ARCHAEOLOGICAL SITE FORMATION OF THE “SEA SCOUT WRECK”:

MALLOWS BAY, NANJEMOY, MARYLAND

By

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ABSTRACT

The purpose of this thesis is to obtain archaeological and historical evidence to examine the archaeological site formation process of the Sea Scout Wreck, located in the recently formed Mallows Bay-Potomac River National Marine Sanctuary (Nanjemoy, Maryland). To achieve this, historical and archaeological data were used to create three-dimensional (3D) models that represent key stages of the vessel’s use-life and to document the deterioration process of the wreck. Through this research, the Sea Scout Wreck was identified as a 104’ Aircraft Rescue Boat built during World War II for the U.S. Army Air Force in support of long-range aircraft missions. This information was used to create these 3D models by establishing a base model from which environmental and cultural processes documented in the historical and archaeological record were applied. From these representative models, resource managers and maritime archaeologists can examine possible future patterns of archaeological site transformation.

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By

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DEDICATION

This thesis is dedicated to Julie and Carl Conti for their endless support of my endeavors that have allowed me to overcome a great many challenges to reach this point. To Percival Royce for encouraging and assisting me during a strange and challenging period of our lives. Finally, to the individuals who served on Aircraft Rescue Boats and braved the dangers of war and rough seas to save lives.

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CHAPTER ONE: INTRODUCTION

Mallows Bay, Maryland sits among the many bays along the shores of the Potomac River, all of which have an extensive history of maritime cultural use (Shomette 1996:209). Specifically, it is situated between Sandy Point to the north and Liverpool Point to the south, with two small freshwater creeks that feed into it (Figure 1.1) (Shomette 1994:1-2). Mallows Bay's history was set apart from other bays on the Potomac River when in the Summer of 1925, Western Marine and Salvage Company (WM&SC) began the reduction process of nearly 200 ships there (Shomette 1996:251). These ships were a part of the Emergency Fleet Corporation (EFC), created by the necessity for the United States to send critical supplies to European allies during World War I. After their reduction, these vessels formed the foundation of one of the largest ship graveyards in the world (Shomette 1996:213-214). This led to a pattern of abandoning and salvaging ships in Mallows Bay that continued until the late twentieth century. One of the more recent ships abandoned in Mallows Bay is a vessel with a wooden hull and metal bulkheads known locally as the Sea Scout Wreck (Chesapeake Conservancy 2020).

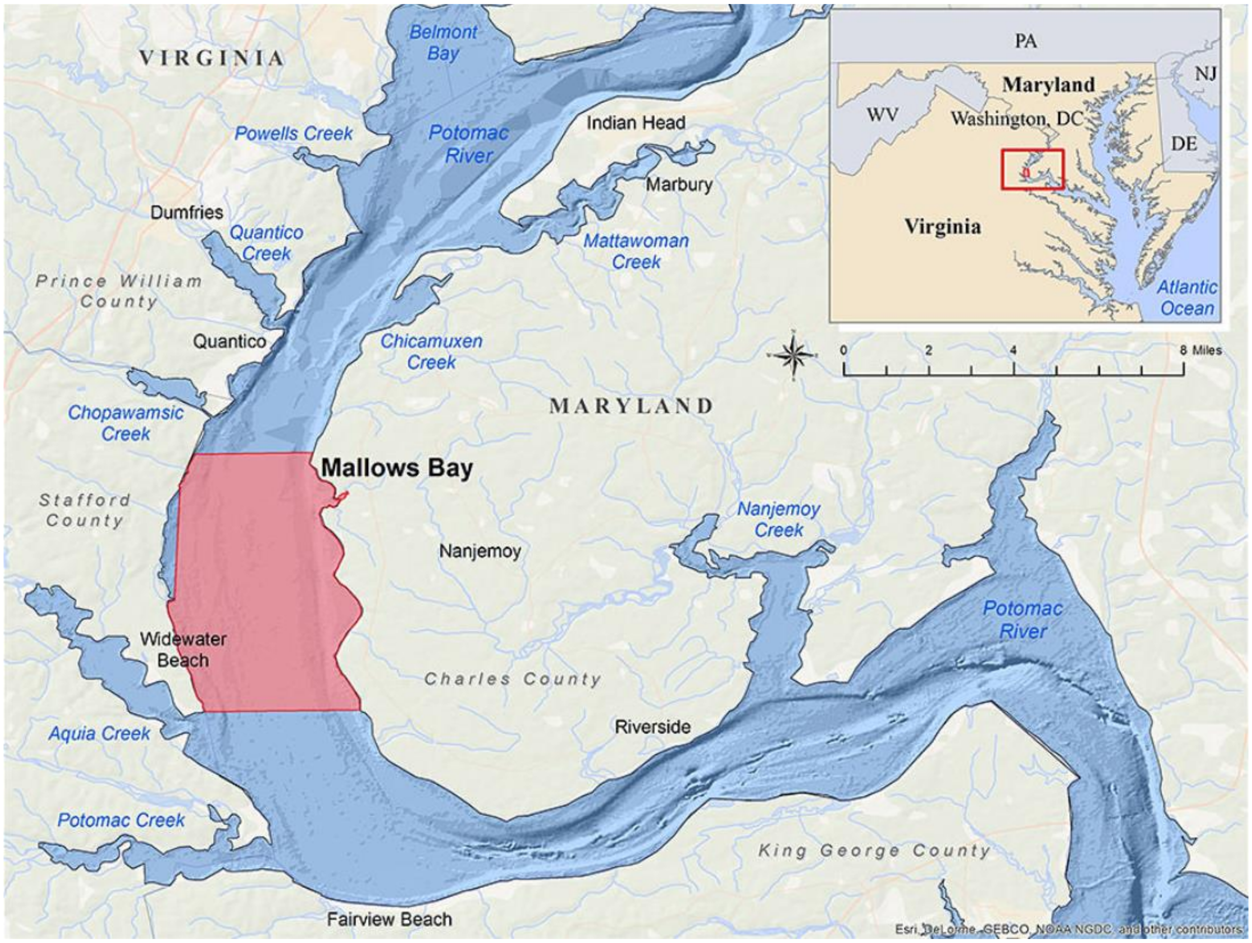

FIGURE 1.1 Map of the Mallows Bay National Marine Sanctuary (NOAA 2019a).

Several factors cause the Sea Scout Wreck to present an opportunity for this archaeological site formation study. The vessel was abandoned relatively recently, as a review of available historic aerial photographs indicates the Sea Scout Wreck was deposited between March 24, 1977, and March 27, 1980 (Figure 1.2) (U.S.G.S. 2021). Despite being abandoned more recently than most of the other vessels in Mallows Bay, the Sea Scout Wreck has experienced extensive disintegration since 1997 when it was included in an archaeological inventory of Mallows Bay (Figures 1.3 and 1.4). The vessel was abandoned away from other wrecks within a feature known as the Burning Basin, on the eastern extent of Mallows Bay. Here the wreck is accessible to foot and watercraft traffic, and exposure to freshwater currents, tides, and wave action. Finally, research conducted for this thesis shows that the vessel has historical significance at the national level, as the vessel has now been identified as a 104' Aircraft Rescue Boat (ARB) built for the United States Army Air Force (U.S.A.A.F.).

Mallows Bay was listed to the National Register of Historic Places in 2015, then designated as a National Marine Sanctuary in 2019. The Mallows Bay-Potomac River National Marine Sanctuary (MPNMS) is under joint management by National Oceanic and Atmospheric Administration (NOAA) and Maryland Historical Trust (MHT) to protect the remaining ship hulls (National Center for Preservation of Technology and Training 2017; NOAA 2019b:32587). As a National Marine Sanctuary, Mallows Bay is protected under the National Marine Sanctuaries Act, which charges NOAA as the federal agency that established the sanctuary with several duties. These duties are to:

> ...improve the conservation, understanding, management, and wise and sustainable use of marine resources; enhance public awareness, understanding, and appreciation of the marine environment; and maintain for future generations the habitat, and ecological services, of the natural assemblage of living resources that inhabit these areas (U.S. Congress 1987).

In the case of the MPNMS, the primary marine resources are the remains of abandoned ships (NOAA 2019b:32587). As such, archaeological site formation studies may help the Sanctuary's managers by developing an understanding of remains of a vessel that could assist in future management decisions. This archaeological site formation study was achieved through historical research and archaeological fieldwork on the Sea Scout Wreck. The data collected through this study were used to create six three-dimensional (3D) models of the Sea Scout

Wreck that reflect its current condition, a reconstruction before abandonment, interpretations of the disintegration process, and possible future disintegration.

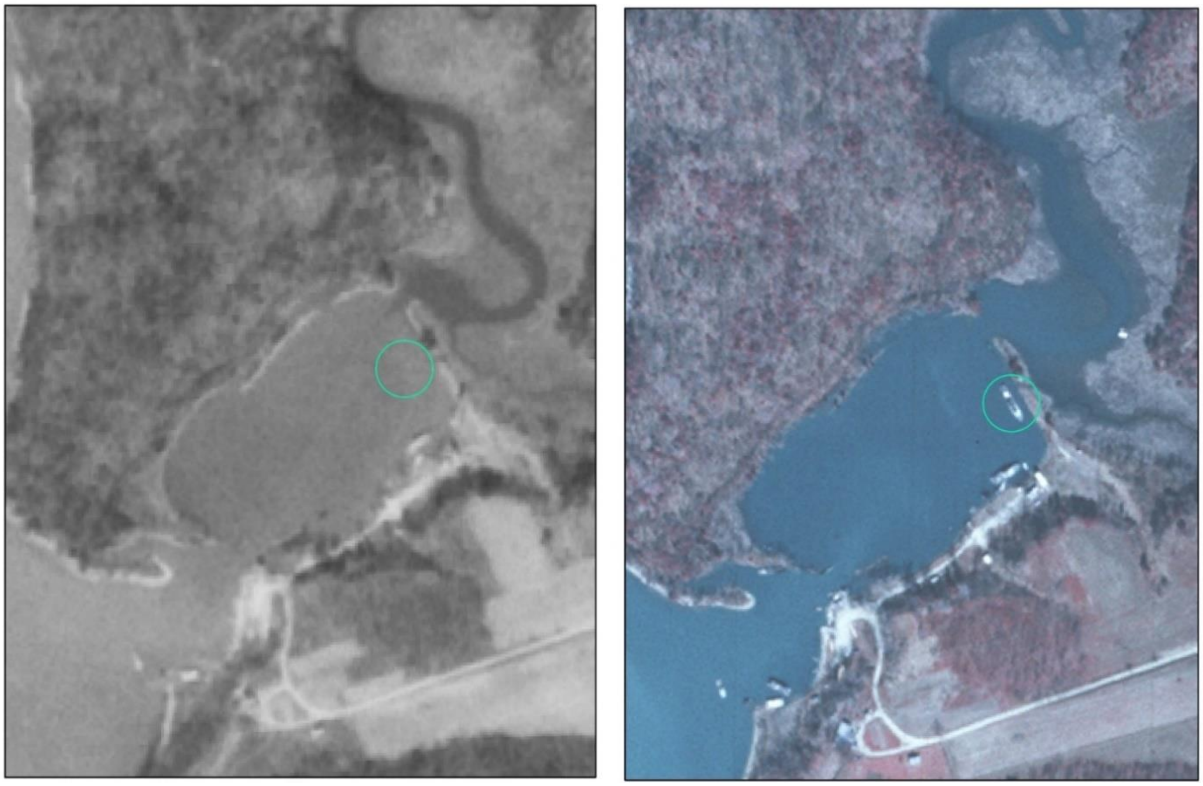

FIGURE 1.2 Side-by-Side Map of the Burning Basin on March 24, 1977 (Exposure number 4-49) and March 27, 1980 (Exposure number 17-186) (U.S.G.S. 2021)

FIGURE 1.3 Picture of the Sea Scout Wreck taken in 1997 (Photo credit Susan Langley, 1997).

FIGURE 1.4 Sea Scout Wreck in May 2021 in a severely disintegrated state compared to Figure 1.2 (Photo credit Priscilla Delano, 2021).

Research Questions

The primary goal of this thesis is to understand the archaeological site formation processes that affect the Sea Scout Wreck with the hope that this knowledge will help inform potential practices for its management. This was achieved through a case study of the site which assesses the environmental and cultural transforms that have or are currently affecting the site and by extension other submerged cultural resources within the MPNMS.

Primary Research Question

- What is the disintegration process of the Sea Scout Wreck, and how does it compare to known processes of other near-shore freshwater shipwrecks?

Secondary Research Questions

- What are the factors that have contributed to the current state of preservation of the Sea Scout Wreck, what factors are likely to drive its future archaeological site formation?
- What management strategies could help preserve the Sea Scout Wreck?

Justification and Management History

MPNMS is under the joint management of NOAA, MHT, the Maryland Department of Natural Resources (MDNR), and Charles County making the primary stakeholders the American public as state and/or federal taxpayers. NOAA, as a federal agency, is accountable for site preservation and interpretation under the National Marine Sanctuaries Act (U.S. Congress, 1980). As historical and archaeological resources are nonrenewable, it is up to management agencies to make decisions that do not impact site integrity and allow future generations to enjoy cultural resources. In the case of the Sea Scout Wreck, preservation may be difficult as it is partially submerged and accessible to human traffic by foot and by watercraft (increasing the chances of potential human impacts), and the vessel is lightly constructed, representing a mass-produced wartime watercraft.

The Abandoned Shipwreck Act of 1987 shifted the management responsibility for the Mallows Bay ship graveyard to the State of Maryland as the vessels rest inside state waters (U.S. Congress, 1987). The following year the state of Maryland passed the Submerged

Archaeological Historic Property Act which protected all vessels over 100 years old, or eligible for the National Register of Historic Places (Maryland State Senate, 1988). This would have only guaranteed protection for vessels that fall under these criteria. All other vessels abandoned in Mallows Bays would not receive this protection because they were less than 100 years old. From 1986 to 1997, an archaeological inventory of Mallows Bay was conducted by Donald Shomette, focusing on the impact of EFC vessel abandonment and reduction (Shomette 1998:1). In 2001, the State of Maryland began buying the land around Mallows Bay to protect it from commercial interests. This protection only covered the environment of the bay and did not include protection for the wrecks despite an increase in public access caused by developing the land into public parks (Shomette 2013:116). The designation of MPNMS is the first time the entirety of the ship graveyard has come under official preservation management.

Historical Context of Mallows Bay

Captain John Smith, the first European to chart the Potomac River, did not include Mallows Bay in his map or notes; however, the area was known and used by the Piscataway and Patawomeck peoples (NOAA 2020). The features of the bay were first documented in 1735 by Walter Hoxton. This region of Maryland was lightly settled, with only a few families populating the region around the bay. Due to this, only a handful of European and Euro-American maritime activities define the history of Mallows Bay. These include fishing (which was quite extensive at times), two small skirmishes, one that occurred during the Revolutionary War and the other during the Civil War, and the intentional abandonment of vessels (Shomette 1994:1-3, 6).

Most of the vessels in Mallows Bay belong to the Emergency Fleet Corporation (EFC), created in response to Germany's declaration of unrestricted warfare. The United States (U.S.) government provided up to $3 billion to the United States Shipping Board (U.S.S.B.), which was established in 1916. While the U.S. had the capability of building steel merchant vessels, the U.S.S.B. funded a program to build a fleet of wooden steamships, the "Emergency Fleet" itself. The goal of this project was to have over 700 ships, each with a carrying capacity of 3,500 tons, finished by the end of 1917. By the end of the war in November 1918, none of the ships had sailed for Europe (Shomette 1996:213-229).

In 1922, under pressure from Congress, the EFC began accepting bids for the fleet as an entire unit. After three rounds of bidding, a final offer of $750,000, was accepted from Western Marine and Salvage Company of Alexandria, Virginia (WM&SC). WM&SC agreed with the War Department to store the fleet at Widewater, Virginia while individual ships were dismantled at a shipyard in Alexandria, Virginia. Unfortunately, several issues arose with the location in Widewater, including complaints by the local fisherman about the obstruction of fishing ways, and ships drifting away during natural events (Shomette 1996:234-249). Soon WM&SC found a shallow bay just northeast of Widewater, known as Mallows Bay, and moved the fleet there in 1924. Even after this transition to Mallows Bay, WM&SC had recurring issues of burning the remaining hulls of ships to salvage them. WM&SC's operations to recover metal from the EFC ships formed the initial salvage and deposition events of the Mallows Bay ship graveyard. Large metal components, which were removed at the beginning of the deposition process, included those that made up the coal furnace and propulsion system. Initial plans included designing rail systems to pull the hulls into shallow waters to begin burning them, or to use a shallow water wharf; however, both plans were rejected. In late 1925, with little regard for the opinion of the government or locals, WM&SC set fire to 31 ships linked together by a large steel cable. Over the next three years, WM&SC would continue this pattern of burning hulls in Mallows Bay. This method released the iron components of the ship into the water, which had to be collected by hand or with a clam bucket (Shomette 1996:252-254). This created the massive ship graveyard of over 200 watercraft of EFC ships and started the trend of abandonment that continued for the rest of the twentieth century.

It was not long after the stock market crash of 1929 and the onset of the Great Depression that WM&SC was dissolved, leaving the hulls of Mallows Bay unattended. Iron remains could still be found among the hulls in Mallows Bay, and it was commonplace for local residents to hunt for metal scraps between 1932 and 1934. In 1934, Harry Steinbraker and his company, Potomac Realty Company Limited, acquired the rights to the hulls from the stockholders of WM&SC. Steinbraker permanently moored one of the last four-mast schooners, *Ida S. Dow*, on the southeastern edge of the bay to serve as a floating barracks for his salvage crew (Shomette 1996:253-262). Shortly after losing a court ruling regarding the rights of the EFC hull remains, *Ida S. Dow* was deemed unsuitable for habitation as it had deteriorated to the point that it was no longer towable (Court of Appeals of Maryland, 1936). Steinbraker had the schooner hauled to the southern edge of the containment areas of the hulls and filled with mud. Following this, resident salvagers made their home on five inexpensive houseboats. These individuals frequently used dynamite to break up vessels, usually working from the outer edge adjacent to the Potomac Channel inward towards shallow waters. These salvage efforts affected the hulls as their upper sections and metal components were removed, they became light enough to float out of Mallows Bay. To prevent them from drifting into the channel and creating a navigation hazard, U.S. Army engineers poured sand and gravel in and around the hulls on the outer edge of the bay (Shomette 1996:266-267).

After the hulls were secured from drifting into the Potomac River, they were forgotten for a few years. In 1942 Mallows Bay became of keen interest to the U.S. government as it had just entered World War Two (WWII). The War Production Board (WPB) issued orders to the Metals Reserve Company (MRC) to begin a new effort to salvage metal from the hulls in Mallows Bay. MRC contracted Bethlehem Steel to recover the needed metals from the submerged vessels. Bethlehem Steel quickly went to work building a basin at the outlet of a creek on the eastern edge of the bay, which had a flood gate at either end so that it could be drained. This allowed the remains of the hulls to be burned in their entirety and the metal scrap material to be collected before the basin was refilled with water to move more hulls into it (Shomette 1996:273-274). At the end of 1944, the price of scrap metal dropped, and Bethlehem Steel was instructed to scrap one final ship before stopping their efforts; this vessel was, *Bodkin*, formerly U.S.S. *Nokomis*, a sub-chaser during the First World War (Shomette 1996:275). Vessels of various sizes were deposited in Mallows Bay as late as 1998, and the Sea Scout Wreck was among the last of the vessels abandoned (Shomette 1998:48-49).

Past Research regarding the Sea Scout Wreck

Little is known about the pre-depositional stage of the Sea Scout Wreck since it was deposited in Mallows Bay. From 1986 to 1997, historian and archaeologist Donald Shomette conducted an inventory survey of the shipwrecks in Mallows Bay from a line drawn from Sandy Point to Liverpool Point as the western extent, to the eastern edge of the Burning Basin. The survey had three goals: produce an inventory of maritime archaeological and historical resources, evaluate the environmental impact of the salvaging of the Emergency Fleet in Mallows Bay, and conduct an archaeological investigation that consisted of a representative sample of shipwrecks. This investigation used a variety of methods to document the entire site including three aerial surveys, site mapping, floral and faunal documentation, historical document research, and four transects using small boats and divers covering 175.96 acres. Two devices, a sub-soil radar and a magnetometer were deployed on transect 1 to locate the remains of four railway sites (Shomette 1998:1-3). A representative sample of the shipwrecks in Mallows Bay was recorded for the following characteristics:

> …condition; orientation; identification if possible; proximity to other vessels or landmasses; typology of the hull remains; hull configuration; propulsion system and the number of screws; dimensions, typology of fastenings, strapping and concrete features; the existence of stemposts, sternposts, and rudder posts, rudders, gudgeons and pintails, and flora and fauna existing on the site (Shomette 1998:4).

