilac* was decommissioned), which will help to lay the foundation for understanding *Lilac*'s role within broader maritime institutions. This is followed by a section devoted to *Lilac*'s construction, launch, and early career as part of the USLS, including a discussion of the vessel's operations and duties. The subsequent section explores *Lilac*'s history while serving as part of the USCG's fleet. Together, these sections provide a detailed historical background that enables readers to develop a better understanding of *Lilac*'s role in history and how the maritime institutions the vessel served affected its design and operations. This chapter concludes by describing the period in *Lilac*'s history following its decommissioning to present day (1972-2020).

History of the U.S. Coast Guard and U.S. Lighthouse Service

The USCG received its name in 1915 when an act of Congress merged the Revenue Cutter Service with the Life-Saving Service (Johnson 1987:34). The United States Life-Saving Service was a government agency created in 1848 as a result of civilian efforts to save the lives of shipwrecked mariners. Lifesaving stations, small shed-like structures supplied with rescue equipment, were manned by full-time volunteer crews along the nation's coastlines (O'Connor 1879:183; Noble 1994:20). The stations, however, were mainly located around large ports, leaving large gaps of coastline without lifesaving equipment (Noble 1994:20). In 1878, the network of life saving stations were formally organized under the name "Life-Saving Service" as an agency of the U.S. Department of the Treasury (Noble 1994:28). Originally intended to enforce tariff and trade laws and prevent smuggling, the Revenue Cutter Service was founded in 1790. The Life-Saving Service's dedication to help mariners in need aligned with the Revenue Cutter Service's dedication to protect America's waterways and maintain maritime law. The merging of the Revenue Cutter Service and the Life-Saving Service in 1915 provided the USCG with a solid foundation on which to improve and maintain the safety of the nation's waterways (King 1989).

The 1915 legislation expressly states that the Coast Guard, established January 28, 1915, "shall be a military service and a branch of the armed forces of the United States at all times" (14 U.S.C. 1). In doing so, Congress codified the one-time civilian coastal patrol service (the Life-Saving Service) and treasury agency (the Revenue Cutter Service) as a military establishment intended to serve the country alongside the nation's other armed services as well as enforce maritime laws. While the Revenue Cutter Service played a pivotal role in the War of 1812, World War I would provide the first conflict in which the USCG would act in a true military capacity. In addition to its peacetime duties, the Coast Guard was responsible for upholding neutrality laws (before the U.S. entered the war) and assisting naval operations (after the U.S. entered the war) (Johnson 1987:45; Larzelere 2003).

The Coast Guard's national defense responsibility has been one of its most important duties since its founding. During times of peace, the USCG enforces the nation's federal laws at sea and in coastal waters and inland waterways; protects the nation's vast coastline and ports; maintains navigational aids; and works to preserve and protect at-risk lives and vessels. In times of war, the USCG serves under the Navy Department. The 1915 legislature states the USCG would "operate as part of the Navy, subject to the orders of the Secretary of the Navy, in time of war or when the President shall so direct" (Johnson 1987:44). As such, the USCG is simultaneously a military force and federal law enforcement agency dedicated to maritime safety, security, and stewardship missions. Following WWI, the next monumental shift to the organization of the USCG was the incorporation of the U.S. Light House Service (USLS) in 1939 (Johnson 1987:44).

Established in 1789, the USLS sought to provide and maintain safe and dependable sea routes along the American coasts to support maritime commerce and traffic and to protect life at sea (Marshall 1998:3). The USLS would change its configuration several times following its creation in 1789 up to its incorporation into the USCG in 1939; however, its mission remained the same: "to facilitate commerce by ensuring the efficient lighting and marking of the United States' coast, and to provide safe and reliable navigational aids of all types" (Marshall 1998:4). After a long and illustrious period of service, the USLS joined the ranks of the USCG when President Franklin Roosevelt ordered the transfer of the Lighthouse Service to the Coast Guard in 1939. The transfer integrated approximately 30,000 navigational aids (including light vessels and lighthouses), 5,200 employees, 64 buoy tenders, 30 depots, and 17 district offices. Following the merge, the USCG began to maintain the aids to maritime navigation, including operating the nation's lighthouses and buoys (Johnson 1987:161-65; Marshall 1998:155). Lighthouse and buoy tenders, like *Lilac*, would become a vital part of the USCG's management strategies for the nation's maritime navigational devices, in addition to its military operations, especially during World War II.

Perhaps one of the most important changes to USCG policy and operations came about during WWII when Coast Guard vessels were racially desegregated and Congress established the Women's Coast Guard Reserves, known as SPARs (an acronym for *Semper Paratus* – Always Ready) (Johnson 1987:198-99). This change in USCG policy would greatly impact subsequent military policy and operations, opening the doors to future minority populations enlisting and undertaking active roles in the USCG and other military branches. Following the end of WWII in 1946, control of the Coast Guard was transferred from the Navy back to the Department of the Treasury (Johnson 1987:260). In 1948, U.S. President Harry Truman issued Executive Order 9981 which abolished racial segregation in the U.S. military (Harry S. Truman Presidential Library 2018). By this time, the Coast Guard had opened all rates to qualified individuals regardless of race (Johnson 1987:196-97). Noting President Truman's Committee on Civil Rights (1947-48), the Coast Guard observed "the importance of selecting men for what they are, for what they are capable of doing, and insisting on good conduct, good behavior, and good qualities of leadership for all hands…As a matter of policy Negro recruits receive the same consideration as all others" (Harry S. Truman Presidential Library 1948:41). Shortly after, the Coast Guard ruled that former enlisted women of the Coast Guard Reserve could join the Women's Volunteer Reserve (SPARs) (Johnson 1987:196-97).

With the influx of newly enlisted individuals into the Coast Guard's ranks, the USCG made a public statement (Public Law #207) to name its duties and functions. This law confirmed the Coast Guard was a branch of the U.S. armed forces. Additionally, the law states the Coast

Guard's general functions consists of marine safety, maritime law enforcement, and military readiness to operate as a branch of the Navy during war or under presidential directives (USCG Historian's Office 2018). Effectively, Executive Order 9981 and Public Law #207 established enlistment eligibility and operations; this would be important in the years to follow as the Coast Guard was transferred to a new overseeing body.

The large-scale exodus of Cuban immigrants attempting to enter the U.S. in the late 1960s prompted the U.S. military branches (including the USCG) to consider their policies regarding migrant interdiction. In an attempt to address and alleviate the added stress placed on maritime ports and shipping traffic, the Coast Guard was transferred to the U.S. Department of Transportation in 1969 (Ostrom 2012:12). This added to the Coast Guard's responsibilities to include duties related to economic maritime traffic, migrant interdiction, and hazardous cargo, in addition to those outlined in Public Law #207 (Ostrom 2012:43).

Evolving as needed, the Coast Guard's responsibilities were once more extended in 1970 when the Water Quality Act increased their jurisdiction over hazardous spills, including pollutants such as mercury, petroleum, pesticides, and explosives (Mendelsohn & Fidell 1979:477). Historically, the USCG's role in environmental matters was limited to clearing waterways of debris following vessel collisions or after maritime disasters. The Federal Water Pollution Control Act and the Ports and Waterways Safety Acts of 1972 established cleanup and liability standards for oil spills and pollution (Davis 1974:249). Furthermore, the legislation outlined the necessary steps Coast Guard vessels were to undertake to avoid environmental disasters in the future; for example, authorizing the Coast Guard to examine the construction and design of vessels intended to carry hazardous materials (Mendelsohn & Fidell 1979:477). It also instituted a national emergency contingency plan for oil spills and established Marine

Environmental Response (MER) units concerned primarily with pollution response (Ostrom 2012:115).

Lilac's Construction, Launch, and Early Career in the U.S. Lighthouse Service

During an active career spanning just short of four decades, *Lilac* was the primary vessel responsible for maintaining navigational aids on the Delaware River, the Delaware Bay, and the Delaware Bay's approaches from the Atlantic Ocean (Figure 2.1). The Delaware Bay and River provide access to waterways leading to the Port of Philadelphia and the Philadelphia Naval Yard, lesser ports from Trenton, New Jersey, and the ports surrounding Wilmington, Delaware. In addition, the Delaware River and Bay linked the nation's Intracoastal Waterway System through the Cape May Ship Canal and the Chesapeake and Delaware Ship Canal (National Oceanic Service [NOS] & National Oceanic and Atmospheric Administration [NOAA] 2012:11).

Figure 2.1. *Lilac* at Sea, 1933 (Hagley Digital Archives 2018).

To navigate these waterways, in the 1890s, the United States Lighthouse Board (a predecessor of the U.S. Lighthouse Service), recognizing the necessity of specialized vessels to handle buoys with a maximum amount of safety, developed a basic design for its largest steam tenders (Marshall 1995:9). Steam-propelled vessels were more maneuverable than their sail-rigged counterparts, ensuring a more accurate placement of buoys (Marshall 1998:3-4). Between 1892 and 1939, thirty-three of these vessels were built, most ranging in length from 164 to 174 feet (Brouwer 2004: Section 8-1; HSNA 2014). *Violet*, the namesake of *Lilac*'s vessel tender class, launched in Manitowoc, Wisconsin in August 1930. *Mistletoe*, the third vessel in the class, would not launch until 1938. A fourth tender vessel, *Arbutus*, was constructed along with *Lilac* during 1932-1933 in the same shipyard and was outfitted with the same machinery. *Lilac* and *Arbutus* possess similar dimensions and nearly the same deck layout and hull profile; the difference being that *Lilac* was 173 feet in length while *Arbutus* was 175 feet. However, *Arbutus* is not considered part of the "Violet Class," but rather as an unofficial sistership (Scheina 1982:115-16, 123, 1990:166-67). *Mistletoe* was assigned to Chesapeake Bay, and *Arbutus* was assigned to the district centered on New York Harbor. The cost of construction for each vessel in the "Violet Class" included: $334,900 for *Lilac*, $378,800 for *Mistletoe*, and $337,745 for *Violet* (Scheina 1982:123-24, 1990:171-72).

On August 16, 1931, *Lilac* was contracted for by the U.S. Lighthouse Service (USLS) as one of the three vessels of the "Violet Class." Construction began the following year and *Lilac*'s keel was laid on August 16, 1932 at the Pusey & Jones Shipyard in Wilmington, Delaware. Located on the Christina River a short distance from the Delaware Bay, the Pusey & Jones Corporation built ships and machines beginning in the mid-nineteenth century. In its initial operations starting in 1848, the firm produced general machinery and steam engines, as well as doing a variety of repair work. The firm joined the shipbuilding industry after it established a marine department in 1853. Shipbuilding became the largest part of Pusey & Jones's business. In addition to *Lilac*, *Arbutus*, and other members of the "Violet Class," the shipyard constructed a wide variety of vessels, ranging from large steam yachts to oceangoing steamships. The shipyard's reputation for quality craftmanship, along with its proximity to a major seaport and waterway (the Delaware Bay), made Pusey & Jones an attractive choice to undertake *Lilac*'s construction (Keighton 1891:57-59; Brouwer 2004: Section 8-2).

The work *Lilac* was expected to complete had a heavy influence on the vessel's design. For instance, *Lilac* was built to be extremely stable in order to hoist buoys (weighing up to fourteen tons) above the main deck and swing them onto the main deck or over the side so that crewmembers could service them. Consequently, the vessel's steam-powered hoisting gear was designed for extra heavy loads and the side plating where the buoys would be handled was heavily reinforced and protected along with its hull (Figure 2.2). *Lilac*'s sides were constructed to be largely vertical to make handling buoys easier as well. In the same practical fashion, *Lilac* was designed to have a minimal draft since the vessel would have to maneuver around the shoals and underwater obstructions marked by the navigational aids the vessel would service. In an attempt to promote seaworthiness when servicing lightships and buoys on the open seas off approaches to ports, the vessel was given a high bow. *Lilac* was designed to house its working crew. In addition, the vessel was also expected to ferry crews and keepers to and from lightships and isolated lighthouses, and carry district and national officials during periodic tours of inspection of navigational aids. Consequently, extra space was added to accommodate the vessel's crew and passengers below deck. With the captain's role in mind, *Lilac*'s wheelhouse was constructed to be wider than previous buoy tender designs. This allowed the captain to observe what was happening on *Lilac*'s deck and alongside the vessel while simultaneously maneuvering the ship during buoy handling (Brouwer 2004: Section 7-1). These effective design features allowed *Lilac* to fulfil its duties as part of the USLS and later the USCG.

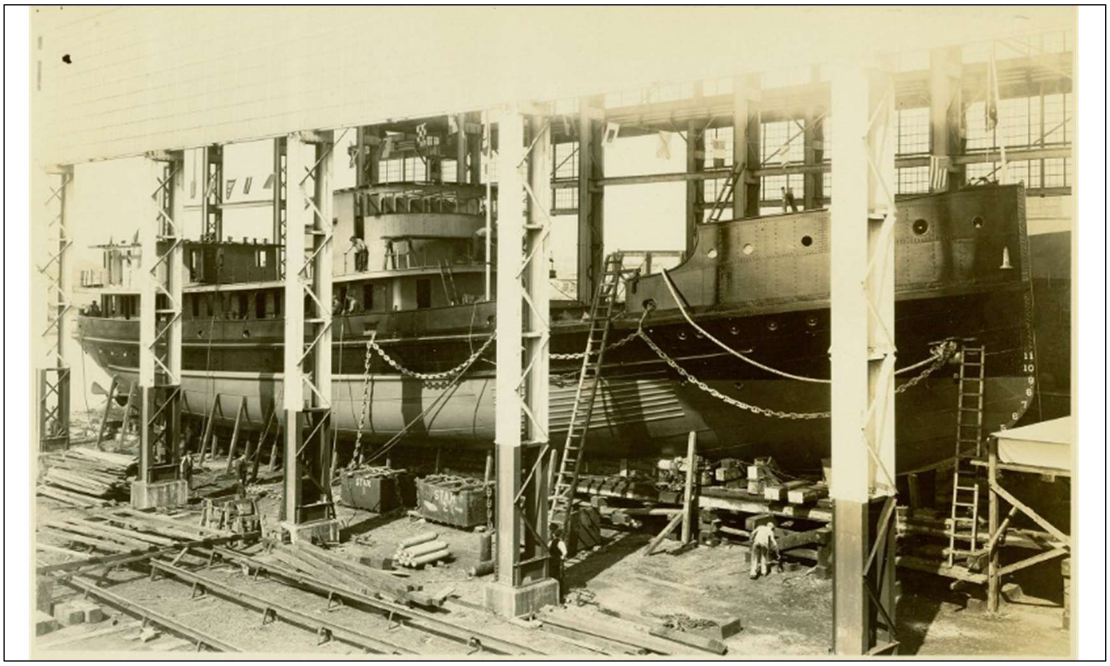

Figure 2.2. *Lilac* under construction, Pusey & Jones Shipyard, 1933 (Hagley Digital Archives 2018).

After careful planning and construction, *Lilac* was launched on May 26, 1933 (Figure 2.3). As per the prohibition laws of the time, government boats could not be christened with bottles of champagne. Kristie Areszk Putnam christened *Lilac* by breaking a bottle of water against the vessel's bow (Figure 2.4). Her sister, Elizabeth Duncan Putnam, had christened *Arbutus* a few months before (*The Morning News* 1933:8). George R. Putnam, their father, served as Commissioner of the USLS from its creation in 1910 until his retirement in 1935 and authored several books on navigational aids. *Lilac* was subsequently assigned to serve as a buoy tender in the Fourth Lighthouse District (this region would later become the Fifth Coast Guard District), which covered the Delaware River, from Trenton, New Jersey south to the Delaware Bay (Scheina 1982:123-24, 1990:171). Intended to replace *Iris* (a tender originally commissioned in 1899 by the U.S. Life-Saving Service), *Lilac*'s first base was located in Edgemoor, Delaware, just north of the mouth of the Christina River.

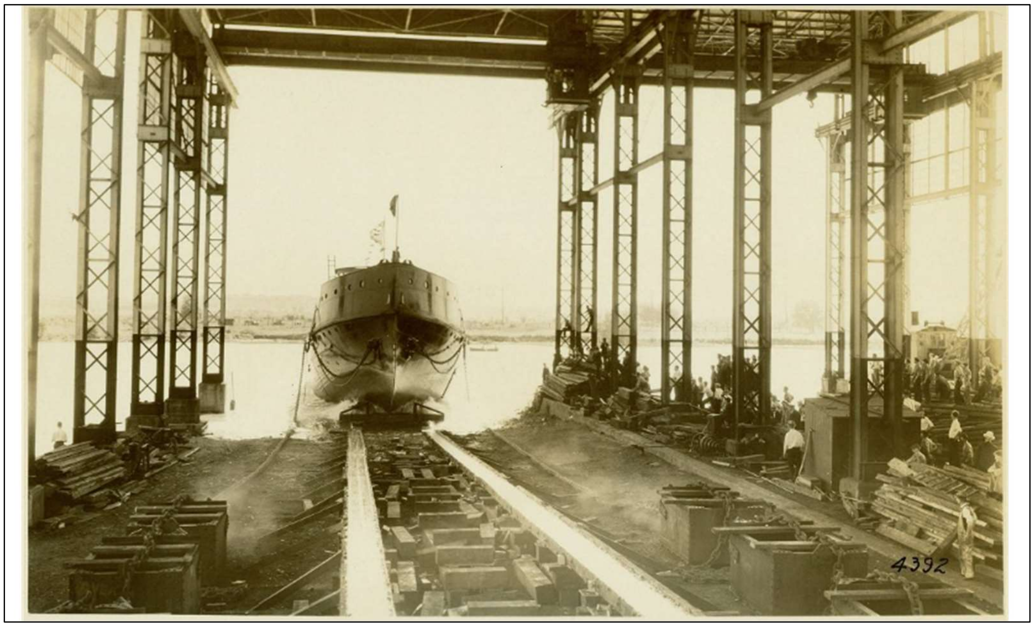

Figure 2.3. *Lilac* launching at the Pusey & Jones Shipyard, 1933 (Hagley Digital Archives 2018).

Figure 2.4. Kristie Putnam christening *Lilac*, 1933 (Hagley Digital Archives 2018).

The ship's regular duties included: "delivering fuels and supplies to offshore lightships and isolated lighthouses, rotating their personnel for shore leave or replacement, servicing buoys on site or transporting them to the base for overhaul after installing replacements, and taking district or national officials on tours of inspection" (Figure 2.5) (Brouwer 2004: Section 8-2). Tenders like *Lilac* were not solely used for lighthouse supply and buoy tending. These vessels were also expected to respond to marine disasters or emergencies in nearby waters. For example, in the winter of 1935-1936, *Lilac* was sent into the lower Delaware Bay to evacuate the keepers on endangered offshore lighthouses. As a result of the heroic response, *Lilac* sustained propeller damage that required drydocking and complete replacement. When repairs or the installation of new equipment was required, *Lilac* was sent north to the Lighthouse Depot at St. George, Staten Island. For drydocking, the vessel was serviced at one of the private yards in New York Harbor. After WWII, most of this work was done at the Coast Guard Shipyard in Curtis Bay, near Baltimore, Maryland; though *Lilac* went to Tiejen & Land Shipyard in Weehawken Cove, Hoboken, New Jersey for drydocking in February, 1950 (Marshall 1995; Brouwer 2004: Section 8-2; HNSA 2014).

Figure 2.5. *Lilac* servicing the Brandywine Shoal Lighthouse in the 1950s (*Lilac* Preservation Project 2017).

The buoys serviced by *Lilac* frequently marked shoals, rocks, and other dangers. *Lilac* had to navigate these dangerous waters to service and relieve buoys and lighthouses. Propellers from passing-deep draught ships occasionally severed the chains anchoring the buoys, and tenders were responsible for picking up these adrift buoys broken from their moorings. To service or recover buoys, *Lilac* had to maintain its position despite wind, current, and sea conditions, while the new or overhauled buoy, together with its sinker and chain, was carefully lowered in the proper location. After placing the buoy, the old buoy, along with its chain and mooring, were then hoisted onboard and secured. This cumbersome task required skillful piloting to maneuver the dangerous surroundings and deft hands on deck to handle the machinery and buoys. Larger lighted buoys were heavier and more fragile than their unlighted counterparts, with massive sinkers and chains. Advances in fuel storage technology allowed tenders to visit buoys less frequently; however, these buoys were powered by high pressure gas cylinders making them potential explosive hazards to tenders' crews and engineers. These were difficult to handle on *Lilac*'s deck except under ideal weather and sea conditions; which rarely prevailed in the coastal waters around the Delaware Bay (Putnam 1937:263; Johnson 1987:165; Marshall 1998:96).

Surprisingly, a children's book entitled *All Among the Lighthouses: The Cruise of the "Goldenrod"* written by Mary Bradford Crowninshield in 1886, is a useful source of information on tender operations (such as those *Lilac* undertook) as it includes a detailed description of a steam tender setting a spar buoy off the coast of Maine. Crowninshield writes:

> ..the boys noticed there was unusual activity on the forward deck.
> "What is going on down there in front, Violet?" asked John.
> "I think they must be getting ready to set a buoy. They seem to be pulling a long one forward, even with the opening, and they've taken away the rail."
> "What sort of buoy?" asked Courtland.
> "A spar buoy, I suppose, of course," returned Violet. "We haven't any other on board. It's that long, red, mast-looking thing that you see sticking out past the opening there."
> "How long is that buoy, Uncle Tom?" asked John.
> "About forty-five feet long, my boy. It is a red one, as you see, and we shall set it on the starboard side. After that, we shall have to set a black one, so you will have

> a good opportunity to see the operation; and what you fail to comprehend during the first trial, you can inquire about on the next."
> The boys looked over, and saw that the rail on one side of the forward deck had been unshipped, leaving that side quite open to the sea. It looked very unsafe as the men walked carelessly past this opening, stepping sometimes on the very outer edge of the deck, the blue water rushing past below them, making the boys dizzy to look at it.
> "Do you see the red buoy sticking forward there, past the opening? It has, as you see, an iron strap fastened high up on either side; and at the bottom the strap hold, as you see a strong iron ring. Now look at that enormous block of granite on the deck there. That is what we call a sinker. That is the buoy's anchor, and moor it in its place."
> "How much does it weigh, Uncle Tom?"
> "About three ton, I guess sir, that one," [replied the captain]. "Sometimes we hev'em weigh five ton when we are puttin' down a big thing like a bell- buoy, 'specially ef the weather's likely to be rough out there."
> There came the rumbling sound of the working of the steam winch.
> "Now, boys, the derrick comes into play. See the derrick," the boys looked upward, "how it is swinging around. Now the tackle lowered, and Mr. Guptil puts the heavy iron hook into the ring on top of the stone [sinker]."
> "Hoist away!" shouted the captain. "Go ahead with the winch!" And the immense stone was lifted as if it were but a feather's weight, and, was deposited close to the edge of the steamer.
> "Now look at Robson," said Uncle Tom. "He hands Mr. Guptil that short piece of chain; and now Mr. Guptil is fastening it to the end of the buoy with a shackle, and Robson shackles the other end to the ring in the sinker."
> "Stand clear!" shouts Mr. Guptil. The lines that hold the buoy in place, by men stationed for the purpose, are slipped; and at the same moment the great rock, pushed from its position on the edge of the deck, tips over the side, and, with a great splash which send the water high overhead, sinks swiftly to the bottom. The steamer starts ahead and the buoy bobs and jerks and whirls round about for a moment, and then settles down as a channel guide in its proper place, until broken off by some reckless vessel, or swept away by some overwhelming sea (Crowninshield 1886:183-85).

Although Crowninshield's story was written in 1886, spar and ice buoys continue to be set using similar methods. Presently, tenders rely on differential global positioning devices to accurately determine buoy positions, but they still place buoys in a manner consistent with those available to the *Goldenrod*'s crew in 1886. Of course, there are differences between late nineteenth century tenders and vessels like *Lilac*; such as: construction and design advances, safety features available to crews, as well as differences in boom and mechanical capabilities. Despite these disparities in the tenders themselves, the fundamental procedures *Lilac* utilized to set buoys was similar to the methods used by *Goldenrod* (Crowninshield 1886; Marshall 1998:88-89).

Like Crowninshield, Francis Collins provided a detailed account of the process of servicing buoys in *Sentinels Along Our Coast*, written in 1922. Collins accompanied the crew of *Larkspur* (a steam buoy tender like *Lilac*) as it fulfilled its duties from Newport, Rhode Island, to Cape May, New Jersey (near the area *Lilac* was assigned to). In his notes, Collins writes:

> The first call of the inspection trip was made upon a monster buoy which rang a bell to the swash of the waves, and flashed a red light with clock-like regularity. It seemed a mere red speck in the distance, but, as the Larkspur came alongside, the light atop the red frame actually towered above the forward deck. The visit was made to find if the buoy needed more pressure to keep its light burning, and, in case it did, to supply it.
>
> To come alongside the great buoy in such a sea required delicate navigation. The Larkspur was skillfully maneuvered alongside, while half a dozen trained men stood at their stations forward. The towering steel structure of the buoy bumped alongside and drifted swiftly past with surprising speed. The instant the buoy touched the vessel's side experienced hands lassoed it. This may not be the correct nautical phrase, but it describes the action. Ropes were thrown about it, which were quickly caught by long boat-hooks and drawn in. Heavy hawsers had been attached to the lines, which in turn were drawn about the buoy, which was thus held rigidly to the vessel's side despite the motion of the sea.
>
> With the agility of a cat a sailor sprang from the deck to the cage-like frame at the top of the buoy, and holding to the ribs, which swung violently from side to side, opened the lamp and inserted a complicated instrument. It would be difficult to picture a more unusual position for making a scientific observation. A moment later he turned to the ship and shouted a single word, "Four." The signal had nothing to do with the game of golf.
>
> The captain shouted an order in return, and then explained that 'four' meant that the tank of the buoy still contained a pressure of four atmospheres. This would be sufficient to keep the light burning for two months or more, but would nevertheless be renewed to twelve atmospheres.
>
> A flexible hose had meanwhile been carried to the buoy and attached. In the choppy sea the Larkspur and the buoy bobbed about outrageously; but the supply of compressed air was carried across the open water, and in a few minutes the tank was filled and the pipe drawn in. The sailor on the buoy rose to his feet and made a flying leap across three or four feet which separated him from the deck of the Larkspur, landing in safety. A moment later the rope had been drawn in and the buoy quickly floated away with sufficient air pressure to last her for six months (Collins 1922:159-61).

Collins' account of *Larkspur*'s voyage and its duties mirror those *Lilac* would perform under similar conditions in nearby waters eleven years later. *Larkspur*'s operations can be used as an example of typical buoy tender operations during the time in which *Lilac* was active (Marshall 1998:134-35). Although *Lilac*'s duties would remain constant, the governmental body overseeing *Lilac*'s operations changed in 1939.

Lilac's Transfer to the U.S. Coast Guard

After a long and illustrious period of service, the Lighthouse Service joined the ranks of the Coast Guard when President Franklin Roosevelt ordered the transfer of the USLS to the USCG in 1939 (Johnson 1987:161-65; Marshall 1998:155). Following the dissolution of the USLS in 1939, *Lilac* joined the USCG's fleet. *Lilac*, now operating under the USCG, continued to uphold the USLS's mission to facilitate commerce by providing safe and reliable navigational aids (Marshall 1998:4).

The USCG took over all the responsibilities for maintained aids to navigation previously handled by the USLS, including the operation of roughly 30,000 aids to navigation, ranging from the more than 400 lighthouses and 30 lightships to the numerous unlighted buoys and shore marks, throughout the harbors and navigable waterways in the U.S. and its territories (Johnson 1987:161-65; Marshall 1998:152-156). While serving under the USLS, *Lilac* had a crew consisting of six officers and twenty seamen. Following the 1939 incorporation of the USLS into the USCG, the Coast Guard increased *Lilac*'s crew to two officers, two warrant officers, and 34 seamen. As such, *Lilac*'s crew and responsibilities correspondingly grew in size. The ship and its crew continued to be based in Edgemoor, Delaware. Nevertheless, *Lilac*'s internal structure and outward appearance underwent change. *Lilac*'s appearance was altered so that the all black stack, typical of USLS tenders, was repainted to Coast Guard buff with a black top (Figure 2.6).

Additionally, the brass lighthouse emblems bolted to either side of the bow were removed, and the triangular USLS pennant was changed to the USCG flag (Brouwer 2004: Section 8-2).

Figure 2.6. *Lilac* at sea after incorporation into the USCG, prior to 1942 (*Lilac* Preservation Project 2018).

Lighthouse and buoy tenders, like *Lilac*, would become a vital part of the USCG's management strategies for the nation's maritime navigational devices, in addition to its military operations, especially during World War II. After President Franklin D. Roosevelt signed the declaration of war in December, 1941 and the U.S. entered WWII, the Coast Guard was officially transferred from the jurisdiction of the Secretary of the Treasury to that of the Secretary of the Navy as per the 1915 legislature outlining the USCG's relationship to the Navy during wartime (Johnson 1987:44; Marshall 1998:112). Henceforth, the vertically striped Treasury commission pennant flying on *Lilac* was replaced by the longitudinally striped Navy pennant. Regardless, logistically, *Lilac* continued to function according to regular Coast Guard procedure (Pell 1942:77).

As part of this transfer from the U.S. Department of the Treasury to the Naval Department in February 1942, the USCG adopted the U.S. Navy's ship classification system. Consequently, *Lilac* was given the Coast Guard pennant number designation WAGL-227 based on the Navy's classification system (Brouwer 2004: Section 8-3). In this system, each vessel is designated with a two-letter abbreviation based on the type of ship and its hull number. The first letter was a general classification and the second letter defined a sub-category; several additional letters might have followed to modify the initial general category. To differentiate Coast Guard vessels from their Navy counterparts, all USCG ships were given the prefix "W." At the same time, an exclusive hull number was assigned to each cutter and craft. The vessel designations are shorthand for ships' capabilities and limitations, specifically in regards to the length of time the vessel may spend on patrol without replenishment (Scheina 1990:169; USCG Historian's Office 2018). *Lilac*'s WWII designation, WAGL-227, reflects its role as an auxiliary vessel (A), and a lighthouse and buoy tender (GL) (HAER 1968:14). During WWII, all tenders were grouped together, regardless of whether they were coastal or riverine types (Scheina 1982:81).