Although Shomette provided an inventory of the wrecks at Mallows Bay, he focused extensively on the wrecks related to the Emergency Fleet. He also offered a brief description of the Sea Scout Wreck, otherwise documented in his report as Site Field number 124, and Site State Number 18CH601. The Sea Scout is the easternmost wreck in Mallows Bay, on the east edge of the Burning Basin with the bow on a bearing of 137 degrees, or southwest. He categorized the vessel as a historic small boat, probably of American origin. At the time of Shomette's investigation, the Sea Scout Wreck was a mostly intact hull above the water sitting on its keel with a 45 degree list to starboard (Shomette 1998:426). Shomette reported "…deck and superstructure intact and rapidly disintegrating. Stern in an advanced state of decay" (Shomette 1998:426). The ship has a single screw propulsion system, and a pipe fitting in the engine bore with "WPC 1945" stamped on it. Shomette believed this may be a date or a manufacturing serial number, although he stated that other components of the wreck are from a later construction date (Shomette 1998:426-427). Shomette recorded three different oral traditions regarding the identity of the vessel as being the remains of either a United States Navy (U.S.N.) patrol torpedo boat (PT-boat), or a fishing yacht that may have been used by the Sea Scouts (Shomette 1998:427). He also stated the vessel has only marginal historic significance, but there was a need for verification (Shomette 1998:49, 426). This assessment of the vessel’s lack of significance is due to the investigation focusing on the impact caused by the reduction and salvaging of the EFC vessel and other abandoned craft in the bay (Shomette 1998:1). Despite being abandoned relatively recently compared to the other vessels in the ship graveyard, the Sea Scout Wreck has suffered from extensive disintegration since 1997 (Figures 1.2, 1.5, and 1.6).

FIGURE 1.5 Middle Section of the Sea Scout Wreck in 1997 which shows the collapsed hull behind Bulkhead 6 (Photo credit: Susan Langley, 2020).

FIGURE 1.6 Portside view of the front section of the Sea Scout Wreck in 1997 (Photo credit: Susan Langley, 2020).

Thesis Structure

This study uses historical research and archaeological site formation theory to evaluate the Sea Scout Wreck. This chapter has introduced the topic of this study, its goals, the history of Mallows Bay, the past research conducted there, and an outline for the structure of this thesis. At the core of the study is archaeological site formation theory, a theoretical framework that establishes how archaeological sites form. This is discussed in detail in Chapter 2. The methodology used to collect historical and archaeological data necessary to carry out the site formation study of the Sea Scout Wreck, how it was analyzed and used to create 3D models to represent the results of the formation processes is presented in Chapter 3. Chapter 4 examines the history of Aircraft Rescue Boats (ARBs). In Chapter 5, data from the historical and archaeological work conducted during this study is examined to establish the identity of the Sea Scout Wreck as a 104’ ARB, and evaluate the oral history which suggests that this vessel was used by the Sea Cadets in Alexandria, Virginia (VA) before its abandonment. The analysis of the site formation process of the Sea Scout Wreck is discussed in Chapter 6 by combining the theoretical framework from Chapter 2, the historical context in Chapter 4, and the results of historical and archaeological research outlined in Chapter 5. Finally, Chapter 7 presents concluding remarks about this study.

CHAPTER TWO: FORMATION OF SHIP ABANDONMENT SITES

To understand how the Sea Scout Wreck of Mallows Bay has reached its current state of deterioration, it is important to understand how archaeological sites are formed. In archaeology, this may be accomplished by applying site formation theory. Archaeologists make inferences about past human behavior based on the material record that is left behind by those behaviors. To make these inferences, archaeologists attempt to understand the variety of processes that act on these sites and the permanent alterations that are caused. These formation processes include factors that determine the overall condition of an archaeological site such as reuse, salvage, and deterioration. Archaeologists may be able to decipher these formation processes to more accurately understand an archaeological site (Schiffer 1987:4-5, 7).

One of the fundamental developers of archaeological site formation theory is Michael Schiffer. He explained that the material records archaeologists study fall into two categories: the *historical record* and the *archaeological record*. The historical record is made up of the objects that maintain a presence in contemporary societies as evidence of diverse human behaviors that have continued to the present. Objects that are discarded because they cease to serve a purpose create the archaeological record. Another way of understanding archaeological site formation is that artifacts are either part of the *systematic context* or the *archaeological context*. Artifacts in the systematic context are participating in a behavioral system, while artifacts in archaeological context only interact with their surrounding environment. An artifact can move between systematic and archaeological contexts, but it cannot exist in both at the same time. Of importance to archaeologists, Schiffer notes, is the ability to explain the systematic context of an artifact found in the archaeological record. To do this, inferences about a behavioral system are made that are supported by the available evidence as well as consideration for the changes that occur over time (Schiffer 1987:3-5).

According to Schiffer, archaeologists need to develop an understanding of the formation of the historical and archaeological record. In particular, the archaeologist must consider the bias of formation processes that create these two records. Schiffer separates these processes into two categories, *cultural transformations* (c-transforms), and *noncultural transformations* (n-transforms). C-transforms are defined as the activities of human behavior that affect an artifact after its initial use. It is c-transforms that create both the historical record, by keeping artifacts in systematic context, as well as the archaeological record through the act of discarding artifacts. On the other hand, n-transforms are the environmental conditions that are always acting upon an artifact regardless of being in the systematic or archaeological context. Schiffer (1987:7) believes that the biases created by these processes to remove or modify artifacts from the material record must be accounted for when it is being examined; however, his work focused on terrestrial archaeology, only considering hydraulic processes regarding their effect on the land-based archaeological record (Schiffer 1987:243-256).

Working at approximately the same time as Schiffer, Keith Muckelroy was one of the first maritime archaeologists to begin examining the site formation process of shipwrecks. He developed a model of the shipwrecking process by studying twenty sites around the British Isles and Ireland and examining eleven of their environmental characteristics (Muckelroy 1978:270-271). He believed that shipwrecks experienced depositional and post-depositional processes in a similar manner to terrestrial sites and that the study of these processes should be critical to the subdiscipline of maritime archaeology (Muckelroy 1978:268). Muckelroy states that the underwater environment minimizes human interference, the primary destructive force on terrestrial sites and that it is primarily environmental factors that affect submerged shipwrecks. He proposes that in the shipwrecking process, the ship is a closed system of highly organized artifacts that become disorganized upon wrecking. This process includes a series of *extractive filters*, factors that prevent objects from being located at an archaeological site, and *scrambling devices*, events that move artifacts around an archaeological site, that together alter the material remains of a shipwreck site when examined by archaeologists (Muckelroy 1978:268). These appear like Schiffer's transforms, the difference being that Muckelroy categorized formation processes based on their effect, while Schiffer's categories are based on their cause. While Muckelroy was not able to further expand on his site formation model, the work was carried on by many others and includes additions of salvaging from before the wrecking process to after, and the movement and effects of sediments on an archaeological site (e.g., Ward et al. 1999; Gibbs 2006).

Following Schiffer's perspective on site formation, Nathan Richards examined the site formation processes of intentional abandonment of watercraft. He states that people assign meaning to the abandonment of ships, and that understanding this is a part of understanding human behavior in the past (Richards 2008:1). This appears as several themes that Richards (2008:19-28) identified during his work that represented different types of behavior. Additionally, the cause of intentional discard can reveal major behavior changes, such as technological innovation and conflict, or the socio-ideological beliefs of the society (Richards 2008:28-37). The main foci of his research were ship graveyards, where vessels are left at varying frequencies due to economic or technological changes, with the area of deposition becoming unused, except within the context of watercraft salvage or reclamation (Richards 2008:57-58).

This chapter is a synthesis of the work of the archaeologists that use site formation theory to understand the development of archaeological sites, particularly when it comes to the abandonment of watercraft. As archaeological sites are formed through a linear process of pre-deposition, deposition, and post-depositional periods each with its formation processes, this chapter examines these processes in each stage.

Pre-depositional Processes

Leading up to the time an object is integrated into the archaeological record, it exists in the systematic context, from its point of manufacturing to when it is discarded (Schiffer 1987:3-4). While it is important to understand the original social, technological, and/or ideological purposes of artifacts, the function and form can change while still in a systematic context. Once an artifact moves beyond its intended function it is already affected by c-transforms and its shift to the archaeological record is a cultural one (Schiffer 1987:7). An artifact keeps within the systematic context, and once the initial period of use is over it enters what is known as the reuse process. One of the most basic forms of reuse is *lateral cycling* or the transfer of an object from one individual or social unit to another, but this process is not easily identified in the archaeological record. Another form is *recycling*, the process of an artifact reentering the manufacturing process as a raw material. This is a common reuse process that is easily identifiable in the archaeological record. This process can occur simply as a means of maintenance, where the object retains its appearance, but may experience a change in function. Evidence of the process will be visible on the artifact itself regardless of the purpose. Objects can change their primary function without significant modification in the process known as *secondary use*. This change in function without modification may not show clear evidence of its primary use depending on the evidence left on the artifact. The final mode of reuse is the *conservatory process* where an artifact's use and function are changed simply to preserve the object in the systematic context. Often, these artifacts exist as a part of a collection that is rarely deposited together (Schiffer 1987:28-35).

Due to the significantly high cost of watercraft, they can experience any, or all, of the reuse processes before they are deposited in the archaeological record. Richards' (2008:54-55, 118) research on the site formation of abandoned ships found that understanding these pre-deposition c-transforms is important to understanding the *use-life* of a vessel, or the period the vessel is in good enough condition to be useful. These transforms may leave *signatures*, or evidence of the process occurrence, in the archaeological record. This reflects changes in behavioral, technological, or even economic conditions of those associated with the vessel and could therefore influence the discard process. Richards (2008:118-120) charts the timeline of vessels through two use phases, *primary use,* and *secondary use*. The primary phase is the time of a vessel's use-life when its uses and intended function are the same. When a vessel's function changes from its intended purpose, through any of the means of reuse, it enters its secondary phase (Richards 2008:118-120).

The process of changing the form of a vessel, known as *conversion*, is often a means of curation behavior to prevent the vessel from being discarded. Changes to propulsion and hull are two of the most common types of modifications seen during the transition. When propulsion is changed from one type to another, it is known as a *retrofit*, which is often a sign of new technology replacing older ones. Retrofitting can occur in one of three ways, the most complicated being *technological substitution*, the transition from one form of motive power to another, often with a significant reconstruction of the vessel. When an additional or different technology is added to the vessel, it undergoes *technical augmentation*. Finally, *technological reduction* is the removal of a type of propulsion. This is often the least expensive and simplest of the three. In addition to changes in propulsion, vessels can have their hulls modified in both dimensions and material (Richards 2008:121-124). Often, modifications extended the use-life of a vessel by approximately ten years on average (Richards 2008:127). These changes create visible signatures in the archaeological record (Richards 2008:144). Eventually, the cost of maintenance will be too high to bear, and the vessel will become abandoned (Richards 2008:137).

Before abandonment, a site, or in this case a vessel, may undergo the first of three stages of salvage, the reclamation of artifacts from abandoned sites for reuse (Schiffer 1987:100; Richards 2008:155). This first stage of salvage is known as *primary salvage* and is defined by pre-depositional salvaging of the vessel.

l. During this process the hull and expensive materials can be removed for later use, leaving the vessel in a state that it can remain afloat and be transferred to its place of abandonment (Richards 2008:155-156). This may follow systematic salvaging patterns by involving professional salvors with substantial time, workforce, and technology to dismantle the vessels. Some of the factors that determine the amount of primary salvage that may occur include proximity of available equipment, personnel, time available, economic cost, social cost, and benefits of the recovered material. While time is a factor to determine the extent of primary salvage, if an abundance of time is available, the process can last for years before the vessel is finally abandoned (Gibbs and Duncan 2016:191-192). Eventually, these activities will cease leading to the vessel becoming deposited into the archaeological record.

Depositional Processes

As Schiffer (1987:3-4) described, the archaeological record is composed of objects that have been discarded as they no longer serve a purpose, and these objects become artifacts and features. This is the *depositional process* or the moment when they shift from the systematic context to the archaeological context. The depositional process of a single deposit containing multiple artifacts can occur as a single event, or multiple events (Schiffer 1987:266). Schiffer separated artifacts found in deposits into two categories: *primary refuse* and *secondary refuse*. Primary refuse are artifacts discarded at their place of use, while secondary refuse denotes artifacts that have been deposited away from their place of use, even if it is adjacent to that original location. Even so, Schiffer expressed that this does not need to be a literal interpretation, as deposition at the site of refurbishing and manufacturing would be primary refuse (Schiffer 1987:58-59).

As Chapters 5 and 6 will show, the type of depositional process that the Sea Scout Wreck underwent was one of *abandonment*. This is one of the many paths for an object to shift from a systematic context to an archaeological context. Abandonment is the process where an entire area, settlement, or structure undergoes the depositional process. Schiffer proposes two types of modes of abandonment: *normal occurrence*, where a pattern of abandonment is present, and *unanticipated catastrophe*, where an event triggers the need to abandon a site (Schiffer 1987:89). The type of abandonment can be determined by examining the context of the *de facto refuse*, or cultural materials still usable but left behind during the abandonment process. The amount of de facto refuse is affected by the cultural process of *curation behavior*, or the act of moving usable artifacts from the abandoned site to be used elsewhere (Schiffer 1987:89-91).

Several situational factors influence the amount of de facto refuse left at an abandonment site, including:

> … rate of abandonment (rapid and unplanned versus slow and planned), means of available transport, season of abandonment, distance to the next settlement, principal activities in the next settlement, size of emigrating population, and whether or not return is anticipated (Schiffer 1987:90-91)

The characteristics of an artifact can influence if they are subjected to curation behavior as well. Such characteristics include "artifact size and weight, replacement cost, remnant use-life, and function(s)" (Schiffer 1987:91). While he admits that further research is needed, Schiffer suggests that the probable variables that determine the amount of de facto refuse are the rate of abandonment, means of transportation, or if the site will be returned to. In sites where abandonment was rapid and unplanned, an abundance of de facto refuse may be present, while little is present in slow, *planned abandonment*. In the latter example, de facto refuse is often found in small amounts in areas that are abandoned early in the process but found in higher amounts in areas that were abandoned last (Schiffer 1987:91).

The cause of abandonment is another factor in the amount of de facto refuse found at the site. The extreme form of unplanned and rapid abandonment is *catastrophic abandonment*, which can produce a nearly complete inventory of artifacts used at the site since few materials are carried away. While the term catastrophic abandonment may imply a natural event, Schiffer (1987:92) suggests that conflict may also be considered under this category. *Ritual abandonment* may produce a large amount of de facto refuse depending on the cultural practices (Schiffer

1987:92). Planned abandonment, which has a lower amount of de facto refuse, can be divided into two subcategories that define how de facto refuse is located at a site. The first subcategory is *planned abandonment with intention to return to the site*. In this case, de facto refuse is often stored away in specific locations, known as abandonment caches, where the artifacts can be easily found if the site was returned. The second subcategory is *planned abandonment without intention to return*. When this happens, artifacts are left in common storage areas or their place of use (Schiffer 1987:92). Additionally, *curate behavior*, the removal of objects that maintain a use-life, may occur during or after the time of abandonment. Schiffer (1987:94) has identified that sites that are either close to the newly inhabited site, or along common trade routes, experience delayed or sporadic curation behavior.

When a substantial assemblage de facto refuse is found at a site, it may appear to be a *systematic inventory* or all objects are expected to be associated with a site; however, the previously mentioned factors all play a role in the depletion of a systematic inventory. Additionally, other factors such as lateral cycling and *draw-downs,* or the failure to replace an object that has reached the end of its use-life, also contribute to its depletion. In situations of planned abandonment, lateral cycling occurs when those leaving the site may give over artifacts that would have been deposited as de facto refuse to those that are staying behind to leave later. Schiffer identifies four possibilities that can be expected of draw down factors when abandonment is not sudden but expected to occur. The first is the discarding of worn or broken items without replacement, as they may be intended as a reserve or can be replaced with the remaining inventory. Second, if replacements were wanted, they may not be available. The third is the decreasing amount of manufacturing activities as the population declines. Finally, dwindling populations cause a breakdown of inequality in society, leading to the diminishing number of artifacts of social, economic, or idealistic importance. Together, lateral cycling and draw-downs reduce the potential for artifacts to be discarded as de facto refuse. The final evidence that Schiffer describes is the decreased standards of maintenance at a site during the abandonment process, in which occupants discard refuse in previously unused locations. This then becomes known as abandonment stage refuse (Schiffer 1987:97-98).

Muckelroy points out that in the marine environment, one must consider the impact to the site caused by environmental factors, like Schiffer's n-transforms; however, he only considers buoyancy as both an extraction filter and a scrambling device that affects which artifacts are deposited at the site and their context within the site (Muckelroy 1987:275, 278). This creates an immediate reduction of the de facto refuse and the systematic inventory as the artifacts are moved away from the site. While many maritime archaeologists have revisited and modified Muckelroy's model since its introduction, most focus on additional post-depositional processes rather than the shipwrecking event.

Richards defines three types of ship abandonment, two of which go beyond those presented in the Muckelroy model. The first type is *catastrophic abandonment*, or the abandonment of a vessel to protect lives. The second type is *consequential abandonment,* which is the destruction of the ship in a deliberate act of the owner or crew to save lives or property. This often occurs by scuttling the ship or running it aground. The final type, and the focus of his research, is *deliberate abandonment*, when the abandonment of a ship is planned out without threat to life or property, like Schiffer's definition of planned abandonment. The exception is when the vessel is en route to its place of abandonment and an accident occurs, causing it to sink before reaching the intended destination. Additionally, deliberate abandonment occurs over time, which further complicates understanding the point of abandonment. The exact moment in time for abandonment can be difficult to determine, as discarded vessels may be reused or refloated after their abandonment (Richard 2008:8-11).

Richards identified many patterns and themes when reviewing the archaeological research of deliberately abandoned vessels. He identifies three types of sites found in the archaeological record: "isolated ship finds, discarded and recycled disarticulated vessel components, and accumulations of watercraft known popularly as ships' graveyards" (Richards 2008:19). These finds fall into three themes: *ritualistic discard*, *use as terrestrial structures*, and *formation of ship graveyards*. The ship graveyards are a high concentration of deliberately discarded watercraft in a defined area, such as the one located within Mallows Bay. Often these watercraft are abandoned at these locations because these areas have few other uses, and the vessels are no longer effective for their intended use. These sites are easily identified by close vessel proximity and the dilapidated state of the watercraft of the site (Richards 2008:19-27). Richards identified the causes of deliberate abandonment as being linked to either conflict, technological and mercantile obsolescence, the high economic cost of maintenance, or any combination of these factors at once (Richards 2008:32).

Unlike most artifacts, watercraft can be subjected to an extended discard process as they move from the systematic context to the archaeological context. These processes have a direct relationship to the spaces in which they occur. In the case of discarded craft, they can exist in primary refuse sites such as shipbreaking yards; however, if these ships are discarded elsewhere, they become secondary refuse sites like ship graveyards. More frequently, ships are abandoned without going through a shipbreaking yard, although they still experience initial curate behavior through the removal of useful objects during the abandonment process. This reduces the de facto refuse initially deposited at an abandoned watercraft site, which is further reduced by post-depositional processes (Richards 2008:55-58).

Post-Depositional Processes

Once an artifact has entered the archaeological context, it can be affected by a variety of formation processes that alter it (Schiffer 1987:7). Watercraft that are found on or near shorelines, experience the combined effect of n-transforms found in terrestrial and maritime environments. This manifests an extensive list of n-transforms that act on the watercraft that can enhance or inhibit each other when found in combination. Additionally, the proximity to land allows easier access to these sites by people, adding a variety of c-transforms, some of which are like those seen during pre-deposition.

N-Transforms

In his introduction, Schiffer describes "Noncultural formation processes are simply any and all events and processes of the natural environment that impinge upon artifacts and archaeological deposits" (Schiffer 1987:7). He states that these processes are always acting upon an artifact, even before it is deposited. It is these processes that ultimately define how artifacts in archaeological context decay or are preserved (Schiffer 1987:7). Schiffer (1987:147, 150) divides the types of n-transforms into three categories: *chemical agents*, *physical agents*, and *biological agents*, but notes that it is important to remember that an agent can occupy more than one category. Chemical agents are those that cause chemical reactions to artifacts that change their characteristics. Schiffer described physical agents as processes that mechanically alter an artifact without an organic component. Biological agents are the effects on artifacts directly caused by nonhuman organisms (Schiffer 1987:148-149). As composite vessels such as the Sea Scout Wreck are made up of wood and metal, it is important to look at how these agents impact both material types.

Chemical Agents

Essentially wood is made up of cellulose (approximately 50% of weight), hemicellulose (approximately 25% of weight), and lignin (approximately 25% of weight). Permeating the wood and making up a small percentage by weight are compounds known as extractives which are specific to the species of tree the wood comes from. Extractives are important in the chemical deterioration of wood as they help define a wood's resistance to water permeation, as well as shrinking and expansion; however, extractives are withdrawn from the wood when submerged in water, weakening its resistance to decay all types of agents. As extractives are found more abundantly in heartwood than sapwood, and differ from species to species, understanding the species of wood, as well as the section of a tree the wood comes from, can inform the archaeologist about the resistances to expect from wooden remains found in the archaeological record (Schiffer 1987:165). When in sunlight, ultraviolet light will make more extractives soluble in water. Additionally, the photochemical reaction between ultraviolet light and lignin causes the lignin to break down. This combination of missing lignin and extractives produces a silver-grey appearance in the wood (Schiffer 1987:179). Additionally, the cellulose of the wood undergoes a chemical breakdown process known as hydrolysis when in the presence of water, causing the structure to weaken (Schiffer 1987:167).