In addition to the change in classification, *Lilac*'s appearance was altered yet again and painted gray for the duration of WWII. Furthermore, the vessel was also armed with one 3 in. 50 ca. gun on the fo'c'sle head, two 20 mm anti-aircraft machine guns on the bridge, and two depth charge tracks on the stern (Scheina 1982:124). Throughout the War, the vessel was charged with port security in addition to its duties to maintain aids to navigation and respond to maritime emergencies (Brouwer 2004: Section 8-2). Tenders were useful in a variety of roles during WWII besides maintaining aids to navigation. For instance, they served on occasion as antisubmarine net layers, small cargo vessels, and salvage ships. The Army, Navy, and other governmental agencies frequently requested that tenders assist them in other ways. Nonetheless, tenders' primary occupation was maintaining the safety of U.S. waterways and providing mariners with a reliable navigation system. The construction of new military and naval bases and the extension and improvement of navigable channels by the Army Corps of Engineers increased the Coast Guard's obligation to navigational aids, as each new or altered waterway had to be accurately marked before it could be used regularly. Correspondingly, Admiral Waesche, the Commandant of the Coast Guard from 1936-1945, instructed district commanders that nothing should be allowed to interfere with the tenders' work on aids to navigation as it was of the upmost importance to domestic security and military operations (Johnson 1987:192-95).

Following the end of the WWII, the Coast Guard was transferred back to the Department of the Treasury. Congruently, *Lilac* was disarmed and returned to its peacetime color scheme. The ship's home base was moved to the Coast Guard Station in Gloucester, New Jersey, located further up the Delaware River near the Port of Philadelphia and the Philadelphia Naval Yard, in 1948 when the Edgemoor Base was closed. Soon after, *Lilac* was fitted with its first radar in 1949 (Brouwer 2004: Section 8-3). *Lilac* resumed peacetime duties by maintaining navigational aids and responding to maritime emergencies. From May 15-17, 1952, following the collision of the cargo ship *Barbara Lykes* and the coastal tanker *F.L. Hayes* in the Chesapeake and Delaware Canal, *Lilac* worked to clear the waterway after *F.L. Hayes* burned and sank. *Lilac* responded to another emergency from June 6-12, 1953 following the collision and fire of the tankers *Phoenix* and *Pan Massachusetts* off the Delaware Bay's entrance to the Delaware Canal. *Lilac* served as a command post, searched for survivors, and brought the fires under control. The following month, the vessel spent two days fighting a fire on the tanker *Pan Georgia* in the Christina River (Scheina 1990:171-72). At this time, in 1954, *Lilac* was outfitted with radar equipment. The USCG continued to use the Navy's vessel classification system up until 1965 when the service adopted its own system. Under the Coast Guard's new ship classification system, *Lilac* was re-designated WLM-227; marking it as a medium sized buoy tender (HAER 1968:14; Scheina 1990:1, 169; USCG Historian's Office 2018).

Rising to meet the needs of the nation, the USCG assumed duties related to economic maritime traffic, migrant interdiction, and hazardous cargo when it was transferred to the U.S. Department of Transportation in 1969 (Ostrom 2012:12, 43; USCG Historian's Office 2018). The USCG's role in environmental matters changed following the Clean Water Act (previously called the Federal Water Pollution Control Act) and the Ports and Waterways Safety Acts of 1972; which established cleanup and liability standards for oil spills and pollution. Prior to the 1972 legislation, the USCG's role was limited to clearing waterways of debris following vessel collisions or after maritime disasters; for example, when *Lilac* worked to clear the Chesapeake and Delaware canal following the collision of *Barbara Lykes* and *F.L. Hayes* in 1952 (Davis 1974:249; Mendelsohn & Fidell 1979:477; Ostrom 2012:115). The Clean Water Act regulated the discharge of pollutants into the nation's surface waters (e.g., lakes, rivers, streams, wetlands, and coastal areas). Prior to the 1972 legislation, *Lilac*'s waste was pumped over the vessel's sides. The Clean Water Act prevented *Lilac* from continuing that practice. *Lilac*'s added responsibilities under these administrative and legislative changes, coupled with new requirements regarding waste disposal, pushed the vessel's aging machinery to its limits and took a toll on its structure. Shortly after, *Lilac*'s career as a USCG buoy tender came to an end.

The predicted lifespan of a tender like *Lilac* was approximately twenty-five years. Since these vessels were vital to the completion of the Coast Guard's mission, tenders capable of service were not discarded until they finally lost all working ability (Marshall 1998:117, 146). After almost forty years of continuous service, *Lilac* was decommissioned on February 3, 1972

(Scheina 1990:171-172). When retired, *Lilac* was the last steam buoy tender in service, powered by reciprocating (piston-driven) steam engines.

A few years prior to *Lilac*'s decommissioning, in a newspaper article published in 1968, *Lilac*'s servicemembers proposed converting the vessel into a maritime museum. Lt. H.E. Purdy, *Lilac*'s commanding officer at the time, stated that as a museum, "she would symbolize one of the Coast Guard's major roles – maintenance of navigational aids on all navigable inland and coastal waterways" (Hopkins 1968:52-53). The crew proposed berthing *Lilac* near the Coast Guard Base in Gloucester City, NJ, where it could then be opened to sightseers. The Philadelphia Maritime Museum (what is now the Independence Seaport Museum) also expressed interest in mooring *Lilac* at Penn's Landing. There, they anticipated *Lilac* would be displayed with other historic vessels, including a replica of William Penn's *Welcome*. Rather than retiring the vessel to a scrapyard, the article writes, "Lilac's 40-man crew readily agree [converting *Lilac* into a museum] is a better way to treat an old but still active lady" (Hopkins 1968:52-53).

Upon *Lilac*'s decommissioning in 1972, the vessel was not converted into a museum; instead, *Lilac* was donated by the USCG to the Seafarers International Union (SIU). SIU installed electric heat and remodeled *Lilac* to function as a dormitory offering classroom space for the Harry Lundeberg School of Seamanship in Piney Point, Maryland. The school trains merchant mariners who crew commercial ships. *Lilac* served as a temporary facility to house and train mariners upgrading within the non-officer positions in the bridge and engine room departments. SIU retired *Lilac* in 1984 and sold the vessel to the Atlantic Towing Company, also located in Piney Point, Maryland. The Company's ownership, however, was short-lived (Brouwer 2004: Section 8-3; *Lilac* Preservation Project 2018).

Starting in 1984, *Lilac* was privately owned by Henry Houck and moored in the Falling Creek Marina on the James River below Richmond, Virginia. To make space for the vessel, a berth was dredged at Falling Creek adjacent to a marine salvage yard. Although the vessel was not significantly altered, some fittings were removed. Houck kept the ship at his boatyard and rented out space on the vessel. Former staterooms and the officers' mess room were utilized as offices for a scrap yard and Houck's associated real estate business. Upon his death in 2002, Houck's widow drydocked *Lilac* and placed the vessel on the market for sale. The Tug *Pegasus* Preservation Project, a non-profit organization based in New York City, purchased *Lilac* in March, 2003 for $25,000. The vessel's hull was inspected prior to sale and received a favorable report on its condition. Before leaving the drydock in Norfolk, Virginia, the ship's hull was cleaned and preserved, and the vessel was painted externally to the top of the stack. After $250,000 of work at Lyons Shipyard in Virginia, *Lilac* was towed to New York City. The organization intended to eventually return *Lilac* to working condition with the intent to operate the steam vessel in New York Harbor. At the time, there were no steam vessels based in the Harbor (Brouwer 2004: Section 8-4; *Lilac* Preservation Project 2018).

The Tug *Pegasus* Preservation Project's ownership was relatively short. *Lilac* changed owners once the non-profit educational foundation *Lilac* Preservation Project was formed later in 2003. On January 1, 2004, ownership was transferred from the Tug *Pegasus* Preservation Project to the newly-created *Lilac* Preservation Project. Soon after, the vessel was towed to a temporary berth in Brooklyn, New York, provided by the Port Authority of New York and New Jersey. *Lilac* was then relocated to the west side of Manhattan, to Pier 40, a covered pier built in 1962 for the Holland-America Line. Additional pilings, along with a mooring system, were installed to support *Lilac* (Brouwer 2004: Section 8-4; *Lilac* Preservation Project 2018).

Lilac berthed at Pier 40 in Hudson River Park in Manhattan from 2003-2011. In May 2011, the vessel moved downtown to Pier 25 in the Tribeca section of Hudson River Park (Figure 2.7). Since arriving there, *Lilac* has been open to the public on a regular basis as a museum ship. The *Lilac* Preservation Project works to preserve the vessel, promote maritime education, and provide the local community with a venue for engaging in history and art. The organization continues to restore *Lilac* and hopes to get the vessel steaming again as a travelling educational facility and exhibit. Moreover, ongoing renovations onboard *Lilac* provide work experience opportunities for young people, supported by organizations such as the Police Athletic League of New York City and the Boy Scouts of America. The *Lilac* Preservation Project's dedicated Board of Trustees is made up of mariners, historians and professionals committed to restoring *Lilac*. Thanks to the efforts of the Project, *Lilac* and those who served onboard will be remembered (Brouwer 2004: Section 8-4; *Lilac* Preservation Project 2018).

Figure 2.7. *Lilac* docked at Pier 25, Hudson River Park, NYC (*Lilac* Preservation Project 2011).

Conclusion

Although several decades have passed since *Lilac*'s ocean-going days, the vessel's illustrious history as a USLS and USCG buoy and lighthouse tender continues to be heralded by organizations such as the *Lilac* Preservation Project. In combination with access analysis, *Lilac*'s history can be used as a tool to better understand the maritime culture fostered and created onboard. The following chapter (Chapter 3) describes the theoretical approach this thesis uses to answer its research questions regarding the relationship between space and society onboard *Lilac*. Chapter 3 discusses spatial archaeological theory, first in a broader context, then on more specific terms. The historical perspective provided in this chapter, combined with the archaeological approach described in the following chapter, will be used to examine the impact society had on space, and vis versa, onboard *Lilac* during the vessel's operational lifespan (1933-1972).

CHAPTER 3: THEORETICAL APPROACH

Introduction

Spatial archaeological theory is a useful tool for determining how society manifests itself within a structure. While the historical record can shed light on society, it alone cannot reveal how social norms translate into space and, in turn, how space affects society. Spatial patterns, studied in tandem with the historical record, can illuminate the hidden relationship between space and society.

This chapter begins with a general discussion of spatial archaeological theory. The focus then shifts to Hillier and Hanson's (1984) space syntax theory, a facet of thought within spatial archaeological theory. During the course of this chapter's discussion of space syntax theory, the associated analytical method, access analysis, is introduced along with its applications in archaeological studies. By analyzing space through the lens of access analysis, it is possible to determine the relationship between structure and society onboard *Lilac*.

Spatial Archaeological Theory

Borrowing methods for structural analysis from disciplines such as sociology, architecture, and environmental studies, archaeologists developed a theory for studying space. Spatial archaeological theory is a system of thought by which archaeological spatial forms, variability, and distributions are explained through logical, verbal, or mathematical means (Clarke 1977:17). Furthermore, spatial archaeology, as defined by Clarke, is "the retrieval of information from archaeological spatial relationships and the study of the spatial consequences of former hominid activity patterns within and between features and their articulation within sites, site systems, and their environment" (Clarke 1977:9). Continuing, Clarke states, "it is the study of the flow and integration of activities within and between structures, sites and resource spaces from the micro to the semi-micro and macro scales of aggregation" (Clarke 1977:9). Spatial archaeological theory analyzes human activities at every scale; including remaining artifacts, physical structures, the impacted environment and the interaction between all these aspects. It focuses on the relationships between the raw materials, artifacts, features, structures, sites, routes, resource spaces and the people who ordered them (Clarke 1977:9).

Discussions within spatial archaeology concentrate on several newer themes and continue to build on foundational ones. For instance, in the 1980s, Hillier and Hanson refined forms of spatial analysis to specifically analyze architecture in a settlement and on an individually-based level. Hiller and Hanson's (1984) "space syntax" theory examines the relationship between space and society by focusing on the structures themselves (rather than artifacts located within) and questioning the meaning of space (Hillier & Hanson 1984; Steadman 1996:66-67).

Space Syntax

Although the way in which it is conveyed is debated among theorists, structures communicate meaning (Kent 1990). Therefore, even without previous knowledge of the builder, one can use the built environment to study cultural conventions or behavior (Sanders 1990:47). Hillier and Hanson's work, *The Social Logic of Space* (1984), was one of the first to not only discuss spatial patterning in connection with social logic, but to develop methods to systematically examine it: "The ordering of space in buildings is really about the ordering of relations between people" (Hillier and Hanson 1984:2). Rather than merely acting as a backdrop or response to certain environmental needs, space is an important element in the development of behavior and culturally meaningful (Giddens 1984; Gregory 1989; Fisher 2009:440). In essence, spatiality enters into "being itself," as the individual subject does not just inhabit space (Gregory 1989; Thomas 1993:75). Levi-Strauss for example, influenced by Durkheim and Mauss (1903), saw in space the opportunity to “study social and mental processes though objective and crystallized external projections of them” (Levi-Strauss 1967:285; Hillier & Hanson 1984:4). The argument of *The Social Logic of Space* (1984) largely centers on Hillier and Hanson’s theory of space syntax and the belief that space is both produced by, and in turn produces and reproduces social relations. Using the techniques of Hillier and Hanson (1984), researchers have demonstrated that observed spatial patterns can be explained in social terms on the basis of historic and ethnographic evidence (Yiannouli & Mithen 1986; Foster 1989; Fairclough 1992).

The theoretical basis for Hillier and Hanson’s space syntax theory (1984) falls generally within a structuralist approach, based on theories developed by Giddens (1984) and influenced by Hall’s theory of proxemics (1969). Broadly defined, structuralism is “the belief that there exist underlying rules or laws that, though unspoken, give meaning to people’s myths, concepts and cultural behavior; similar to the manner in which the unspoken rules of grammar bring meaning to strings of individual words” (Cutting 2003:3). The deep structure of social grammar, Clarke writes, generates “different spatial surface manifestations and spatial moieties, as elements of social structure are present in spatial structure” (Clarke 1977:18). Hillier and Hanson (1984) argue that structure represents a unified system of rules that possesses an internal logic of its own, by which individuals internalize and mirror their behavior. Nevertheless, space’s laws of pattern are independent; thus, creating a dialectical relation with society. In other words, “Space can answer back, it does not obey some set of social determinants without imposing some of its own autonomous reality” (Hillier & Hanson 1984:198-99). The fault with structuralism, Hillier and Hanson (1984) maintain, is that it studies how structures organize society, but not how society organizes structures. Structuralism, consequently, avoids the question of the origin and locus of structure. Space syntax theory shows that spatial organization is not only a means by which people can constitute a society, but, because space has its own laws and its own logic, it can also act as a system of constraints on society. Thereby, the origin and locus of structures lie within society itself (Hillier & Hanson 1984:201-2).

Undoubtedly, structuralism's conceptual scheme yields useful insights into some aspects of social reality. Nevertheless, Hillier and Hanson (1984) developed their theory of space syntax in response to a perceived deficit in the previous sociologies of space, structuralism in particular. They argue that an authentic sociology must show how different forms of society produce different forms of thought and behavior in individuals. A comprehensive social theory of space, they maintain, "would account for the relations that are found in different circumstances between the two types of spatial order characteristic of societies – that is, the arrangement of people in space and the arrangement of space itself – and second it would show how both were a product of the ways in which a society worked and reproduced itself" (Hillier & Hanson 1984:200). Space syntax investigates the relationship between space and human societies by theorizing the structuring of inhabited space (Bafna 2003:17). The essence of the argument put forward by Hillier and Hanson is:

> All social processes, whatever their abstract and conceptual nature, are realized in space. Space syntax tries to socialize the notion of space, show how our conception of society can be usefully spatialized. The convergence on the notion of a system that is at once social and spatial will suggestion, certain perfectly natural – and in some cases often observed – correlations between spatial organization and fundamental structuring mechanisms in society – mechanisms that seem close to what a society essentially is (Hillier & Hanson 1984:200).

Space syntax's basic principles maintain that social structure is inherently spatial, and the configuration of inhabited space has a fundamentally social logic (Bafna 2003:18). The ordering of space by humans is a social behavior, "a form of order…which is created for social purposes" (Hillier & Hanson 1984:9). Moreover, space syntax theory rejects the idea that the configured space allows an existent social structure to be mapped onto itself. In contrast, the relationship between society and space is not merely that of mapping one domain onto the other but has a "dynamic" aspect as well; each modifies and restructures the other (Hillier & Hanson 1984:9; Bafna 2003:18). Structural changes are more than merely physical adaptations to the external world; instead, they are "symbolic elements that are shaped by social dynamics at multiple scales" (Rotman & Nassaney 1997:58). In essence, space syntax posits human beings as physical objects occupying a finite area of space. As such, their only choice is to occupy a defined area of space and to move from one point in space to another to accomplish anything. Subsequently, the theory's three basic assumptions are: "that people use space both consciously and reflexively; that the way spaces are linked together affects how people move through and use those spaces; and that such movement and use in turn in some way affect the behavior of the people living within those spaces" (Hillier 1996; Cutting 2003:3).

The aim of space syntax research is to develop strategies of description for configured inhabited spaces (built complexes) in such a way that their underlying social logic can be enunciated. Configurational descriptions, "deal with the way in which a system of spaces is related together to form a pattern, rather than with the more localized properties of any particular space" (Hanson 1998:22–3). Inside a structure, walls define enclosed spaces. These boundaries between constructed spaces can be penetrated by doorways allowing access from one enclosed space to another. These entranceways can open and close, and thereby effectively segregate spaces and control the means of access to any point (Foster 1989:41).

The flexibility and permeability of boundaries, Kooyman claims, demonstrate the way human activities are structured and can be telling of social rules and classifications that underlie that structure (Kooyman 2006:425). Bafna (2003) argues that in component spaces, the demarcation of boundaries allows particular relationships of access or visibility to emerge, generating probabilistic patterns of movements and encounters within the housed population. The effect is direct on both spatial configuration and society (Bafna 2003:18). The spatial patterning within the structure's configuration will offer higher rates of unplanned encounters and higher degrees of privacy between the inhabitant populations. As such, "giving selected members control of movement to and from particular spaces and limiting the freedom of movement of others vis-à-vis particular spaces creates levels of responsibilities, division of labor, and hierarchies of status that help maintain social organization with some degree of complexity" (Bafna 2003:18). Moreover, the historic role of architecture, Guidino states, "in all its particulars, is a fundamental instrument of power" (Guidino 1975:10). Space syntax theory (Hillier & Hanson 1984) provides the opportunity to study the social logic of structure and illuminate the distribution of power and any hierarchies present in configured spaces.

Access Analysis

To illustrate space syntax, Hillier and Hanson (1984) translated the theory into a form of abstract mathematics referred to as access analysis (Fisher 2009:440). Access analysis considers the arrangement of different spaces as a pattern of permeabilities, in terms of the interconnections between spaces, based on syntactic relations (Foster 1989:41). Based on "alpha-analysis" (a theory intended for spatial analysis in larger contexts, such as settlements), their original spatial analysis method, Hillier and Hanson (1984) created a mapping system that demonstrates the permeability and control of interior space, called "gamma-analysis" (Fisher 2009:440).

The foundation of gamma-analysis is the basic cell which represents a bounded space accessed from outside. A room with one access point is represented by a closed cell (Figure 3.1*a*); whereas a room with more than one access point is represented by an open cell (Figure 3.1*c*). Permeability, any access between spaces, is represented as a line or a circle connecting the cells (Figure 3.1*b* and 3.1*d*). Exterior space outside the building, referred to as the "carrier," is demarcated by a circle with a cross (Hillier & Hanson 1984:147–8). Although the carrier represents the entirety of the exterior environment, it is treated as a single point (Fisher 2009:440).

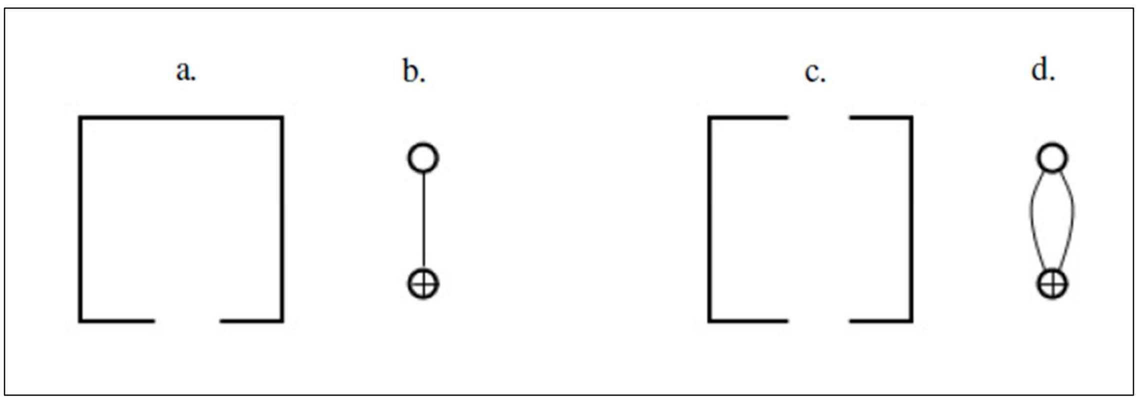

Figure 3.1. Representations of cells: (*a*) (*b*) closed cells; (*c*) (*d*) open cells (Hillier and Hanson 1984:147).

Symmetry and *distributedness* are two dominant characteristics represented by the linking of these cells. Symmetric cells follow the pattern of "A is to B" as "B is to A" with respect to space C (Figure 3.1*a*); as a consequence, neither cell controls permeability to the other. In an asymmetric design, one cell controls access to another from space C (Figure 3.1*b*). Asymmetry, thereby, reflects the importance of a space in terms of its degree of segregation or integration. In conjunction, distribution depicts relations of boundary (the means of access to a space).

Distributedness involves the amount of movement through a cell. A distributed system features more than one route from A to B, including going through space C (Figure 3.2*a*), while in a nondistributed system any route from A to B must go through C (Figure 3.2*b*).

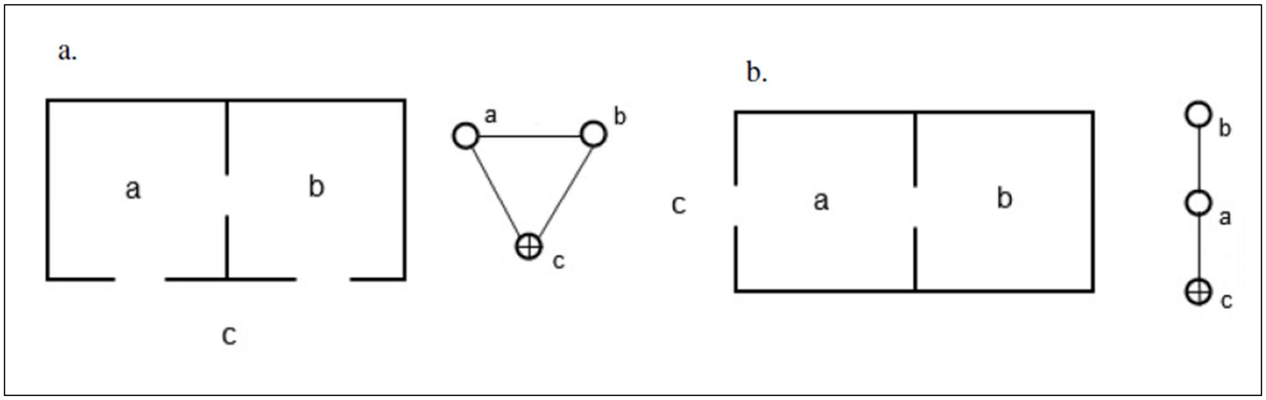

Figure 3.2. (*a*) symmetric and distributed system with respect to space C (*b*) asymmetric and nondistributed system with respect to space C (Hillier and Hanson 1984:148).

Hillier and Hanson (1984:148) write:

> In gamma, two spaces *a* and *b* will be: symmetric if *a* is to *b* as *b* is to *a* with respect to *c*, meaning that neither *a* nor *b* controls permeability to each other; asymmetric if *a* is not to *b* as *b* is to *a*, in the sense that one controls permeability to the other from some third space *c*; distributed if there is more than one independent route from *a* to *b* including passing through a third space c (i.e., if a space has more than one locus of control with respect to another); and nondistributed if there is some space *c*, through which any route from *a* to *b* must pass.

In justified gamma maps, the point-line system (Figure 3.2) is used to represent spaces and permeabilities to plot the relationship of bounded rooms. Spaces that have the same depth value, or that take the same number of boundary crossings to arrive at, are lined up horizontally above the carrier with access routes drawn in. All points of a certain depth (the minimum steps taken to reach them) are positioned on the same horizontal line, and subsequent depth values on lines parallel to the first. Any line will either connect with points on the same level of depth, or two levels separated by only one level of depth (Foster 1989:41). For example, in map A (Figure 3.3), spaces a and b are positioned parallel on a horizontal line because they have the same depth – it takes an equal number of steps to reach each of those spaces. Map C (Figure 3.3) depicts spaces on separate levels of depth – meaning, it takes more steps to reach space b than space a. These maps highlight any variations of symmetry and distribution within a system (Hillier and Hanson 1984:149). Hillier and Hanson state, “Changing the placement of access points or doorways between rooms, without altering the position of the spaces themselves, greatly modifies the symmetrical and distributedness properties of the entire structural complex. These characteristics are entirely reliant upon the permeability of the interior space” (Hillier and Hanson 1984:150).

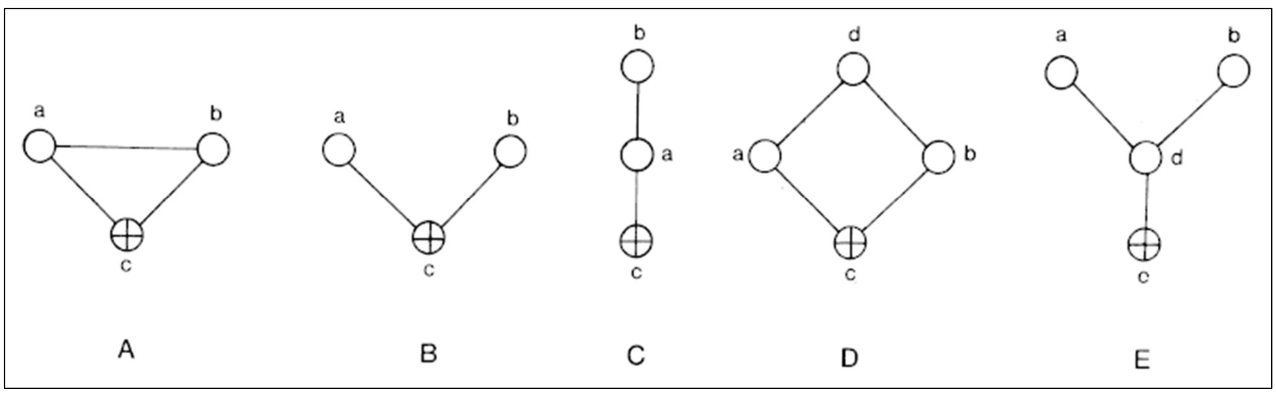

Figure 3.3. A) a and b are in a symmetric and distributed relationship with c. B) a and b are in a symmetric and nondistributed relationship with c. C) a and b are in a nondistributed and symmetric relationship with respect to c. D) a and b are symmetric to each other with respect to c, but d is asymmetric to both a and b with respect to c. E) d is in a nondistributed and symmetric relation to a and b, a and b are symmetric to each other with respect to c or d.
(Foster 1989: figure 2; Hillier & Hanson 1984: figures 88-92).

In space syntax, when a structure is analyzed from the view point of its various constituent spaces, it is possible to determine the variations in the syntactic parameters (how spaces relate to the complex as a whole) that transmit social information about the realities of inhabiting a particular space (Hillier & Hanson 1984:154). Distributedness and symmetry indicate variance in spatial patterning. For instance, variations can indicate: where and how frequently physical encounters occur between occupants; and how these encounters might be controlled. These encounters can be observed in terms of relations of symmetry/asymmetry and patterns of distributedness/nondistributedness (Hillier & Hanson 1984:148). Variants can indicate inhabitants' social standing based on: the comparative position and the inter-relationships between rooms; a room's relationship or access to essential facilities (e.g., kitchens, specialized or defended entrances) and whether that access is shared or monopolized; and the relationship to parts of the structure considered higher or lower status (for example, a throne room versus storage space) (Fairclough 1992:353).

Once the presence of variants is established, the challenge is to identify their cause and explain how the observed topological patterns relate to social factors. Previous studies highlight the manner in which social organization is embodied in spatial configuration by demonstrating the vital role that the control of movement and accessibility has in the creation and management of relationships of power and inequality (Fairclough 1992; Laurence 1994; Ferguson 1996; Bustard 1999; van Dyke 1999; Grahame 2000; During 2001; Bafna 2003:18; Cutting 2003; Richardson 2003a, 2003b; Brusasco 2004). For example, Richardson's (2003b) application of access analysis in an archaeological study of the Bishop's Palace in Salisbury, England, highlights how the building's changing spatial configuration from the thirteenth through the fifteenth centuries reflects growing changes in medieval society and perceptions regarding the social standing of ecclesiastical figures, specifically the eminence of the Bishop, and the "architectural manifestation of a hegemonic masculinity that characterized seigneurial society" (Richardson 2003b:382).

According to Richardson, "spatial analysis can reveal much about the configuration of space in the social formation of power relationships, and its more reasoned and systematic use might decode the signals given out by medieval architecture and understood in the context of contemporary sources" (Richardson 2003b:374). Of the approaches used in spatial analysis, Richardson (2003b:373) argues that one of the most informative is access analysis, in which spaces inside a structure are categorized by their relative ease of access and interpreted in social terms; in the case of Richardson's study, the results of access analysis are interpreted in terms of privilege and privacy. The first step in Richardson's investigation was to locate interior plans for the Bishop's Palace to be used for access analysis. Richardson coded the rooms and their access points based on a scheme of symbols (Figure 3.4).

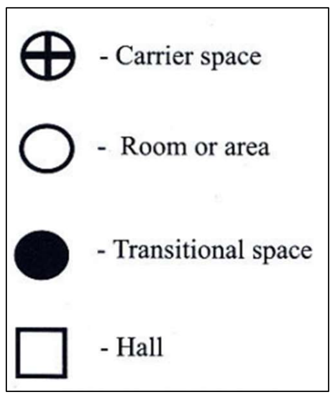

Figure 3.4. Richardson's key for access analysis, diagrams' commonly used codes (Richardson 2003b:374).

Using an access analysis mapping diagram (Figure 3.3), the symbols are composed in a manner which summarizes the associations between rooms and the routes that are possible between them. Once the diagram is completed, the resulting pattern is interpreted based on its characteristics of relative control or freedom. The diagrams serve to model the flow of people through the building and by implication, the social relationships that control access (Hillier & Hanson 1984:154; Foster 1989:42; Richardson 2003b:374-75). Examples of the patterns produced by access analysis (Figures 3.5 and 3.6) can be seen in Richardson's case study examining the Bishop's Palace from different historical contexts to configure medieval society and chart changes within it.

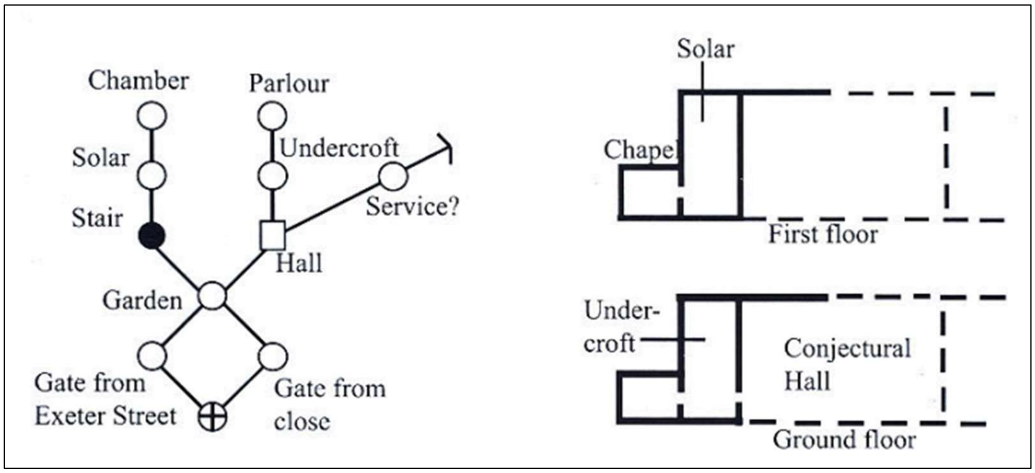

Figure 3.5. The Bishop's Palace in the thirteenth-century; access analysis map (on left side) and interior map (on right side) (Richardson 2003b:378).

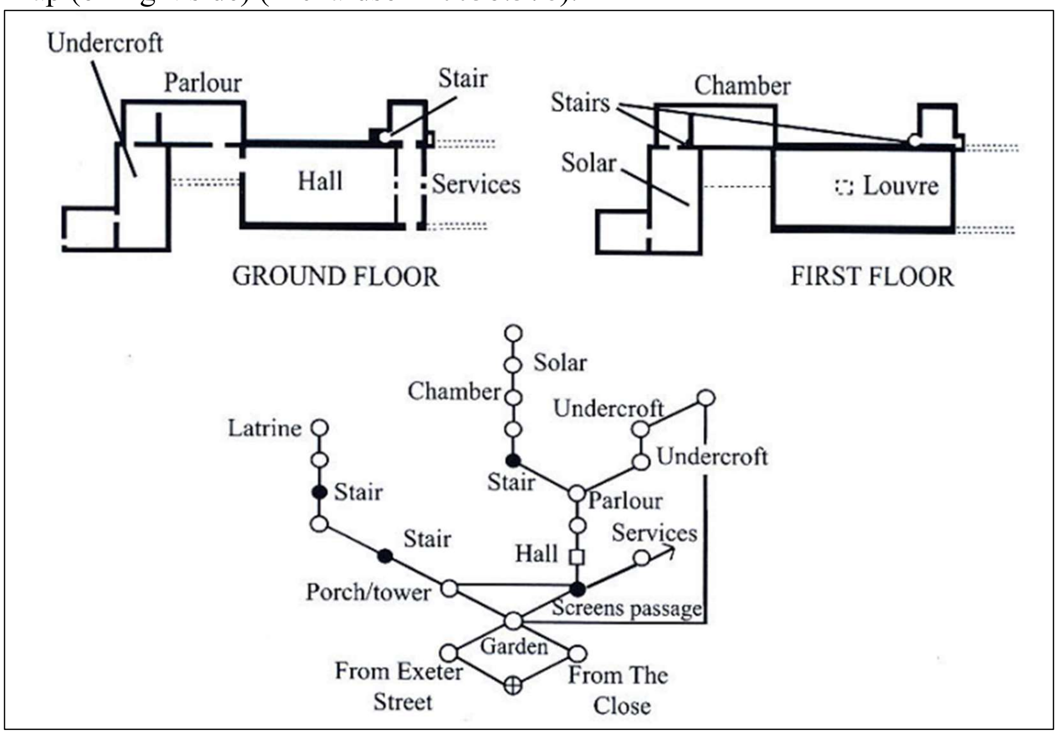

Figure 3.6. The Bishop's Palace in the fifteenth-century; interior maps (above) and access analysis map (below) (Richardson 2003b:379).

Based on the spatial patterning highlighted by access analysis and the social logic it reflects, Richardson argues that an aspiration among the clergy for shared identity with noble society appears to have been a significant factor motivating the structural changes to the Bishop's Palace throughout the course of the thirteenth and fifteenth centuries (Richardson 2003b:382-83). Although the diagram of the thirteenth-century Bishop's Palace (Figure 3.5) is dissimilar to contemporary royal residences, certain features were shared. For example, the thirteenth-century interior plans depict hallways intended for servants' use, reflecting social divisions in a hierarchal society based on that control of space (Richardson 2003b:377). Richardson notes that by the fifteenth century, the ecclesiastical dwelling (Figure 3.6) had much more in common with its royal and feudal counterparts; specifically, its "axes of honor" (the ceremonial route to principal chambers), the hall's location, and the slight increase in access points, all of which reflect a rise in the social eminence of the Bishop as the residence adopts "royal" building characteristics during the time period studied (Richardson 2003b:382).

As evidenced in the access analysis of the Bishop's Palace circa fifteenth century (Figure 3.6), later medieval Bishops' residences exhibited more internal divisions than those of noblemen, but they generally tended to follow the same architectural patterns. For example, between the thirteenth and the fifteenth centuries, there was a multiplication of rooms in the Bishop's Palace which induced, in tandem, "a heightened emphasis on social distance within more compact environments." As such, Richardson claims "the access analysis of the thirteenth and fifteenth-century palaces, Episcopal and royal, appear to show the architectural manifestation of a hegemonic masculinity, or at least an aspiration to values shared throughout seigneurial [feudal] society" (Richardson 2003b:382-383).

Richardson's study (2003b) is an example of the way in which architecture reflects social change (evident in the comparison between the thirteenth- and fifteenth-century Bishop's Palace), while reinforcing the status and identity of different groups. Placing emphasis on the role of architecture in the formation of identities deserves further study. Access analysis of the medieval buildings in Salisbury, England improves understandings of the way various identities are reflected in architectural space. Access analysis's potential for measuring hidden social properties in buildings should encourage its employment in other archaeological contexts (i.e., *Lilac*).

With Richardson's (2003b) medieval archaeological case study in mind, it is important to consider the type of type of social relations (e.g., gender, race, age, class, or social status) that might produce observed spatial order and if those are the social relations on which a society is organized. Furthermore, researchers should consider the possibility that the repetitive occurrence of patterns represents the acknowledgement of a code whereby authority was sustained by inhabitants. Social analysis can study the way the spatial organization of a structure intervenes to construct part of the cycle of social reproduction as it articulates an understanding of social logic (Foster 1989:43). The resultant syntax model produced by access analysis (see Figures 3.5 or 3.6) is an aid to visual decipherment of the spatial pattern and, as a result, social logic.

Although Richardson's (2003b) analysis relies solely on qualitative analytical techniques (access maps), many space syntax studies often use qualitative methods in conjunction with quantitative methods. The configurational description of space discussed by Hanson (1998) is reached in four stages: the identification of convex spaces; the insertion of the links joining those spaces; the representation of the linked spaces visually through a justified access graph; and the calculation of the numerical relationship (usually expressed in terms of integration values) between those spaces (Hanson 1998; Cutting 2003:3). To calculate the numerical relationship, each space is given an integration value that reflects its connectivity, or "the extent to which it is connected to all the other spaces within the network" (Cutting 2003:3). Using integration values, the accessibility of spaces from the entrance, inside, and outside of the structure can be calculated. Oftentimes, computer software is used to produce quantitative descriptions of the connective properties and to determine the accessibility of defined spaces.

Archaeologists studying spatial organization have applied space syntax's quantitative access analysis techniques to archaeological material with varying degrees of success. In her study of a Chalcolithic Hacılar settlement, Cutting (2003) makes a distinction between access analysis as a quantitative methodology and as a non-quantitative "tool to think with" and discusses the level of architectural definition needed for the quantitative approach. Cutting (2003) concludes that access analysis as a quantitative technique is of limited use in studying constructed space unless the archaeological record defines individual spaces and it provides unambiguous evidence as to how those spaces were accessed. In contrast, using access analysis as a qualitative "tool to think with" in a non-quantitative way enables the internal layout of individual buildings and the relationship between groups of buildings to be studied and compared in ways that are overlooked by quantitative analysis. By adopting this approach, qualitative access analysis can highlight repeated associations between certain activities, access and privacy (Cutting 2003:18).

While some theorists disagree (see Fisher 2009), qualitative analysis appears to be more practical when compared to the lengthy and complex process required to achieve the same results with quantitative methods. In many cases, the integration values derived from quantitative techniques confirm what is already visually apparent from the access map. By using access analysis's visually-rich qualitative methods as a "tool to think with," the relatively simple process can provide useful insights into the underlying social logic of space (Cutting 2003). As such, this thesis uses access analysis's qualitative methods as a "tool to think with" to elucidate social logic behind the organization of space onboard *Lilac*.

Conclusion

This chapter defined spatial archaeological theory and its developments, specifically Hillier and Hanson’s (1984) space syntax theory and described and demonstrated the usefulness and possible applications of space syntax’s analytical methodology to the study of the built environment. The following chapter discusses the methodology used to study *Lilac*’s spatial patterning and its underlying social logic using the theoretical framework provided by Hillier and Hanson’s (1984) access analysis and historical data.

CHAPTER 4: METHODOLOGY

Introduction

The previous chapter outlined the basic tenets of Hillier and Hanson's (1984) space syntax theory, specifically access analysis, and examples of its use in various archaeological contexts; for example, in Richardson's (2003b) study of Bishops' Palaces. This chapter aims to explain the methodology used to study *Lilac*'s spaces and corresponding social logic by means of historical and archaeological research, as well as analysis. This thesis's methodology can be broken into three distinct areas of investigative approaches: historical research, archaeological research, and analysis. The historical and archaeological phases of this thesis's research attempted to acquire pertinent data that would enable a spatial analysis of *Lilac*. The third investigative approach analyzes *Lilac* within the context of the historical and archaeological data gathered and applies and interprets access analysis.

Throughout this chapter, the specific methodology used to conduct the historical, archaeological, and analytical investigative phases is detailed. It begins with a discussion of the methods utilized to conduct *Lilac*'s historical and archaeological research, followed by the methods used to analyze the gathered data. In doing so, it provides readers with a guide that could potentially aid them in their efforts to apply access analysis to other maritime subjects, specifically ships.

Historical Research

This thesis's historical investigation began by searching and examining three historical data groups. These sources include: 1) relevant secondary documents (i.e., histories of the USLS and USCG, and information related to buoy and lighthouse tenders in the USLS and USCG); 2) primary documents (i.e., *Lilac*'s construction and renovation plans from the Pusey & Jones shipyard, USLS, and USCG, ship logbooks, operational reports, newspaper articles, and photographs); and 3) vessel specific histories (i.e., crew members' personal diaries or memoirs). There were varying degrees of success finding and retrieving sources from each data group; however, each yielded vital information regarding *Lilac*'s operations, design, and duties. Of the three historical data groups, secondary sources were the most bountiful fonts of information.

Preliminary research necessitated looking into secondary sources (document group 1) devoted to USLS, USCG, and buoy and lighthouse tenders' history, such as Amy Marshall's *A History of Buoys and Tenders* (1995) and *Frequently Close to the Point of Peril: A History of Buoys and Tenders in U.S. Coastal Waters 1789-1939* (1998), along with Robert Scheina's *U.S. Coast Guard Cutters & Craft of World War II* (1982) and *U.S. Coast Guard Cutters & Craft 1946-1990* (1990). To further supplement the information gathered from those secondary sources, works like Robert Erwin Johnson's *Guardians of the Sea* (1987) and Irving H. King's *Coast Guard Under Sail* (1989) were also consulted for their insight into the USCG's history. Most of the secondary sources consulted during the historical research phase were made available by East Carolina University's Joyner Library in Greenville, NC. Other published secondary materials were retrieved from the Historic Naval Ships Association (HNSA) and the USCG's Historian's Office's online platforms.

The goal of gathering information from secondary sources was to learn more about *Lilac*'s roles in the USLS and USCG and the related social-historical implications. Ultimately, the information obtained from the works of Scheina (1982, 1990), Marshall (1995, 1998), Brouwer (2004), Crowninshield (1886), and Collins (1922) proved to be invaluable as it formed the contextual framework which enabled a historical understanding of *Lilac*'s role in the USLS and USCG's histories, the scope of *Lilac*'s operations as a buoy tender and its mechanics, and a general idea of life onboard a vessel like *Lilac* during its operational lifespan (1933-1972). Furthermore, secondary sources (document group 1) helped to locate other sources and primary documents related to *Lilac*.

Primary historical sources in data group 2 consisted of *Lilac*'s USCG logbooks, newspaper articles, *Lilac*'s USCG and USLS design plans, and USCG and USLS photographs of *Lilac*. A select number of *Lilac*'s USCG logbooks were obtained from the U.S. National Archives and Records Administration (NARA) in Washington, D.C. in December, 2018. Unfortunately, it was only possible to locate *Lilac*'s 1940, 1941, and 1962 USCG logbooks at NARA in Washington, D.C. Little of the information provided by *Lilac*'s USCG logbooks was incorporated into this thesis' analysis. This was partially because the information located within the logbooks' pages was incomplete – some pages were damaged, missing, or otherwise unintelligible due to the documents' age and their authors' poor penmanship.

Like *Lilac*'s logbooks, there was little success locating useful newspaper articles during the historical investigative phase of research. While related to *Lilac*, the newspaper articles' specific topics range from *Lilac*'s launch in 1933 to reports of *Lilac*'s servicemembers being arrested for various legal infractions (*The Morning News* 1933:8; *Courier-Post* 1963:2). Unfortunately, most of the articles shared more similarities with the latter topic, rather than the former. Consequently, only two newspaper articles, one from *The Morning News* (*The Morning News* 1933:8) and one from the *Courier-Post* (Hopkins 1968:52-53), are included in this thesis because they focus on *Lilac*'s initial launch and eventual retirement. These articles were located using an online newspaper archive (newspapers.com).

Other primary documents included *Lilac*'s construction and design plans from 1933 and 1942 (revised in 1958), as well as *Arbutus*'s design plans from year 1941. These documents were retrieved from the cartographic department at NARA's College Park, MD location and from the *Lilac* Preservation Project in New York, NY in 2018. The *Lilac* Preservation Project provided a collection of photographs related to *Lilac*'s service as part of the USCG. Images of *Lilac* when it was a USLS lighthouse and buoy tender and its initial launch were obtained from the Hagley Digital Archives, an online platform that provides access to selected items from the Hagley Library located in Wilmington, DE. Photos of *Lilac*'s present condition were taken by the author in July 2019 and by Dr. Nathan Richards in July 2017.

Vessel specific histories, the third document group, were difficult to locate. USCG Chief Petty Officer Ray Burdeos wrote briefly about his experience serving onboard *Lilac* as a steward's apprentice from 1956-1958 in his book *Pinoy Stewards in the U.S. Sea Services: Seizing Marginal Opportunity* (2010). His account of events, however, did not provide enough information to warrant its inclusion in this thesis. Burdeos's story is fascinating, but the small section devoted to his time aboard *Lilac* mostly focuses on his personal life. As such, it was not included in this thesis. Other vessel specific histories were provided by Mary Habstritt, the director of the *Lilac* Preservation Project. Habstritt relayed anecdotes told to her by former USCG servicemembers. She also provided access (via the *Lilac* Preservation Project's website) to audio recordings of previous USCG servicemembers talking about their experiences onboard *Lilac*.

Each document group provided vital data that enabled a detailed analysis of *Lilac*'s history and function, both as a single entity and as a representation of a larger maritime institution. Sources related to buoy tender design (specifically *Lilac* or its sisterships in the Violet Class) and operations onboard *Lilac* (including general responsibilities, personnel, accounts of important actions, and vessel specific histories) form the bulk of the historical information contained within this thesis.

Archaeological Research

A prerequisite for an archaeological application of access analysis based on Hillier and Hanson's (1984) theory is an accurate map, preferably with all entrance points marked. While the support of a photographic record is helpful, the analytic procedures described in the next section do not depend on it. Therefore, the first goal in the archaeological research phase was to collect *Lilac*'s initial construction plans and any plans representing the vessel's modification.

The plans for *Lilac*'s construction and alteration were obtained from the Cartographic Division of the National Archives in College Park, MD and from the *Lilac* Preservation Project in New York, NY. Unfortunately, the USLS 1933 design plans for *Lilac*'s lower deck were not found during the investigation. In lieu of the original or a copy of *Lilac*'s construction blueprints for the lower deck in 1933, the design plans for *Lilac's* sistership *Arbutus* were used as a substitute (Figure 4.1).

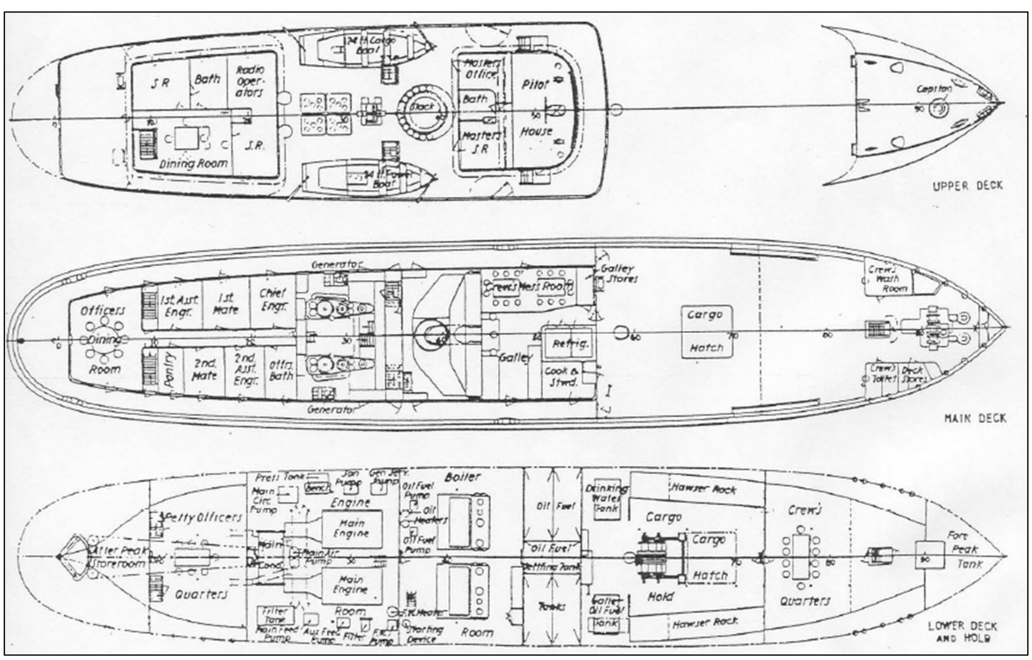

Figure 4.1. Deck plans for *Lilac*'s sister ship *Arbutus* (Brouwer 2004).

A further complication arose when it became apparent that the USCG did not create new design plans to reflect *Lilac*'s spatial modifications in 1958; rather, the 1942 plans were revised to indicate *Lilac*'s 1958 configuration. This made it difficult to determine what design changes occurred when. It was up to the author's discretion to decide when specific design modifications took place based on historical evidence and the existing photographic record. Some images of the 1942/1958 design plans have been altered as a consequence to clarify certain design features (see Figures 5.4, 5.12, 5.14, 5.16, 5.17, 5.18, 5.19, 5.20, and 5.21).

Photographic records were recovered from the *Lilac* Preservation Project in New York, NY. They show *Lilac* during its service as part of the USLS and USCG. *Lilac*'s present-day configuration was photographically documented by the author in July 2019 and by Dr. Nathan Richards in July 2017 to provide additional support for the analysis of the vessel's space.

Lilac's available design plans were studied individually, and then compared to one another, to determine key structural features and differences in the designs. A detailed description of all of *Lilac*'s component spaces, as depicted in the 1933, 1942, 1958 design plans and present-day photographs, was written. Each space's function, contents, proximity to other spaces, and access routes were recorded. After doing so, *Lilac*'s design plans and written descriptions were compared to one another in order identify any modifications to the vessel's design over time. Any noted changes were recorded along with the specific modified space's function, contents etc., using the same format as before. These written descriptions were then compiled. The result was a written record documenting *Lilac*'s 1933 anatomy and any significant changes that happened over the course of the vessel's lifetime up to present day (1933-2020). The potential ramifications of those design modifications were then explored in the analysis portion of this thesis's investigation.

Analysis

After obtaining *Lilac*'s design plans created in 1933, 1942, and modified in 1958, from NARA in College Park, MD and the *Lilac* Preservation Project in New York, NY, it was possible to begin mapping the vessel's spatial organization within the parameters of space syntax theory. The first step was to determine the carrier for the vessel. As outlined by Hillier and Hanson (1984), the carrier represents the entirety of the exterior space surrounding the complex. It is treated as a single point that indicates the place of entry from the outside world into the complex's interior (Hillier & Hanson 1984:147–8). Other studies utilizing space syntax theory have been conducted on terrestrial, relatively stationary, settlements and buildings (for examples, see Foster 1989, Fairclough 1992, and Stockett 2005 among others). *Lilac*, as a subject for spatial study, is unique in that it is a mobile, maritime structure with an exterior landscape that changed depending on the vessel's location. Given that the entry point from the outside world to *Lilac*'s decks depended on where the vessel was (e.g., at sea or port) and the means of boarding the vessel (e.g., from the dock or via another vessel), the initial challenge, therefore, was to determine how to arrange *Lilac*'s component spaces in the access diagram in regards to the carrier. It was decided that the carrier would represent the point of access from the mooring dock onto *Lilac*'s buoy handling deck. This site was chosen to act as the carrier because it was where the crew would often embark and disembark the vessel. It is from this designated carrier that *Lilac*'s components spaces are oriented in the access diagrams (see Figures 4.5 and 4.6).

The next step in the access diagraming process was to determine how to map exterior spaces onboard *Lilac* (e.g., the walkways surrounding *Lilac*'s deckhouses, open deck space, and exterior stairs). Interior spaces within built structures have traditionally been demarcated as transitional spaces in access diagrams. Transitional spaces are passageways, lobbies, and the like whose function is to provide access to other areas (Richardson 2003a:132). Using this notion, *Lilac*'s exterior walkways, exterior stairs, and open deck spaces (excluding the buoy-handling deck), along with the interior passageways and stairs linking each deck, were incorporated into the access diagram and labeled as transitional spaces.

After making decisions regarding the carrier and exterior transitional spaces, the initial access mapping stage involved creating separate access diagrams for *Lilac*'s 1933 and 1942 design plans (Figures 4.5 and 4.6). \ After conducting an archaeological investigation of *Lilac*'s spaces and their changes throughout time, the author determined that the 1958 revisions made to *Lilac*'s 1942 plans would not produce an access diagram with results significantly different from the 1942 access diagram. Consequently, an access diagram was not created to reflect *Lilac*'s 1958 configuration.

Although this thesis refers to the maps as access diagrams, they are also called justified interface maps or justified permeability maps by Hillier and Hanson (1984:106). A key indicating the various symbols used in the diagram was created (Figure 4.2). The carrier's symbol is a circle with a cross in it. The other rooms and spaces onboard *Lilac* are depicted as blank circles. Black lines linking the various circles indicate the access points and connections between each space. Once the diagram's key was created, the mapping process began.

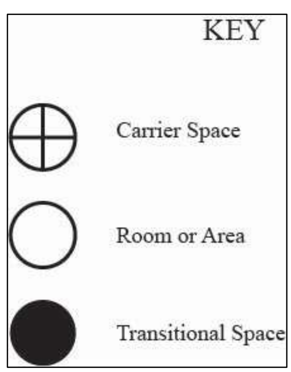

Figure 4.2. Access Diagram Key (D'Jernes 2019).

The first step in mapping *Lilac*'s spaces was to place the carrier at the base of the diagram. Then, all points with a depth of one from the carrier were horizontally aligned above it (Figure 4.3). All points with a depth of two were then placed above those points (Figure 4.4), and so on until all levels of depth from the carrier were represented; which totaled seven levels of depth in each diagram. This methodology was used to create two different diagrams; one mapped *Lilac*'s spaces as depicted in *Lilac*'s 1933 design and the other *Lilac*'s 1942 design (Figures 4.5 and 4.6). Rather than writing out the name of each space in the diagram, they were assigned a number. A key was created to accompany each diagram indicating the space associated with the numbered circles.

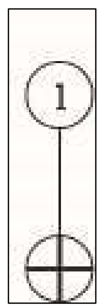

Figure 4.3. Point with a depth of one in the access diagram (D'Jernes 2019).

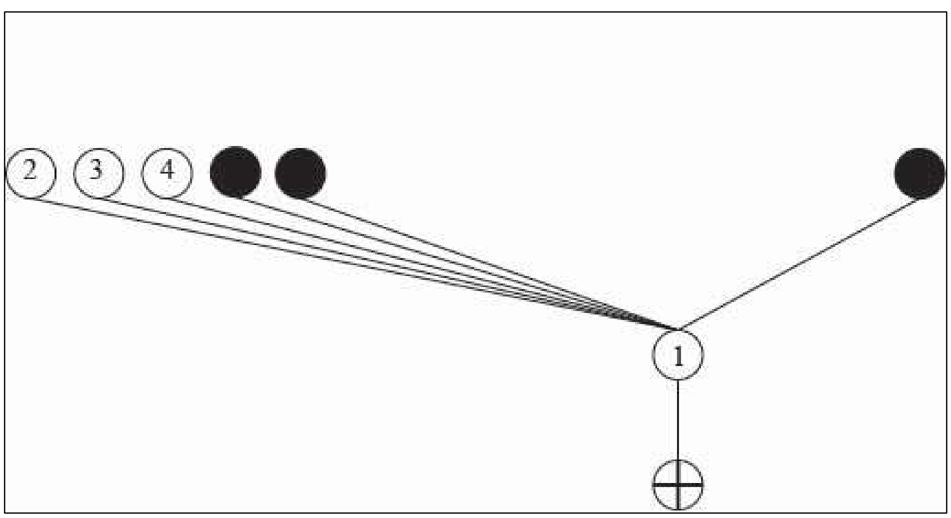

Figure 4.4. Points with depths of three in the 1933 access diagram (D'Jernes 2019).

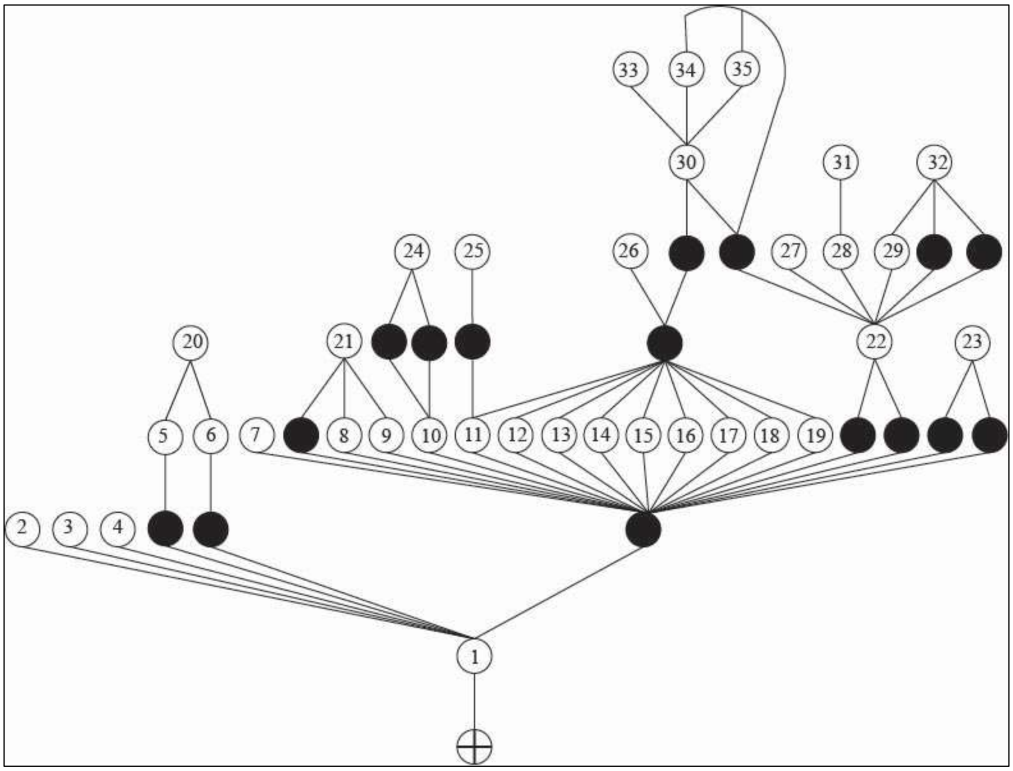

Figure 4.5. Access diagram mapping *Lilac*’s 1933 design (D’Jernes 2019).

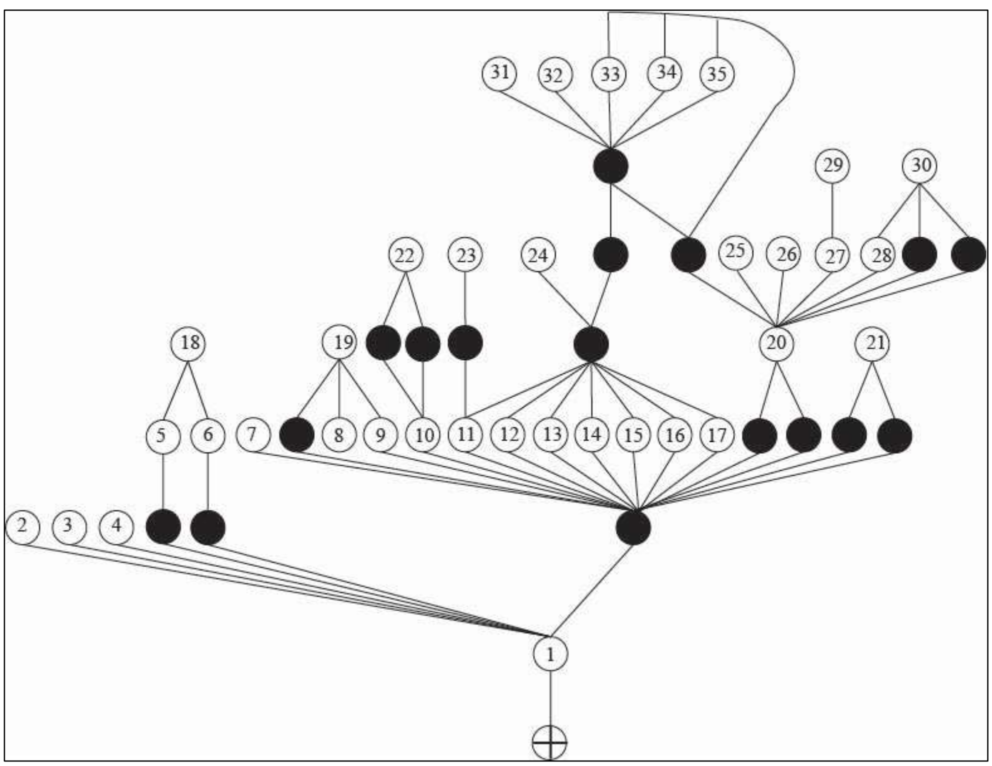

Figure 4.6. Access Diagram mapping *Lilac*’s 1942 design (D’Jernes 2019).