Chemical agents are the primary means of degradation of metals in a process known as corrosion. The corrosion process occurs because most metals are culturally modified to be chemically different from their natural state, bringing them out of equilibrium with their environment. In the corrosion process, this modified metal will react to ions present in its environment to reach equilibrium again. This process produces corrosion products often seen as chemical compounds, such as rust or patina. This process requires a medium, or solution, that contains the necessary ions for the metal to interact with to cause the corrosion process. This medium is often water, however, it is the dissolved materials in the water that cause corrosion, not the water itself. This means that the type of water has different effects on metal for a variety of reasons. One such example are the acids found in rainwater that have ions that can trigger this process, while the salt in seawater will participate in this ion exchange (Schiffer 1987:190). Dissolved oxygen is another agent of corrosion, which is found in higher levels in freshwater than in saltwater. Temperature increases will decrease the amount of dissolved oxygen found in the water, therefore reducing the corrosion rates caused by the presence of dissolved oxygen (MacLeod 2016:93, 95); however, there is a direct relationship between the increase of temperature and corrosion rates. Temperature also plays a role in the presence of marine life on metal objects. Increased corrosion also occurs with increased humidity. Finally, the presence of other metals will affect preservation as the nobler metal will leech from the baser metal, leaving the baser metal in a more deteriorated state than the nobler metal (Schiffer 1987:192-193; MacLeod 2016:95).

Physical Agents

Regardless of the material and environmental context, wind and water are the primary physical agents that affect artifacts. This is largely due to their effect on the movement of sediments at the site. In sites with flowing water, sediments can be either deposited or removed from a site depending on several geologic, geographic, and cultural factors (Schiffer 1987:200-203). If the deposition of sediments on a shipwreck is fast enough, it can create a barrier to the physical processes that are affecting the site, while influencing the chemical and biological processes. Partial burial by sediments will leave part of the wreck exposed to these processes, as well as cause deformation. This process can be identified if the sediment encompasses the exposed part of the wreck later. At nearshore sites, waves are the dominant means of transporting sediments and artifacts if they are light enough. The artifacts can become a part of the sediment load and are moved around, or away from, a site (Ford et al. 2016:19-20).

Wave energy can keep finer sediments suspended, allowing heavier artifacts to sink below the suspended sediment, burying it when sediment is finally deposited on the site. Events, such as storms that create high energy waves, can cause artifacts to become buried deeper in the site, as the waves can transport more sediments, as well as increasing erosion of nearby landmass adding more sediment to the site (Schiffer 1987:233; Ford et al. 2016:20-21). Rivers, streams, and creeks have their own, independent sediment load that is determined by environmental factors, such as precipitation, temperature, and proximate geology (Ford et al. 2016:22). Streams that feed into lakes and bays deposit most of their sediment load at the mouth due to the decreased energy of the flow. If left undisturbed, these periodic deposits can build layers, creating unique stratigraphy for that stream (Schiffer 1987:247). Finally, scour can cause movement on a site as sediment is eroded down current from a shipwreck due to Bernoulli's principle, or the increase in velocity of a fluid when it passes through a narrow path (Ford et al 2016:22). The evidence of scouring has been tested and proven to follow a clear pattern based on the orientation of the shipwreck relative to the direction of the flow of water caused by tidal currents and waves (Quinn et al. 2016:74-83). The combination of the vessel's orientation and the substrate it resides upon are major factors in the amount of deterioration caused by wave action (Riley 1988:195).

As a physical agent, water saturates wood upon contact and is measured in relation to the wood's dry weight. During saturation, wood expands as it is saturated and shrinks as it dries. When the amount of saturation is equal to the wood's dry weight, it has reached the state known as the fiber saturation point. Exposure to fully saturated air causes wood to become approximately 30% saturated depending on the species; however, when fully submerged the wood goes beyond its fiber saturation point, which causes it to swell and become weak (Schiffer 1987:167). When in an environment where the wood is constantly transitioning between being wet and dry, it forms cracks, particularly in areas that are in two different states (such as where wet wood meets dry wood). During this process, water penetrates the surface layers of the wood and then travels through cracks, where it is absorbed by cell walls. This causes the wood to expand across the grain instead of with the grain leading to further stresses. The process is evident in the wood when the grain rises, cracks and checks form, and planks of wood become warped (Schiffer 1987:179).

<u>Biological Agents</u>

When discussing the biological agents of wood, the presence of water, or lack thereof, is the most important component to consider because it dictates the vulnerability of the wood to biological processes. Bacteria that aid in the decay of dead wood requires it to be at its fiber saturation point or higher due to the bacteria's need for free water, which makes wood found in marine environments more susceptible to bacterial attacks; however, there appears to be no correlation between the amount of water available and speed of decay caused by these bacterial attacks. This bacterial attack will cause permanent mechanical weathering (Schiffer 1987:167-169). Wood in seawater first needs to undergo biocolonization by bacteria before other microorganisms can attach themselves to it. The bacteria will deteriorate the material it grows on through the production of extracellular enzymes (Gregory 2016:116). Tunneling bacteria may be present on the wood when it is waterlogged and in the presence of dissolved oxygen. Tunneling bacteria deteriorate the wood in a very slow process by degrading the lignin and middle lamella of cell walls, followed by the layers of the secondary walls. This process produces a slime byproduct that can be seen under a microscope (Gregory 2016:124). Bacteria is the only biological agent that can deteriorate wood in anoxic environments, usually caused by the wood being buried in sediment. This occurs by a change in the chemical used during the oxidation reduction of organic material. The type of chemical present during the process determines the speed of reduction (Gregory 2016:120-121). Rather than tunneling bacteria, waterlogged wood in anoxic environments suffers from deterioration by erosion bacteria. Unlike tunneling bacteria, erosion bacteria will only degrade the cellulose in the cell wall, leaving behind modified lignin that can be seen under a microscope (Gregory 2016:125).

Another major threat to wood degradation is fungal attack, which occurs when the wood is waterlogged. Key factors in the type of fungi present are the amount of free oxygen, free water, and wood saturation level (Schiffer 1987:170; Gregory 2016:123-124). When this attack occurs, the fungi release enzymes that break down the cellulose of the wood into molecules of glucose that the fungi then absorb (Schiffer 1987:167). Additionally, fungi require dark spaces and moderate to warm temperatures to develop, meaning they will not be present in areas with extensive sunlight, or in temperatures below freezing (Schiffer 1987:169). Unlike bacteria, the amount of water present does correlate with the speed at which fungal attacks occur, and humid and temperate environments see a faster decay rate than dry and hot environments. An additional difference between the two is that fungal attacks can destroy the wood that they are attached to and will weaken the structure of the wood before they are noticeable. This can even occur in microenvironments that are favorable for fungi growth that exists in macroenvironments that prevent their growth (Schiffer 1987:170-173). Waterlogged wood in a *suboxic* environment, where oxygen is present at very low levels, will be attacked by fungi that cause soft rot, which can be identified by cavities found in the cell wall. This is often a contributing factor for the softening of other timber that has been buried and exposed to or had previously been exposed to, water (Gregory 2016:123-124).

Finally, wood is highly susceptible to insect and animal intrusions that can weaken or completely disintegrate it. In the temperate areas of North America, a variety of insects, mostly termites, and beetles, will attack dead wood when it is available. While wood in a marine environment is typically not ideal for attack by these types of insects, wood above the waterline may still be vulnerable to their destruction. In the case of termites, this is seen in the hollow caverns created by the colony using wood as a source of nutrients. For beetles, a visible flight hole will be connected to a series of smaller tunnels created by the beetle during its larval stage (Schiffer 1987:173-177). In the marine environment, wood is extremely vulnerable to two categories of animals: “marine borers” and “wharf borers” (Schiffer 1987:177). Marine wood-boring molluscs, commonly known as shipworms, are found throughout the world and are incredibly proficient at destroying wood (Schiffer 1987:177; Gregory 2016:116). Once shipworms have settled onto a piece of wood, they often burrow into it during when in their larval state. Only on rare occasions will they bore along the surface. This process leaves a less than one-millimeter hole on the surface of the wood, but the shipworm can bore from a few millimeters up to a meter in the piece of wood they inhabit. These molluscs will only inhabit the same piece of wood for their whole life cycle and will not move to other pieces of wood. Marine wood-boring crustaceans, such as the gribble, will burrow into the surface of the wood, and will then swim or crawl to other adjacent pieces of wood. This leaves the surface of the wood heavily degraded and can make surface features of these artifacts difficult to interpret (Gregory 2016:116-120). Additionally, terrestrial animals that can reach the site may move artifacts within the site, or remove them entirely, such as birds gathering materials to build nests (Schiffer 1987:209).

Metal does not suffer from biological agents in the same way that wood does. Instead, the degradation process is caused by the byproducts of organisms, often bacteria. As previously mentioned, temperature affects the presence of marine life growing on metal objects. As temperature rises, so does the presence of marine organisms which has an effect like increased electrical resistance, helping preservation. Additionally, organisms that encapsulate metallic artifacts effectively create a barrier between the metal and the corrosive dissolved materials of the solution the artifact is in. The growth rate of marine organisms on iron artifacts is substantially higher due to the presence of free iron which is used for energy. In anaerobic conditions, bacteria will get their energy from sulfate ions causing the production of sulfides that will cause the deterioration of nearby metals. When bacteria are trapped between encrusting organisms and iron artifacts, they will produce phosphines that will increase the growth rate of concretion on the artifact (Macleod 2016:95-96, 99-100).

C-Transforms

Once artifacts become part of the archaeological context, they can reenter the systematic context through the *reclamation process*, though the different signatures of reuse *before deposition* and reclamation *after deposition* are difficult to distinguish (Schiffer 1987:99-100). Shipwreck components may go through the reclamation process as scavenging removes materials and artifacts from the site. This is known as *secondary salvage* or *systematic salvage,* which occurs shortly after a vessel is abandoned by the owner of the vessel, authorized agents, or those that participate in the abandonment process (Richards 2008:155; Gibbs and Duncan 2016:191). This process will be systematic in the same way the primary salvage was in the pre-depositional stage, but there may be archaeological signatures around the site that may indicate further salvage. This can include the development of temporary roads or tramways, shore-based equipment such as winches, and even camps or bases for the salvors working on the vessel (Gibbs and Duncan 2016:192). The extent of this salvaging process will depend on the same set of variables that contributed to the primary salvage effort. For vessels with wooden hulls, fire is not an uncommon means to remove the hull to gain access to more valuable components inside, such as metal fasteners or bulkheads (Richards 2008:160-162). Fire can be used to hide evidence of previous salvage efforts and could be indicative of covering up illegal opportunistic salvage (Richards 2008:160-162; Gibbs and Duncan 2016:197). Finally, *tertiary salvage* is long-term salvaging by people not associated with the vessel and probably not authorized to salvage it. This occurs as opportunistic salvage at irregular intervals of time (Richards 2008:156-157). This means the salvage process is not systematic like the other two stages and will show a range of different archaeological signatures. This is often undertaken by local community members that can access the shipwreck. These salvaging efforts will focus on removing artifacts of relevant social or economic value (Richards 2008:155; Gibbs and Duncan 2016:196-197).

Once a vessel is abandoned and salvaged, it may undergo a series of other c-transforms known as *placement assurance*. Placement assurance prevents shipwrecks from drifting from their place of abandonment and becoming navigation hazards (Richards 2008:162-163). There are two categories of placement assurance that are commonly practiced: appropriate *hull treatment* and appropriate *environmental conditions*. Appropriate hull treatment is the process of affecting the hull of a ship to remove the vessel's ability to float. There are several methods to achieve this, including puncturing holes in the ship below the waterline using hammers, chisels, drills, or explosives, filling the hull with material that will serve as an excessive ballast to sink the vessel, and/or using piling in or around the hull to prevent it from moving out of place. Grounding a vessel is another common method of abandonment placement assurance, and this is when consideration for an appropriate abandonment environmental condition is needed. Two environmental conditions are important to choosing an appropriate location to beach a vessel: the substrate and tidal conditions. Certain substrates are more favorable for placement assurance than others. Silty substrates allow beached vessels to sink into them, preventing movement. Sand is not a very good material for securing a vessel, but it allows salvors better access to the vessel to reduce it beyond a floatable state. Rocky substrates break up the vessel, causing the least amount of recoverable materials. The tidal conditions of a site are just as important to environmental conditions when beaching a vessel. The decreased weight of a reduced vessel can be picked up by a tidal force and moved into navigable waters. Additionally, if a vessel is not beached high enough, it will be pulled out of the substrate by the high tide, making it important to beach the vessel at high tide to get it as high up the shore as possible. This is achieved by either beaching the vessel at a high speed, beaching perpendicular to the shore for larger vessels, or parallel to shore for smaller watercraft. When vessels in the archaeological record show this pattern of placement assurance, it can be a clear sign that their abandonment was intentional (Richards 2008:166-177). As shown in Chapter One, Mallows Bay has an established history of many of the post-depositional patterns described here.

Conclusion

When discussing near-shore vessels, like the Sea Scout Wreck, it is important to understand the site formation processes that affect them. As a watercraft goes through its use-life following construction, it is constantly being acted upon by cultural (c-) and noncultural (n-) transforms through pre-depositional, depositional, and post-depositional processes. By deciphering the signatures associated with these phases, it is possible to develop a model of abandoned wrecks from their construction to their present conditions. It is important to understand that there are a variety of reasons that evidence of these transforms may not be present for observation. Of primary concern for this consideration is that some processes can cover other processes, one example is rapidly destructive processes, such as fire. All of this informs the archaeologist on the methods needed for such a study, as well as the archaeological signatures they need to be aware of while conducting investigations.

CHAPTER THREE: METHODOLOGY

To understand the archaeological site formation processes that impact the material remains of an archaeological site, it is important to collect a variety of data. The data collected covers everything about the history of the archaeological site, the history of the artifacts and features of the site, and the current conditions of the site and its contents. All of this is essential as the archaeologist needs to be able to differentiate the types of transformative processes, the results of which they observe, as well as establish a timeline for when those transforms occurred. This chapter discusses the process of historical and archaeological research conducted to gather data used to analyze the Sea Scout Wreck. Historical research was then used to create four 3D models, including a 104’ ARB (1942), a Post-War ARB (1945), an Alexandria 104’ ARB (1976), and Sea Scout Wreck (1997). The archaeological data were used to verify the Sea Scout Wreck as a 104’ ARV and to create the last two models: Sea Scout Wreck (2021), and Sea Scout Wreck (Future). Additionally, the 3D models were supported by a photogrammetric model of the Sea Scout Wreck created from archaeological data collected during fieldwork in May 2021. Each of these represents key moments of the site formation processes that resulted at the Sea Scout Wreck site.

Historical Research

The first stage of this research was to collect contemporary and historical resources regarding the Sea Scout Wreck to identify the vessel type and history of the vessel. As a primary component of site formation theory related to watercraft relates to their usage (Richards

2008:118), the focus of the historical research was to locate and acquire information regarding the construction and use of the primary vessel type candidate. From this dataset, a 3D model was constructed to help identify the vessel and provide insight into how formation processes affected it.

Of all the potential candidates, which will be discussed in Chapter 5, one vessel type that quickly gained a substantial amount of circumstantial evidence supporting it was the United States Army Air Force Aircraft Rescue Boat, which was confirmed through archaeological fieldwork. Due to these factors, the ARB was chosen as the primary candidate vessel type for historical investigation. The process of archival research focused on acquiring ship builders' plans, design documents, construction documents, information regarding the usage of ARBs, and information about the Sea Scout Wreck. Design documents were essential in creating the 3D model of an ARB that would be used to model the results of site formation processes. Information regarding the Sea Scout Wreck established a timeline for when these processes occurred, as well as revealed transforms that may no longer leave an archaeological signature due to the wreck's disintegrated state.

Archival Research of ARBs and Sea Scout

During the preliminary stage of this research, Dr. Susan Langley provided photographs from the MHT archives of the Sea Scout Wreck she had taken in 1997. This helped in developing an early list of potential vessel types that matched the appearance of the Sea Scout Wreck. To find more information on the Sea Scout Wreck, both the Charles County Historical Society and Charles County Archaeological Society were contacted. Carol Cowherd of the

Charles County Chapter of the Archaeological society of Maryland (Carol Cowherd 2020, elec. comms.) directed the questions to Susan Langley, who was already aware of this research, and to utilize Donald Shomette's book *Ghost Fleet of Mallows Bay* (1996). There has not been a response from the Charles County Historical Society. To find further circumstantial evidence that could help expand the list of potential vessel types, online sources regarding the shipwrecks of Mallows Bay were examined. Many of the websites repeated Shomette's statement that the Sea Scout Wreck was a former PT-boat; for example, an ESRI story map claimed that the vessel was a US Coast Guard Cutter (U.S.C.G.C.) vessel named *Chester* (ESRI n.d.). Online comments on a website called *Sometimes Interesting* stated that the Sea Scout Wreck was a vessel known as *Morris Springer* (Sometimes Interesting 2013). Further searching for a vessel of this name found a comment on the website for AVR Society that suggested *Morris Springer* was a 104' ARB (AVR Society 2020). This supported one of the early candidates already on the list. Finally, the list of candidates was checked against measurements of the wreck site taken on Google Earth (Google Earth 2020) to determine a candidate of best fit, which was the 104' ARB.

To develop the history of the 104' ARB several organizations and museums with repositories that potentially had information relating to the construction of ARBs were contacted to locate information about these vessels. A focus for this search was design documents and ship construction plans that could be used to create a 3D model of a 104' ARB. Expecting to find information regarding the use of ARBs in either the U.S. Army, U.S. Army Air Force (U.S.A.A.F.), U.S. Air Force, U.S. Navy, or U.S. Coast Guard (U.S.C.G.), the National WWII Museum, U.S. Naval History and Heritage Command, U.S. Air Force National Museum, U.S. Army Aviation Museum, U.S. Army Transportation Corp Museum, and U.S. Coast Guard Historian's Office were contacted. Apart from the U.S. Army Aviation Museum, all of these museums responded by directing ARB research to the National Archives and Records Administration (NARA) (Archangelo DiFante 2021, elec. comms.; Mathew Fraas 2021, elec. comms.; Mark Mollan 2021, elec. comms.; Mike Reagan 2021, elec. comms.). The U.S. Army Aviation Museum has yet to respond to email requests for information. Before the responses from these museums, NARA was contacted for information regarding ARBs. The boxes that held ARB materials do not have finding aids, so requests were submitted by requesting digital copies of 104' ARBs found in the boxes that contain them. This amounted to information from seven boxes being requested from the Textual Reference Archives II Branch (NAI: 3033354, 4687431, 6006093, 6066148, 6066152, 6935423, 40570155), four boxes from the Still Picture Reference Branch (NAI: 672323, 176312238, 203267492, 2093907832), and two boxes from the Cartographic Branch (NAI: 3033354, 203262624). The response from NARA was that the files in the requested box had not yet been digitized and that the research room was closed to the public due to the Coronavirus Pandemic, therefore they could not share the documents (Amy Edwards 2020, elec. comms.; Russell Hill 2020, elec. comms; Holly Reed 2020, elec. comms.). This request was resubmitted the following year (2021), and the Still Picture Reference Branch and Cartographic Branch reported that they were closed (Andrew Knight 2021, elec. comms., Holly Reed 2021, elec. comms.). Textual Reference Archives II Branch responded stating they were processing the order, but in December 2021 had to shut down due to a rise in COVID-19 cases while attempting to fulfill the request (Paul Cogan 2021, elec. comms.). Once that number of cases subsided, the order was reprocessed but is expected to be delivered between April to June 2022 (Paul Cogan 2022, elec. comms.). Secondary sources consulted regarding the use of ARBs and other similar vessels in other military branches included books by Robert Scheina (1982, 1990), Maurer Maurer (1983), David Grover (1987), Norman Friedman (1987), Michael

E. Haas (1997), James T. Flynn (2012, 2014) and James D. Gray and Phil G. Garn (2019). Websites containing material about ARBs, or the Sea Scout Wreck, reviewed included AVR Society, Chesapeake Conservancy, Sometimes Interesting, U.S. Crash Boats, U.S. Navy Beach Jumper Association, and an ESRI Story Map (Sometimes Interesting 2013; AVR Society 2016; U.S. Navy Beach Jumper Association 2016; Chesapeake Conservancy 2020; U.S. Crash Boats 2020a; ESRI n.d.).

The U.S. Crash Boats website contained some low-resolution digitized documents from NARA and the Haggin Museum in Stockton, CA which holds the repository for Stephen Bros. Boat Building, one of the handful of ARB manufacturers. The Haggin Museum was contacted and were able to send a high-resolution scan of the Outboard Profile and Armaments design document for the 104's ARB (Design 235A) (Figure 3.1). Tod Ruhstaller, Director and Historian at Haggin Museum, stated that beyond that design document they only had notes of the individual vessels built by Stephen Bros. as the other documents were sent back to the U.S.A.A.F. after the war. The Haggin Museum was visited in December 2021 to review their photo archive and available design documents, but all construction photos were from oblique angles, thus making it difficult to accurately take measurements, and no interior photos were available. The design documents available related to changes made to the Design 235C, therefore were not useful in this study. Additionally, the Outer Banks History Center was contacted as it houses information about ship building in the Outer Banks of North Carolina; however, they did not have information about ARBs being built in North Carolina (Samantha Crisp 2020, elec. comms.).

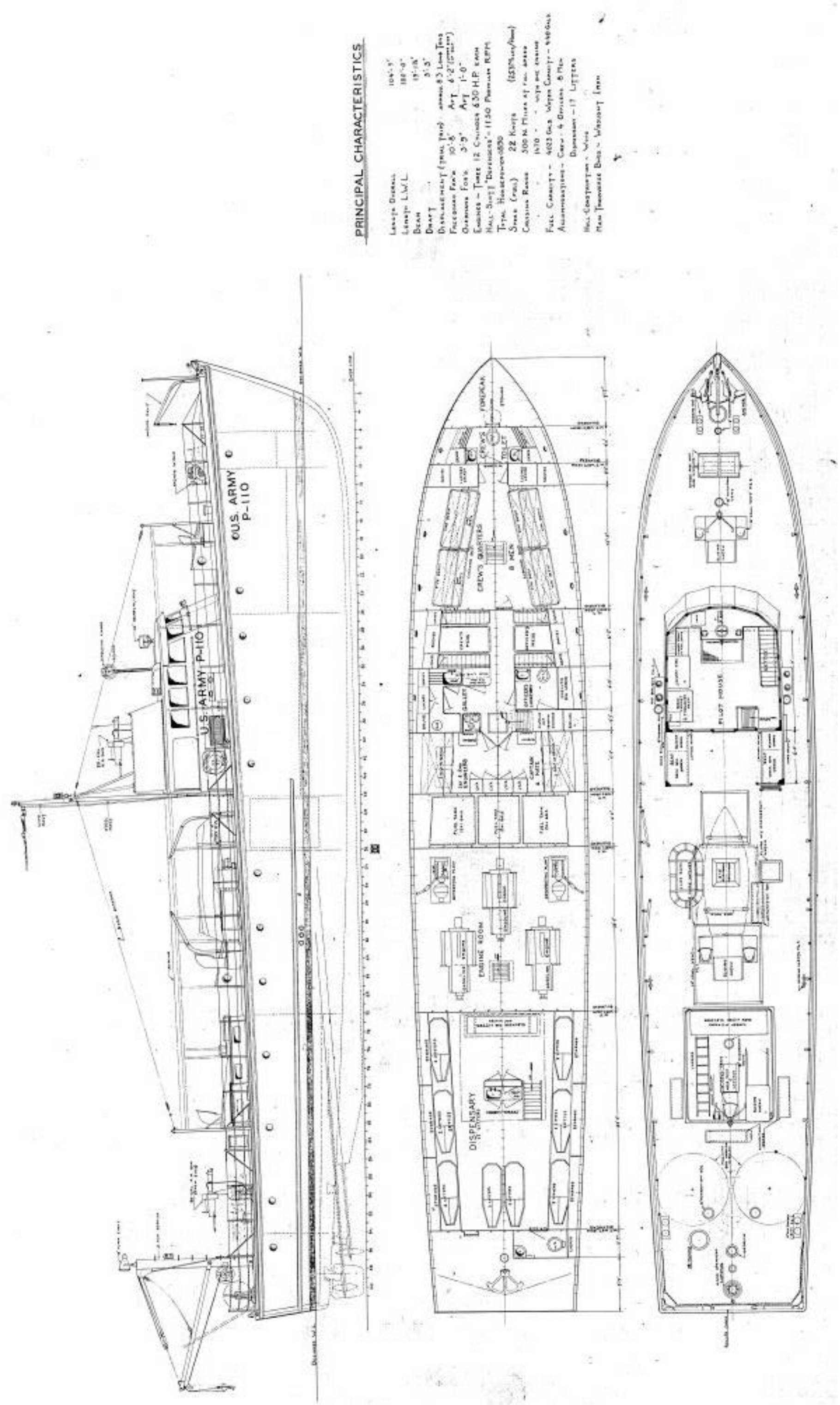

FIGURE 3.1 Outboard Profile of 104' ARB (Design 235A) (Document courtesy of Haggin Museum, 1942).

To help determine the Sea Scout Wreck's identity, a list of all ARBs was created using information available on the Shipbuilding History and U.S. Crash Boats websites, and Donald Grover's book *U.S. Army Ships and Watercraft of World War II* (Grover 1987; Shipbuilding History 2017; U.S. Crash Boats 2020d). These sources provided information about individual ARBs such as the builder, date built, number of engines, and any major events related to the vessel (name changes, sales to foreign nations, and date sunk). This list showed that out of 184 ARBs that were built, only 36 of the Design 235A's have unknown fates (Appendix 1) (Grover 1987:150-151; Shipbuilding History 2017; U.S. Crash Boats 2020). While building this list, a vessel known as P-239 came up as a vessel that sunk in Lake Champlain in 1945 and was later identified by the Lake Champlain Maritime Museum (LCMM) as part of their 1996 Lake Survey. Chris Sabick, Director of Archaeology and Research at LCMM, was contacted to see if any information regarding P-239 was available (Sabick et al. 2000:78-81). He sent the section of the report for that year that included the inboard (Figure 3.2) and outboard profile (Figure 3.3) and cross-section (Figure 3.4) design diagrams of the 235-C design, which was very similar to the original 235A design and could be used for 3D modeling the 104' ARB(Chris Sabick 2020 elec. comms.).

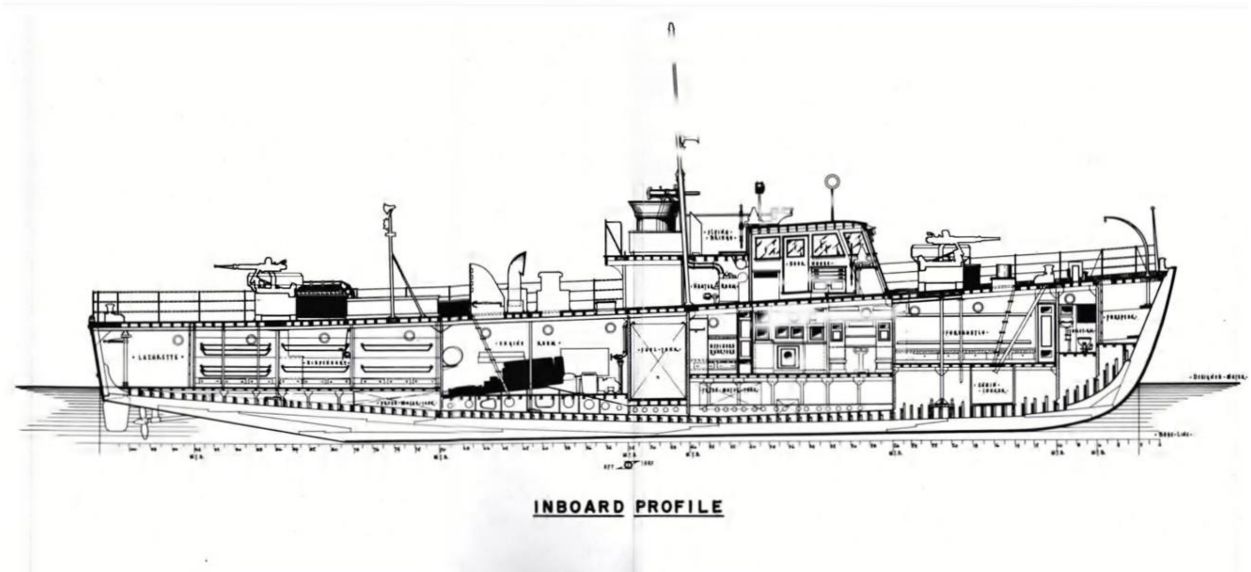

FIGURE 3.2 Inboard Profile of 104' ARB (Design 235-C) (Sabick et al. 2000:79; Document ownership: National Archives).

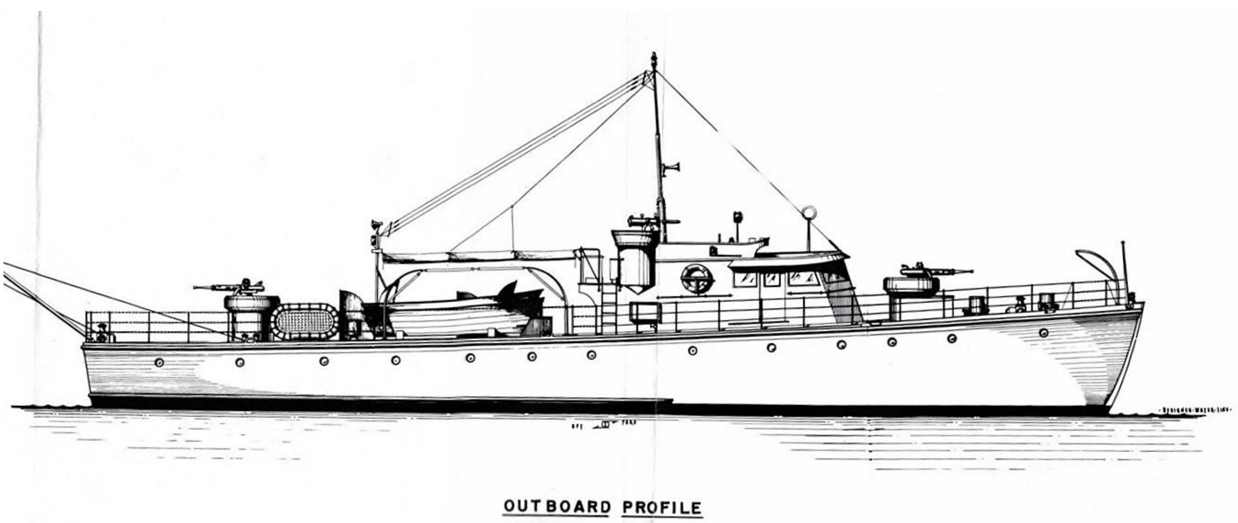

FIGURE 3.3 Outboard Profile of 104' ARB (Design 235-C) (Sabick et al. 2000:79; Document ownership: National Archives).

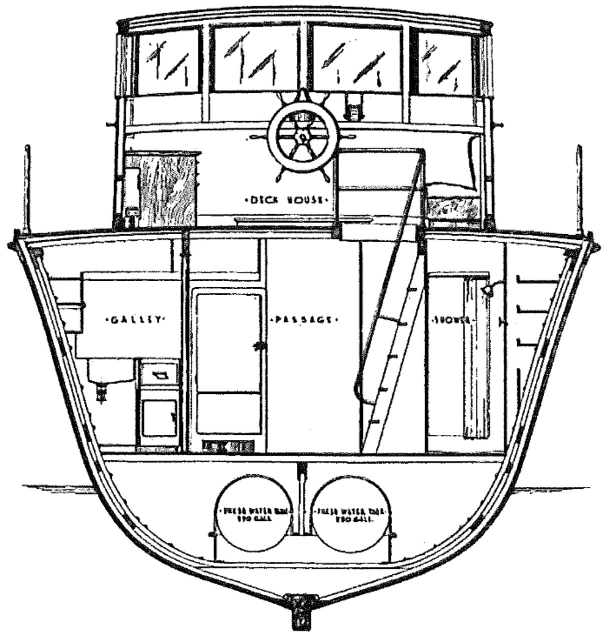

FIGURE 3.4 One cross-section of 104's ARB (Design 235-C) looking forward from the galley (Sabick et al. 2000:80; Document ownership: National Archives).

To gather more information, oral histories about the vessel were provided by Jack Marsett (2020, elec. comms.) and Brian Hodgson (2021, elec. comms.), which indicated that the vessel was known as Naval Cadet Ship (N.C.S.) *Lexington* then renamed N.C.S. *Morris Springer*. Since the 104’ ARB used by the Sea Cadets was reported to have been docked in Alexandria, the Alexandria Archaeology Museum and Alexandria Library were contacted about the local Sea Cadet/Scout organization that operated at the Torpedo Factory between the 1960s and 1970s. The Alexandria Archaeology Museum did not have information about an ARB docked at the torpedo factory, N.C.S. *Lexington*, N.C.S. *Morris Springer*, nor the youth organization that used it (Jennifer Barker 2020, elec. comms.); however, the Alexandria Library was able to locate and scan articles that included mentions of both a Sea Scout and Sea Cadet organization in Alexandria at the same time (The Washington Post 1954:M13), and an obituary for a man named Morris Springer, who helped found the Sea Cadet organization in Alexandria (The Washington Post 1964:B17). Since the Sea Scout group that was in Alexandria, VA was dissolved, then later recreated, there was no one to contact about information regarding vessels that were used. The Sea Cadets organization was contacted to see if they maintained records of vessels used by their organization and responded by stating that they did not own, operate, nor keep records of vessels used by their organization (Chris Collins 2020, elec. comms.). Finally, according to Jack Marsett's history of the vessel, when it sunk at the dock in Alexandria, it was raised by the Naval Diving and Salvage Training Center as part of an exercise. The Naval Diving and Salvage Training Center was contacted to locate any information about its past projects and training exercise. In the response, Michael Reagan stated that following their move to Panama City, Florida in 1980 the Naval Diving and Salvage Training Center archives were transferred to NARA (Michael Reagan 2020, elec. comms.). Copies of this report were included in both requests sent to NARA Textual Reference Archives II Branch.

To determine if the vessel was provided to the organization by the U.S.C.G., the U.S.C.G. Historian's Office was contacted. The U.S. Coast Guard Historian's Office reported that they had no records on ARBs being used in the U.S.C.G. (Mark C. Mollan 2021, elec. comms.). Additionally, Greg Willams' *World War II U.S. Navy Vessels in Private Hands* (2013) was reviewed but could not find sales of ARBs used by the U.S. Navy. To evaluate the oral history and identity of the 104' ARB used by the Sea Cadets of Alexandria, VA, historical aerial photographs of the torpedo factory in Alexandria, VA were examined (U.S.G.S. 2021). These photos revealed that the vessel appeared at the Alexandria Torpedo Factory from November 9, 1959, to March 16, 1977; however, photos in the 1980s did not have enough spatial resolution to identify a vessel. Further research found a digital copy of *Torpedo Factory Art Center* (1976) by Eugene Pandula, a report on the process of making the Torpedo Factory Art Center, in the George A. Smathers Library at the University of Florida (Pandula 1976). The slides at the end of the report include two images that partially include a vessel in the location where the Sea Cadet's 104' ARB is reported to have been docked (Figures 3.5 and 3.6) (Pandula 1976:41, 52). Finally, to verify information about the vessel used by the Sea Cadets volumes of the *Merchant Vessels of the United States* for 1945-1952, 1955-1965, 1968-1979, 1981 were examined by searching the following key terms: Boys Scouts of America, Lexington Division, Morris Springer, Naval Cadet League, N.C.S. (NAME), P-#, Q-#, Ralph Mancill, S.E.S. (NAME), S.S.S. (NAME), Sea Cadets, Sea Explorers, and Sea Scouts, but could not find any information about the vessel in question. Neither physical nor digital copies were available for 1953, 1954, 1966, 1967, and 1980.

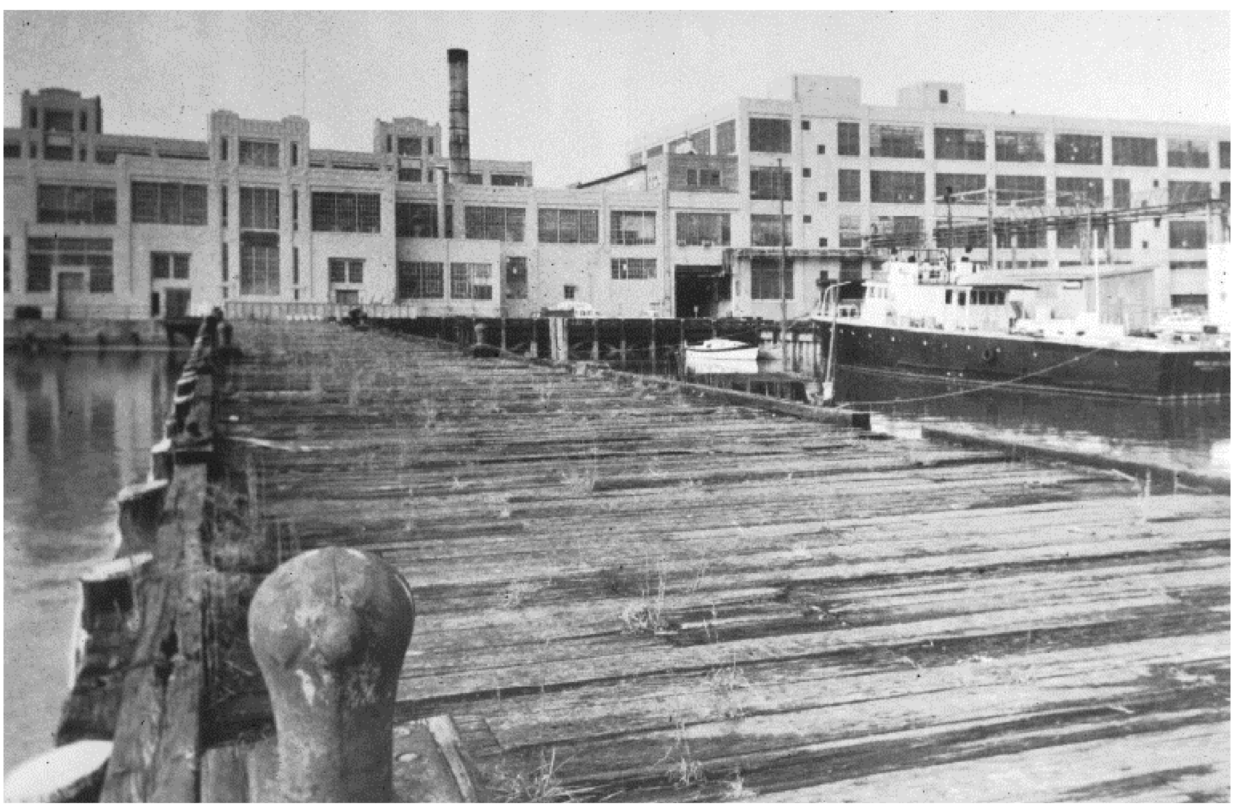

FIGURE 3.5 Photo of a 104' ARB, possibly N.C.S. *Morris Springer*, at the Torpedo Factory Art Center (Pandula 1976:41).

FIGURE 3.6 Photo of a 104’ ARB, possibly N.C.S. *Morris Springer*, at the Torpedo Factory Art Center (Pandula 1976:52).

3D Model Building

Among the primary tools of this research was the creation of 3D models that represent key stages of the site formation processes of the Sea Scout Wreck. This was achieved by using the computer-automated design (CAD) software McNeel’s & Associates Rhinoceros 6 (Rhino 6). The first stage of this process was to import design documents acquired from Haggin Museum and LCMM of the 104’ ARB and begin digitizing them to create the 104’ ARB (1942) model. Traditionally, the ship reconstruction process mirrors the ship construction process; however, as the construction plans could not be located, the reconstruction process used the information available from the design documents to recreate the vessel. In this case, the design documents were imported into Rhino 6, and the ship was digitized, starting with the hull and backbone of the ship. Once the 104’ ARB (1942) model was finished, it was then modified in a separate file to create the Post-War ARB model that represents changes that would have likely occurred when transferred to civilian ownership. The Post-War ARB (1945) model was then used as a template for the Alexandria 104’ ARB model which matches photographs from the Pandula 1976 report to help evaluate it as a potential vessel identity (Pandula 1976:41, 52). Once completed, the Sea Scout Wreck (1997) model was created to represent the site as described by Donald Shomette’s inventory and as seen in the 1997 photographs. From this model, the Sea Scout Wreck (2021) model was made to represent the site as it appears based on the archaeological work conducted in May of 2021. Finally, the Sea Scout Wreck (Future) model was created to represent a hypothetical future site layout of the Sea Scout Wreck once it has completely submerged into the water (see Table 3.1 for a list of models).

TABLE 3.1 Table of models created to represent key stages of Sea Scout Wreck’s formation processes.

Model Name	Model Description
104’ ARB (1942)	Model of a 104’ ARB Design 235A based on the design documents acquired from Haggin Museum and LCMM.
Post-War ARB (1945)	Altered model of the 104’ ARB (1942) model with wartime features, such as weaponry, removed to represent its change from use in the U.S. Army to civilian ownership.
Alexandria 104’ ARB (1976)	A model representing the 104’ ARB seen in the photographs from Pandula’s 1976 report, using the Post-War ARB model as the base.
Sea Scout Wreck (1997)	Alterations were made to the Alexandria 104’ ARB model to match the photographs of the wreck taken in 1997.
Sea Scout Wreck (2021)	A model of the Sea Scout Wreck site based on the archaeological fieldwork conducted in May of 2021.
Sea Scout Wreck (Future)	A model showing a hypothetical future of the Sea Scout Wreck once it becomes nearly completely submerged.

Modeling the ARB

The goal of modeling the 104' ARB was to have a comparative model for the identification of the Sea Scout Wreck, but more importantly to model the formation processes that have occurred by altering the original model to reflect key stages based on the historical and archaeological evidence. The software of choice for 3D modeling was Rhino 6 because of the software's wide availability, versatile features, and access to support materials online. The process occurred in three phases: preparation, interpreting the hull, and building the superstructure and internal features. The modeling process had to be meticulously detailed to have the most accurate comparison model for the archeological investigation; however, as only design documents were acquired, it is important to understand the step-by-step process of making this 3D model.

<u>Preparation</u>

As the software operates in a virtual space, it needs the means to relate virtual space to real-world values. Rhino 6 prompts the user to set this reference when starting a new project by asking the user to define the size of the virtual workspace (small or large) and the units of measure (centimeters, feet & inches, feet (in decimals), inches, meters, and millimeters). The size of the virtual workspace determines the size of a background grid used to help designers work on new objects without additional references. As the 3D modeling process relied on the design plans acquired from the historical research process described above, the size of the workspace was generally irrelevant, but the "large object" option was selected given the size of the ARB. Additionally, as these vessels were designed and built using feet and inches, the "feet & inches (in decimals)" option was selected. The design plans were then imported into the software as a "Background Bitmap", which displays a 2D image in one of the 2D view settings in the software (i.e., Front, Top, Left, Right, etc.). Each bitmap was added one at a time and had to be scaled and aligned to the model each time it was imported into the software. The first bitmap added was the Outboard Profile & Armaments diagram acquired from Haggin Museum. The plan view of the deck of the vessel was used to start the outlining process and create a point of reference for the other bitmaps.