At this stage, syntactic descriptions of space and measures of integration (visually represented in the access diagrams) were considered as a means of interpreting the access diagrams and the information contained within. Through the visual representation of *Lilac*'s spaces via the access diagrams, it was possible to see that each space has certain syntactic properties: "it will either be distributed with respect to other spaces (have more than one way to it) or nondistributed (the only way), and it will be either symmetric with respect to other spaces (having the same relation to them as they do to it) or asymmetric (not having the same relation, in the sense of one controlling the way to another with respect to a third)" (Hillier & Hanson 1984:108). A space's description is its distribution and symmetry properties; they indicate the accessibility of a space based on its relationship to nearby spaces and access points.

Integration values are closely tied to syntactic descriptions of symmetry and distribution. Integration, or depth, is the measure of how many steps distance each space from the carrier; spaces are either deep (located far from the carrier), or shallow (close to the carrier). Shallow spaces are integrated within the system and relatively more accessible; whereas deep spaces are segregated and less accessible (Hillier & Hanson 1984:108). Measures of depth are directly related to symmetry and distribution; for example, a space is deep (far from the carrier) because it is asymmetric (it is necessary to pass through surrounding spaces to enter it). Ultimately, integration values help to reveal the accessibility of a space. Accordingly, integration values were studied in conjunction to the access diagrams' syntactic descriptions of *Lilac*'s spaces. A table was created to document each space's measures of integration (depth) and syntactic descriptions (symmetry and distribution). Once done, historical data was studied alongside to build a general picture of how *Lilac*'s structural interface possibly generated and controlled social relations among servicemembers.

Conclusion

Using the information gathered during the historical and archaeological research phases, in conjunction to the results of the 1933 and 1942 access diagrams, it was possible to study *Lilac*'s spatial patterning in relation to USLS and USCG societal norms. The methodology by which it was done was outlined in this chapter. By describing the methodology used, it hopefully provides readers with a better understanding of how access analysis can be applied to maritime subjects in future studies. The next chapter, Chapter 5, focuses on the results of the archaeological investigative phase of this thesis. It describes *Lilac*'s design throughout, and beyond, the vessel's operation lifespan up to present day (1933-2020).

CHAPTER 5: RESULTS OF ARCHAEOLOGICAL INVESTIGATION

Introduction

The last chapter elaborated on the methodology used throughout the course of this thesis to answer the guiding research questions; mainly, if, how, and why space was organized on *Lilac* in connection to societal norms. This chapter describes *Lilac*'s changing anatomy beginning with the vessel's initial design at the time of its construction (1932-1933) up to its present-day configuration (2020). This information is then coupled with corresponding access diagrams in the following chapter (Chapter 6), along with historical data (see Chapter 2), to answer the research questions.

In order to determine the potential relationship between space and social logic, *Lilac*'s spatial organization was first analyzed in two different contexts: *Lilac*'s original construction and design plans drawn by Pusey & Jones Shipyard in 1933; and *Lilac*'s design plans copied from Pusey & Jones's original plans and revised by the USCG in 1942 and again in 1958. This was done so that it would be possible to conduct a comparative analysis of *Lilac*'s constituent spaces during various design changes, and, in the subsequent chapter, combine it with the data previously gathered throughout the historical research phase of this thesis's investigation.

The first portion of this chapter describes *Lilac*'s original construction and the matching design plans drawn by Pusey & Jones's shipyard in 1932-1933. It is then further broken into subsections devoted to each of *Lilac*'s decks. Each subsequent section in this chapter details the changes or additions made to the spaces discussed in the first section using a similar format. The final section details *Lilac*'s present day (2020) configuration as it relates to the vessel's previous designs. This chapter concludes by highlighting the significant changes that happened over the course of the vessel's lifetime and the potential ramifications of those modifications.

The figures included throughout are deck design plans, supplemented with inboard and outboard profile plans and images retrieved from the cartographic department at NARA's College Park, MD branch and from the *Lilac* Preservation Project in New York, NY. The design plans for *Lilac*'s lower deck, drawn by Pusey & Jones in 1933, were not found. As such, the USCG's plans for *Lilac* from 1942/1958 and *Arbutus*'s (*Lilac*'s unofficial sistership designed by Pusey & Jones in 1933) 1941 USCG design plans were used as a substitute. The USCG did not make a separate drawing of *Lilac*'s plans in 1958; rather, the 1958 updates to the vessel's design were drawn directly onto *Lilac*'s pre-existing 1942 plans created by the USCG. Consequently, some of the figures included in this chapter are altered versions of the USCG's 1942 and 1958 plans created to distinguish between the changes made to *Lilac*'s design during those years (see Figures 5.4, 5.12, 5.14, 5.16, 5.17, 5.18, 5.19, 5.20, and 5.21).

Lilac's 1933 Design

Contracted by the USLS, the Pusey & Jones Shipyard began *Lilac*'s construction in 1933. The buoy tender's hull, decks, deckhouses and masts were all steel, while the tops of the uppermost deckhouses (the pilothouse, captain's quarters, and staterooms) were surfaced with either spruce or pine wood protected by painted canvas. During construction, *Lilac*'s steel structure was riveted. At the time of launch, *Lilac*'s hull measured 174 feet 6½ inches overall. The molded breadth was 32 feet, and the minimum depth of hull at the side, from the top of the main deck to the top of the keel, was 14 feet 6 inches. At a displacement of approximately 770 tons, the draft was 10 feet 7 inches in saltwater. The fuel capacity was 102.5 tons. Twin four-bladed propellers (both 7 feet and 5 inches in diameter) propelled *Lilac* through the water (Figure 5.1). The propellers were powered by a triple expansion, reciprocating steam engine with 500 indicated horsepower at 160 revolutions per minute. Reciprocating steam engines could run just as fast forward as backward, providing *Lilac* with extra maneuverability. Built by Pusey & Jones, *Lilac*'s engines had high, intermediate, and low-pressure cylinders, with 11½, 19, and 32-inch diameters and a 24-inch stroke. Two Babcock & Wilcox oil-fired, water-tube boilers supplied the steam to operate the engines at 200 pounds per square inch. The designed speed of *Lilac* was approximately 13.7 knots, but this changed depending on mechanical upgrades (Scheina 1990:171; Brouwer 2004:Section 7:1-4).

Figure 5.1. *Lilac*'s twin four-bladed propellers, Pusey & Jones Shipyard, 1933 (Hagley Digital Archives 2018).

Lower Deck

The 1933 design plan for *Lilac*'s lower deck was not found during this research. A copy of *Arbutus*'s design plan depicted the vessel's lower deck is used in lieu of *Lilac*'s plans (Figure 5.2). *Arbutus*'s layout was similar enough to *Lilac*'s so that its plans can feasibly act as a substitute.

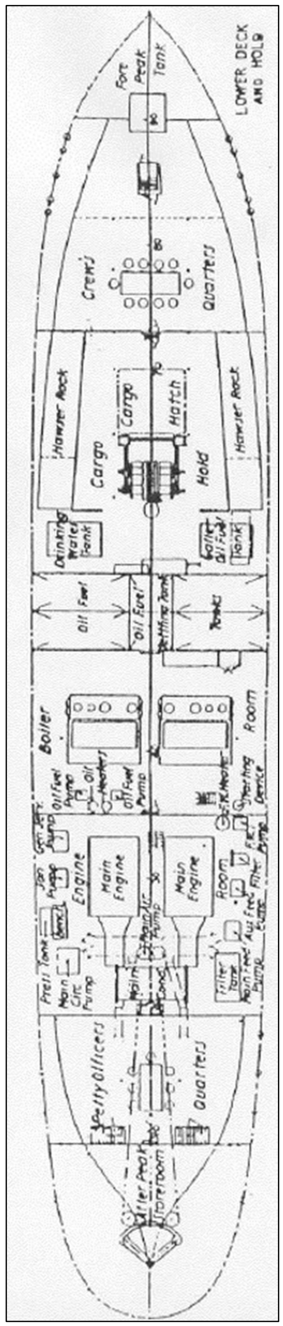

Figure 5.2. *Arbutus*'s Lower Deck (Brouwer 2004).

The lowest level of *Lilac*'s hull consisted of the cargo hold near the bow, forward of amidships, along with the oil fuel tanks, and the ship's boiler and engine, all aft of amidships. There were ladders in the cargo hold, lower boiler room, and lower engine rooms all leading up to the main deck. At the very front of the bow was the forepeak tank; which served as ballast to maintain the ship's trim and as a collision bulkhead. The vessel's freshwater tanks were located behind the forepeak tank. Between the freshwater tanks and the cargo hold, there was an area divided into two levels; the lower level was intended for storage, while the upper area provided living quarters for crewmembers. Entrance to these living quarters was gained through a steep set of stairs on the bow of the main deck under the fo'c'sle head. Aft of the cargo hold was the drinking water tank, fuel oil compartment, the lower boiler room, followed by the lower engine room towards the stern of the vessel. Just aft of the lower engine room was another space divided into two levels. The bottom level could be entered by way of the lower engine room; it housed *Lilac*'s two propeller shafts. The upper level was located immediately aft of the engine room bulkhead and provided additional living quarters. Crewmembers could access these quarters through a ladder leading to an open passageway outside of the deckhouse on the main deck near the stern of the vessel. Beyond the two-level space containing the propeller shafts and crew's quarters, at the stern of the lower deck, was the trimming tank (after peak tank), freshwater reservoir, and after peak storeroom.

Main Deck

The 1933 design plans for *Lilac*'s main deck are in figures above (Figures 5.3 and 5.4). Figure 5.4 is a guide that indicates where the subsequent figures (Figures 5.6, 5.7, and 5.8) are located within the vessel.

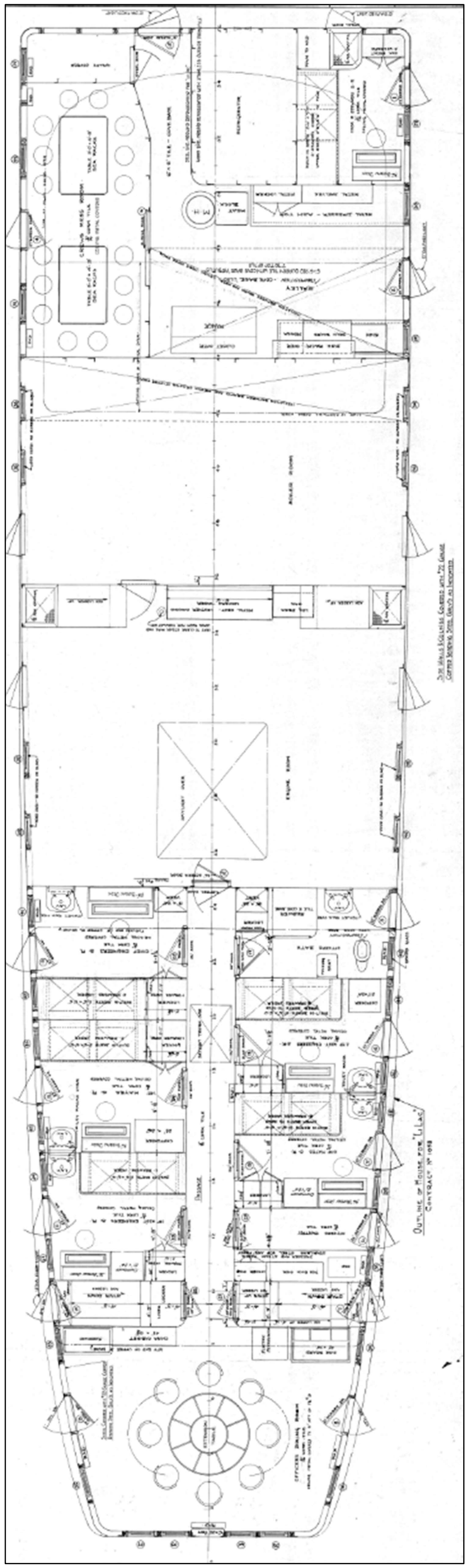

Figure 5.3. *Lilac*'s Main Deck (USLS 1933).

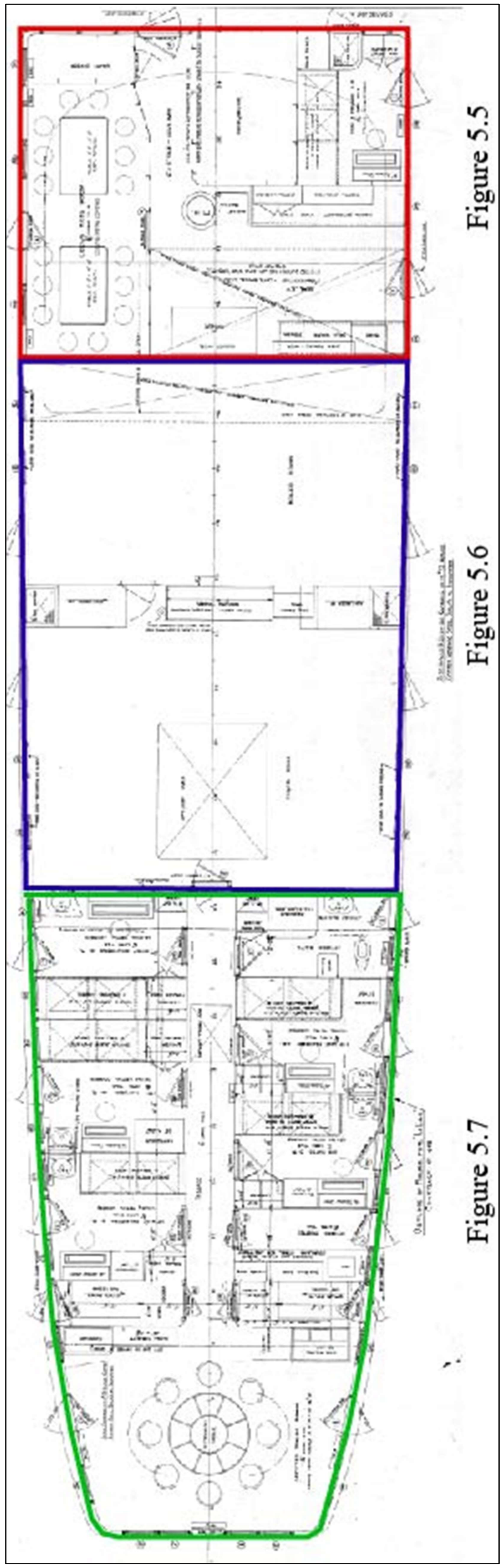

Figure 5.4. *Lilac*'s main deck with figures highlighted (USLS 1933, modified by D'Jernes 2019).

To reach the main deck of the vessel from the lower deck, *Lilac*'s crew used the steep stairs in either of the living spaces fore or aft of amidships, the cargo hold, or in the lower engine and boiler rooms. A fo'c'sle head sheltered the bow of the main deck and the ladder to the forward living quarters on the deck below. In addition to storage space, *Lilac*'s anchor windlass and associated handling equipment were located under the fo'c'sle head (Figure 5.5). The anchor windlass was steam powered and could be clutched into the capstan making it possible to be run by hand or by steam. A small cabinet, forward of the windlass, contained lamps, as well as lamp and illuminating oil cans. Rooms on the starboard side of this area within the fo'c'sle head included a small storage room and a bathroom with a double toilet (Figure 5.5).

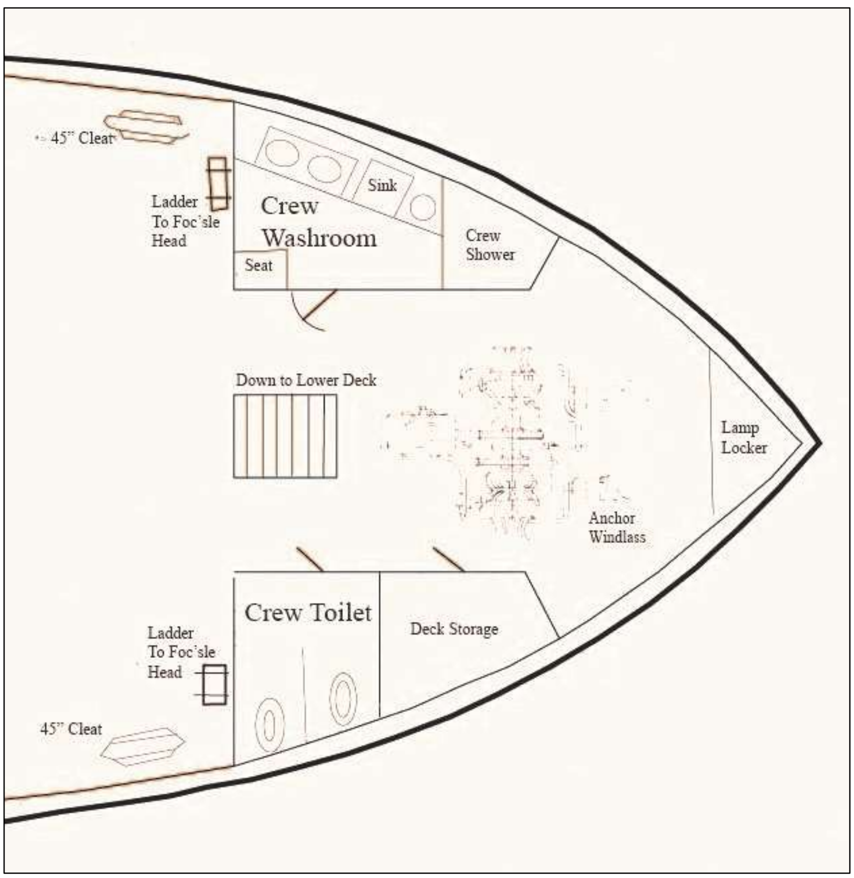

Figure 5.5 Forward main deck, *Lilac* (USCG 1942, Modified by D'Jernes 2019).

Across from these rooms, on the port side, was a single washroom with a large shower stall (Figure 5.5). The bathroom and washroom were intended for the crew's use; officers had separate facilities. The open area directly on top of the fo'c'sle head was encircled by a pipe railing. It was accessed from the main deck via external vertical steel ladders. The jack staff and bow range light were placed there. This area was primarily used when handling the forward mooring lines. It was fitted with chocks, mooring bitts, and a single capstan to secure lines and cables, along with a crutch that stowed the forward end of the boom when not in use.

The fo'c'sle head's main area was open from the bow to the primary working deck where buoys were handled. This deck area was kept clear of any physical impediments that would hinder operations during the movement and stowage of buoys and other related tasks. The steel bulwarks on the port and starboard sides of the buoy handling deck were removed during operation. A metal grated hatch at the center of the buoy handling deck acted as a skylight and provided ventilation for the cargo hold below. The hatch could be opened and closed as needed during buoy-related operations. Along the steel bulwarks on the port and starboard sides of the vessel, steel cable stoppers were mounted on the deck to control buoys' anchor chains. When tripped, these stoppers allowed the chain to run over the side of the vessel when installing and setting buoys' anchors (also called "sinkers").

Aft of the buoy handling deck was an enclosed deckhouse with open walkways on either side of the vessel enclosed by pipe railing. The vessel's galley, the cook and steward's living quarters, the crew's mess room, a storeroom containing galley supplies, and a large refrigerated storeroom for food were located inside (Figure 5.6). A steel door from the buoy handling deck led to a passageway inside the deckhouse. The passageway was lined with doors leading into the mess room and storeroom on the port side, and into the galley on the starboard side. In the forward starboard corner of the deckhouse, there was a ladder leading down to the cargo hold. Along the open walkways on either side of the deckhouse, there were steel watertight doors (with inner screened doors) providing direct access into the galley, the mess room, and the cook and steward's berths (Figure 5.6). The cook and steward's living quarters could not be accessed by any means other than the door from the walkway outside the deckhouse.

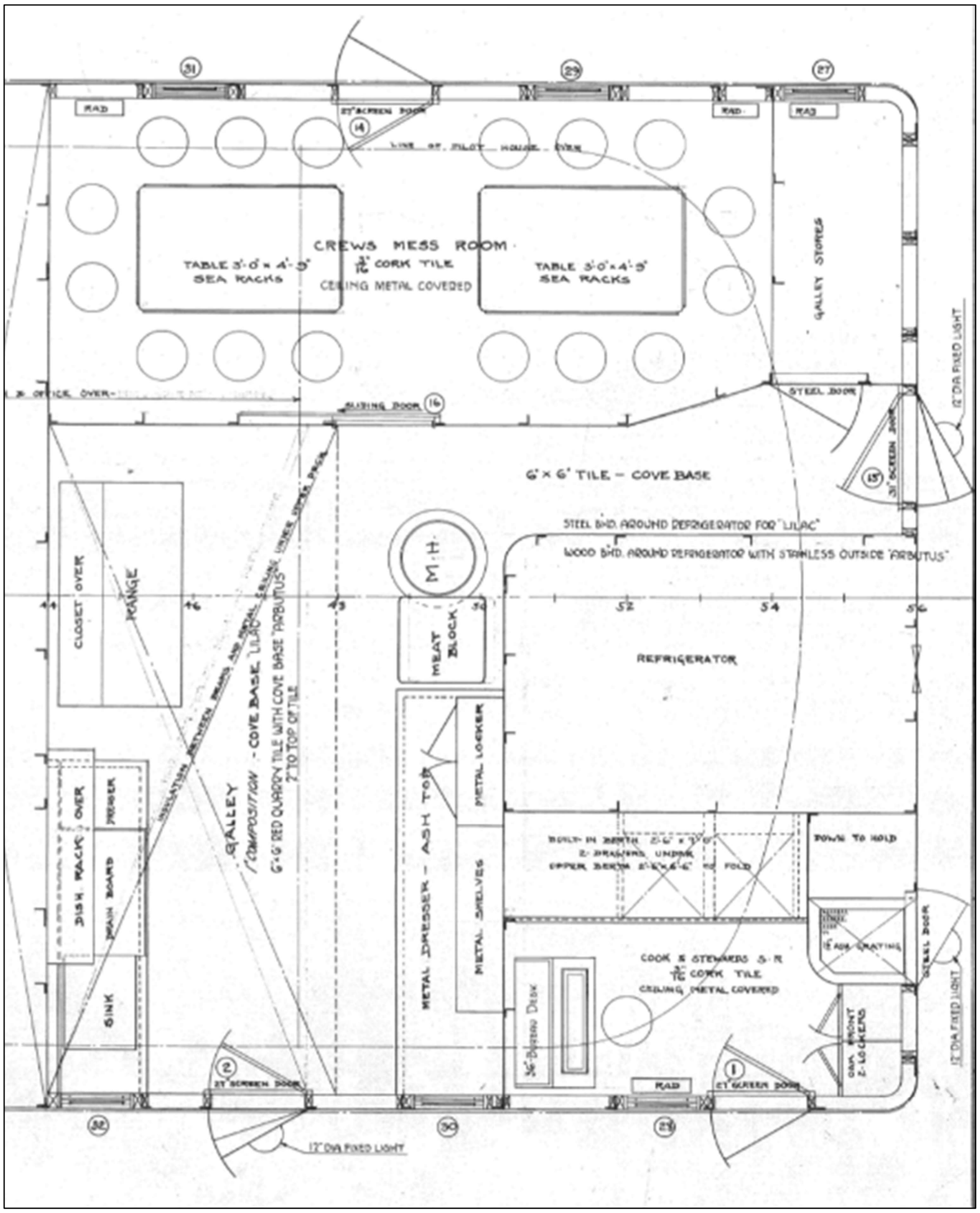

Figure 5.6. The crew's mess room, galley, refrigerator, and the cooks and stewards' quarters (USLS 1933).

Inside the cook and steward's living quarters, most of the space was occupied by: lockers, a bureau desk, chair, and a built-in berth with drawers below and foldable berth above. The crew's mess room contained two large tables outfitted with sea racks and sixteen complementary chairs. The galley was furnished with a cooking range with an overhead closet, a metal dresser with shelves and a locker above it, a meat block, a sink, a drainboard on top of a dresser, and a dish rack overhanging the sink and dresser (Figure 5.6).

Past the galley, doors on either side of the open passageway outside the deckhouse led into the upper boiler room, where the boiler's uptakes connected to the ship's stack above (Figure 5.7). Sharing a wall aft of this space was the upper engine room. A steel door connected the upper boiler room and the upper engine room. The upper engine room housed the upper portions of the two engines, assorted auxiliary machinery, ladders to the lower engine room and stairs leading to the open area on the upper deck aft of the master's quarters and pilothouse (Figure 5.7). A large cushioned bench with storage space under it and a desk containing the ship's log were also placed in the upper engine room (Figure 5.7).

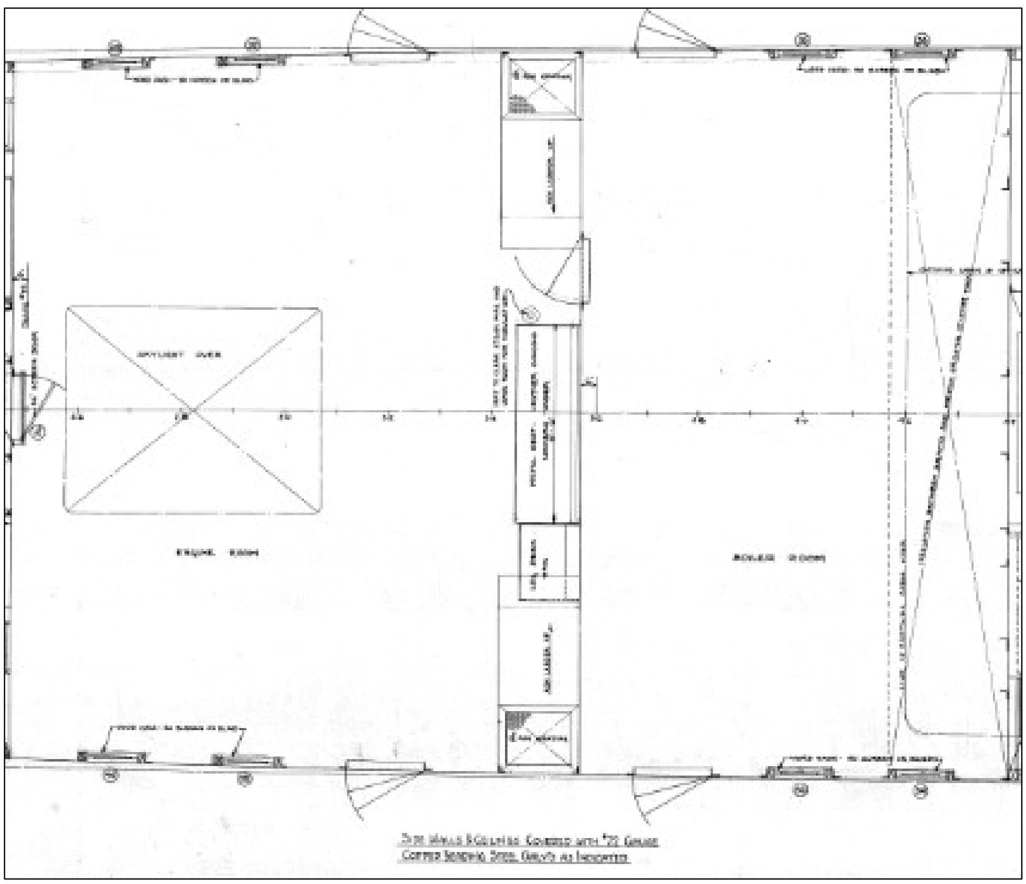

Figure 5.7. *Lilac*'s Upper Boiler and Engine Rooms (USLS 1933).

A door aft of the upper engine room led into an inner central passageway with doors on the starboard and port sides leading into the officers' living, dining, and related compartments (Figure 5.8). On the starboard side of the central passageway, doors led into the officers' bathroom, the second assistant engineer and the second mate's living spaces, in addition to the officers' pantry. The officers' bathroom contained a toilet, sink, shower stall, locker, and folding seat. Both the second assistant engineer and the second mate's living spaces consisted of a bureau desk and chair, along with a sink, locker, chiffonier, and a built-in berth with drawers below and a foldable berth above. Aft of the second mate's quarters was the officers' pantry (Figure 5.8). The officers' pantry was composed of a sink, with a locker and a dish rack hanging over a stainless-steel dresser and steam table. From this room, *Lilac*'s stewards served the officers' mess. Directly behind the officers' pantry were two enclosed spaces: one contained a ladder leading down to the lower deck; while the second enclosed space had a ladder leading to the upper deck (Figure 5.8). The ladder leading to the lower deck was accessible from a doorway to the open passage outside of the deckhouse; whereas, the ladder leading to the upper deckhouse was only accessible through a doorway in the central passageway within the deckhouse (the same passageway by which the officers' entered their living quarters and dining areas).

The chief engineer's living quarters were located directly across from the officers' bath on the port side of the inner central passageway, towards the bow of the deckhouse. Aft of this space was the first mate and first assistant engineer's living quarters. The chief engineer, first mate and first assistant engineer's quarters contained the same furniture and features as the other officers' (second assistant engineer and the second mate's) living quarters in the deckhouse (Figure 5.8). Behind the first assistant engineer's room was another space divided into two separate sections: one section contained a linen locker; the other included a ladder down to the lower deck. The linen locker's door was placed along the central passageway inside the deckhouse. The room with the ladder leading to the lower deck could only be entered from the open passageway outside of the deckhouse (Figure 5.8).