Interpreting the Hull

Traditionally during the reconstruction of a ship using CAD software, the development of the model starts with the vessel's stem, stern, keel, and frames; however, as construction documents that would have provided this information could not be obtained, a different method was needed to reconstruct the vessel. The outline of the ship was created using the *Polyline* tool, which creates a series of lines that connect to vertices created by the user, by tracing the inner edge of the gunwale. Once the outline of the hull was put into place the next step was to create the backbone of the ship: stem, sternpost, keel, and supporting structures such as knees using the polyline tool again. The outline of the hull and the vessel's backbone would help define the horizontal (x, y) and vertical (z) boundaries of the vessel's interior. A complication was encountered as the diagram from Haggin Museum only displayed the sections of the backbone that were external. This was corrected by using the diagrams obtained from Lake Champlain Maritime Museum (LCMM) (Sabick et al. 2000:78-81); however, these diagrams represented a later version of the 104's ARB known as the 235C as opposed to the 235A which the Sea Scout Wreck was identified as. The key difference between the two designs is that the 235-C was upgraded to have two engines that had more horsepower, causing the middle engine to be removed altogether (Grover 1987:150-151). This created a slight variation in the design of the keel (Figure 3.7); however, this was able to be corrected as the changed portion of the keel was on the exterior of the hull, so it was able to be adjusted to accurately reflect the keel of the 235A.

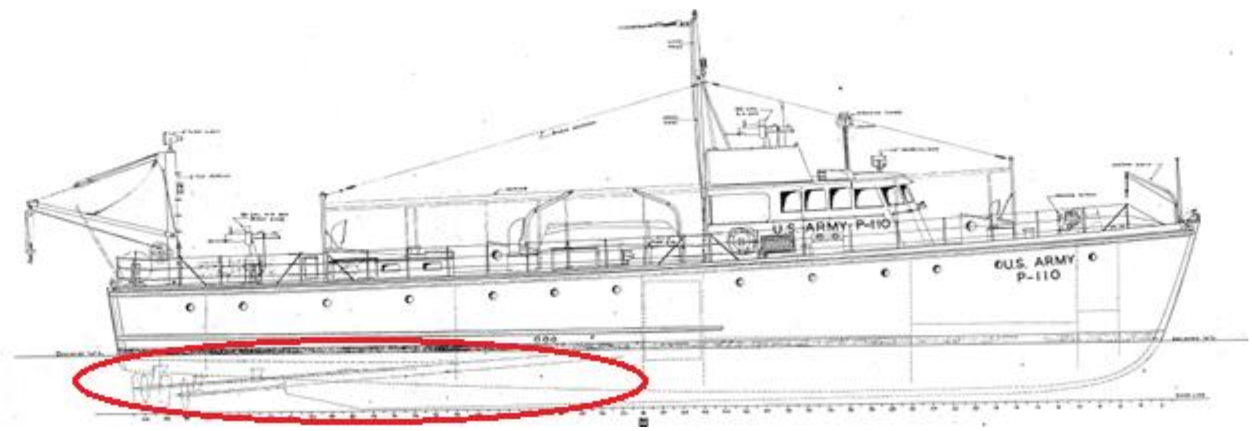

FIGURE 3.7 104' ARB Design 235A with a propeller shaft going through the keel circled in red (Document courtesy of Haggin Museum, 1942).

Three cross-sections of the ARB obtained from LCMM (Sabick et al. 2000:80) were used to define the hull shape, and each one was added to the "Front" view as a background bitmap. During this process, it was discovered that the cross-sections were looking to the fore of the vessel and not the aft as originally believed. Since the purpose of this section was only to trace out the hull which is symmetrical regardless of the position of the viewer (fore or aft), the images were still traced; however, this affected the longitudinal position of each cross-section. As the cross-sections did not have a scale bar to use to adjust the size of the image, the width between the gunwales was used to set the scale of the image. Once each cross-section was in place, they were traced using the *polyline* tool with each feature (hull, frames, stringers, bulkheads, and ceiling planking) getting its sublayer to organize them. The width of the backbone components was added during this step (Figure 3.8).

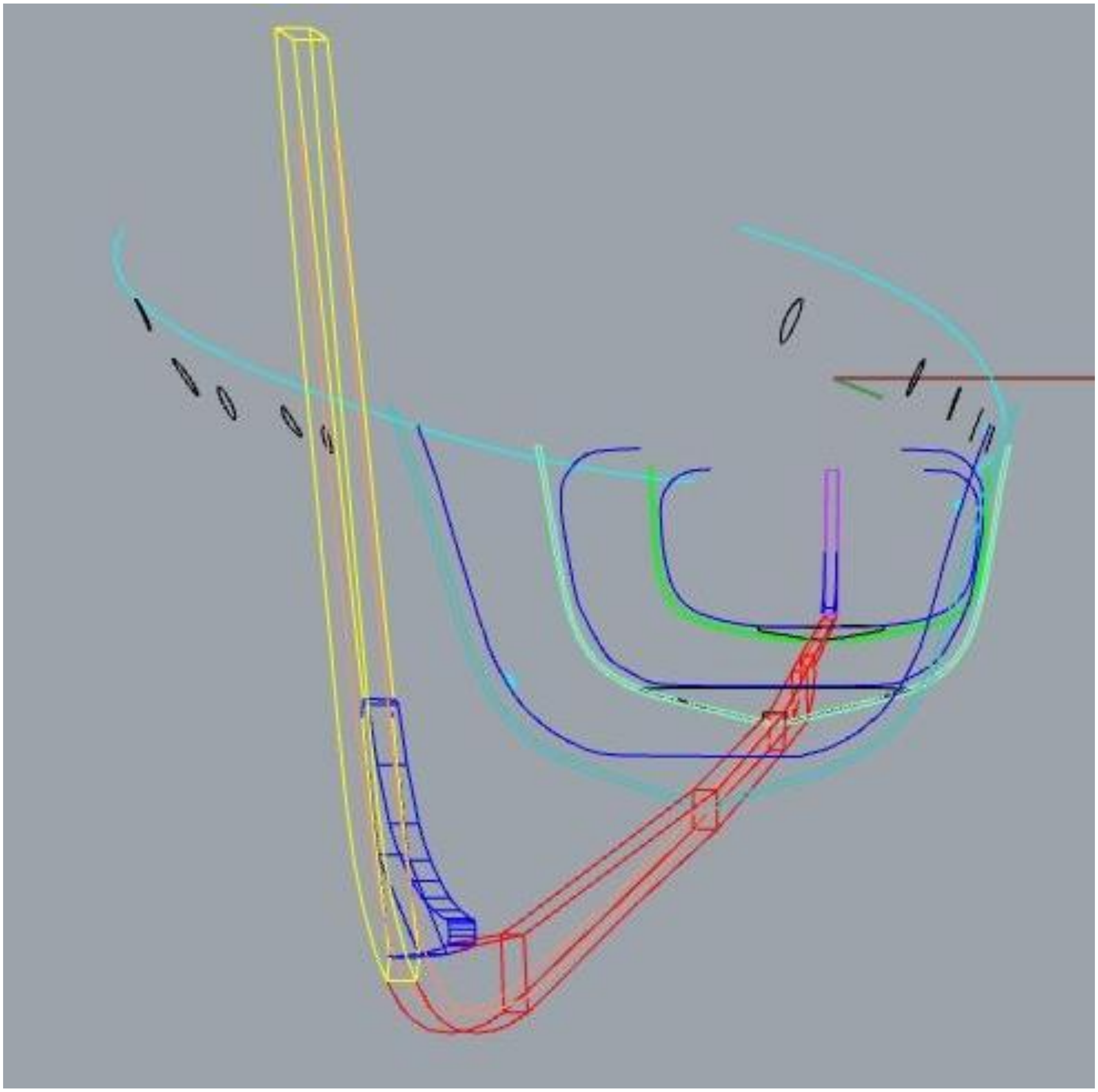

FIGURE 3.8 Early Stages of the 104' ARB 3D Model (isometric view) (Model created by Taylor Picard).

A second issue was encountered after the cross-sections were adjusted for their correct positions, which was that there were no cross-sections forward of amidship. To calculate the slope of the hull in the forward half of the vessel, various features of the vessel's interior were traced to create a series of points that could be used with the *Curve* tool, which creates a fair curve through a series of anchor points. The first feature traced in this process was the portholes because they were cut directly into the hull and were visible from both the internal top view and the external right profile view which was enough to determine their position. Next, were the edges of shelves, drawers, and litters (bunks) that connected to the ceiling planking (as these objects were visible in both the internal top view and internal right profile). The *Curve* tool was used by placing anchors along with different points of these features but maintained a latitudinal constant to prevent any bends in the curve. Once this was completed several times, sections with wide gaps were filled in using the "Between Curves" command, which creates a new curve that is the average difference of the changes between the two curves and is placed halfway between both curves (Figure 3.9). This was also done in the aft section to fill in the spaces between the cross-section to create more reference points for the "Loft" command, used to create a surface between curves, which would create a smoother more accurate hull surface. This process was repeated to create the frames and the ceiling planking. All curves forward of the foremost porthole were created entirely through interpretation of the angle between the stem and the gunwale, and well as using reference images of ARBs. Similarly, the section that makes the aft of the vessel was copied from the aftmost cross-section and adjusted to fit the gunwale outline and the keel.

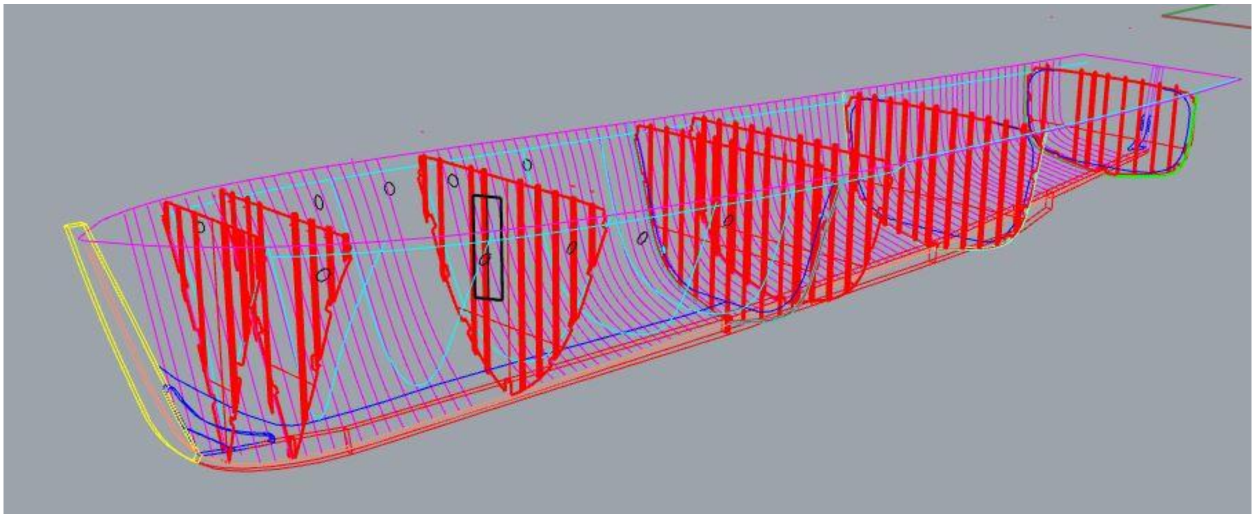

FIGURE 3.9 Interpreted position of frames and bulkheads prior to testing with solids (isometric view) (Model created by Taylor Picard).

Once all the cross-sections and interpreted lines of the hull, frames, and ceiling planking were completed, the next step was to evaluate the position of the line using surfaces. Surfaces in CAD are planes that do not have any thickness but can be produced in a variety of ways to produce a variety of different shapes. To create an approximate shape of the hull, the “Loft” command was used, which creates a surface using a series of curves to define that shape. When using this command, the user must be aware of the issue that the surface will take a direct path from one curve to another, which encourages the use of more curves when attempting a rounded shape such as the hull of a ship. Additionally, the surface is defined by a set of vertices that pass through the input curves, but the number of vertices does not change based on the size difference between curves. Instead, the vertices move closer together, or further apart, which can create a rigid surface and produce issues when creating a solid from the surface. Once the surface is created, it is evaluated by the user to determine if the shape is accurate. If issues such as bumps or divots are found, the curves are adjusted to fix the problem and the surface is deleted and recreated with the adjusted curves. This process continues until no issues are found on the surface of the hull. A similar process is conducted with the frames and ceiling planking, but the frames used a different command known as “Extrude Curve” that creates a surface from a single curve extending in one direction for a distance set by the user. For the frames, the direction was set to go inward towards the centerline of the ship for two inches. This was determined by measuring the distance between hull planking and ceiling planking. The surfaces of the frames were used to help adjust surfaces produced from the curves of the ceiling planking as the frames had a set thickness that defined the place of the ceiling planking. Once the surface for the ceiling planking was produced, the next step involved evaluating the model using solids.

With all surfaces aligned correctly, they were converted into solids using the “Extrude Surface” command that extends a surface in a straight line for a set distance determined by the user. The first surface extruded was the outer hull as that had a known value of 1/2(.5) inches based on the historical research. Since the inner edge of the gunwale was used to trace the hull, this meant that the surface created earlier was the inside edge of the hull, so the surface was extruded outward. Some issues occurred at the bow of the hull as the vertices for the surface moved closer together, which resulted in some minor folding of the hull, largely on the interior side. This process was repeated on the bulkheads of the vessel by extruding them 3/16 (0.1875) inches based on historical research and confirmed by the archaeological work. This led to the adjustment of the position of nearby frames and created additional points for creating a path for the stringers to follow. The frames of the vessel were then extruded towards the hull of the vessel three inches based on measurements taken from the drawing. This allowed the positioning of the ceiling planking to be corrected to remove areas where the two objects intersected each other. Next, a path for each of the stringers was created as a path to make surfaces from them using the “Rail” command. When using the “Rail” command, one curve follows the path of another curve to create a surface, which is an excellent choice when creating objects that had a defined shape when viewing a cross-section of the object (i.e., a rectangle when examining the cross-section of a stringer). Once the surfaces for the stringers were created, the “Cap” command was used to close the ends of the stingers and convert them from a surface to a solid. With the stringer in place, further adjustments to the ceiling planking were made to prevent further intersections between the stringers and the ceiling planking. Once all the ceiling planking curves were adjusted, a new surface was made and extruded 1/4 (.25) inches towards the centerline of the vessel. Some challenges were encountered due to the irregular shape of the keel. The process of making them into solids required a combination of the “Rail” command and making separate polygons to fit the irregular areas. These solids were merged into one object by using the “Join” command to turn the group of surfaces into a solid. The final step of creating and interpreting the hull was to use the “Extrude Curve” command, which works similarly to “Extrude Surface” but used a curve as input, on each of the porthole curves to create a surface that intersected both sides of the hull (Figure 3.10). This surface was used with the “Trim” command to cut out the holes in the hull at the locations of portholes.

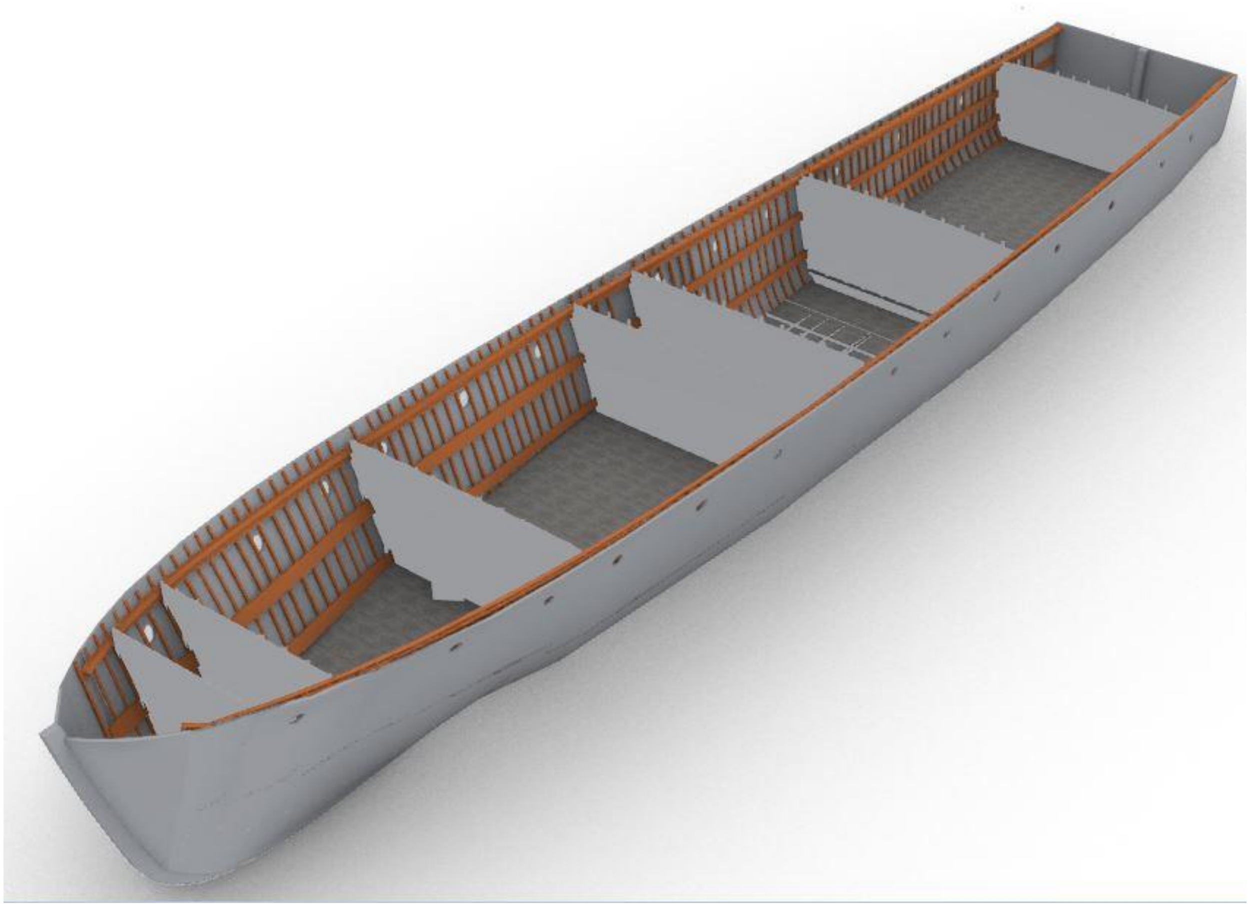

FIGURE 3.10 Interior Structure Components of 104' ARB (isometric view) (Model created by Taylor Picard).

Creating the Internal and External Features

The final step of the model creation process is the fastest of the three as the features do not contribute to the structure of the hull; as such, they must conform to the hull of the vessel, adding the internal and external components of the boat to better understand its use-life as well as identify key artifacts that may be encountered at the site. This process started by creating the floor of the ship, which was a simple process of tracing the diagrams, creating surfaces, and extruding the surfaces into solids using the previously described methods. The priority of this process was to model features that had a high probability of enduring noncultural transforms and would leave evidence of cultural transforms. This included internal features such as gas tanks, engines, engine room pipes, rudder post, ladders, and doorways (Figure 3.11). For the external features, this included features such as the pilothouse, anchor davits, anchor winch, rudders, cleats, and hatches (Figure 3.12).

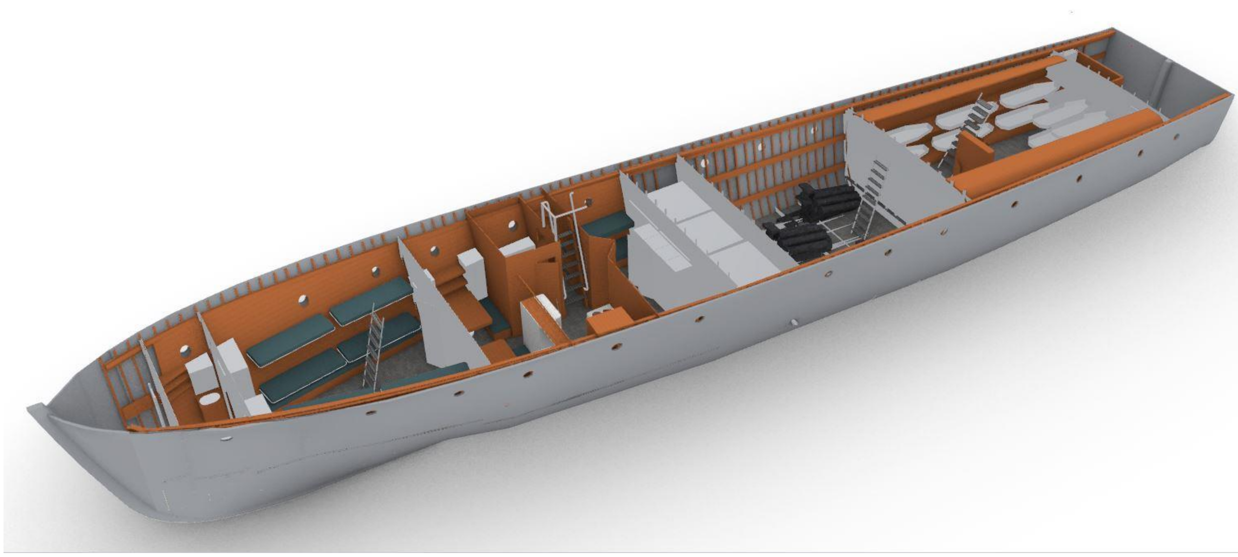

FIGURE 3.11 Interior of 104' ARB (isometric view) (Model created by Taylor Picard).