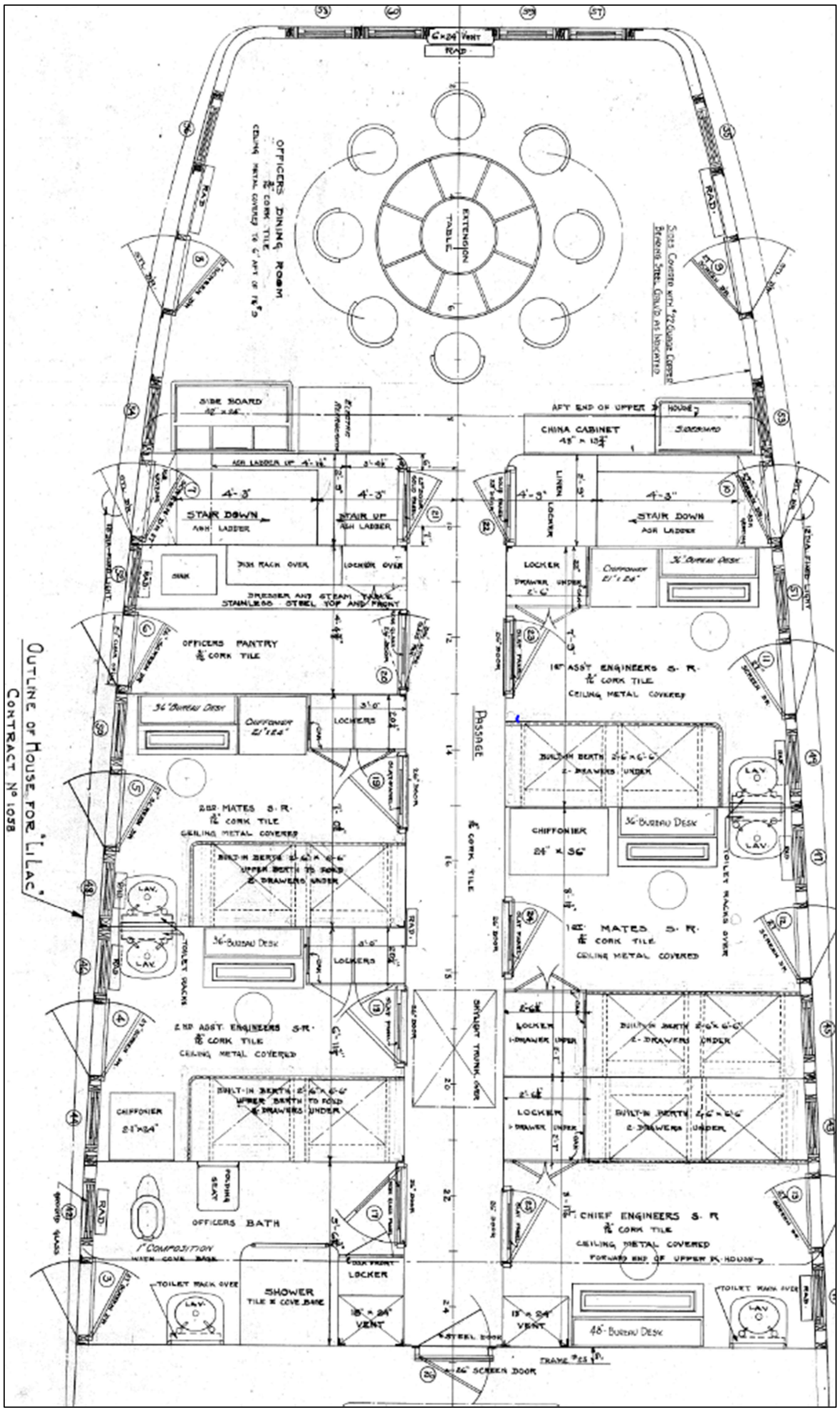

Figure 5.8. Aft portion of deckhouse on *Lilac*'s main deck (USLS 1933).

Beyond the officers' living quarters, bathroom, pantry, linen locker, and the rooms with stairs leading up and down to different decks, the central passageway led directly to the spacious officers' dining room at the stern of the vessel (Figure 5.8). The officers' dining room was furnished with a large table with corresponding seats, two side boards on the port and starboard sides of the room, a china cabinet, and an electric refrigerator. Like the officers' living areas, pantry, and bathroom inside the aft portion of the deckhouse, the officers' dining room could be entered through steel watertight doors (with wooden screen doors on the inside) leading from the open passageway outside of the main deck. The officers' dining room had a window on both the port and starboard sides, and four windows facing the stern of the vessel. The windows had wooden sashes, but no screens or blinds. Every room on this deck, including the upper boiler and engine rooms, contained at least one window.

Upper Deck

The upper deck above the main deck was divided into two separate deckhouses (Figure 5.9). The forward deckhouse was located directly above the ship's galley, refrigerator, storeroom, crews' mess room, and the cook and steward's living quarters. It was divided into the pilothouse, and the master's stateroom, bathroom, and office. The pilothouse, the forward most room on the upper deck, was elevated four steps above the master's stateroom for increased visibility over the buoy handling deck and the bow of the vessel (Figure 5.9). Within the pilothouse was the ship's wheel, a large wooden chart table, a long, cushioned seat with lockers beneath, the flag locker, and telephone to the engine rooms below.

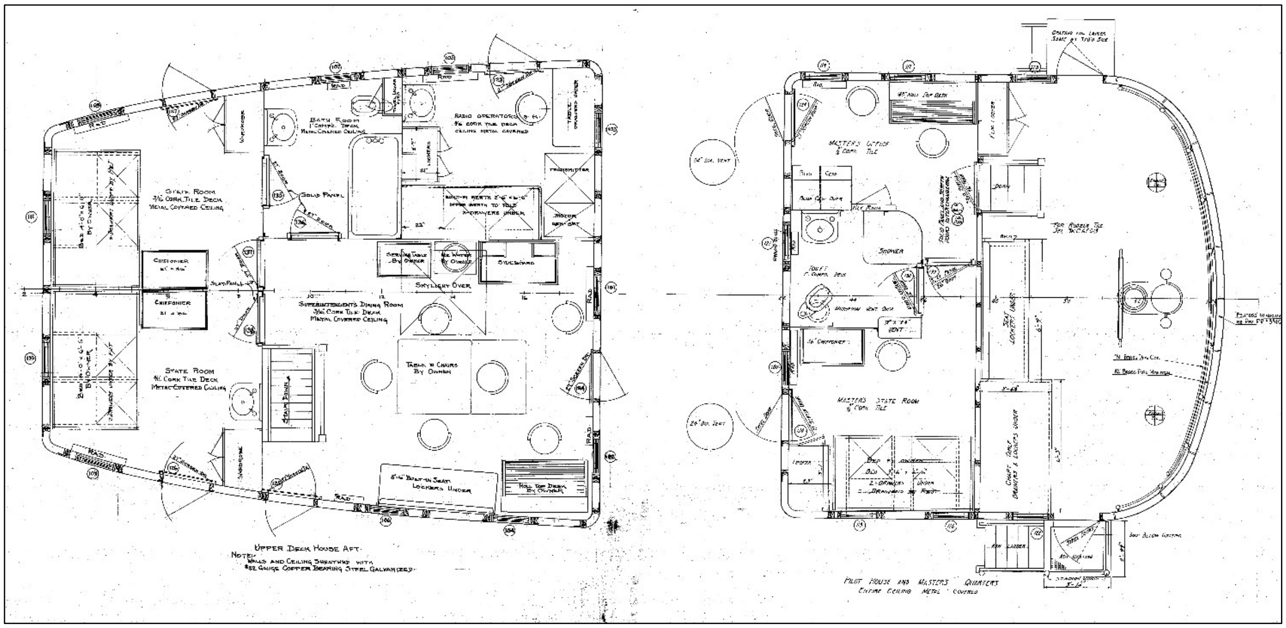

Figure 5.9. Two deckhouses on *Lilac*’s upper deck (USLS 1933).

On either side of the pilothouse were two open bridge wings on steel framework supports fenced with pipe railings. Two ladders on the port and starboard sides led down to the open passageways outside of the main deck below. An open walkway encircled the forward side of the pilothouse. The set of levers used to control the hoisting gear was located there; these mechanisms were operated outside in the open in all weather (Figure 5.10). Above the pilothouse was an open deck, which acted as a “flying bridge” equipped with an auxiliary steering wheel and searchlights for signaling and additional illumination. It acted as an operating station for *Lilac*’s officers and master by providing unobstructed views of the bow, stern, and the port and starboard sides of the vessel.

A door from the pilothouse led into the master’s office (Figure 5.10). The master’s office was furnished with a roll top desk, two chairs, a key rack, and file cases with a bookcase above them. A door led into the master’s stateroom through the master’s office. Adjacent to that entryway, another door led to the master’s bathroom. The master’s bathroom had a sink, toilet, and shower stall in it (Figure 5.10). Although more spacious than the other living quarters, the master's stateroom consisted of similar furnishings; including: a chair, chiffonier, and locker. However, unlike the crew and officers' living quarters on the decks below, the master's stateroom had a much larger bed (not berth) with ample storage space built under it.

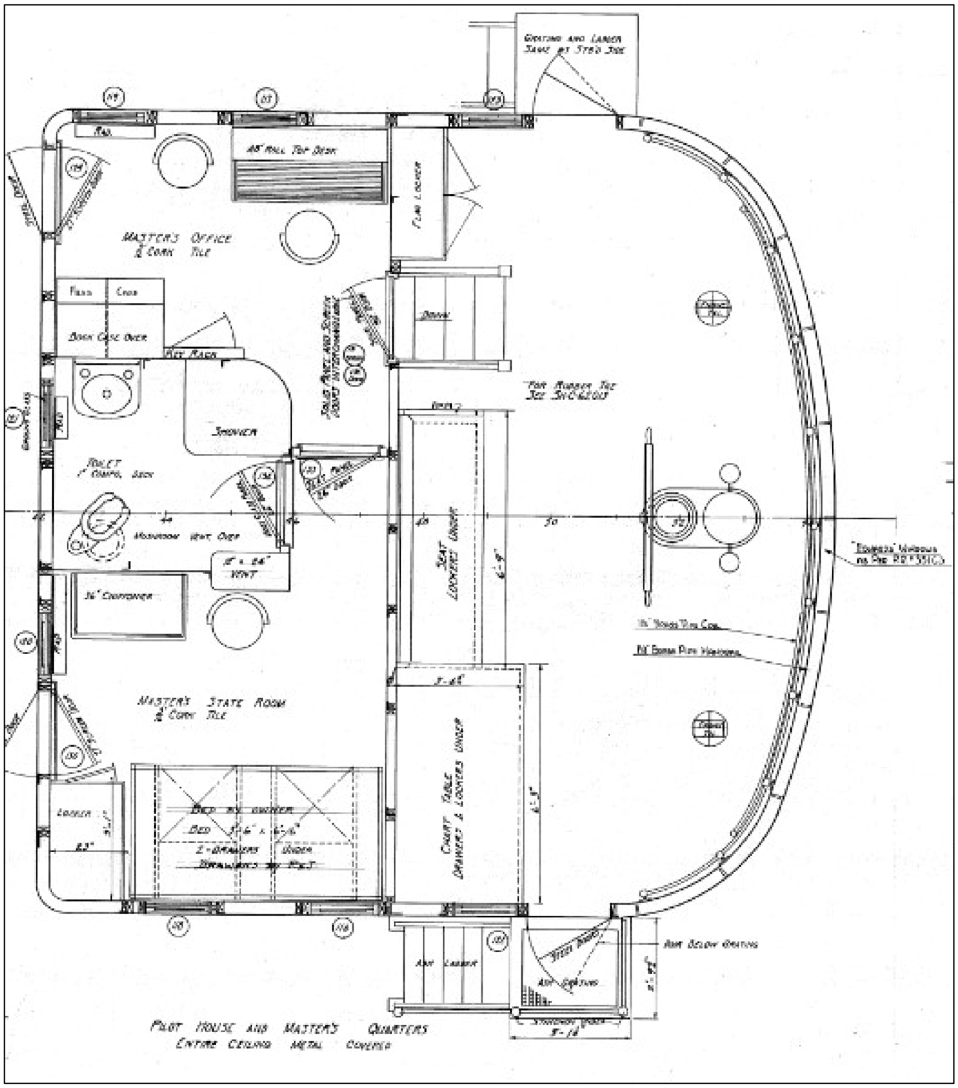

Figure 5.10. Pilothouse, master's state room and office on *Lilac*'s upper deck (USLS 1933).

Steel doors (with inner screened doors) in the master's stateroom and office led to an open boat deck between the two deckhouses. The ship's stack, a steam winch, and the skylight above the upper engine room occupied the centerline of this area. The ship's stack was tall and straight with a slight rake aft, typical of a steam powered vessel (Brouwer 2004: Section 7:4). The skylight aft of *Lilac*'s stack was made of steel with portholes and openings along the sides intended to provide natural light and ventilation for the engine room below. In conjunction, large cowl ventilators located on either side of the ship's stack and the skylight also ventilated the boiler room and the engine room on the deck underneath. The ship's two wooden lifeboats were stowed in chocks on either side of this deck; the radial davits used to launch the boats were nearby.

A door on the port side of this open deck led into the radio operator's living quarters (Figure 5.11). Like the officers' living quarters located in the deckhouse below, the radio operator's lodgings were of a comparable size and included a locker and sink, in addition to a built-in berth with drawers below it and a foldable berth above. The radio operator's quarters were correspondingly occupied by a table with drawers beneath it and an accompanying chair. As expected, the ship's transmitter and motor generator set were in this space. This room could only be accessed from the open passageway surrounding the aft deckhouse and not from another room within it.

Adjacent to the radio operator's living quarters is the superintendent's dining room, also at the fore of the deckhouse. A door on the starboard side of the open boat deck led into the superintendent's dining room (Figure 5.11). The superintendent's dining room featured a table and four corresponding chairs, a roll top desk, two additional chairs, a long, cushioned bench with lockers under it, a serving table, ice water container, and a sideboard. The stairs leading to and from the central passageway inside the main deckhouse below (where *Lilac*'s officers accessed their living and dining quarters) were in this dining room. Two state rooms and a bathroom could be accessed through solid paneled wooden doors with brass hardware, which led from the superintendent's dining room (Figure 5.11). The bathroom in this deckhouse was approximately the same size as both the officers and master's bathrooms. It was outfitted with a sink, a toilet with a towel rack above it, and a bathtub (not a shower stall). Aft of the superintendent's dining room, the radio operator's living quarters, and the bathroom were two staterooms (Figure 5.11). The staterooms were used to accommodate the U.S. Lighthouse Saving Service district inspector as he traveled between lighthouses in his district (Scheina 1990:172). Both staterooms could be entered through a door leading from the superintendent's dining room. The two aft staterooms were similar in size and contents; both featured a wardrobe, chiffonier, and bed (not built-in or foldable berths). The only difference between the staterooms was that a sink occupied the space in the starboard side stateroom where the door leading into the bathroom was in the port side stateroom. Every room in the two deckhouses, besides the bathrooms, had doors to the encircling open walkways and windows facing their respective sides of the deckhouse.

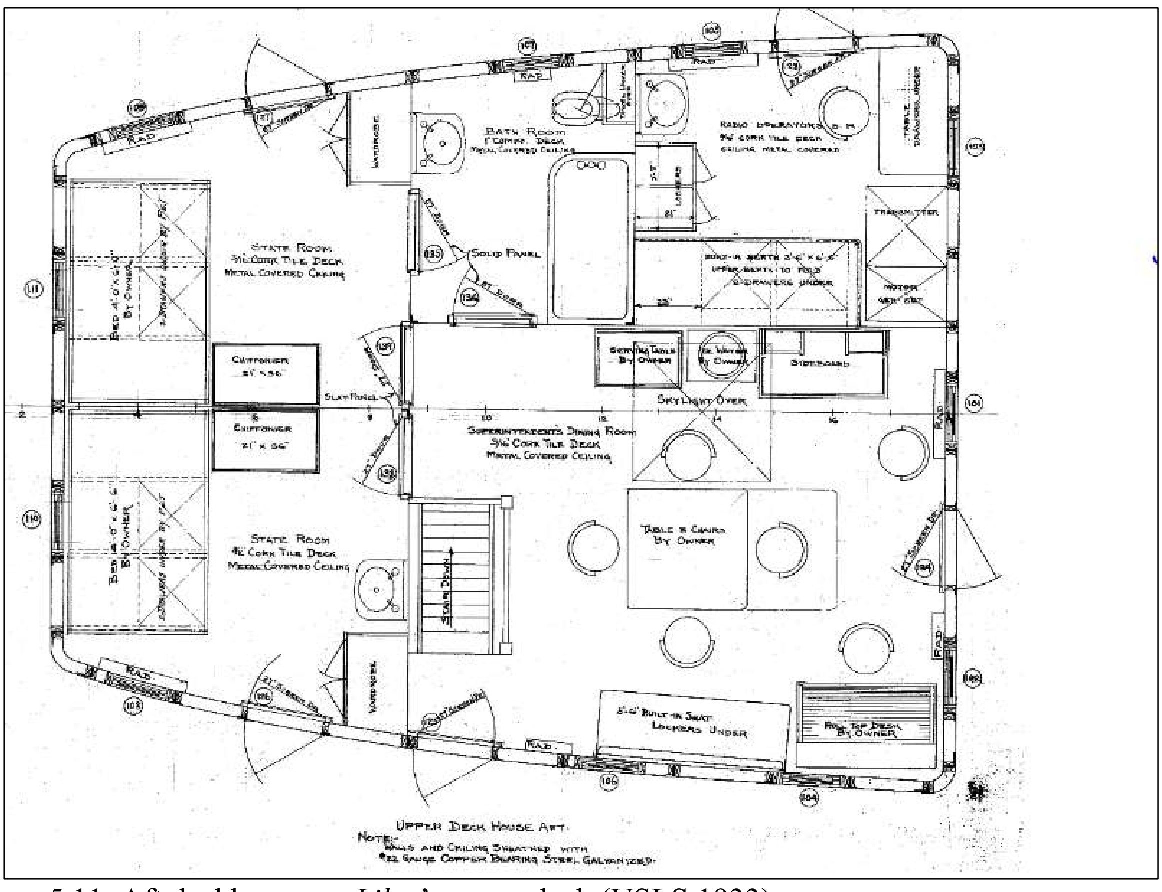

Figure 5.11. Aft deckhouse on *Lilac*'s upper deck (USLS 1933).

Lilac's 1942 Design

The administrative body overseeing *Lilac*'s operations transferred in 1939 following the incorporation of the USLS into the USCG that year. In April of 1942, the USCG drew plans for *Lilac* based off the vessel's original design plans created by Pusey & Jones shipyard in 1933. Soon after, in August of 1942, the USCG revised the copied plans to show the addition of armament to *Lilac*. This revision also reveals major changes made to the vessel's design since its construction; specifically, modifications to *Lilac*'s living quarters and indoor workspaces. On the next page, is an image of *Lilac*'s lower, main, and upper decks as depicted in the vessel's 1942 design plans (Figure 5.12). Figure 5.13 presents *Arbutus*'s inboard profile drawn by the USCG in 1941/1942. It will be used as a supplementary visual aid when describing *Lilac*'s 1942 design modifications.

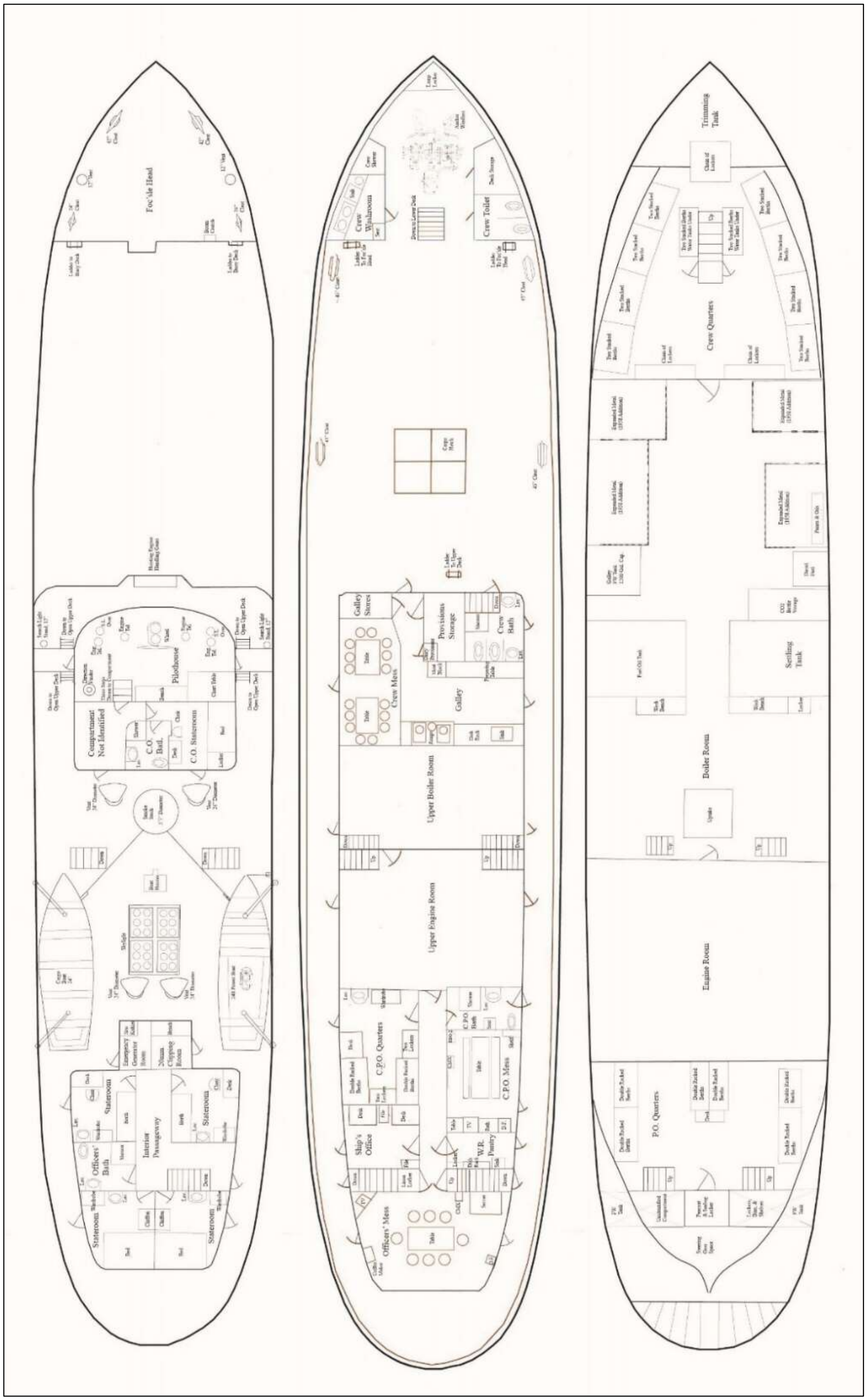

Figure 5.12. *Lilac*'s upper, main, and lower deck (USCG 1942/1958, modified by D'Jernes 2019).

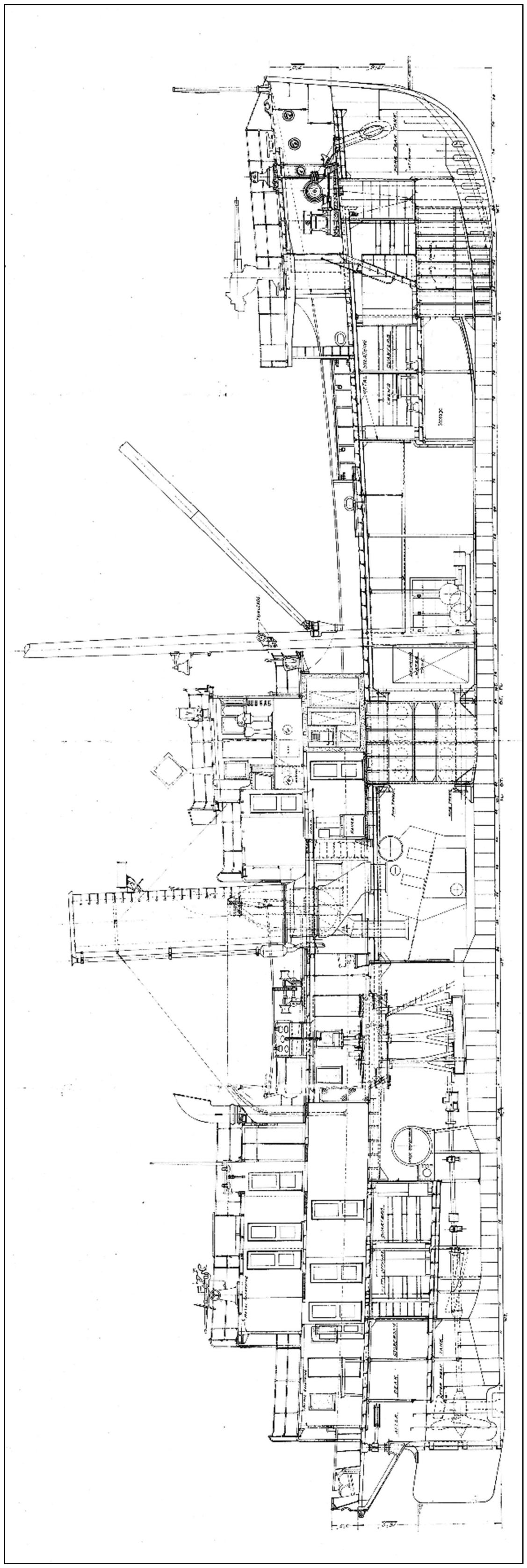

Figure 5.13. *Arbutus*'s inboard profile (USCG 1941/1942).

Lower Deck

The lower deck composed mostly of the ship’s propulsion and engine machinery, along with the crew’s quarters and holding tanks, changed only slightly when compared to the design alterations on *Lilac*’s other two decks (Figure 5.14). In terms of holding tanks, the feed water tank was extended during WWII. *Lilac* was expected to be at sea longer, and the vessel needed to hold more feed water for the steam engines.

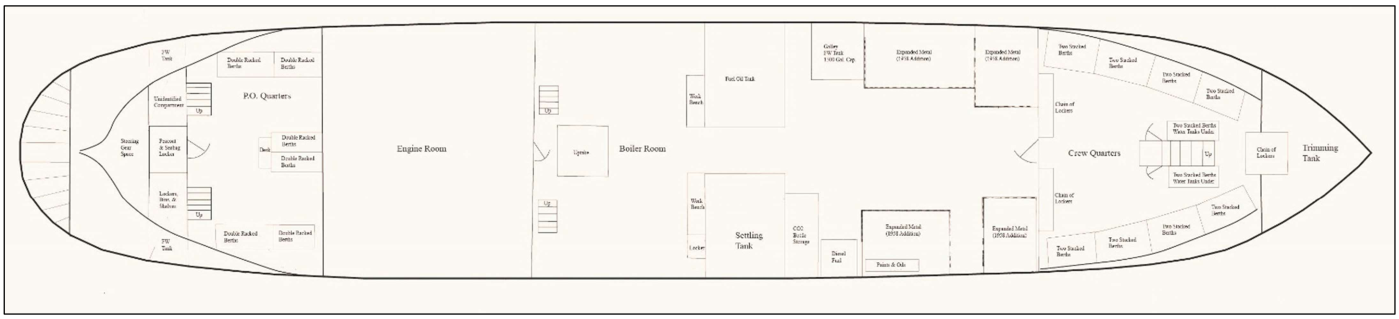

Figure 5.14. *Lilac*’s lower deck (USCG 1942/1958, modified by D’Jernes 2019).

The 1942 plans label the space below the crew’s living quarters (towards the bow) as ammunition storage for *Lilac*’s 3”/50 caliber anti-aircraft gun. Extra ammunition for the vessel’s depth charges were also stored there. The vessel’s previous design plans drawn by Pusey & Jones in 1933 do not indicate the contents of the storage space but label it simply as cargo storage. Since *Lilac* was under the command of a non-military entity (USLS) at the time of its construction in 1932-1933, it is unlikely that weaponry and associated materials were stored there prior to the vessel’s incorporation into the USCG.

Lilac’s crewmembers could get to the gun’s ammunition through a stairway inside the deckhouse on the main deck leading down into the cargo hold. Likewise, the ammunition storage area could also be entered through a door from the crew’s living quarters on the lower deck into the cargo hold. *Lilac*’s 3”/50 caliber anti-aircraft gun was mounted on top of the fo’c’sle head on the main deck (Figure 5.15). Below the fo’c’sle head were the stairs leading down to the crew’s quarters on the lower deck. The route through the crew's living quarters was likely the quickest way to go back and forth between the gun and the ammunition storage space. *Arbutus*'s inboard profile (drawn in 1941/42 by the USCG) shows the placement of where the 3"/50 caliber anti-aircraft gun was placed on Lilac's bow above the fo'c'sle (Figure 5.15).

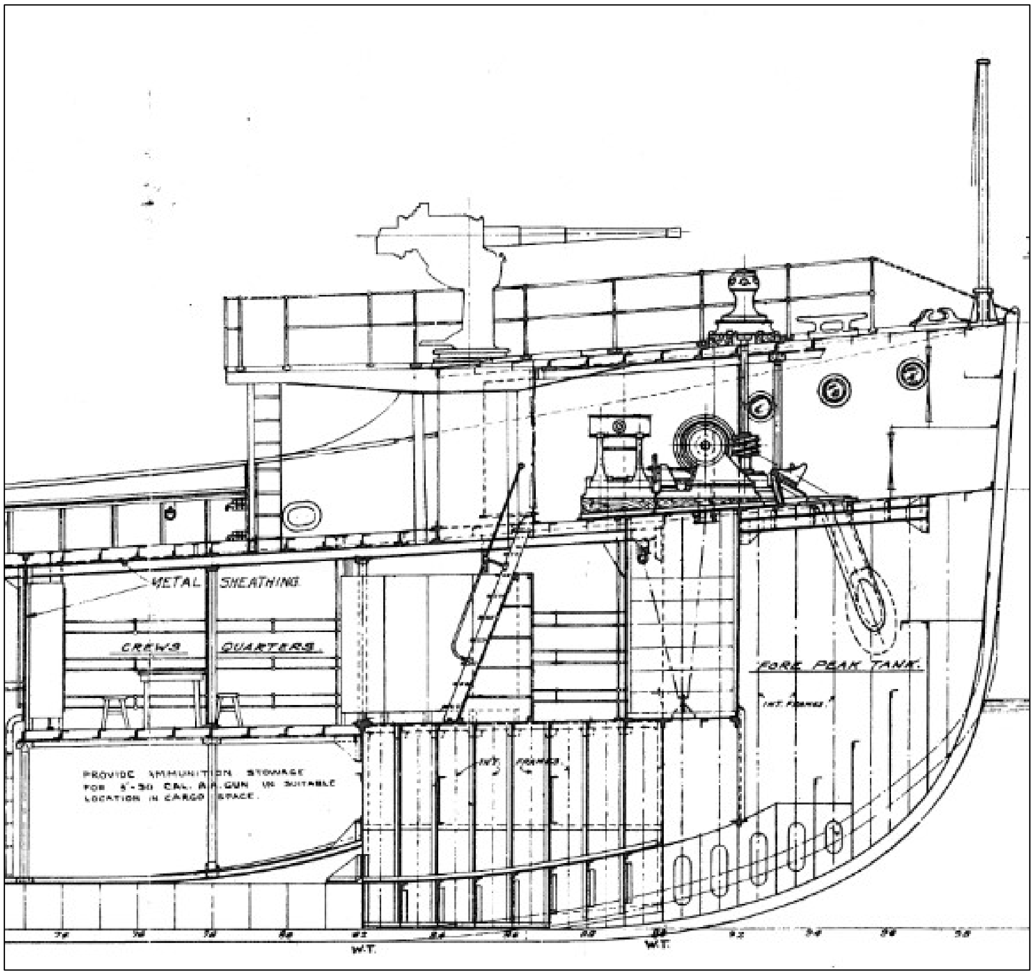

Figure 5.15. Location of 3"/50 caliber anti-aircraft gun on *Arbutus*'s bow (USCG 1941/1942).