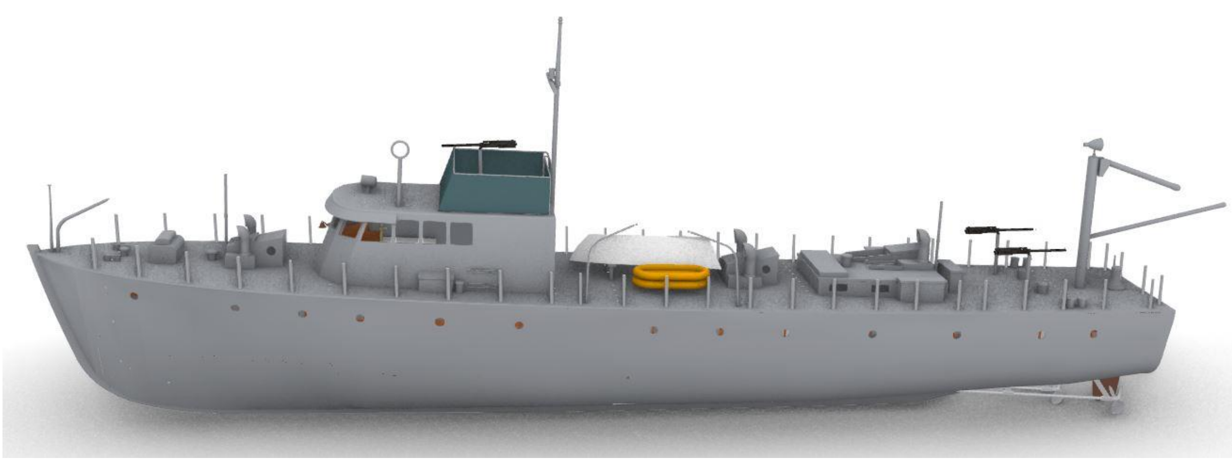

FIGURE 3.12 Exterior of 104' ARB (isometric view) (Model created by Taylor Picard).

Modeling Postwar ARB (1945) and Alexandria 104' ARB (1976)

The modeling process of the Alexandria 104' ARB (1976) relied largely on the images from Pandula's report that only included parts of the vessel (Pandula 1976:41,52). The vessel being a modified 104' ARB made it possible to map out the features that were added to or removed from the original design. The first stage was to modify the vessel to represent post-war use, which for many of the 104' ARBs meant conversion to quick supply boats or being sold to other branches of the military or to the public. This would have involved the removal of weaponry and other critical components that could still be useful to the U.S. Army. This started by removing objects that would have been stripped from the vessel following its postwar use and sale to private citizens (such as the three .50-caliber machines guns). Once these elements were removed, the model was saved as the Postwar ARB (1945) model before removing additional features not found on the Alexandria 104' ARB (Figure 3.13). Using measurements of objects found in both the images as well as the digitized vessel plans, it was possible to calculate a relative scale of the vessel in the photo and use measurements from the photographs to add elements found on the Alexandria 104' ARB. While this allowed the key modification of the vessel, mainly the extension of the pilothouse by approximately 20 feet, the photographs only show the aft section of the vessel (Figure 3.14). This meant that any modifications to the forward sections of the vessel could not be modeled.

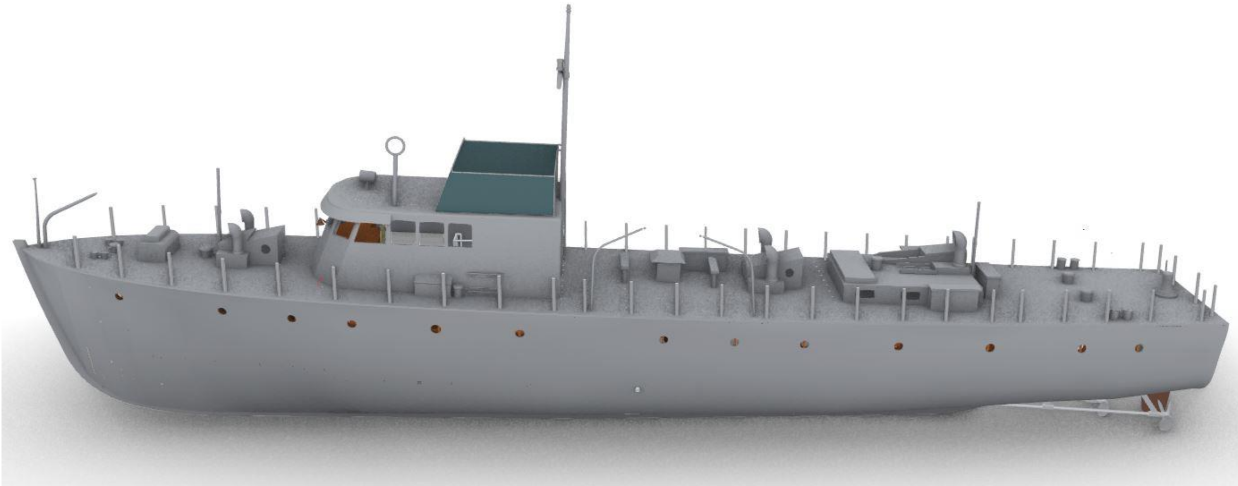

FIGURE 3.13 Postwar ARB (1945) model representing a hypothetical version of a 104' ARB after World War II (isometric view) (Model created by Taylor Picard).

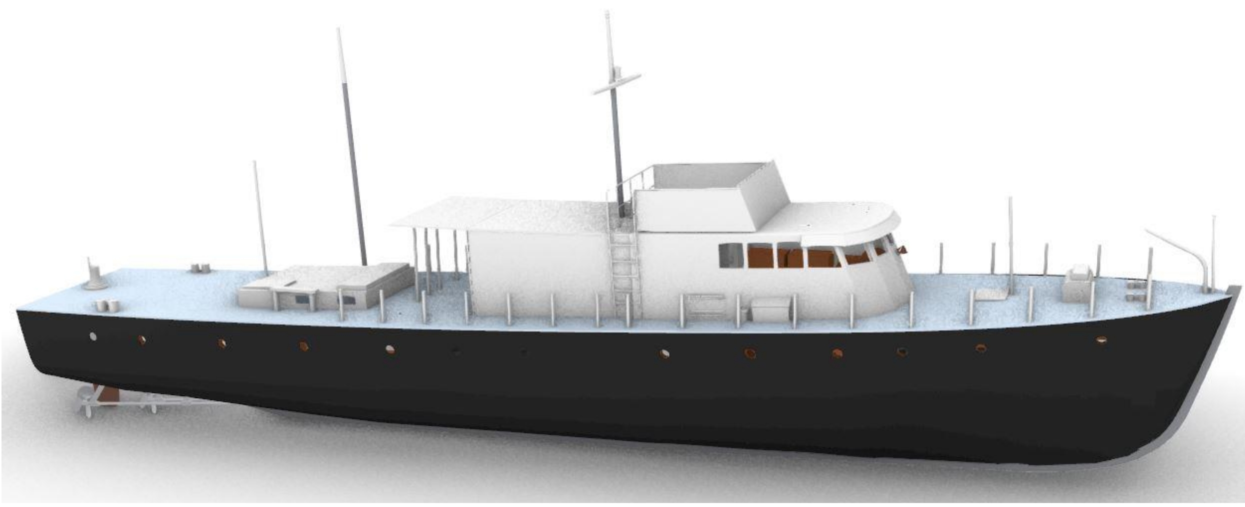

FIGURE 3.14 Alexandria 104' ARB (1976) model representing it vessel seen in photographs from Pandula 1976 (41,52) (isometric view) (Model created by Taylor Picard).

Modeling Previous Archaeological Research

During his inventory of Mallows Bay, Shomette describes the Sea Scout Wreck as mostly intact, resting on its keel mostly above the waterline, the bow bearing at 137^{o} southwest, and the entire vessel listing 45^{o} to starboard. In the notes of his description, the state of the ship is described as "…rapidly disintegrating" (Shomette 1998:426) with the stern in a state of advanced decay. Key characteristics of the vessel, he notes, is that the ship has a single screw propulsion system and a pipe fitting in the engine bore stamped "WPC 1945". Using this description and photographs taken by Dr. Susan Langleya model of the site as it appears in 1997 was derived from the Alexandria 104' ARB (1976) model. The Alexandria 104' ARB (1976) model was chosen as the base model as it contained elements that appear in the photographs from Dr. Langley that neither the original 104' ARB (1942) model nor the Postwar ARB (1945) model contained.

To create this model, the entire Alexandria 104' ARB (1976) model was rotated on its side 45^o to match the angle described by Shomette. This was evaluated by adding a waterline of the approximate depth of the site, which was recorded as approximately 5 feet during the archaeological work in 2021, and comparing the waterline of the model to the waterline in the 1997 photos. Once the entire model was rotated into place, features of the model were moved to match their location in the photos, moved to a hypothetical location if they were not visible, or removed if it was believed that they disintegrated, such as a section of the hull removed using the "Trim" command (Figure 3.15).

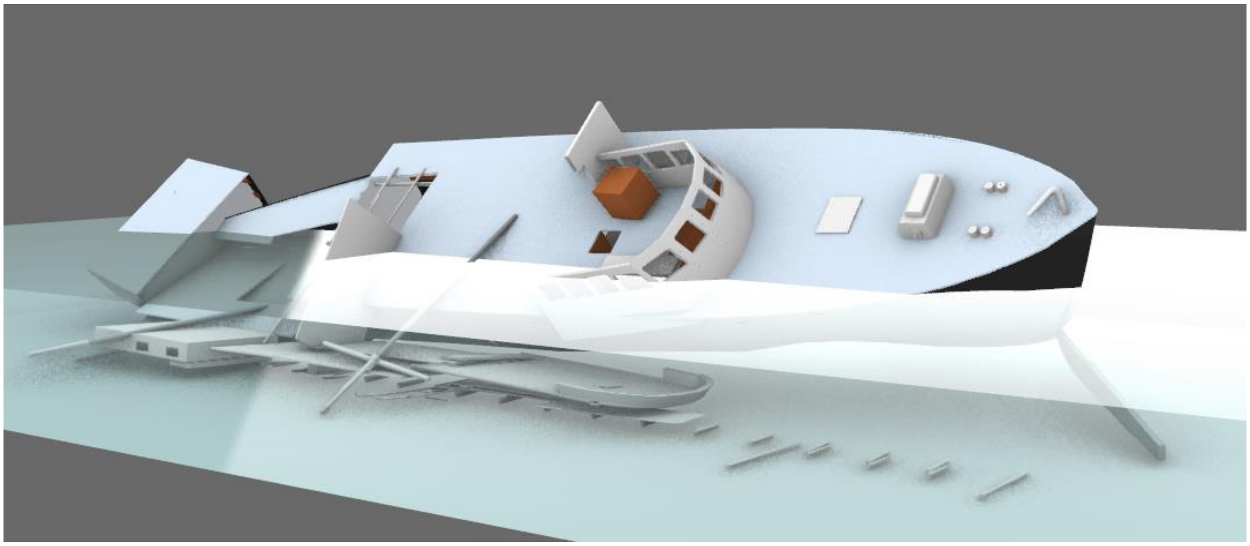

FIGURE 3.15 Sea Scout Wreck (1997) model representing the Sea Scout Wreck based on description by Donald Shomette (1998:426) and photographs provided by Dr. Susan Langley (isometric view) (Model created by Taylor Picard).

Modeling current conditions of Sea Scout

The Sea Scout Wreck (2021) model represents the results of the site formation processes leading to the site's present condition based on the archaeological fieldwork conducted in May 2021 (Figures 3.16 and 3.17). The model of the Sea Scout Wreck based on its condition in 1997 was used as the base model and was modified to capture the changes that were recorded at the site. This saw the removal of all the remaining superstructure components and most of the hull from their positions above the waterline. Individual bulkheads were repositioned to match their current position and orientation of the site. Compared to the Sea Scout Wreck (1997) model, this model benefitted from the measurements taken during the site recording process and was able to capture site conditions than the previous model more accurately. The final positioning of all the site elements was confirmed using the photogrammetric model made of the site by importing the model into Rhino as a .obj file, as well as the site notes.

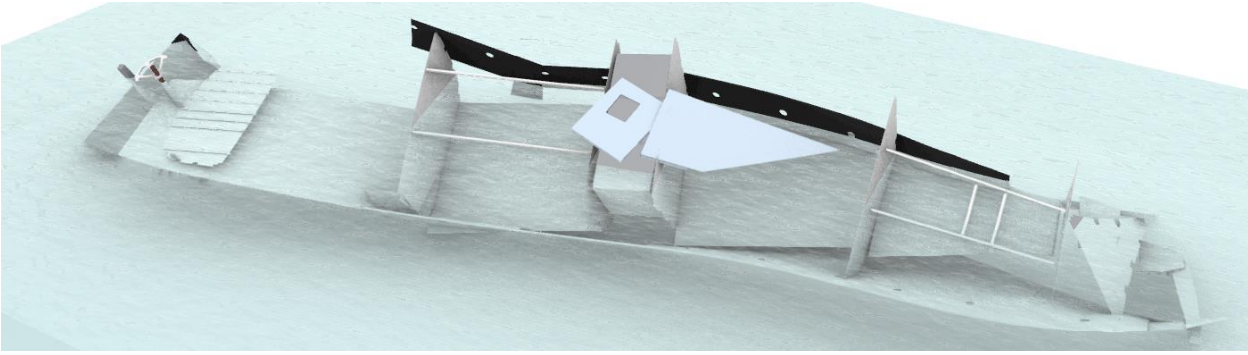

FIGURE 3.16 The Sea Scout Wreck (2021) model showing water level at time of archaeological field work (isometric view) (Model created by Taylor Picard).

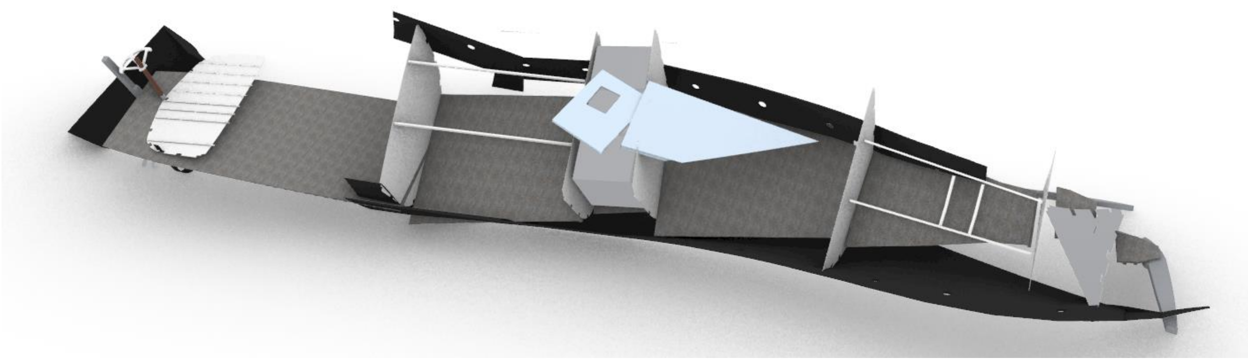

FIGURE 3.17 The Sea Scout Wreck (2021) model without water (isometric view) (Model created by Taylor Picard).

Sea Scout in the Future

Finally, using the analysis discussed in Chapter 6, a model was made by rotating all of the bulkheads in the direction of their hypothesized collapsed once the wooden hull has completely disintegrated and the I-beams holding the bulkheads together have broken away. To do this, the remaining hull sections were deleted to represent their disintegration, and the I-beams were removed to represent that they have broken away from the bulkheads, and have either disintegrated, removed from the site, or buried under the sediment. The bulkheads were then rotated to lay approximately 90° from their position in the Sea Scout Wreck (2021) model to represent a hypothetical position in the future when most of the wreck is submerged. The only features not altered by this process were the bulkheads around the fuel tanks, as it is believed that they will have an extended disintegration process compared to the rest of the site. These alterations resulted in the Sea Scout Wreck (Future) model (Figures 3.18 and 3.19).

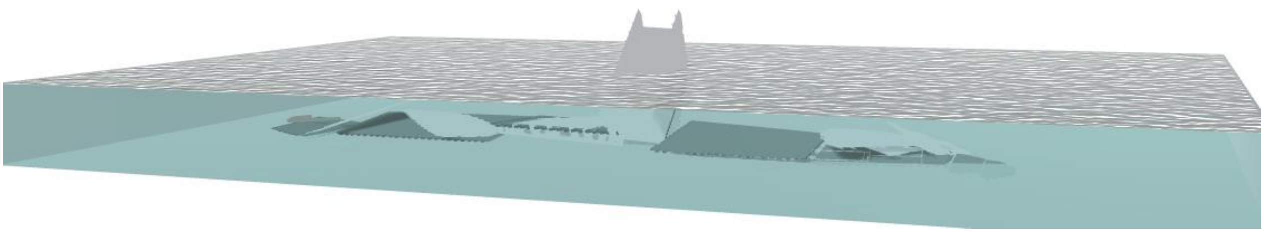

FIGURE 3.18 Sea Scout Wreck (Future) model showing how features may lay out in reference to the water level (isometric view) (Model created by Taylor Picard).

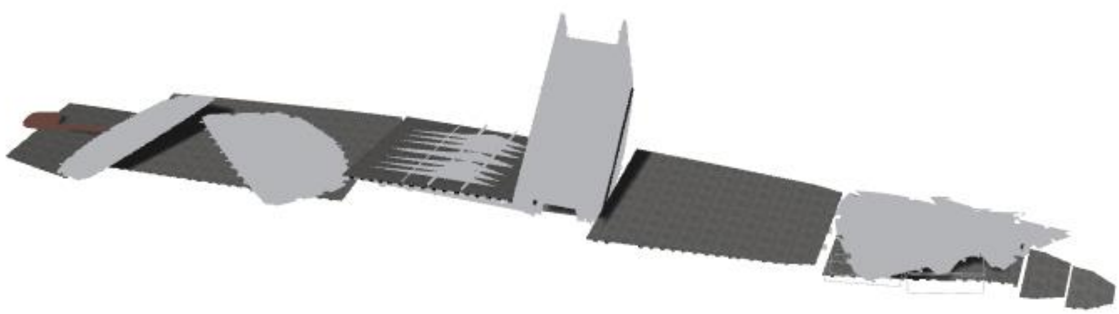

FIGURE 3.19 Sea Scout Wreck (Future) model showing how features may lay out with the water removed (isometric view) (Model created by Taylor Picard).

Archaeological Research

As this research was examining the formation processes of the Sea Scout Wreck, it needed detailed archaeological data of the site. In preparation for the fieldwork, seven proformas were created based on historical research, design documents, and 3D modeling. Each proforma was created to cover specific details of the site and served as an identification key for important features at the Sea Scout Wreck site and to compare them to the key features of the 104’ ARB. These proformas included one that looked at the overall site and compared it to the overall design of a 104’s ARB (Figure 3.20), four that examined specific sections of the wreck to identify individual elements in those sections, a blank one to record additional site features that were not captured in the other proforma, and finally one to record the digital photographs that were taken separately from the video footage. This allowed the team to arrange the workflow based on the conditions of the site. The originally planned date for conducting the archaeological fieldwork on the Sea Scout Wreck was May of 2020; however, the outbreak of the COVID-19 pandemic caused this to be delayed. For any fieldwork to be conducted, permission was acquired from East Carolina University. On May 7 and 8, 2021 an archaeological investigation of the Sea Scout Wreck was conducted under a Maryland permit approved March 25, 2021, that was submitted by Dr. Nathan Richards. During this time, Dr. Nathan Richards, Taylor Picard, and Priscilla Delano used a combination of methods to document the Sea Scout Wreck.

SEA SCOUT WRECK OVERALL SITE FORM					
Name(s):				Date:	
				Times:	
Overall Site Length		Overall Site Width		Debris Field (y/n)	
Number of Bulkheads		Number of Framing Stations		Number of Engines	
Approximate ° of List		Intrusive Elements on Site (y/n; describe below)			
Site Depth at Stem:		Site Depth at Stern		° of orientation (stem to stern)	
Site Description:					
Artifacts Present:					
Abandonment and Salvaging Signatures:	*Description and Location of Signitures*				
Burn Marks					
Explosive Damage					
Gunfire					
Toolmarks					
Modifications					
Cuts					
Environmental Description (Including flora/faunal):					

FIGURE 3.20 Example proforma (overall site) used to document the Sea Scout Wreck in May 2021.

Archaeological Documentation

On May 7, the team examined the entirety of the site to test the hypothesis that the vessel was a 104' ARB, recognize areas with evidence of site formation processes, and identify areas that may be difficult to access when creating the photogrammetric model. The process of examining the site to test the hypothesis involved using a 100-meter tape reel to measure the site's extents as well as distances between the bulkheads. During this process, the team examined the whole of the wreck to find areas of interest that would need further investigation.