Main Deck

Beyond the addition of armament, *Lilac*'s main deck was significantly altered by the time the USCG drew the vessel's revised design plans in 1942 (Figure 5.16). Alterations made to the steward and cook's quarters and the officers' living and working space inside the deckhouse are particularly noteworthy. In the 1933 plans drawn by the USLS, the cooks and stewards' living quarters are located just forward of the galley in the portion of the deckhouse closest to the ship's bow. Based on *Lilac*'s 1942 USCG plans, however, it appears those living quarters were converted to a bathroom for the P.O.s. In order to access their designated bathroom, P.O.s were forced to come up the stairs from their quarters in the stern of the lower deck onto the main deck, and follow the open exterior walkway (which was exposed to the elements) towards the galley just forward of midships. Even though the access route to the P.O.s' bathroom was inconvenient to say the least, it was still their bathroom. Having a separate facility from the rest of the crew boosted their social status onboard *Lilac*. To stress their ownership and exclude lower-ranked crewmembers, the words "P.O.s Only" were painted on the door.

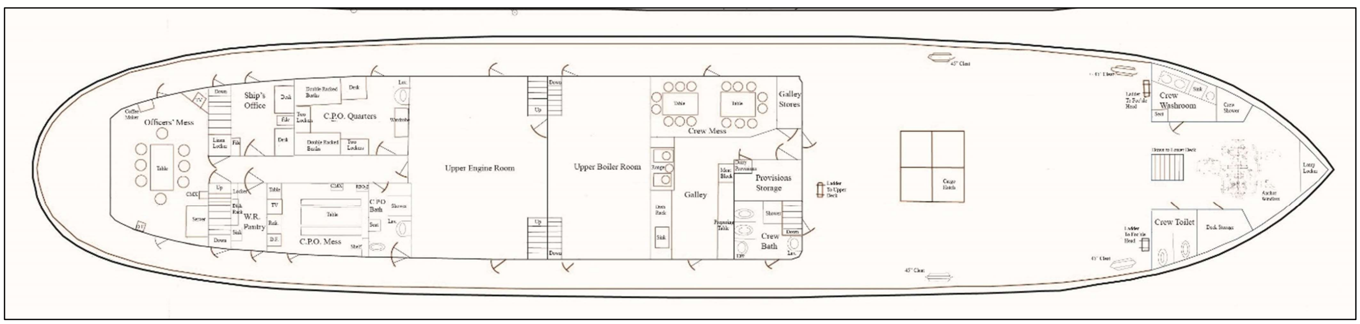

Figure 5.16. *Lilac*'s main deck, (USCG 1942/1958, modified by D'Jernes 2019).

Aft of amidships in the deckhouse, the officers' living quarters also changed drastically (5.17). Previously, the vessel's 1933 plans showed the officers' bathroom, the second assistant engineer and second mate's quarters, and the officers' pantry on the starboard side of the vessel. On the port side, the 1933 plans depict the chief engineer's living quarters, first mate and assistant engineer's quarters, and linen locker. Beyond the officers' living quarters, bathroom, pantry, linen locker, and the rooms with stairs up and down to separate decks, the 1933 plans show the central passageway inside the deckhouse leading directly to the spacious officers' dining room at the stern of the vessel. The 1942 USCG design plans, when compared to those drawn in 1933 by the USLS, reveal that the officers' living arrangements changed from separate rooms intended to house two occupants (one built-in berth with a foldable berth above), to one large room containing two double rack berths (four beds in total), four lockers, sink, small wardrobe, and a desk (Figure 5.17). This new living space was labeled as the chief petty officers' (CPOs) quarters. In terms of size, the CPOs' quarters are comparable to the chief engineer and the first mate's living quarters (as depicted in the 1933 plans). In conjunction, the CPOs' quarters are located on the port side of the vessel in the exact place the chief engineer and the first mate's quarters were previously located in the 1933 plans. The CPOs' quarters could be accessed from the deckhouse's inner passageway and through a steel door (with a screened door attached) to the outside open walkway.

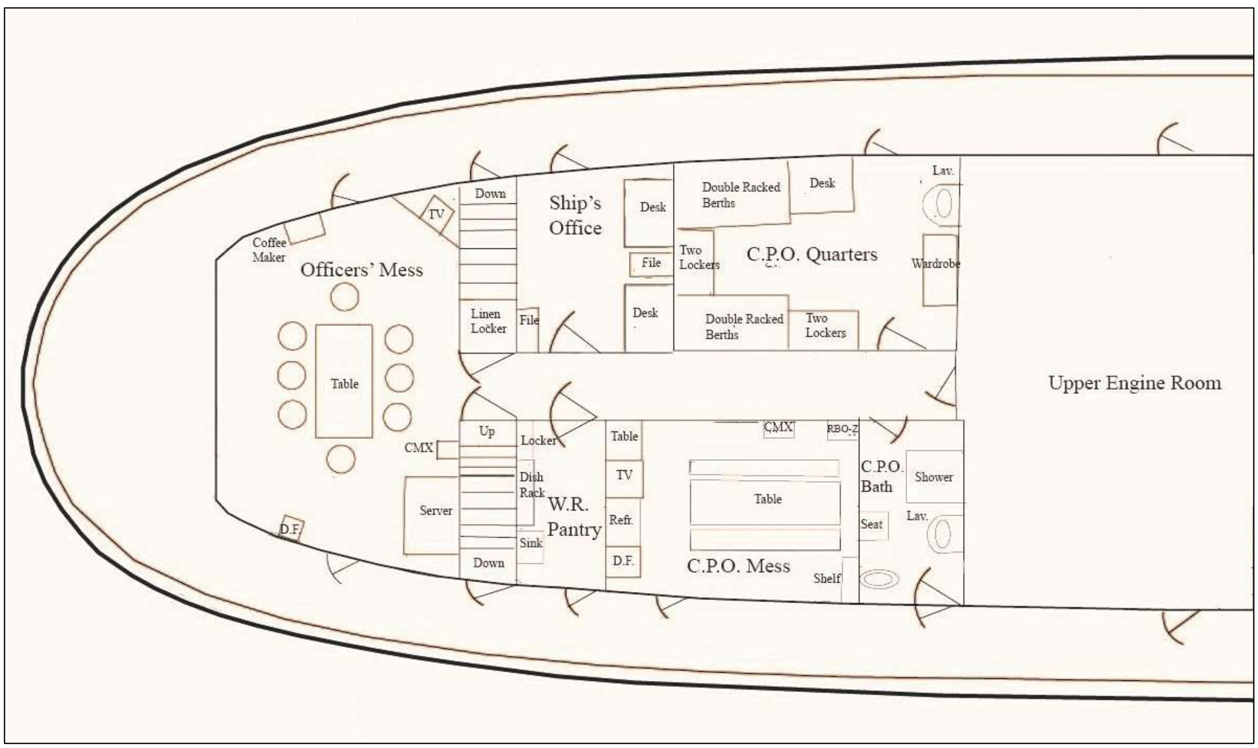

Figure 5.17. Stern of main deck, *Lilac* (USCG 1942/1958, modified by D'Jernes 2019).

Just aft of the CPOs' quarters on the port side of the vessel, in what used to be the first assistant engineer's living space, was the ship's office (Figure 5.17). The ship's office contained two desks and two filing cabinets. Officers could enter this space through doors leading to either the deckhouse's inner passageway or the outside open passageway. On the starboard side opposite of the CPOs' living space and the ship's office was the CPOs' bath, CPOs' mess, and the wardroom pantry (Figure 5.17). The CPOs' bathroom remained consistent with the 1933 plan's depiction of the officers' bath. The CPOs' mess occupied the space which previously contained the second assistant engineer and the second mate's living quarters present in the 1933 plans. The CPOs' mess was approximately the same size as those two living quarters combined. Inside the CPOs' mess room was a large table with two corresponding benches, a bulletin board, shelf, small refrigerator, small side table, direction finding tool (DF) and radio (CMX). Unlike other rooms in this aft portion of the deckhouse, the CPOs' mess could only be accessed from the outside open passage on the starboard side of the vessel; meaning that the CPOs would have to go outside the deckhouse, and walk around to the other side of the vessel should they want to go to and from their living quarters and mess room.

Adjacent to the CPOs' mess was the wardroom pantry. *Lilac*'s 1933 design plans label this space as simply the officers' pantry (Figure 5.17). Despite the change in the room's name, the rooms themselves contained almost the exact same furnishings (a sink and a stainless-steel dresser with a locker and dish rack above it). The label "wardroom" refers to mess rooms and related compartments for commissioned officers above the rank of midshipman. Service to the CPOs and officers' mess was provided by *Lilac*'s stewards via this space.

The deckhouse's inner passageway led to the officers' mess room in both the 1933 and 1942 design plans. The only difference between this space represented in both plans was the furnishings. As depicted in the 1933 and the 1942 plans created, the officers' mess contained a large table with corresponding seats. The 1942 plans created by the USCG show the room's furnishings to include one serving table, DF, CMX, television and coffee maker, but not a china cabinet or electric refrigerator (Figure 5.17). Aside from the inner passageway, the officers' dining room could be entered through steel watertight doors (with wooden screened doors on the inside) leading from the open passageway outside of the main deck.

The television in the CPOs' mess room was likely added to the vessel post-1942 (part of the plan's 1958 revisions), as this was not a common feature aboard USCG vessels until later. The DF and CMX technologies were probably added sometime during WWII. The Navy type CMX-46159 radio (also called the TCS-12 receiver) was designed and used, along with its matching transmitter and power supply, during WWII (Friedman 1982:92; Post 2018). Moreover, DF was used for ship navigation, to locate emergency transmitters during search and rescue operations, and to combat German threats during WWII (Rowland & Boyd 1953:131). It stands to reason that these technologies were added to the ship in 1942 and used during *Lilac*'s wartime, in addition to its peacetime, duties.

Another addition to *Lilac* during WWII were two tracks of depth charges on the stern of the vessel, aft of the deckhouse. The depth charges were anti-submarine weapons placed aboard the vessel to disable German U-boats if they were detected in the Delaware Bay during *Lilac*'s day-to-day operations. The depth charges could be accessed from the open passageway encircling the deckhouse on the main deck, or from the doors in the officers' mess leading outside.

Upper Deck

Using the stairs on either the port or starboard sides of *Lilac*, crewmembers could climb from the main deck up to the pilothouse (Figures 5.18 and 5.19). The only visible alteration made to the pilothouse between *Lilac*'s original construction and 1942 appears to be the addition of radio equipment on a shelf above the room's long bench. Aside from that small modification, the pilothouse does not seem to be a location that underwent noticeable change. It is possible, of course, that minor changes to the room's furnishings were not noted in the design plans. Just aft of the pilothouse is the Chief Officer's (CO) stateroom (starboard side) and bathroom (middle), in addition to an unidentified compartment (port side) (Figure 5.19). The CO's stateroom represented in the 1942 plans mirrored that of the Master's stateroom in *Lilac*'s 1933 design plans drawn by the U.S. Lighthouse Service; as does the adjoined bathroom shown in both sets of plans.

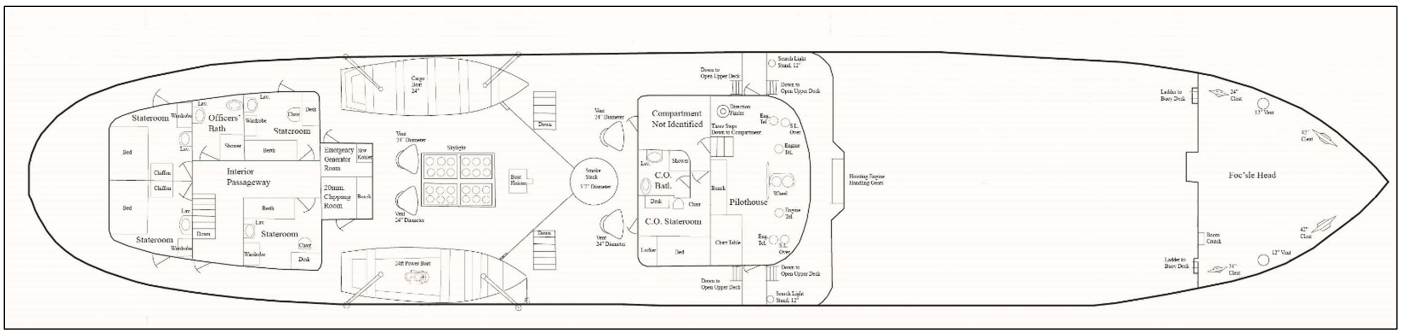

Figure 5.18. *Lilac*'s upper deck, 1941/1958 (USCG 1942/1958, modified by D'Jernes 2019).

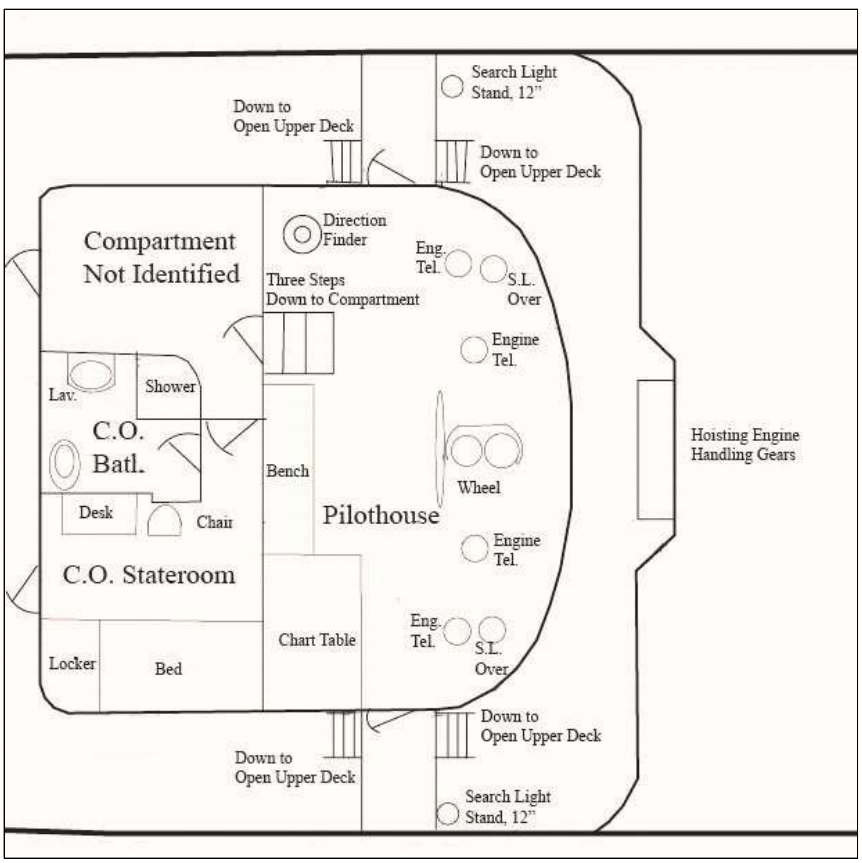

Figure 5.19. Pilothouse on upper deck, *Lilac* (USCG 1942/1958, modified by D'Jernes 2019).

The unidentified compartment on the port side of the vessel drawn on the 1942 USCG plans is in what was formerly the master's office (as seen on the USLS's 1933 plans for *Lilac*, Figure 5.10). It is unclear what this room's purpose was in 1942 or 1958 as it appears empty on the USCG's plans; however, it is unlikely that this space was unused or left empty. The gyroscopic compass is currently (as of 2020) located in the unidentified compartment. It is estimated that the gyroscopic compass was added when *Lilac* was transferred to the USCG, but the exact date of installation is unknown. It is a pre-WWII model, but *Lilac* likely received it as secondhand equipment from a Navy vessel. It is possible that the room could no longer be used as the C.O.'s private office because the gyroscopic compass was there; which means that the displacement of personnel could be caused by upgrades in shipboard technology. Access to the C.O.'s stateroom, bathroom, and the unidentified compartment could be gained through a solid wood door (with an interchangeable screened door) from the pilothouse, or through doors (one in the master's stateroom and the other in the unidentified compartment) leading to the open deck aft of the deckhouse.

Both the 1933 and 1942 copies of *Lilac*'s design plans show that the open area on the upper deck between the fore and aft deckhouses was equipped with two wooden lifeboats, along with the ship's stack, steam winch, and skylights for the engine room below (Figures 5.13 and 5.20). One of the two wooden lifeboats stored there was outfitted with a motor engine, but it is unclear if this adjustment took place in 1942 or 1958. A more significant change to this portion of the vessel was the installation of a second mast and structural additions to the aft deckhouse (Figure 5.21). Two small rooms were built at the forward end of the aft deckhouse. These rooms could only be accessed through doors leading to the open outside passageway that encircled the deckhouse; thus, effectively restricting access from rooms in the aft deckhouse. The USCG's

1942 design plans for *Lilac* indicate the newly built room on the port side acted as the emergency generator room; it consequently contained a 5kW Kohler marine auxiliary generator (Figure 5.21).

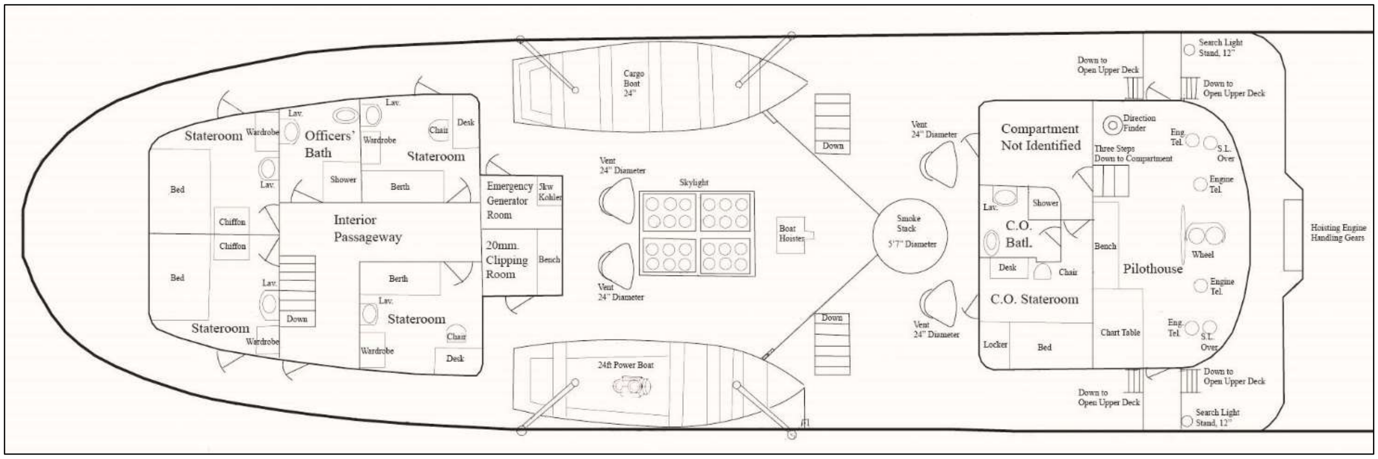

Figure 5.20. Cargo boat deck on *Lilac*'s upper deck (USCG 1942/1958, modified by D'Jernes 2019).

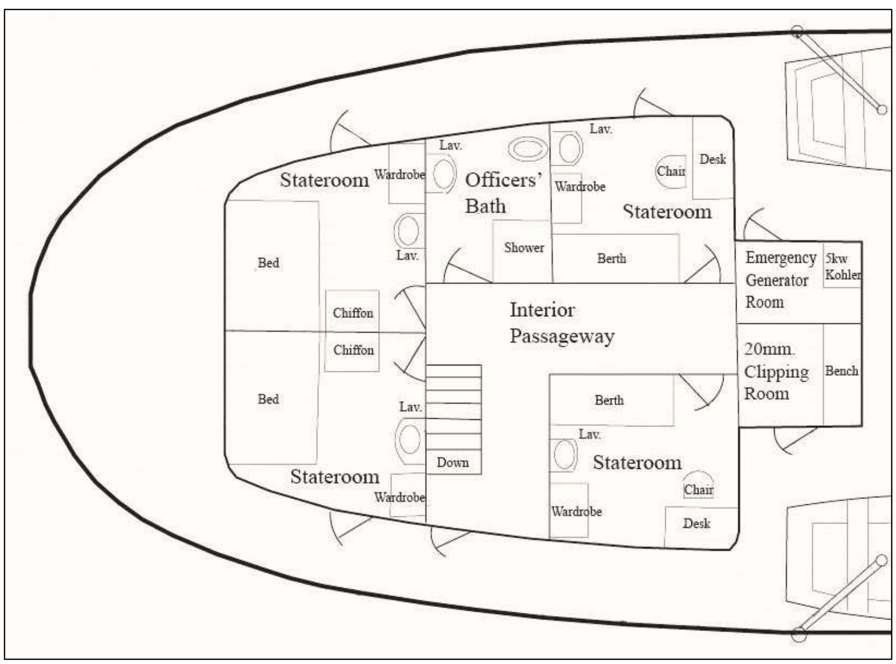

Figure 5.21. Aft deckhouse, *Lilac*'s upper deck (USCG 1942/1958, modified by D'Jernes 2019).

Sharing a wall with the emergency generator room was the recently (as of 1942) constructed 20mm clipping room (Figure 5.21). Located on the starboard side of the sternward deckhouse, the clipping room was entered through a door leading to the outside open walkway.

The clipping room contained a bench, drum magazines and crates of ammunition for the 20mm Oerlikon anti-aircraft guns onboard *Lilac*. These guns were known for their ease of maintenance and good rate of fire. When the guns were in use, a clipping room captain and ammunition handlers (all enlisted men) manned this compartment. They supplied the gun crews with the 20mm magazine drums and reloaded empty magazines from this room. Each magazine contained 60 rounds of ammunition (enough for five continuous seconds of firing); and each gun held one magazine per barrel. The guns were capable of firing 450 rounds per minute, but gun crews could not change the heavy magazines that fast. As such, the average rate of fire was 250-350 rounds per minute (Rowland & Boyd 1953:238; Scheina 1982:124; Brouwer 2004:Section 8:3). The 20mm gun was located on top of the aft deckhouse, and accessible from exterior ladders on either side of the deckhouse (Figure 5.22).

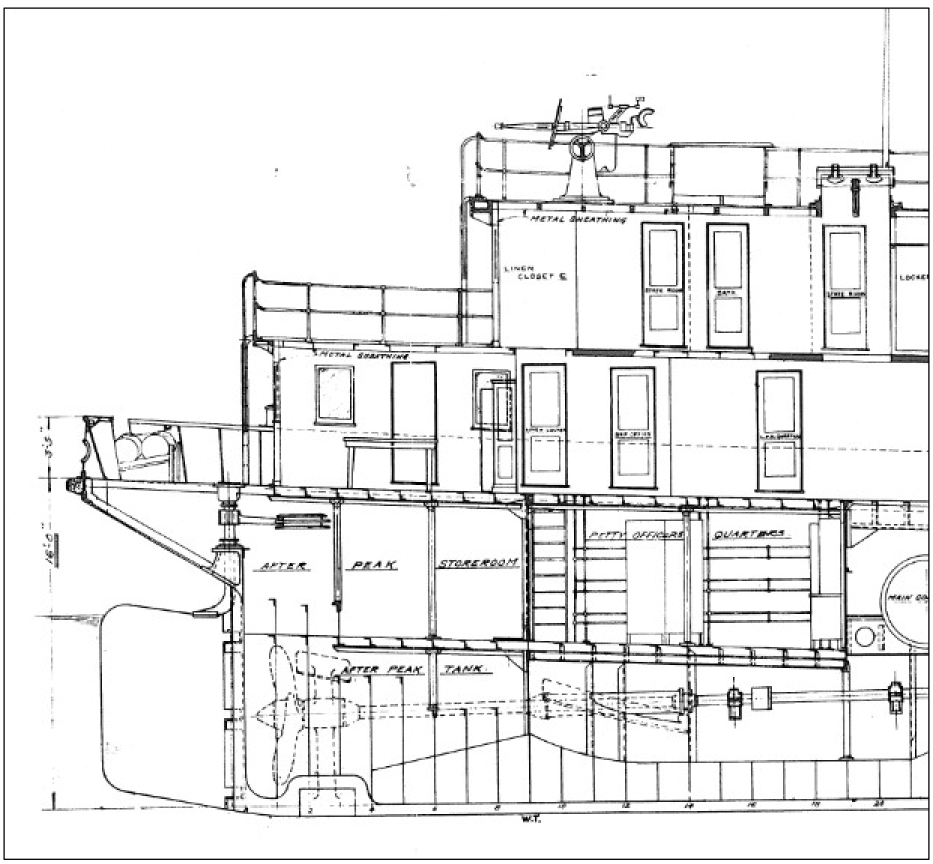

Figure 5.22. 20mm anti-aircraft gun on top of aft upper deckhouse, *Arbutus* (USCG 1941/1942).

Beyond the emergency generator and clipping rooms was the original structure of the aft deckhouse. Most of the rooms in this portion of the deckhouse could be entered through doors leading from the outside open walkway. On the port side of the deckhouse, just aft of the emergency generator room, was a stateroom furnished with a built-in berth (with drawers below), small wardrobe, sink, chair, and a small table with drawers under it (Figure 5.21). According to the USLS 1933 design plans for *Lilac*, this room was previously the radio operator's living quarters. The stateroom contained similar furnishings as those that were in the space when it was the radio operator's living quarters. The ship's transmitter and motor generator formerly occupied this space according to the 1933 plans but were moved after its conversion to a stateroom in 1942. This room could be entered through a door leading from the outside open walkway or through a door leading into the deckhouse's inner passage.

Once inside the aft deckhouse's central passageway, it was possible to enter the stateroom located opposite of the port side stateroom (Figure 5.21). This forward, starboard stateroom contained the exact same furnishings as the one across from it. However, this space is the only stateroom on the upper deckhouse that cannot be accessed from the open walkway outside. *Lilac*'s 1933 design plans indicate that the space was previously the superintendent's dining room. In those design plans, a door led out to the open boat deck; the addition of the 20mm clipping room subsequently made this door inoperable and it was removed, evident in the vessel's 1942 plans.

From the forward stateroom on *Lilac*'s starboard side, the central passageway led to doors that opened to the officers' bath, two additional staterooms, and the inner stairway leading down to the central passageway inside the deckhouse below (Figure 5.21). The officers' bath, situated on the port side of the deckhouse, did not change location from the vessel's original

1933 design. As expected, it contained the same furnishings; although, the spacious bathtub was converted to a shower stall. The bathroom's door led directly into the central passageway, where further doors led into the two sternward staterooms.

The staterooms at the stern of the aft deckhouse were slightly larger than those in either deckhouses on this deck (including the CO's stateroom) (Figure 5.21). The two staterooms were like one another in size and contents. Like the CO's stateroom, both rooms featured a bed (not a built-in or foldable berth). These staterooms are in the same place as the staterooms represented in *Lilac*'s 1933 plans. The only seemingly difference between the 1933 and 1942 versions of these staterooms was the addition of a sink in the port side stateroom and the removal of the door to the officers' bath from that room.

Based on the 1942 USCG's plans, every room in *Lilac*'s two upper deckhouses, besides the emergency generator and 20mm clipping room, had windows facing their respective view out of the vessel. Upon the *Lilac*'s transfer to the USCG, however, the windows were removed, and the vessel was outfitted with portholes instead.

Lilac's 1958 Design

Rather than drawing a separate set of plans to depict *Lilac*'s design in 1958, the USCG revised the 1942 plans to show modifications made to the vessel. As a result, it is difficult to tell exactly when the alterations were made to *Lilac*'s design based off the available plans; for instance, the areas of expanded metal on the lower deck could have been built in 1942 or 1958. While the expanded metal structures on the lower deck could have been installed in 1942, the lines demarcating those spaces are much darker and appear newer than those depicting the vessel's other spaces. Consequently, it is likely that the expanded metal areas were not added to the design plans until 1958. Furthermore, the USCG plans for *Lilac* also label various spaces as unidentified compartments, but it is unclear when those spaces were labelled as such. The area where the expanded metal structures were added previously acted as a workshop for fixing buoys and helping lighthouse keepers with major repairs. Welding equipment, a lathe, buoy batteries and lightbulbs, ropes, the fire suppression system, back up supplies for the generator, sonar transponder, and the bilge pump were all located in that space. Perhaps the metal structures were expanded in order to better store that essential equipment and supplies.

In addition, it appears that not all the vessel's design changes were reflected in the USCG's plans. For example, following the end of WWII, *Lilac* was stripped of its guns and returned to its peacetime outfitting. Correspondingly, there is no visual representation of the two depth charge tracks, 3"/50 caliber anti-aircraft gun or the 20mm anti-aircraft gun onboard *Lilac* in the 1942/1958 plans. The 1958 revisions, however, still depict the ammunition storage area (below the crew's quarters on the lower deck) and the clipping room (on the upper deck) (Figures 5.15 and 5.21). Without armament onboard *Lilac*, these two spaces would no longer be needed for those purposes. As such, it stands to reason that the 1958 revisions would list those spaces as something other than ammunition storage and clipping room, yet they do not.

While other USCG vessel plans include a written list of the specific additions and alterations made to the vessel, the USCG plans for *Lilac* are missing that information. Therefore, the date the changes were made is subject to interpretation. The USCG and *Lilac*'s historical backgrounds help to determine when specific design modifications occurred. The written record shows that a degaussing system was installed on *Lilac* to protect the vessel from magnetic mines placed by German U-boats around the mouth of the Delaware Bay. Although, the placement of the degaussing system was not indicated on the vessel's 1942/1958 design plans. Another technology used onboard the vessel was radar; but radar it was not installed onboard *Lilac* until 1954 (Brouwer 2004:Section 8:3; Habstritt pers. comm.).

Lilac's 2020 Design

Upon *Lilac*'s decommissioning in 1972, crewmembers removed some of the vessel's fittings and took them for souvenirs of their time in the Coast Guard serving onboard *Lilac*. *Lilac*'s last captain, for example, took the ship's wheel. Similarly, the chief engineer took the vessel's name plate and another servicemember took *Lilac*'s bell. Fortunately, the veterans later returned their souvenirs to the *Lilac* Preservation Project so that the vessel could be restored as a pier-side museum. Even though *Lilac* is no longer part of the USCG's fleet, the vessel's bell (on which "USLS *Lilac*" is engraved) remains the property of the USCG. As such, the Project was especially thankful for its return. To this day, the Project must carry a separate insurance policy for *Lilac*'s bell and show the Coast Guard curator that it is in good condition every two years (Habstritt pers. comm.).