On May 8, the team documented the entire site using a GoPro Hero 9 Black, set to linear view, 4k resolution at 30 frames per second, to create a photogrammetric model. Due to the shallow and hazardous nature of the site caused by the sharp rusted metal located throughout the site, the team used a paddleboard with one person sitting or kneeling on the board operating the camera, and the other pushing the board while in the water. This allowed them to circle the site while keeping the camera raised roughly six feet above the waterline and lowered to approximately eight inches above water level (Figure 3.21). Additionally, this allowed access to difficult regions of the site, and the acquisition of smooth continuous footage which is necessary for making a photogrammetric model. Once this was complete, the team systematically documented the site using proformas of predetermined sections defined by the bulkheads. In this process, the team recorded features of the site that were previously unknown, particularly the thickness of bulkheads, hull planking, frames, and girders; however, the focus was to document the angle of the list of the bulkheads and other features of formation processes found at the site using a clinometer. The final step of recording the site was to capture detailed photographs of key site components, which were acquired using a water-resistant digital camera, all of which were logged in the photo log proforma.

FIGURE 3.21 Dr. Nathan Richards (left) and Taylor Picard (right) collecting video footage of the Sea Scout Wreck to use in the creation a photogrammetric model (Photo credit: Priscilla Delano, 2021).

Photogrammetric Model Building

Once the video of the site was collected with the GoPro, it was imported into Agisoft Metashape, the software chosen for producing the photogrammetric model based on its availability and reliable workflow to produce high detailed 3D models. When using video data, the software will grab images at a set interval of frames. As the GoPro was recording at 30 frames per second, the frame interval was set to 30 so that it would use one image for every second of recording. This resulted in 1,563 images being imported into the software, which were then aligned to each other through the “Align Photos” command (Figures 3.22 and 3.23). This aligned 1,592 of the 1,593 images (99.94%), achieving enough alignment to move forward. The next step was to build a depth map, and a dense cloud with a confidence mode turned on (Figures 3.24 and 3.25). This process allowed areas of low confidence to be easily removed using the

"Filter by Confidence" command and setting the range to 0-4 on a scale of 0-255 (Figures 3.26 and 3.27). This left small pieces of water and sky that were captured in the background and added to the model that needed to be removed. Next, the "Build Mesh" command was used to create a 3D mesh of the Sea Scout Wreck using the previously produced dense cloud (Figures 3.28 and 3.29). Once this was completed, the "Build Texture" command was used to provide the final details to the 3D mesh and produce the final 3D photogrammetric model (Figures 3.30, 3.31, and 3.32).

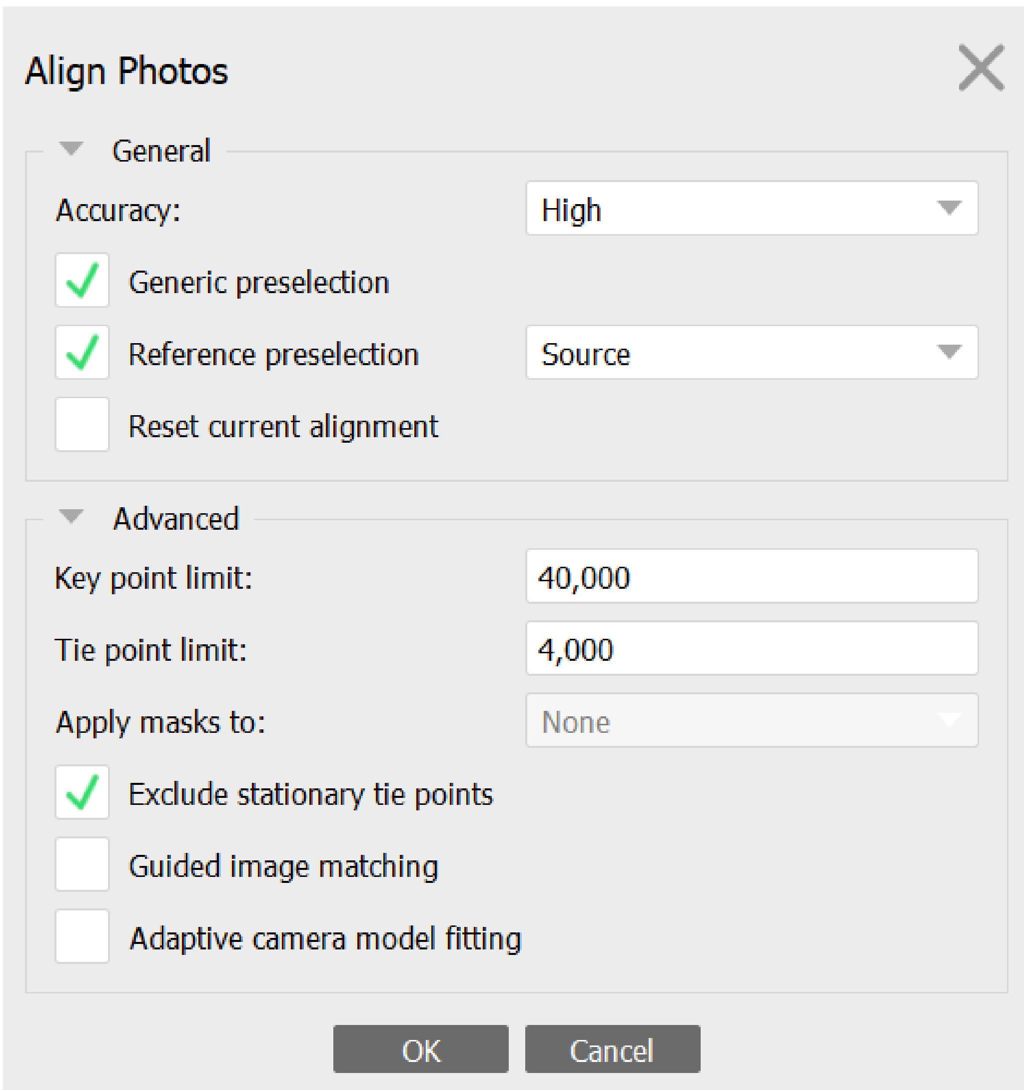

FIGURE 3.22 AgiSoft Metashape setting to align the still images acquired from the GoPro footage of the Sea Scout Wreck (Image by Taylor Picard, 2021).

FIGURE 3.23 The sparse cloud showing the camera tie points for the aligned photos (Image by Taylor Picard, 2021).

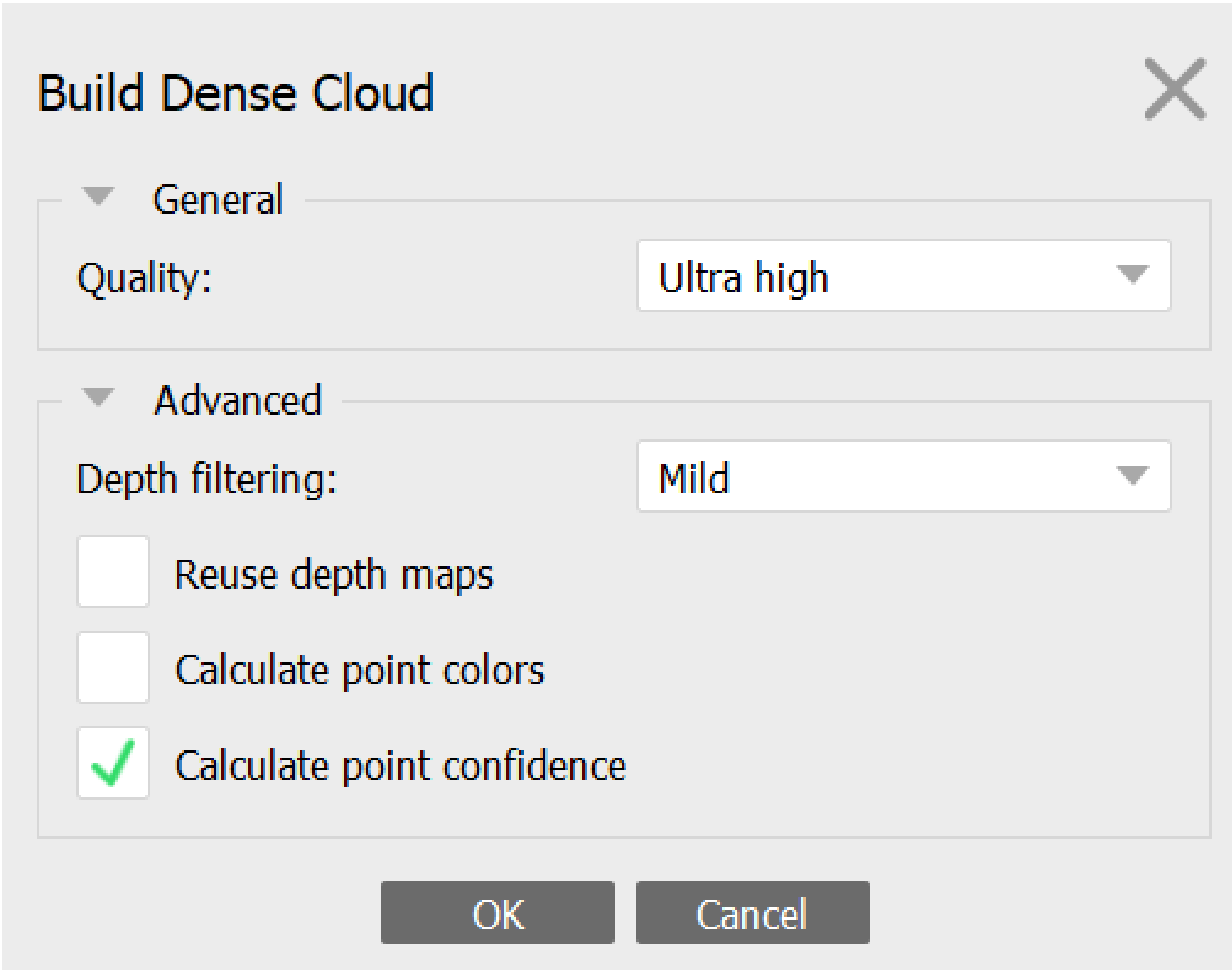

FIGURE 3.24 The settings used for the "Build Dense Cloud" command (Image by Taylor Picard, 2021).

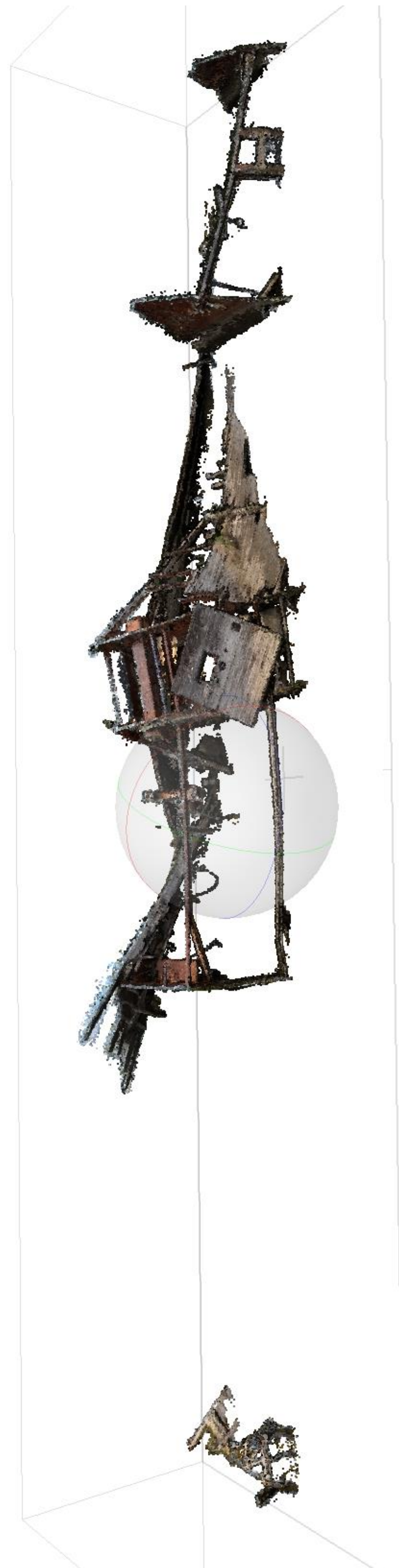

FIGURE 3.25 Dense cloud points created via the "Build Dense Cloud" command using the settings in Figure 4.28 (Image by Taylor Picard, 2021).

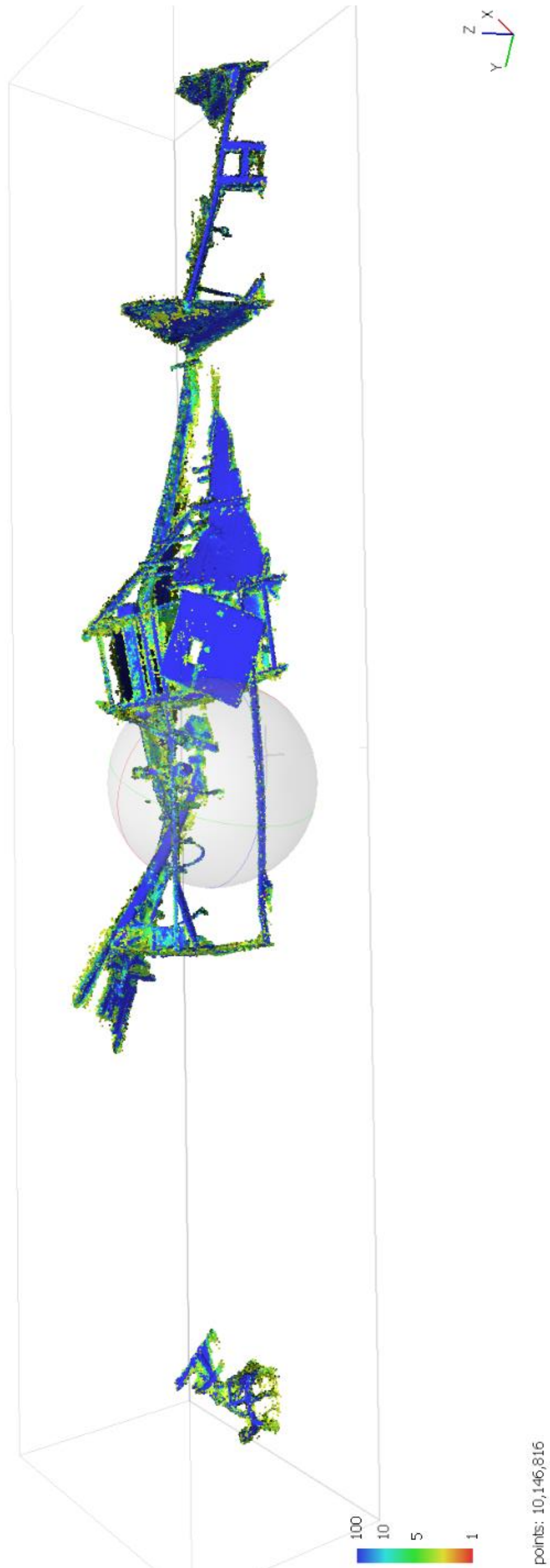

FIGURE 3.26 The dense cloud from Figure 3.25 showing the confidence of each point created using the settings from Figure 4.28 (Image by Taylor Picard, 2021).

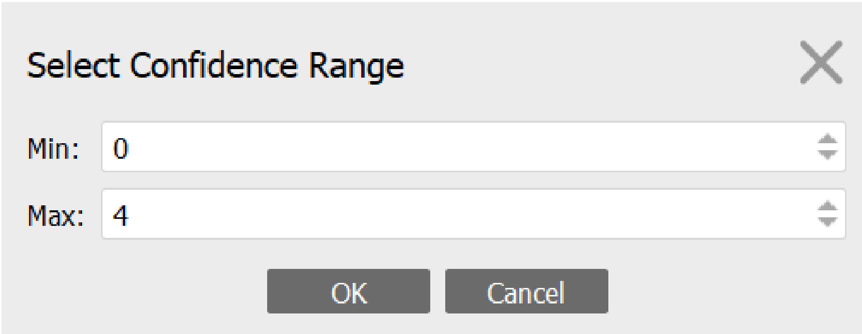

FIGURE 3.27 Settings in the "Filter by Confidence" tool used to eliminate points with low confidence that could create issues when building the mesh (Image by Taylor Picard, 2021).

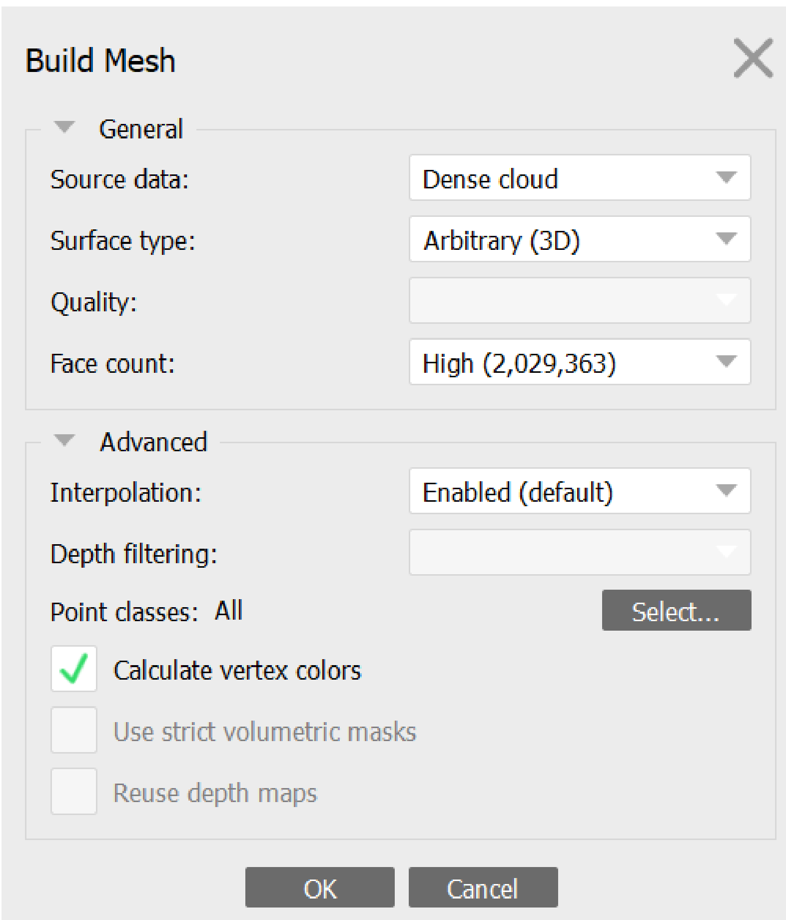

FIGURE 3.28 Settings for the "Build Mesh" command that would create the final model of the Sea Scout Wreck as it was in May 2021 (Image by Taylor Picard, 2021).

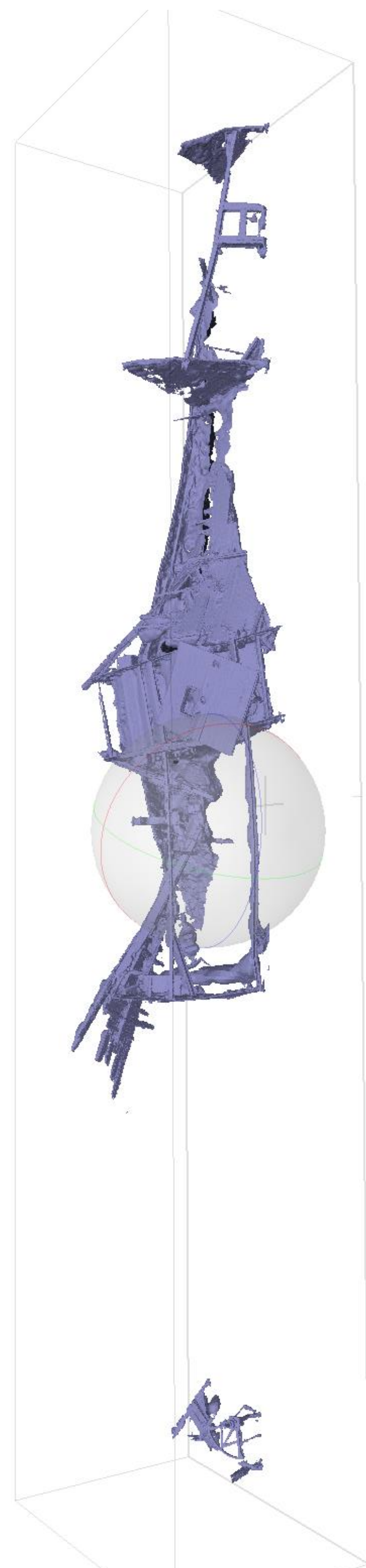

FIGURE 3.29 Final mesh of the Sea Scout Wreck photogrammetric model created by using the above settings (Image by Taylor Picard, 2021).