After *Lilac*'s decommissioning, the Coast Guard donated the vessel to the Seafarers International Union (SIU). SIU installed electric heat and remodeled *Lilac* to function as a dormitory and floating classroom to house and train mariners as part of the Harry Lundeberg School of Seamanship in Piney Point, Maryland. SIU retired *Lilac* in 1984 and sold it to the Atlantic Towing Company, also located in Piney Point, Maryland. *Lilac*'s spatial configuration did not change under the Atlantic Towing Company's ownership. Shortly after, *Lilac* was bought by Henry Houck. Houck kept the ship at his boatyard and rented out space on the vessel. Although the vessel was not significantly altered during Houck's ownership, some fittings were removed, and appliances added. Former staterooms and the officers' mess room were utilized as offices for a scrap yard and Houck's associated real estate business. The toilets onboard the vessel were changed from flush valve to flush tank toilets. Additionally, stacked washing and drying machines were added to the crew's washroom under the fo'c'sle at the same time, replacing an old wringer washer (Brouwer 2004: Section 8-3; *Lilac* Preservation Project 2018).

The Tug *Pegasus* Preservation Project, a non-profit organization based in New York City, purchased *Lilac* in 2003. The vessel's hull was inspected prior to sale and received a favorable report on its condition. Before leaving the drydock in Norfolk, Virginia, the ship's hull was cleaned and preserved, and the vessel was painted externally to the top of the stack. After $250,000 of work at Lyons Shipyard in Virginia, *Lilac* was towed to New York City, NY. In 2004, ownership was transferred from the Tug *Pegasus* Preservation Project to the *Lilac* Preservation Project. Additional pilings, along with a mooring system, were installed to support *Lilac* (Brouwer 2004: Section 8-4; *Lilac* Preservation Project 2018).

Lilac was in a state of disrepair after years of neglect when purchased by the *Lilac* Preservation Project in 2004. Many rooms onboard had collected rainwater and compost over the years causing widespread corrosion. The vessel's stack, for example, was left uncovered and rain entered the boiler room over time. The incoming water corroded the room's interior and caused the asbestos coating on the machinery to expand and explode. Consequently, the *Lilac* Preservation Project is now faced with the arduous, costly task of asbestos abatement and repairing corroded equipment in the boiler and engine rooms. Other areas onboard were also damaged by rainwater. When SIU installed electric heat onboard *Lilac*, they cut through the vessel's interior bulkheads to add ducting. This left holes for water to enter through and damage the interior (Habstritt pers. comm.).

The *Lilac* Preservation Project was awarded a small grant to destroy the electric heat system and install a small boiler to supply heat to radiators throughout the vessel. The Project converted what was the 20mm. clipping room to house the new boiler for the heating system. The adjacent room, formerly the emergency generator room, now contains the vessel's rectifier. Along with these changes, the Project also converted the ship's office on the main deck into the museum's office. Additionally, an environmental group studying the Hudson river stores fish traps and other associated equipment onboard *Lilac* in what used to be the crew's toilet under the fo'c'sle on the main deck. To keep visitors out of the crew's quarters, a door was installed at the top of the stairs leading down to the space in 2003 (Habstritt pers. comm.).

The Project's goal is to eventually restore *Lilac* to operating condition. In order to do so, they must add modern equipment and meet USCG safety standards (e.g., install explosive-proof light fixtures, and other safety features). After many years of hard work, the Project has made some progress towards their goal. *Lilac*'s engine telegraphs, for example, have been restored so that the links can turn over with compressed air. Their most recent restoration efforts have been focused on asbestos abatement, combating corrosion damage, and making interior spaces watertight.

Volunteers, donations, and grants have greatly reduced the costs of *Lilac*'s repairs. Mary Habstritt, the director of the *Lilac* Preservation Project, estimates the Project operates on a budget of approximately $150,000 a year. The pier *Lilac* is moored to only charges the Project a dollar a year on the condition that the vessel is open to the public. Since *Lilac* is not a coast guard inspected vessel, the Project is unable to charge an entry fee for visitors. Habstritt and the board of trustees work hard to reduce costs to maintain their shoe-string budget while fundraising to support their educational programs and create exhibits (Habstritt pers. comm.).

Conclusion

The goal of this chapter was to provide a detailed overview of *Lilac*’s component spaces in the 1933 design plan and the changes and additions made to the vessel in the subsequent years up to present day (2020). The most significant changes to *Lilac*’s design occurred when the vessel was transferred from the command of the USLS to the USCG and the outbreak of WWII. At that time, the officers’ quarters on the main deck were altered in order to accommodate an increased number of servicemembers onboard. Additionally, the living quarters on the main deck were modified to better suit the needs of the USCG’s higher-ranking servicemembers. Doing so changed access routes and levels of privacy, topics that will be the focus of Chapter 6. The consequences of such alternations to *Lilac*’s structure will be further explored in the following chapter which details the application and interpretation of access analysis to *Lilac*’s 1933 and 1942/1958 design plans.

CHAPTER 6: THE APPLICATION AND INTERPRETATION OF ACCESS ANALYSIS

Introduction

The previous chapter described *Lilac*'s architectural form as depicted in the vessel's 1933, 1942, 1958 design plans, as well as *Lilac*'s present-day configuration (2020). This chapter aims to examine the observed changes in *Lilac*'s spatial organization over time through the paradigm of Hillier and Hanson's (1984) space syntax theory, specifically access analysis, to elucidate the social structures which both influenced *Lilac*'s spatial patterning and was influenced by it to maintain a rank-based social hierarchy among individuals serving onboard the vessel. Along with documentary evidence, access diagrams (the visual manifestation of access analysis) will be used throughout this chapter to measure the permeability of rooms and areas onboard *Lilac* to illuminate social patterns.

The symbols associated with access analysis are partially explained in Figure 6.1. The exterior space outside of the vessel (i.e., the dock *Lilac* was moored to), referred to as the *carrier*, is demarcated by a circle with a cross. Although the carrier represents the entirety of the exterior environment surrounding *Lilac*, it is treated as a single point. In addition to the carrier, other symbols used in the following access diagrams represent transitional spaces, rooms, and various areas onboard the vessel; for example, the staterooms, galley, and buoy-handling deck, among others. Transitional spaces within the access diagram are represented by solid black circles. In this study, transitional spaces are defined as a passageway or stairway (interior or exterior), or open deck (excluding the buoy handling deck) that primarily functioned to provide access to other areas throughout the vessel. Rooms and areas are indicated by blank circles in the access diagrams. The solid black lines connecting the various symbols in the access diagrams simply represent the permeability of spaces onboard the vessel.

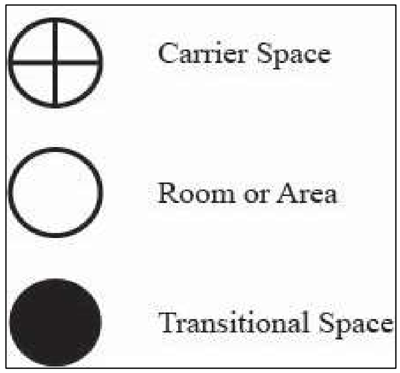

Figure 6.1. Access Analysis Diagram Symbols (D'Jernes 2019).

Once *Lilac* is analyzed from the view point of its various constituent spaces (depicted by the access diagrams), it will be possible to determine the variations in the syntactic parameters (how spaces relate to the complex as a whole) that transmit social information about the realities of inhabiting a particular space onboard the vessel (Hillier & Hanson 1984:154). Measures of depth, distribution and symmetry in the access diagrams indicate variance in spatial patterning onboard *Lilac*. Variations can show: where and how frequently physical encounters occur between occupants; and how these encounters might be controlled (Hillier & Hanson 1984:148). Additionally, variants can reveal inhabitants' social standing based on: the comparative position and the inter-relationships between rooms; a room's relationship or access to essential facilities (e.g., kitchens or bathrooms) and whether that access is shared or monopolized; and the relationship to parts of the structure considered higher or lower status (for example, a stateroom versus storage space) (Fairclough 1992:353). After establishing the presence of variants in the access diagrams, this chapter will identify their cause and explain how the observed topological patterns relate to social factors.

This chapter is broken into three main parts. The first two sections focus on the period of *Lilac*'s operations under the USLS and its service as part of the USCG's fleet. These two sections place access diagrams within the context of documentary evidence to further explore the relationship between space and society during the vessel's operational lifetime. A list of *Lilac*'s spaces, their depth, and their routes' measures of symmetry and distribution will also be included in the first two sections. The third section compares *Lilac*'s 1933 and 1942 access diagrams and identifies their common and dissimilar features. The third section then draws together the results of this application of access analysis in order to highlight the manner in which social practices were embodied in *Lilac*'s spatial configuration and to demonstrate the vital role that the control of movement and accessibility had in the creation and management of relationships of power and inequality among individuals onboard. Finally, the conclusion summarizes this chapter's key points and major findings.

Lilac, 1933

A justified access diagram was generated by the author based on *Lilac*'s design plans drawn by the Pusey & Jones shipyard in 1933 (Figure 6.2, see Table 6.1 for key). This access diagram has a maximum depth of seven, with a combination of distributed/non-distributed and symmetrical/asymmetrical spaces. Table 6.2 presents the qualitative synthesis of the results indicating each space's integration values and syntactic properties in the access diagram. The "deepest" (most integrated) spaces, as depicted in the access diagram, are the two staterooms and bathroom in the aft deckhouse on the upper deck (Figure 5.11). The aft deckhouse's bathroom is labeled as "Superintendent's Bath" on the access diagram to distinguish it from other bathrooms in the vessel's design plan (Figure 6.2, see Table 6.1 for key). While all three of those rooms are the same depth in the access diagram, they each possess unique qualities related to distribution and symmetry, indicators of social organization and hidden expressions of status or power.

In *Lilac*'s aft deckhouse on the upper deck, two staterooms represent some of the deepest spaces (depth of seven) in the access diagram (Figure 6.2, see Table 6.1 for key). The greater the depth, according to Hillier and Hanson (1984), the more inaccessible the room is within the larger spatial unit (Hillier & Hanson 1984:184-85). In the access diagram, the staterooms are depicted as asymmetric and distributed (Figure 6.2, see Table 6.1 for key). The two staterooms are asymmetric because access from either stateroom to another room is indirect. In conjunction, the staterooms appear distributed in the access diagram because there is more than one independent route of access (including routes that pass through another space); as such, their pathways have more than one locus of control (Hillier & Hanson 1984:148).

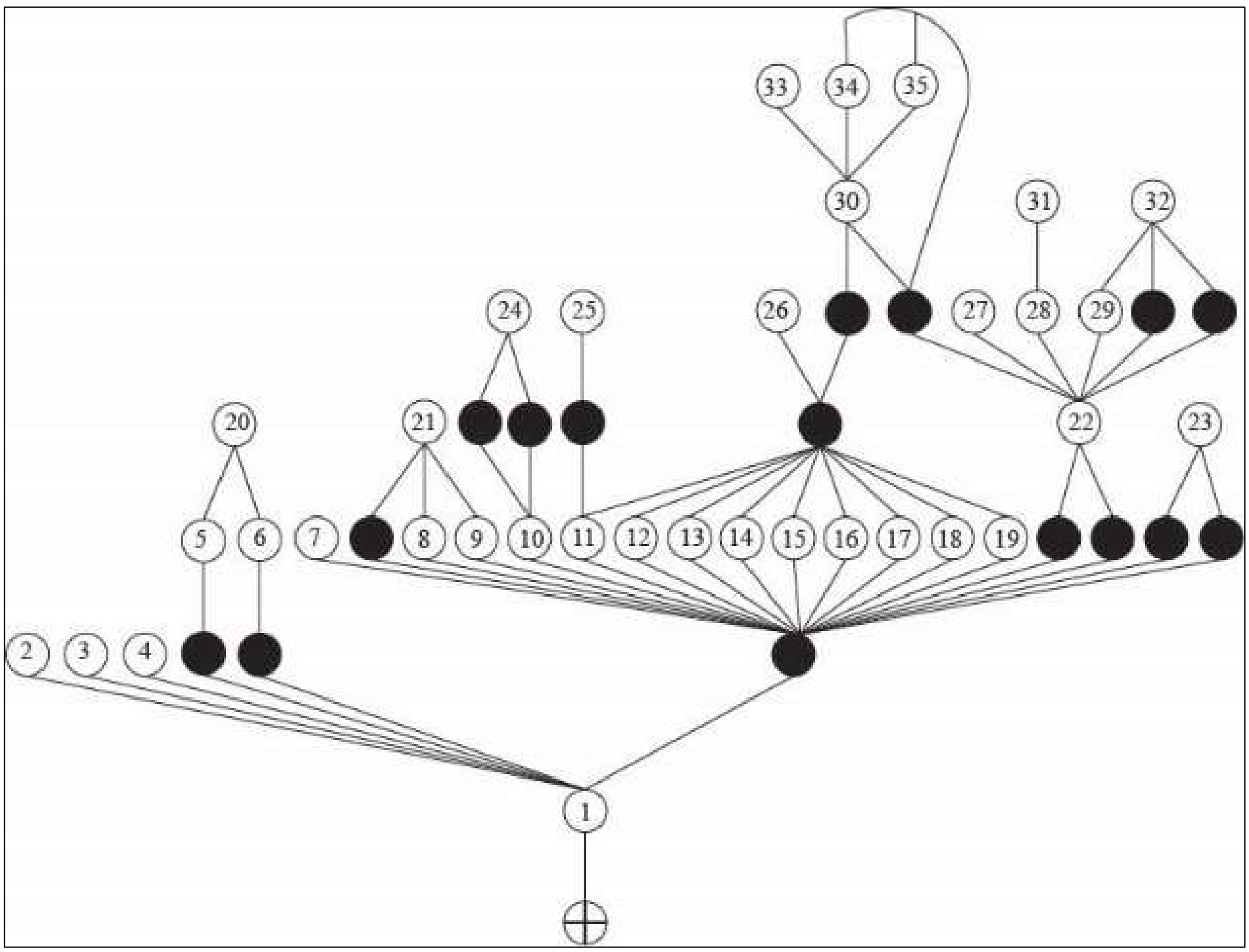

Figure 6.2. Access Diagram for *Lilac*'s 1933 Configuration (D'Jernes 2019).

Circle Number	Corresponding Room in Design Plans
1	Buoy Handling Deck
2	Crew’s Washroom
3	Crew’s Toilet
4	Deck Storage Under Fo’c’sle
5	Crew’s Quarters
6	Cargo Hold
7	Cook and Steward’s S.R.
8	Galley
9	Crew’s Mess
10	Upper Boiler Room
11	Upper Engine Room
12	Officer’s Bath
13	Second Engineer’s Quarters
14	First Engineer’s Quarters
15	Chief Engineer’s Quarters
16	Second Mate’s Quarters
17	First Mate’s Quarters
18	Officer’s Pantry
19	Officer’s Dining Room
20	Storage Under Crew’s Quarters
21	Galley Refrigerator
22	Cargo Boat Deck
23	P.O.’s Quarters
24	Lower Boiler Room
25	Lower Engine Room
26	Linen Closet
27	Radio Operator’s S.R.
28	Master’s Stateroom
29	Master’s Office
30	Superintendent’s Dining Room
31	Master’s Bath
32	Pilothouse
33	Superintendent’s Bath
34	*Stateroom*
35	*Stateroom*

Table 6.1. Key for 1933 Access Diagram (D’Jernes 2019).

Space	Variants	Depth
Superintendent's Bath	Asymmetric, Non-Distributed	7
Stateroom	Asymmetric, Distributed	7
Stateroom	Asymmetric, Distributed	7
Master's Bath	Asymmetric, Non-Distributed	6
Superintendent's Dining Room	Symmetric, Distributed	6
Pilothouse	Asymmetric, Distributed	6
Master's Stateroom	Symmetric, Non-Distributed	5
Master's Office	Asymmetric, Distributed	5
Radio Operator's S.R.	Symmetric, Non-Distributed	5
Lower Engine Room	Asymmetric, Non-Distributed	5
Linen Closet	Symmetric, Non-Distributed	5
Lower Boiler Room	Asymmetric, Distributed	5
Cargo Boat Deck	Asymmetric, Non-Distributed	4
P.O.'s Quarters	Asymmetric, Distributed	4
Storage Under Crew's Quarters	Asymmetric, Distributed	4
Galley Refrigerator	Asymmetric, Distributed	4
First Mate's Quarters	Asymmetric, Distributed	3
Second Mate's Quarters	Asymmetric, Distributed	3
Chief Engineer's Quarters	Asymmetric, Distributed	3
First Assistant Engineer's Quarters	Asymmetric, Distributed	3
Second Assistant Engineer's Quarters	Asymmetric, Distributed	3
Officer's Bath	Asymmetric, Distributed	3
Officer's Dining Room	Asymmetric, Distributed	3
Officer's Pantry	Asymmetric, Distributed	3
Cook and Steward's S.R.	Asymmetric, Non-Distributed	3
Galley	Symmetric, Distributed	3
Crew's Mess	Symmetric, Distributed	3
Upper Boiler Room	Symmetric, Non-Distributed	3
Upper Engine Room	Asymmetric, Distributed	3
Crew's Quarters	Asymmetric, Non-Distributed	3
Cargo Hold	Asymmetric, Non-Distributed	3
Crew's Washroom	Asymmetric, Non-Distributed	2
Crew's Toilet	Asymmetric, Non-Distributed	2
Deck Storage Under Fo'c'sle	Asymmetric, Non-Distributed	2
Buoy Tending Deck		1

Table 6.2. Access Routes' Measures of Symmetry and Distribution Ordered by Depth, *Lilac* 1933 (D'Jernes 2019).

Although the two staterooms' access routes cannot be controlled from any one point, there is no direct passage to the staterooms. The routes' asymmetry suggests that movement from "shallower" (less integrated) spaces to the staterooms is not entirely open or uncontrolled. As described by Fairclough (1992), "the most difficult forms of social control to identify are those which rely on little or no physical or visible signs, but only on well-understood systems of social knowledge - taboos, fear, authority, custom, etc." (Fairclough 1992:353). The intention behind spatial segregation is to deny access to an increasingly large population of individuals. The result is that only those closest in rank to the master can reach the deepest rooms onboard *Lilac*. Nevertheless, there are two exceptions: servants and visitors of higher rank than *Lilac*'s master (Fairclough 1992:354).

Documentary evidence indicates that individuals of higher authority within the U.S. Lighthouse Service (i.e., superintendents), lighthouse keepers, and various guests occupied the staterooms during their stay onboard the vessel. In addition, stewards had access to these rooms as part of their regular duties (i.e., attending to *Lilac*'s master and visiting guests). It is likely that access to the staterooms was privileged. Individuals' social importance (e.g., *Lilac*'s master or USLS superintendent) or their functional role (e.g., stewards) justified their ability to access the staterooms (Fairclough 1992:355).

Social importance and function were also the primary requirements for entry into the superintendent's bathroom (Figure 5.11). The superintendent's bathroom was located adjacent to the two staterooms, in the upper deck's aft deckhouse (Figure 5.11). Based on the access diagram, the route to the superintendent's bath is asymmetric and non-distributed (Figure 6.2, see Table 6.1 for key). An individual must travel through an indirect route, passing through an intermediary space (i.e., the superintendent's dining room) before entering the superintendent's bath; therefore, the route to the superintendent's bath is asymmetric. Simultaneously, the room's route is non-distributed because there is only one locus of control, which effectively restricts access (i.e., the superintendent's dining room). The depth of the superintendent's bath, coupled with its route's asymmetry and non-distribution, suggests: access to this space is highly controlled; the bathroom is intentionally segregated from *Lilac*'s other rooms and spaces; and the room possesses a restricted route of access that forces individuals to follow a specific pathway through *Lilac*'s structure to reach it. Consequently, this space represents a highly privatized area that offers the opportunity to reinforce social status and power by denying access to other individuals onboard based on rank.

There are specific instances where function could override social status thereby allowing specific individuals (e.g., stewards) to enter these private spaces. Stewards, in comparison to other lower ranked USLS individuals, were afforded freer movement throughout the vessel in restricted, private spaces. Within isolated spaces onboard *Lilac*, like the superintendent's bath and staterooms, there were call buttons for the stewards. Regardless of their low rank, stewards were able to enter these high-status areas. Even so, the primary goal of spatial segregation was to limit access; thus, instilling USLS societal norms based on rank simultaneously.

This association of high seclusion coupled with a higher degree of control is also reflected in the master's bathroom (Figure 5.10). The master's bathroom, in the forward deckhouse on the upper deck, possesses a depth of six (Figure 6.2, see Table 6.1 for key). Its access routes are asymmetric and non-distributed. Like the superintendent's bathroom, the master's bath is isolated with restricted routes of access, offering a high level of privacy. Again, an individual's social importance or function determined access to this high-status space.

In comparison to the superintendent's bath, two staterooms, and master's bathroom, the pilothouse was relatively accessible. Located in the forward deckhouse on the upper deck (Figure 5.10), the pilothouse is positioned at a depth of six in the access diagram (Figure 6.2, see Table 6.1 for key). The route to the pilothouse is asymmetric and distributed. The room's depth and asymmetry, as depicted in the access diagram (Figure 6.2, see Table 6.1 for key), confirm that the pilothouse is isolated within *Lilac*'s structure. The routes of access to the pilothouse, however, were not restricted through one locus of control. The distributed nature of the routes to the pilothouse offered access to individuals coming from other shallower (less integrated) parts of the vessel. Since the pilothouse was vital to *Lilac*'s operations, it was essential that the pathways to it were not controlled by any one space that could limit access.

Like the pilothouse, the superintendent's dining room was a high-status area with distributed access routes (Figure 5.11). The superintendent's dining room was the locus of control for the route to the superintendent's bathroom. At a depth of six in the access diagram (Figure 6.2, see Table 6.1 for key), the superintendent's dining room provided access to the two staterooms and superintendent's bath. The superintendent's dining room was the central location for social interaction between *Lilac*'s master and visiting guests as it contained a secluded sitting and dining area. The route to the superintendent's dining room is symmetric and distributed (Figure 6.2, see Table 6.1 for key). Based on those observed characteristics in the access diagram, the room appears to be integrated into the overall structure with multiple routes of access free from any one locus of control. Nevertheless, the depth of the superintendent's dining room separated it from other shallower spaces onboard *Lilac*. Its distance from other parts of the vessel allowed for a level of privacy, while its multiple, equal routes allowed for individuals to access the room and pass through it into the surrounding rooms (i.e., the superintendent's bathroom and staterooms). Here, like the superintendent's bath and staterooms, individuals were admitted into the room based on social importance or function.

Contrastingly, the routes to the radio operator's S.R. were more restricted. At a depth of five in the access diagram (Figure 6.2, see Table 6.1 for key), the route to the radio operator's S.R. were asymmetric and non-distributed. There was only one route that offered access to the space; any movement to or from the radio operator's S.R. required passage through an intermediary space. Furthermore, the route was non-distributed; forcing individuals to move along a single pathway to access the space. The radio operator's S.R.'s depth in the diagram, combined with its route's asymmetry and non-distribution, indicates less permeability and a high degree of access control. Therefore, the radio operator's S.R. was afforded a level of privacy that exceeded that of equal-ranked crewmembers' living quarters.

Slightly more privatized than the radio operator's S.R., the master's stateroom is asymmetric and non-distributed, with a depth of five in the access diagram (Figure 6.2, see Table 6.1 for key). Any path to the master's stateroom, must pass through an intermediary space, making it asymmetric. At the same time, permeability to the master's office is controlled by one space; therefore, it is non-distributed. The room's depth and syntactic variants served as a tool to prevent unwanted entry and further distanced the master from the crew both physically and socially.

A door directly connected the master's stateroom with the master's office. The route to the master's office was symmetric and distributed, with a depth of five (Figure 6.2, see Table 6.1 for key). This space's seclusion (evident in its depth in the access diagram) provided a private space for *Lilac*'s master to discuss sensitive information with other high-ranking servicemembers. While the access diagram (Figure 6.2, see Table 6.1 for key) indicates that it was possible to exercise some control over the surrounding spaces (e.g., the master's stateroom and bath) from the master's office, but it was not a large amount of control due to the various access routes. It is likely that societal rules based on rank were the strongest barrier that privatized the master's office, rather than access itself.

The P.O.s' quarters (Figure 5.2) possessed a relatively high depth when compared to the living quarters of higher-ranked individuals serving onboard *Lilac*. Located on *Lilac*'s lower deck, at a depth of four in the access diagram (Figure 6.2, see Table 6.1 for key), the P.O.s' quarters were more isolated than the first mate and chief engineer's quarters at depths of three in the access diagram (Figure 6.2, see Table 6.1 for key). Routes to the space were asymmetric and distributed. Thus, to access the P.O.s' quarters, servicemembers could follow two different indirect passageways. Despite the space's greater depth and its route's asymmetric variant, this was not a private space. Privacy, within the context of *Lilac*, was about the location of power within the vessel and the exclusion of low-status individuals from that power (Johnson 2002:116). Moreover, privacy was rewarded to high-ranked servicemembers as a means of reinforcing USLS societal norms regarding rank and the corresponding hierarchy of power attributed to higher social and professional status in the USLS. Within *Lilac*'s structure, the P.O.s' quarters were isolated from high-status spaces (e.g., superintendent's dining room) and essential facilities (e.g., galley) onboard the vessel. After all, the P.O.s' quarters were located near the engine and boiler rooms on the aft portion of the lower deck. High-ranked officers, superintendents, and *Lilac*'s master could access the P.O.s' quarters based on their social importance. As such, even though the P.O.s' quarters were deeper in *Lilac*'s structure than officers' quarters, the space lacked privacy.

There is the progression of living quarters leading from the forward deckhouse through successive and increasingly private areas to the officer's dining room on the aft portion of the deckhouse on the main deck (Figure 5.8). Here, although these spaces only possessed a depth of three and their access routes were primarily distributed, an individual's status was enhanced rather than diminished by inhabiting these spaces. Five rooms housed *Lilac*'s chief engineer, first assistant engineer, second assistant engineer, first mate, and second mate. These spaces were served by shared common facilities (i.e., officer's pantry, dining room, and bath) and their location near them reflected the individuals' relative social importance (Fairclough 1992:353). Their distributed access routes made it difficult to control the space. Like other high-status spaces onboard *Lilac*, access was not controlled physically through spatial boundaries, but by instilled societal norms regarding rank and social rules.

The crew's quarters, like the officer's quarters on the main deck, possessed a depth of three in the access diagram (Figure 6.2, see Table 6.1 for key). The crew's quarters had an asymmetric and non-distributed access route; separating it from other spaces at similar depths in *Lilac*'s structure. The physical space was forward on the lower deck, on the opposite end of the vessel as the P.O.s and officers' living and dining areas (Figure 5.2). The isolated nature of the crew's quarters acted to further distinguish the crew's social importance from that of higher-ranked individuals onboard. Its proximity to the cargo holds, and other spaces linked to the vessel's operations, marked the crew's quarters as low status.

Similarly, the cook and steward's S.R. possessed the same depth (three) and variants (asymmetric and non-distributed) as the crew's quarters (Figure 6.2, see Table 6.1 for key). This space, however, was located on the main deck, not the lower deck. *Lilac*'s galley shared walls with the cook and steward's S.R (Figure 5.6). The space's asymmetric route required the cook and steward to pass through an indirect space before entering the galley, but its closeness allowed for easy access back and forth between the two spaces. The cook and steward's S.R. had only one locus of control; giving inhabitants some level of control over access. Given that the steward and cook were two of the lowest ranked USLS individuals onboard *Lilac*, one might expect these individuals would be housed with the other similarly ranked crewmembers in the lower deck.

In sum, most of the spaces diagramed were asymmetric, with varying degrees of distribution. While some spaces were segregated and relatively inaccessible (e.g., staterooms on the upper deck), which reinforced notions of rank and social importance, others were more integrated (e.g., the officers' quarters), blurring the lines between social distinctions among servicemembers. The access diagram for *Lilac*'s 1933 USLS design indicates that, in many instances, access to high-status places onboard *Lilac* was controlled physically by spatial boundaries, as well as by instilled societal norms regarding rank and social rules.

Lilac, 1942

Before looking in detail at the access diagram created to represent *Lilac*'s 1942 design plans (Figure 6.3, see Table 6.3 for key), it is worthwhile to briefly explore the design changes that occurred between these two periods. The most immediately visible change between the first and second periods was the addition of weaponry, and the modification of *Lilac*'s internal structure to accommodate an increased number of crewmembers. Physical changes to *Lilac*'s layout, and the corresponding social changes, are reflected in the access diagrams in the form of depth, symmetry, and distribution. Each space's specific integration values and syntactic descriptions are listed in Table 6.4.

Certain spaces onboard *Lilac* did not change in terms of their spatial configuration between 1933 and 1942. Furthermore, the routes to these rooms did not change enough to alter their variants as depicted in the access diagram (Figures 6.2 and 6.3, see Tables 6.1 and 6.3 for keys). Rather than repeating information discussed above about the same rooms (just with a different name), they will be listed with their current and former names, depth, and variants. It is important to note that the rooms, their function, and their variants remained the same, it was only their names that changed. Any rooms or spaces that had access routes affected by the modifications made to *Lilac*'s spatial layout from 1933 to 1942 will be discussed in detail.

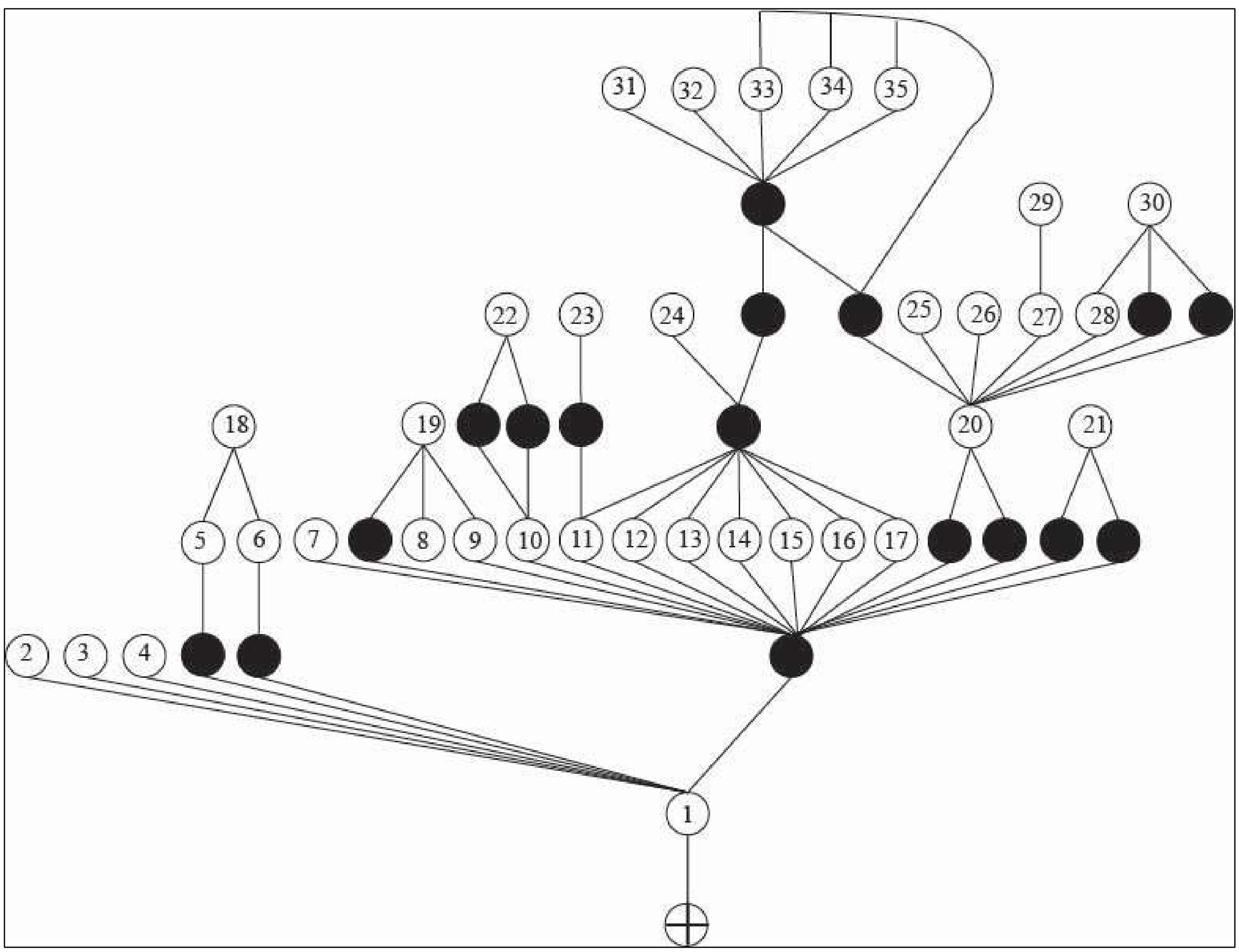

Figure 6.3. Access Diagram for *Lilac*'s 1942 Design Plans (D'Jernes 2019).

Circle Number	Corresponding Room in Access Diagram
1	Buoy Handling Deck
2	Crew’s Washroom
3	Crew’s Toilet
4	Deck Storage Under Fo’c’sle
5	Crew’s Quarters
6	Cargo Hold
7	Crew’s Bathroom
8	Galley
9	Crew’s Mess
10	Upper Boiler Room
11	Upper Engine Room
12	C.P.O.s’ Bathroom
13	C.P.O.s’ Mess
14	C.P.O.s’ Quarters
15	W.R. Pantry
16	Officers’ Mess
17	Ship’s Office
18	3”-50 Caliber
19	Galley Refrigerator
20	Cargo Boat Deck
21	P.O.s’ Quarters
22	Lower Boiler Room
23	Lower Engine Room
24	Linen Closet
25	20mm Clipping Room
26	Emergency Generator
27	C.O.’s Stateroom
28	Unknown Room
29	C.O.’s Bath
30	Pilothouse
31	Officer’s Bath
32	Stateroom
33	Stateroom
34	Stateroom
35	Stateroom

Table 6.3. Key for 1942 Access Diagram (D’Jernes 2019).

Room	Variants	Depth
Officer's Bath	Symmetric, Non-Distributed	7
Stateroom	Symmetric, Non-Distributed	7
Stateroom	Asymmetric, Distributed	7
Stateroom	Asymmetric, Distributed	7
Stateroom	Asymmetric, Distributed	7
C.O.'s Bath	Asymmetric, Non-Distributed	6
Pilothouse	Asymmetric, Distributed	6
20mm Clipping Room	Symmetric, Non-Distributed	5
Emergency Generator Room	Symmetric, Non-Distributed	5
C.O.'s Stateroom	Symmetric, Non-Distributed	5
Unknown Room	Symmetric, Non-Distributed	5
Lower Boiler Room	Asymmetric, Distributed	5
Lower Engine Room	Asymmetric, Non-Distributed	5
Linen Closet	Symmetric, Non-Distributed	5
3-50 Caliber Ammo	Asymmetric, Distributed	4
Galley Refrigerator	Asymmetric, Distributed	4
Cargo Boat Deck	Asymmetric, Distributed	4
P.O.'s Quarters	Asymmetric, Distributed	4
Crew's Quarters	Asymmetric, Non-Distributed	3
Cargo Hold	Asymmetric, Non-Distributed	3
Crew's Bath	Symmetric, Non-Distributed	3
Galley Refrigerator	Asymmetric, Distributed	3
Crew's Mess	Symmetric, Non-Distributed	3
Upper Boiler Room	Symmetric, Non-Distributed	3
Upper Engine Room	Asymmetric, Non-Distributed	3
C.P.O.'s Bath	Asymmetric, Non-Distributed	3
W.R. Pantry	Asymmetric, Non-Distributed	3
Officer's Mess	Asymmetric, Non-Distributed	3
Ship's Office	Asymmetric, Non-Distributed	3
C.P.O.'s Quarters	Asymmetric, Non-Distributed	3
C.P.O.'s Mess	Asymmetric, Non-Distributed	3
Crew's Washroom	Symmetric, Non-Distributed	2
Crew's Toilet	Symmetric, Non-Distributed	2
Deck Storage Under Fo’c’sle	Symmetric, Non-Distributed	2
Buoy Handling Deck		1

Table 6.4. Access Routes’ Measures of Symmetry and Distribution Ordered by Depth, *Lilac* 1942 (D’Jernes 2019).

While *Lilac*'s 1933 configuration featured three staterooms, the superintendent's bath and dining room in the aft deckhouse on the upper deck (Figure 5.11), *Lilac*'s 1942 configuration included four staterooms and an officer's bath all linked by an interior passageway (Figure 5.21). As depicted in the access diagram (Figure 6.3, see Table 6.3 for key), the deepest spaces onboard *Lilac* in 1942 consists of the officer's bath and four staterooms. The officer's bath occupies the same space as the superintendent's bath in *Lilac*'s 1933 design. In addition, the officer's bath's permeability is the same as it was in 1933; only the name of the room changed. Just as the superintendent's bath was asymmetrical and non-distributed, so is the officer's bath (Figure 6.3, see Table 6.3 for key). The officer's bath's linear route forces an individual to pass through one space (i.e., the interior passageway) before accessing the room; consequently, that interior passageway enacts a degree of control over the permeability of the officer's bath. As a result, the route to the officer's bath is asymmetric and non-distributed. The room's extreme depth (seven) and its variants, indicate that the officer's bath was the most isolated space onboard *Lilac* in 1942; much like the superintendent's bath in 1933.

In a similar manner, the forward stateroom on the starboard side is highly secluded. It has only one door leading to an interior passageway; unlike most other living quarters on the main and upper decks that have direct access to both the vessel's exterior and interior passageways. The access diagram (Figure 6.3, see Table 6.3 for key) reveals that this starboard stateroom's depth (seven) and its asymmetrical and non-distributed route, make the room more isolated with restricted routes of access; thus, it offers a greater level of privacy than the surrounding three staterooms as individuals can easily be denied access from only one locus of control.

The other three staterooms, also located in the aft deckhouse on the upper deck, are similarly at a depth of seven in the diagram (Figure 6.3, see Table 6.3 for key). Unlike the forward starboard stateroom, the aft starboard side stateroom and both port side staterooms are asymmetrical and distributed (Figure 6.3, see Table 6.3 for key). Passage from these three staterooms to any other room required an individual to move through a middle space. Although the pathways to the rooms were indirect, there was more than one locus of control through which movement to the staterooms could be controlled. Consequently, access to these three staterooms was harder to control, thereby offering less privacy than the forward starboard stateroom.

One hypothesis for the differing levels of privacy and control afforded to the four staterooms is that guests of high social standing occupied the forward starboard stateroom, while those of a slightly lower social status (but ranked higher than *Lilac*'s crew) would stay in the other three staterooms. Notwithstanding, the forward starboard stateroom was the furthest from the officer's bath in the aft deckhouse. If a room's proximity to important facilities like bathrooms and kitchens is an indicator of a space's importance within the overall structure, it is possible that the forward portside stateroom was the lesser of the four staterooms in terms of the space's importance as a social status marker. Documentary evidence does little to shed light on this matter.

The C.O.'s bath (depth of six) has an asymmetric, non-distributed route in the 1942 access diagram (Figure 6.3, see Table 6.3 for key); exactly like the master's bath in the 1933 design plans (Figure 6.2, see Table 6.1 for key). This separation from other areas onboard *Lilac* afforded a level of privacy to the room's users. The physical separation between the C.O. and guests' living spaces and the crew affected the social distance between higher and lower ranking servicemembers. The intentional segregation between the living quarters and baths on the upper deck (which predominately housed officers) from those on the lower decks (where crewmembers resided) acted as a tool to enforce USCG societal norms regarding interactions among lower and higher ranked servicemembers.

This conjecture is further supported by an anecdote from a former USCG *Lilac* servicemember (Habstritt pers. comm.). Based on the crewmember's account, while at sea, *Lilac*'s Captain inhabited his stateroom; but when docked, the Captain resided in the staterooms in the aft portion of the upper deck. A possible interpretation of the Captain's actions is that he wanted to maintain the hierarchy of power associated with USCG rank and the corresponding social norms while at sea. At sea, *Lilac* and its crewmembers operated in their official capacities and adhered to the social distinctions instilled by USCG rank. While docked, it would seem, *Lilac*'s Captain broke down the barriers of rank (to an extent, he still resided in an isolated, private space) and thereby altered the social landscape onboard. In effect, the Captain re-branded himself as one of "them," rather than someone above them. This anecdote reveals that space was an important factor in how individuals onboard perceived themselves and others. Depending on where an individual lived onboard *Lilac*, space became either a tool for alienation or unity.

Just as the C.O.'s bath maintained its physical position and route in *Lilac*'s 1933 and 1942 design plans and access diagrams (Figures 6.2 and 6.3, see Tables 6.1 and 6.3 for keys), so did the pilothouse. Also, at a depth of six, the pilothouse's route remained asymmetric and distributed (Figure 6.3, see Table 6.3 for key), just as it was in the 1933 access diagram (Figure 6.2, see Table 6.1 for key). The pilothouse's permeability was maintained to ensure access and clear passage as servicemembers moved back and forth from this deep space and *Lilac*'s other shallower areas.

Conversely, two spaces were added to the upper deck that were not present in *Lilac*'s original 1933 design. The 20mm clipping room and the emergency generator room were built forward of the aft deckhouse on the cargo boat deck. Access routes to both spaces were asymmetrical and non-distributed (Figure 6.3, see Table 6.3 for key). The 20mm clippings were for the 20mm Oerlikon anti-aircraft guns on top of the aft deckhouse on *Lilac*'s upper deck.

Although labelled differently, the C.O.'s stateroom is the same room as the master's stateroom in *Lilac*'s 1933 design plans. Additionally, the C.O.'s stateroom is at the same depth within *Lilac* (five) and it maintained the same symmetrical and non-distributed route as the space did in 1933 (Figures 6.2 and 6.3, see Tables 6.1 and 6.3 for keys). The physical separation between the C.O. and crew's quarters assisted in socially distancing *Lilac*'s chief officer from the crew.

Sharing a wall with the C.O.'s stateroom, is a room marked as unknown in the vessel's 1942 design plans. This space was previously labelled as the master's office in *Lilac*'s 1933 design plans. The unknown room has the same depth and symmetrical and non-distributed route as the master's office (Figures 6.2 and 6.3, see Tables 6.1 and 6.3 for keys). *Lilac*'s 1942 plans were updated in 1958 to show the removal of armament from the vessel following the end of WWII. It is possible that the unknown room maintained the same function as the master's office until that time. Without documentary evidence to indicate when the room's purpose became unknown, it is difficult to determine how the space was used and by whom definitively. Given the room's location and direct connection to the C.O.'s stateroom and bath, it can easily be assumed that social importance played a role in a servicemembers ability to access the room.

Slightly shallower in the 1942 access diagram (Figure 6.3) than the C.O.'s stateroom and the unknown room, the storage area (depth of four) under the crew's quarters had an asymmetrical and distributed route. While anyone who wanted to enter this space was required to pass through a middle area, the room had two loci of control making it harder to physically restrict permeability. This storage space grew in importance following *Lilac*'s incorporation into the USCG as it was repurposed to store the ammunition for the 3"/50 caliber anti-aircraft gun mounted on top of the fo'c'sle head on the main deck. The necessity for freer access to these vital materials is reflected in the distributed nature of the space's route (Figure 6.5, see Table 6.3 for key).

Other spaces with routes less restricted by distance or loci of control include the P.O.s' quarters, crew's mess, galley, W.R. pantry, officer's mess, ship's office, C.P.O.'s mess, bath and quarters, and the ship's office. Each of these spaces possess a depth of three and their routes are all asymmetrical and distributed, making them relatively accessible (Figure 6.3, see Table 6.3 for key). Moreover, those spaces had direct access to both the interior and exterior passageways on the main deck. A high degree of accessibility allowed for immediate access to many necessary spaces related to *Lilac*'s operations (i.e., boiler and engine rooms). The galley is surrounded by the crew's living areas (i.e., the crew's mess). The C.P.O.s' mess, quarters, and bath are grouped together in the middle of the deckhouse. The sternward portion of the deckhouse features the officer's dining area, W.R. Pantry, and ship's office. Despite the high level of accessibility, there is a noticeable progression of social importance leading from *Lilac*'s stem to stern.

Based on the access diagram for *Lilac*'s 1942 configuration, the vessel's most accessible spaces included the crew's washroom, bath and toilet, and deck storage under the fo'c'sle. These spaces all had less points of entry from the carrier and did not lead to other rooms within the vessel. In essence, they were dead ends for those attempting to gain access to other spaces from these compartments. They were not significant points of control in terms of access to other parts of the vessel.

Comparison of the 1933 and 1942 Access Diagrams

The results of the two access analysis diagrams reveal the manner through which *Lilac*'s spatial structure articulated societal norms, and impacted interaction and power among servicemembers. Firstly, most of the spaces were attributed with a depth of three or higher in both access diagrams (see Tables 6.2 and 6.4). This means that servicemembers were required to pass through three or more spaces to access most of the spaces onboard. The maximum depth of the 1933 and 1942 access diagrams was seven. Ultimately, access to these deep spaces was dependent on the accessibility and clear passage through several, shallower spaces.

Deep spaces in the diagrams correspond to what were considered high-status areas onboard the vessel. For example, the deepest spaces were the superintendent/officer's bath and the master/captain's bath on the upper deck (Figures 6.2 and 6.3, see Tables 6.1 and 6.3 for keys). Their depth within *Lilac*'s structure, coupled with their routes' variants, made them isolated and less accessible than a majority of spaces onboard. The level of privacy afforded to those two rooms mark them as high-status. Other similar deep spaces are the superintendent's dining room and staterooms, along with the master/captain's stateroom. The access diagrams mapped the routes to each of these deep spaces as predominately asymmetrical and non-distributed (Figures 6.2 and 6.3, see Tables 6.1 and 6.3 for keys). These variants indicate that movement from one of those deep spaces to any other space required passage through an intermediary space. Access to the deep rooms could be controlled from that intermediary space. With only one locus of control, individuals could easily be denied access to those rooms; which, in effect, controlled the relationships and interactions among servicemembers.

The observed separation of high-status rooms from low-status rooms in the access diagrams (Figures 6.2 and 6.3) reflect the USLS and USCG's societal norms regarding social status. Both maritime organizations (one civilian and one military) structured social and spatial relations around a hierarchy of power dependent on rank. Space was intentionally utilized onboard *Lilac* to mark the difference between servicemembers using distance and permeability; thereby revealing the deeply rooted societal norms associated with rank in both the USLS and USCG.

As observed in the access diagrams, *Lilac*'s complex spatial layout provided several routes for servicemembers to navigate and access various areas of the vessel. Despite the number of routes, access was not free or unrestricted; it was controlled through defined spaces. As a result of this control, only certain routes would be available for select servicemembers to use. Interaction among servicemembers was necessary for the continued development and maintenance of societal norms. The likelihood of interactions among crew members was increased when access routes were restricted; accordingly, so was the potential for the continued maintenance of societal norms. Thus, the proliferation of societal characteristics onboard depended on the way *Lilac*'s spatial layout fostered social interaction.

In its design, *Lilac* generated, and controlled interaction and avoidance differently based on the location of the space in relation to the vessel's exterior or interior. Based on the access diagrams (Figures 6.2 and 6.3), there are several distinctions that can be made regarding the differences between *Lilac*'s interior and exterior spaces in 1933 and 1942. To begin with, the spaces inside *Lilac* had more control over what could happen and where, and, ultimately, the relationships among individuals; in essence, interior spaces had well-defined connections to social categories and roles (Hillier & Hanson 1984). In the case of *Lilac*, the social roles were based on rank and the hierarchy of power associated with it in the USLS and USCG.

Drawing from Hillier and Hanson's (1984) space syntax theory and Bourdieu's theory of practice, it can be argued that *Lilac*'s interior represented an ideological space in which a fixed set of social categories and relations were continually re-affirmed by use (Bourdieu 1977; Hillier & Hanson 1984:19-24). USLS and USCG societal characteristics were reproduced in *Lilac*'s interior because those spaces were designed to control movement. In this sense, permeability and accessibility onboard *Lilac* were methods through which societal norms were reinforced. This practice is evident in the access diagrams (Figures 6.2 and 6.3, see Tables 6.1 and 6.3 for keys), whereby societal norms are reflected in the isolation of high-status areas (i.e., the master/captain and superintendent's bathrooms and staterooms) from lower-status areas (i.e., the crew's toilet, quarters, and mess). This segregation of space, as seen in the access diagrams (Figures 6.2 and 6.3), shows that *Lilac*'s spatial patterning is directly related to USLS and USCG societal norms.

Lilac's exterior, in contrast, generated more possibilities for interaction among servicemembers because access was less controlled. The diagrams (Figures 6.2 and 6.3, see Tables 6.1 and 6.3 for keys) illustrate how access to and throughout the exterior passageways on *Lilac*'s main and upper decks could not be controlled from any one locus. Rather, as the access diagrams reveal, there were multiple routes of access to exterior spaces. For example, most living quarters onboard the vessel had direct access to exterior spaces. Any individual, therefore, had freer movement in these exterior locations versus interior spaces. As such, *Lilac*'s exterior spaces provided a fluid system of encounters (and avoidances) that was continually renegotiated by use (Hillier & Hanson 1984). New relationships and interaction among servicemembers were less structured in exterior spaces (where access was not as controlled), making them the primary location in which ship-board society was produced. Subsequently, any resistance to relations of power, authority, and inequality onboard would likely occur in these exterior spaces. In sum, *Lilac*'s interior spaces were more socially deterministic; whereas, *Lilac*'s exterior spaces had a higher degree of inter-determinacy.

With the understanding that *Lilac*'s constituent spaces, both interior and exterior, are locations for the affirmation and negotiation of societal patterns, any alterations to *Lilac*'s spatial organization are therefore indicative of changes in the social structure of society. Comparing the vessel's 1933 and 1942 design plans, along with the access diagrams (Figures 6.2 and 6.3), can assist in the identification of changing social rules within society. The analysis of *Lilac*'s 1933 design shows how social rules were structured and maintained prior to the vessel's incorporation into the USCG. The spatial changes that occurred between 1933 and 1942 highlight the shift in the social rules within two different maritime societies: one civilian (USLS) and one military (USCG).

The changes that occurred between 1933 and 1942 illuminate a few important characteristics of the relationship between space and society onboard *Lilac*. The internal structure of the vessel was heavily altered in 1942 to accommodate living spaces for an increased number of crewmembers; this is especially apparent in the deckhouses on the main deck. Instead of retaining the same categoric segregation of space based on occupational position and rank as displayed by the vessel's 1933 design (Figure 6.2, see Table 6.1 for key), *Lilac*'s 1942 design plans show a rearrangement of space, particularly noticeable in the main and upper decks (Figure 6.3, see Table 6.3 for key). For example, the 1933 access diagram depicts the crew's quarters, cook and stewards' S.R., first, second, and chief engineer's quarters, along with the first and second mates' quarters at a depth of three (Figure 6.2, see Table 6.1 for key). In contrast, the access diagram representing *Lilac*'s 1942 design shows the crew's quarters and C.P.O.s' quarters as the only living spaces at a depth of three (Figure 6.5, see Table 6.3 for key). Officers (i.e., chief petty officers) were displaced from their individual quarters and were instead grouped into one larger room (labeled as C.P.O.s' Quarters in Figure 6.3). Rather than keeping the original arrangement of living quarters, *Lilac*'s internal structure was modified to make room for an increased number of crewmembers. This modification reflects a change in social rules that corresponds with the transfer of the vessel from a civilian organization into the U.S. military.

At the same time, by eliminating the proliferation of living quarters aggregated to the interior passageway, it opened additional public space for servicemembers to congregate and form new relationships. The living quarters in *Lilac*'s 1933 design encroached on public space, which reveals that the USLS prioritized private space for higher ranked servicemembers than public space. The modification of *Lilac*'s interior in 1942 essentially un-privatized the living areas on the main deck; this created a space in which interactions between different ranks of servicemembers was increased as it became a center of co-habitation. That is not to say that the various ranks of servicemembers shared the same public space. Rather, their private and public living and dining spaces were simply grouped closer together. This still enabled increased interaction among servicemembers as they were placed in closer proximity to both higher and lower ranked individuals on the main deck – not on the lower or upper decks. This structural change between 1933 and 1942 reveals two things: firstly, the importance and scale of private space; and, secondly, how that privatization of space translated into the distribution of power among servicemembers.

The distribution of power among *Lilac*'s servicemembers is strongly linked to the spatial organization of the vessel. After the living spaces on the main decks were modified in 1942, it is possible that the disruption in spatial organization either maintained or upset the balance of authority among the various ranks of USCG servicemembers. The regrouping of what were previously individual USLS officers' living quarters into larger, communal quarters might have created uncertainty among crewmembers regarding their power onboard the vessel. This is based on the theory that space acted as an extension of an individual's image, a physical manifestation of their power and authority onboard *Lilac*. The ship's logbooks for the time period following the vessel's structural change cannot fully express or identify authority relationships, but they can tell researchers if there were more instances of unrest or altercations among servicemembers than the years prior to the 1942 renovations.

Conclusion

In this chapter, access analysis was used to study the possible connection between the USLS and USCG's social norms and *Lilac*'s spatial patterning. The above access diagrams were used to study how space was organized and controlled onboard *Lilac* (Figures 6.2 and 6.3). Documentary evidence was incorporated into the analysis of the diagrams to determine the specific logic behind *Lilac*'s spatial patterning. Information gleaned from the 1933 and 1942 access diagrams reveals that space had a significant effect on *Lilac*'s shipboard society (Figures 6.2 and 6.3). *Lilac*'s design reflects the USLS and USCG's thinking regarding social hierarchies among the ranks of its servicemembers. Space was a tool by which the two maritime organizations instilled social practices associated with a rank-based hierarchy of power. *Lilac*'s crewmembers encountered those instilled social norms everyday as they navigated the spaces around them. The spaces an individual inhabited often reflected their position onboard *Lilac*, in terms of both their USLS or USCG rank and their social standing. Higher ranking individuals (e.g., the captain, superintendent, or visiting guests) were isolated from the other crewmembers onboard; higher and lower ranked USLS and USCG servicemembers often slept, dined, and worked on different decks entirely. Therefore, space was a tool for segregation from, or integration into, a larger group. *Lilac*'s spatial patterning reinforced the code of conduct associated with rank in the USLS and USCG.

CHAPTER 7: CONCLUSION

This thesis examined the spatial patterning of *Lilac*, a former USLS and USCG buoy and lighthouse tender, using access analysis, the graphical manifestation of Hillier and Hanson's (1984) space syntax theory. By utilizing access analysis, in conjunction to historical and archaeological research, this work aimed to identify *Lilac*'s major design features and their socio-historical implications; and, in doing so, gain a better understanding of *Lilac*'s shipboard society and its relationship to larger maritime institutions. To do so, this thesis posed three central questions:

1. What does the spatial patterning onboard *Lilac* suggest in terms of the social logic of its configuration?
2. Does the spatial patterning indicate a rank-based hierarchical relationship among USLS and USCG servicemembers?
3. If the presence of a rank-based social hierarchy onboard is observed in the spatial patterning, is there any evidence of resistance to authority as represented in the social logic of *Lilac*'s structuring?

Launched in 1933, *Lilac* served as part of both the USLS and USCG's fleets during its active career that spanned nearly four decades (1933-1972). Throughout its operational lifespan, *Lilac* was the primary vessel responsible for maintaining navigational aids on the Delaware River, the Delaware Bay, and the Delaware Bay's approaches from the Atlantic Ocean. *Lilac* fueled and supplied offshore lightships and lighthouses, transported personnel to and from isolated outposts, serviced and repaired buoys and navigational devices, took district and national officials on tours of inspection, responded to marine disasters and emergencies, and ensured port security (Brouwer 2004:Section 8-2).

Lilac's effective design enabled servicemembers to fulfil their duties onboard and uphold the vessel's responsibilities as part of the USLS and USCG. Likewise, the vessel's design replicated the USLS and USCG's ideology regarding social hierarchies among the ranks of the servicemembers onboard. This became apparent after reviewing the access diagrams created to reflect *Lilac*'s 1933 and 1942 design plans in tandem to documentary evidence.

The integration values and syntactic properties of the spaces depicted in the 1933 and 1942 access diagrams (Figures 6.2 and 6.3) indicate a disparity in access control between areas associated with higher-ranking individuals (e.g., captain, superintendent, and visiting guests) and those associated with lower-ranking servicemembers (e.g., stewards). For example, in the access diagrams, the deepest spaces were the superintendent/officer's bath and the master/captain's bath on *Lilac*'s upper deck (Figures 6.2 and 6.3). Those spaces possessed higher integration values and their syntactic descriptions were primarily asymmetric and non-distributed. These variants indicate that movement from one of those deep spaces to any of *Lilac*'s other spaces required passage through an intermediary space. Access could be controlled from that intermediary space. With only one locus of control, individuals could easily be denied access to those rooms; which, in effect, controlled the relationships and interactions among servicemembers.

Organized in this manner, space was used to segregate servicemembers based on rank and their corresponding social standing onboard the vessel. In doing so, *Lilac*'s spatial patterning duplicates the social practices instilled by the USLS and USCG. Both maritime organizations (one civilian and one military) structured social and spatial relations around a hierarchy of power dependent on rank. Space was intentionally utilized onboard *Lilac* to mark the difference between servicemembers using distance and permeability; thereby revealing the deeply rooted societal norms associated with rank in both the USLS and USCG.

Interaction among servicemembers was necessary for the continued development and maintenance of USLS and USCG societal norms onboard *Lilac*. The likelihood of interactions among servicemembers was increased when access routes were restricted; accordingly, so was the potential for the continued maintenance of societal norms. For this reason, the proliferation of societal characteristics onboard depended on the way *Lilac*'s spatial layout fostered social interaction. While *Lilac*'s interior was designed to control movement, *Lilac*'s exterior, in contrast, generated more possibilities for interaction among servicemembers because access was less controlled. In *Lilac*'s exterior spaces, relationships and interaction among servicemembers were less structured, making them the primary location in which shipboard society was produced. Subsequently, any resistance to relations of power, authority, and inequality onboard would likely occur in these exterior spaces.

Limitations and Future Avenues for Research

Like most archaeological and historical research, this study was afflicted with various limitations. The inability to access historic records like *Lilac*'s USLS and USCG logbooks was a shortcoming in the research conducted. Nevertheless, as Fairclough (1992) points out, the writers of historic documents (like *Lilac*'s logbooks) did not intend to explain the fundamentals of their social organization to readers (Fairclough 1992:351). Written sources like *Lilac*'s logbooks were not given primacy in the interpretation of the material presented in this study. Rather, access analysis was employed alongside documentary evidence to form a perspective that, as Richardson (2003) conjects, "integrates their respective strengths while eliminating their respective weaknesses" (Richardson 2003a:375).

The methods used to archaeologically apply access analysis to *Lilac* in this thesis were qualitative. Hillier and Hanson (1984) translated space syntax theory into a form of abstract mathematics (i.e., access analysis) that consists of both qualitative and quantitative components. Drawing inspiration from Stockett's (2005) analysis of Las Canoas and Cutting's (2003) study of prehistoric Anatolian sites, this thesis applied access analysis's qualitative methods as a "tool to think with." Although some spatial archaeological theorists might disagree (see Fisher 2009), qualitative analysis can be more practical when compared to the lengthy and complex process required to achieve results with quantitative methods. In many cases, the integration values derived from quantitative techniques confirm what is already visually apparent from the access diagram. By using access analysis's visually rich qualitative methods as a "tool to think with," the relatively simple process provided useful insights into the underlying social logic of space onboard *Lilac*.

Part of this thesis's novelty is that it is one of the few studies to apply access analysis in a maritime context. Without a large body of existing precedent, it required a bit of imagination to take a methodology intended for settlements and adapt it to study *Lilac*. Although this thesis did not employ access analysis's quantitative methods in conjunction to qualitative, it is hoped that some of the archaeological potential of access analysis has been successfully demonstrated, especially as it relates to the study of maritime subjects.

There exist numerous research opportunities for the archaeological application of access analysis in maritime contexts. To apply access analysis, however, the subject's spaces must be defined. If, for example, the subject of study is a ship, the vessel's spaces need to be clearly demarcated through its existing structure or design plans. While many ships would be fascinating subjects, only vessels that meet those requirements could feasibly be studied. This eliminates many historic ships from consideration for the archaeological application of access analysis. Vessels like *Vasa*, *Mary Rose*, and *La Belle* could be potential subjects for study using the methodology outlined in this thesis. While each of those ships have been the focus of much historical and archaeological research, it is possible that access analysis can yield additional information about the vessels' designs and underlying social logic.

To conclude, the archaeological application of access analysis helped illuminate the complex, dynamic relationship between space and society onboard *Lilac*. The USLS and USCG's social norms structured, and were in return reinforced by, *Lilac*'s design. Interactions and relationships among servicemembers were controlled through the permeability of the vessel's component spaces. The integration values and syntactic properties observed in the 1933 and 1942 access diagrams reveal that *Lilac*'s interior spaces were more socially deterministic; whereas, *Lilac*'s exterior spaces had a higher degree of inter-determinacy. To this end, *Lilac*'s design reflects the USLS and USCG's thinking regarding social hierarchies among the ranks of its servicemembers. While an effort was made to counter for potential sources of error, it is possible that the material presented here will be challenged and redefined with future research. With any luck, future researchers will be able to expand on this thesis's work and uncover additional information regarding *Lilac*'s design and its socio-historical implications.

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