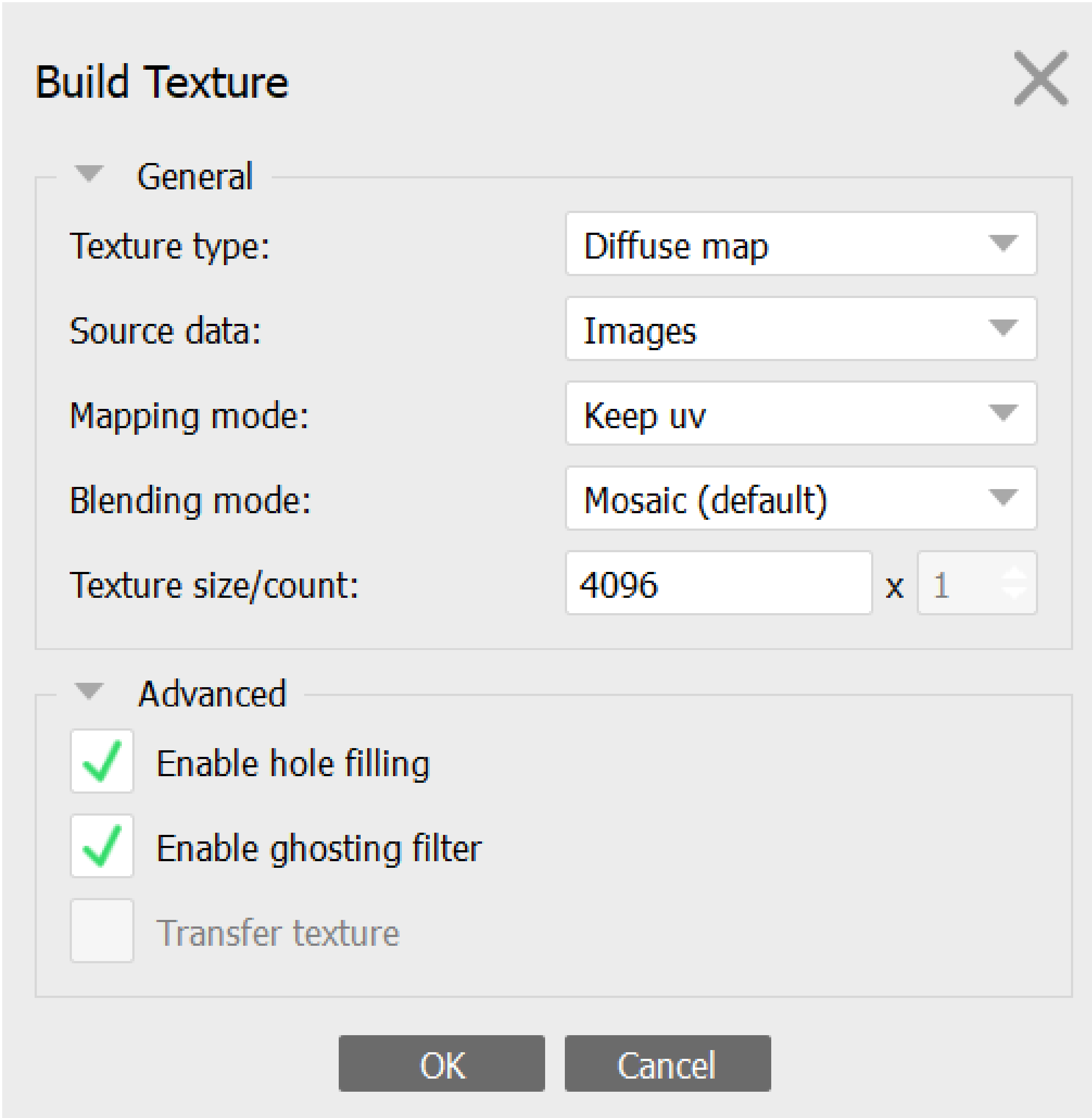

FIGURE 3.30 Settings for the "Build Texture" command that added the color and texture to produce the final model (Image by Taylor Picard, 2021).

FIGURE 3.31 Results of the "Build Texture" command using the settings in Figure 4.34 (Image by Taylor Picard, 2021)

FIGURE 3.32 The final photogrammetric model of the Sea Scout Wreck in May 2021 using the steps and settings described above (Model created by Nathan Richards, 2021; Image by Taylor Picard, 2021).

CHAPTER FOUR: HISTORY OF AIRCRAFT RESCUE BOATS

Sitting alone against the eastern berm of Mallow Bay's Burning Basin in a dilapidated state are six bulkheads, a handful of wooden hull strakes, and two sections of a deck that make up the Sea Scout Wreck. Of all of the vessels in the ship graveyard of Mallows Bay, the majority belonged to the Emergency Fleet Corporation, but many other wrecks contributed to the site from the fishing and salvage operation of the early to mid-1900s; however, the trend of vessel abandonment continued until the late-1990s. The Sea Scout Wreck represents one of the most recent abandonments in Mallows Bay, having been abandoned between March 24, 1977, and March 27, 1980 (U.S.G.S. 2021). As previously mentioned in Chapter 1, Shomette stated that he did not believe that the site had historical significance; however, as Chapter 5 will show that the Sea Scout Wreck is now confirmed to be a U.S. Army Air Force (U.S.A.A.F.) 104-foot (104') Air-Sea Rescue Boat (ARB) that may have been used by Sea Cadets in Alexandria, VA before being abandoned in Mallows Bay. ARBs, also known as Aircraft Vessel, Rescue (AVR) or "crash boats," were developed by the U.S.A.A.F. to rescue pilots that went down over the water during World War II. As these vessels did not serve a major combat role, their history has fallen to the wayside. This makes establishing their role and intended purpose the key focus of this chapter as their history is important to understand the significance of the Sea Scout Wreck and creates a foundation for this site formation study.

To understand both the development and purpose of ARBs, this chapter examines the history of air-sea rescue boats that first came around in World War I, once combat aviation became extensively used. This started with early developments by the Italian Navy, which helped influence other similar craft by the Allied forces. After the war, the United States used the knowledge from the World War to combat smuggling during the American Prohibition (Gray and Garn 2019:7, 9-10). As World War II broke out, they used these developments to help build the three main ARBs (63’, 85’, and 104’) that they would use (Grover 1987:149-151). Along with the main function of the ARBs, it is also important to examine the various secondary function and post-war use to see how these vessels were later modified. Finally, this chapter provides a brief overview of a potential identity for the Sea Scout Wreck that is fully explored in Chapter 5.

History of Air-Sea Rescue Boats

While the Air-Sea Rescue Boat (ARB) was the product of World War II, the need to rescue pilots from the water in an effective manner has been a concern since the full-scale use of naval aviation. The Italian Navy was the first to develop swift attack boats during World War I; known as *Motoscafo Armato Silurante* (MAS), motorboats armed with torpedoes. These crafts operated against the Austro-Hungarian fleet in the Adriatic Sea and were successful in sinking pre-dreadnought capital ships, such as SMS *Wein* and SMS *Szent Istvan*. Other missions included anti-submarine warfare, laying and sweeping for mines, conducting raids, deploying and recovering special operatives, but most importantly they tendered to and recovered seaplanes, as well as rescued downed pilots. Later in the war, the British developed Coastal Motorboats (CMBs) and Motor Torpedo Boats (MTBs) to attack the German torpedo boats in the Aegean Sea and on Lake Tanganyika, but it is unclear if they were used in air-sea rescue operations (Gray and Garn 2019:7, 9). When the United States entered the war in 1917, the U.S. Navy only had “sea sleds” for air-sea rescue missions (Figure 4.1). These were small boats with an inverted-V shape and could achieve 30 to 40 knots depending on sea conditions; however, the vessels were only 32’ in length and could not carry any armaments. Many of the sea sleds bought by the U.S. Navy during World War I, were swiftly sold off after the war (Friedman 1987:99, 105).

FIGURE 4.1 U.S. Navy Sea Sled at Rockaway, Long Island, on 19 November 1918 (Naval History and Heritage Command 2022; Photo Ownership: National Archives, 1918).

During the interwar years, the U.S. Coast Guard (U.S.C.G.) needed to develop fast response craft to challenge the speedboats used by rumrunners during the American Prohibition (1920-1933) (Gray and Garn 2019:10). The U.S.C.G. had to develop new small boat engines, and hull shapes that could handle the fast speeds needed to catch rumrunners (Friedman 1987:105). Meanwhile, the U.S. Navy did not develop small watercraft between World War I and 1937. Starting in 1937, the U.S. Navy began examining the use of fast response craft, particularly ARBs (Friedman 1987:97; Gray and Garn 2019:10). The need to have swift craft able to respond to aircraft crashes was essential as the longer aircrews were in the water, the higher likelihood they would succumb to the natural environment or enemy combatants. As these boats were stationed at the naval air stations along the open sea, they needed to be able to handle rough sea conditions while on a rescue mission (Friedman 1987:97). This was achieved by combining the powerful small boat engines developed by the U.S.C.G. during Prohibition with a hard-chine hull that could handle high speed and rough seas (Friedman 1987:105). Additionally, this meant that the ARBs had to be lightly armed at most to be able to respond quickly, although this would change later in the war (Friedman 1987:97). The ARBs developed by the U.S. Navy were similar in size to the sea sleds used in World War I, being 36' or 45' in length (Friedman 1987:431). The U.S. Navy designated them Patrol Aircraft Rescue Boat (West 2018:38).

In 1940 one of the companies contracted to build an experimental PT-boat for the U.S. Navy was Miami Shipbuilding Corporation (MSC). At approximately the same time, MSC was under contract with the U.S. Army Air Force to begin designing and producing ARBs there were different from the ones the U.S. Navy developed (Friedman 1987:431; Grover 1987:149; West 2019:41). This was to blend the patrol and rescue vessels the U.S. Army had already been using years before World War II, with the prototype being built in 1940 (Grover 1987:149). While MSC was commissioned to design some of the ARBs, the actual construction was conducted by boat-building companies across mainland United States that flourished in the interwar years through the development of standardized stock boat building (see Appendix 1) (Grover 1987:150-152; Labaree et al. 1998:539).

The ARBs designed for the U.S.A.A.F. were commonly used by Allied forces in World War II (Friedman 1987:433). Three different designs were developed, the 63' (Class III, Design 168, 314, and 416), the 85' (Class II, Design 379), and the 104' (Class I, Design 235a, and 235c) vessels (West 2018:38; U.S. Crash Boats 2020a). All of the ARBs were vessels with a wooden hull, frames, keel, stem, stern, and wrought iron watertight bulkheads throughout the ship. The hull planks were two layers 1/4 (0.25) inch fir plywood planks and stiffeners that made the outer hull approximately 1.5 inches thick, and the spine of the boat was constructed of Honduran mahogany (*Swietenia macrophylla*) (West 2019:38; U.S. Crash Boats 2020a). While under contract by the U.S. Navy in 1940 to build experimental PT-boats, MSC was already aware of the potential speed that could be obtained from the Packard and Hall-Scott engines; however, the Packard engines were restricted to use in PT-boats, and the entire line of Hall-Scott engines produced in 1940 and 1941 was sold to the United Kingdom. This left MSC to use Kermath Sea Raider engines for the first few years of production. With this information at hand, Dair N. Long designed the 63' ARB as a swift boat capable of reaching at least 42-knots; he scaled up the design for construction of the 85' variant (West 2019:38, 41; U.S. Crash Boats 2020a). The ARBs designed for the U.S. Army would prove to be more effective than those developed by the U.S. Navy, as the 63' variant was able to reach 54-knots fully loaded making it the fastest surface vessel in the U.S. Navy (Friedman 1987:431; West 2018:38). The U.S. Navy replaced their fleet of ARBs with those designed by the U.S. Army, and the former U.S. Navy ARBs (36' and 45') were converted for use as harbor pickets by having their high-speed engines removed (Friedman 1987:431).

By the end of the war 740 of the 63' design, 140 of the 85' design, and 158 of the 104' design had been produced (Figure 4.2) (Gray and Garn 2019:10). A large number were sold to American allies through the Lend-Lease Act, including over 200 of the 63' type being sold to Russia, England, Australia, The Netherlands, and South Africa. The original crash boats were unarmed, but when the Luftwaffe began attacking them in the English Channel, they were armed with two twin-mounted .50-caliber machine guns (Friedman 1987:433; West 2018:41). Despite the added armament, speed and maneuverability served as the vessel's main defense in combat.

As these vessels often operated solely, they were vulnerable to patrolling enemy vessels such as submarines, and patrol craft, particularly the German E-boats. In response, the crews picked up additional weapons and supplies, such as .30-caliber machine guns to fight aircraft and surface vessels, and bazookas for anti-submarine defense. In the south Pacific, crews added an extra .50-caliber machine gun to the bow, which helped add more weight to the front of the boat allowing it to plane more effectively (West 2018:38-39, 41, 43). The crews of the ARBs used by the U.S. Army were crewed by U.S.A.A.F. personnel, and both branches (U.S.A.A.F. and U.S.N.) cross-trained their crews to be able to fill any role (Grover 1987:149; West 2018:43). ARBs served as the backbone to rescuing airmen shot down over the water or enemy-occupied territories (Gray and Gran 2019:12). Along with their mission on the frontlines, ARBs were used at training facilities to rescue tug planes that were accidentally shot down being mistaken for the target during the training of fighter pilots (West 2018:48).

FIGURE 4.2 104' ARB (Design 235A) P-110 built by Stephen Bros. in June 1942 (Photo courtesy of Haggin Museum, 1942).

104' ARBs

Of all the ARB variants, the 104’ ARBs were designed to travel long distances in rough water to recover the crews of medium and heavy bombers. This is significantly different from the missions of the smaller ARB variants that were recovering short-range aircraft such as smaller bombers, fighters, and naval aircraft. The difference in mission is particularly notable when considering the difference in the design of each vessel type. The 104’ design resembles U.S. Navy SC-1 Subchasers rather than PT-boats like the 63’ and 85’ boats do; however, it is unknown if this was intentional (Figure 4.3) (Friedman 1987:431; Grover 1987:149; Sabick et al. 2000:81; Gray and Garn 2019:10). Although the 104’ ARB had more space, a longer range, and better capability to handle rougher sea conditions, it was less popular than the other two variations as it was significantly slower. The 104’ ARB’s capability to handle rough seas led to the 104’ model being favored in the North Pacific (Alaska and Aleutian Islands), as well the fact that they could be equipped with an electric heating system better suited for the cold climate. As the North Pacific theater ended some of them were redesignated as Quick Supply (QS) Boats. This appears to align with a change in the number and types of engines used in the vessels (Figures 4.4 and 4.5) (Grover 1987:150-151; U.S. Crash Boats 2020b).

FIGURE 4.3 Three SC-1 Subchasers moored together (NavSource 2020b; Photo ownership: National Archives).

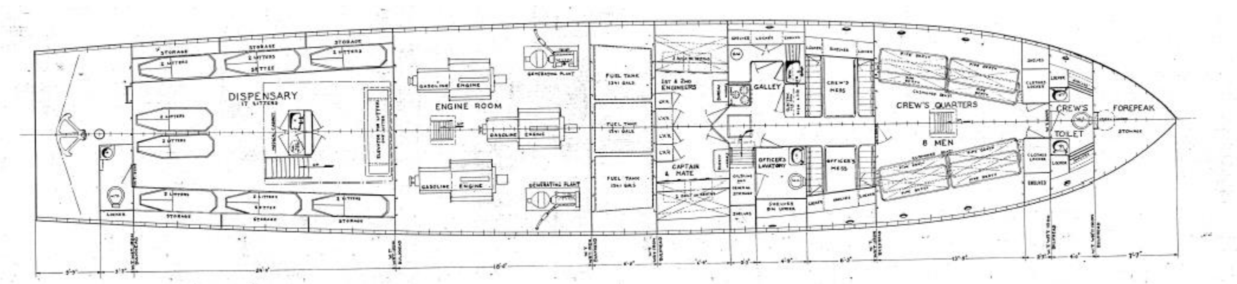

FIGURE 4.4 Internal Arrangement plan of 104' ARB Design 235a (Document courtesy of Haggin Museum. 1942).

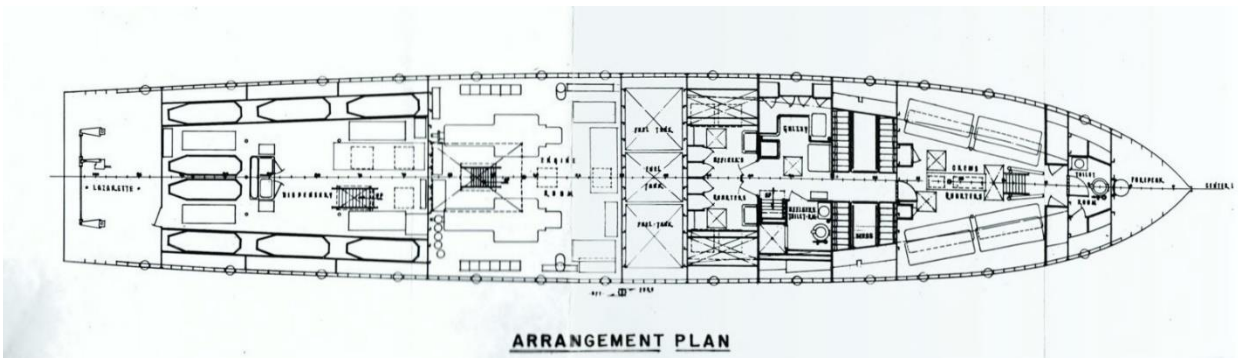

FIGURE 4.5 Internal Arrangement plan of 104' ARB Design 235c (U.S. Crash Boats 2020c; Document ownership: National Archives).

Secondary Function of Crash Boats

Almost immediately after ARBs were constructed, they were being converted for alternative purposes due to their swiftness. During Operation Torch, a 63’ ARB was used as a command craft by a U.S. Army colonel to direct troops landing at Yellow Beach, south of Safi, Morocco. To accommodate the additional crew and supplies needed for these alternative operations the medical crew was transferred off the vessel to other stations. Additionally, the infirmary was converted for use as an armory, cargo hold, general-purpose area, or additional crew quarters. By 1942 the U.S. Navy started using ARBs for sub chasing and patrol activities (Friedman 1987:433; West 2018:38, 40-41). These vessels were modified to be armed with depth charges and an Oerlikon 20 mm cannon on the aft deck, with the 104’ ARBs having a second 20mm cannon mounted on the foredeck (Figure 4.6) (Sabick et al. 2000: 79; West 2018:41).

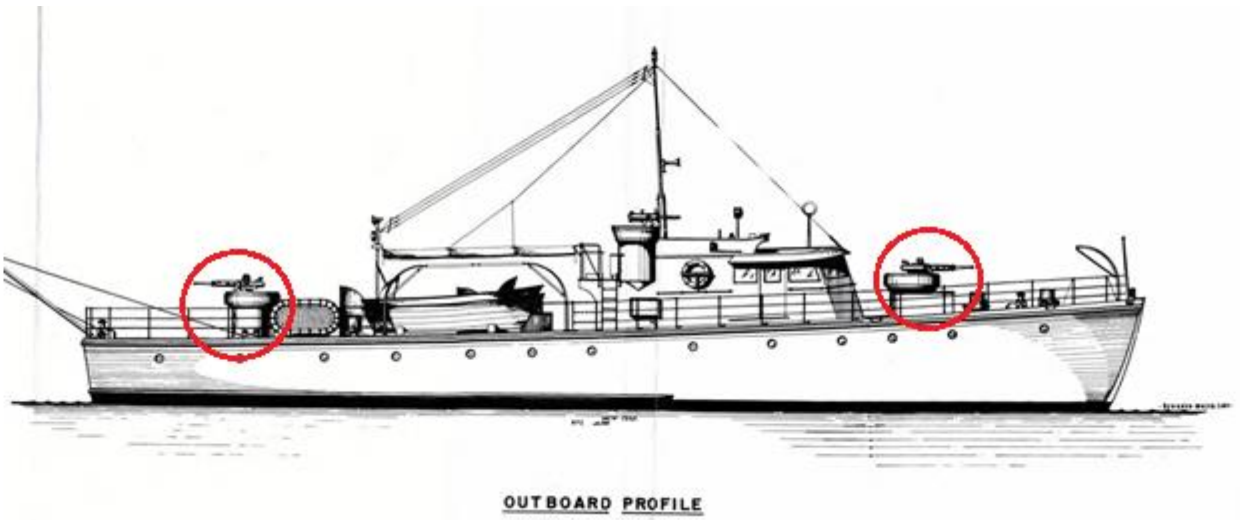

FIGURE 4.6 104' ARB Design Plans showing two 20mm cannons circled in red, one mounted forward of the pilothouse the other on the aft deck (Sabick et al. 2000:79; Document ownership: National Archives).

Special Operations

The speed and cargo capacity of the ARBs made them excellent for use in special operations, such as covert operations, decoy tactics and deploying and retrieving commandos and special agents (U.S. Navy Beach Jumper Association 2016; West 2018:39-40). One such example is the use of ARBs during Operation Husky to create diversions along the coast of Sicily to cause German and Italian forces to deploy troops and equipment away from the landing beaches. During these decoy operations, ARBs offloaded all excess gear to make room for the U.S. Navy “Beach Jumpers” and their gear (West 2018:39-40,45-46). Beach Jumpers were the deception and tactical cover units developed by U.S. Naval officer, and actor, Lieutenant Douglas Fairbanks, Jr. while working with British commandos as part of an exchange program.

The Beach Jumpers used the converted infirmaries as both quarters and a storage area while onboard. Standard decoy equipment included smoke generators, time-delayed floating explosive packs, ten 3.5-inch window rockets (five mounted on each side of the boat), a wire recorder with an amplifier and 12 horn speakers, radar reflective strips, and various jammer transmitters (U.S. Navy Beach Jumper Association 2016; West 2018:40).

As these raids took place at night the hull was painted dark gray, and canvas was nailed over the portholes to conceal any light from within the boat. These decoy operations started with laying a heavy smokescreen at the target location. Once the area was covered in smoke, the other decoy devices would be used: the 3.5-inch window rocket would be fired to emulate the explosions of naval artillery, the amplified audio recordings played the sounds of anchor chains rattling, landing craft ramps dropping, and naval guns firing (U.S. Navy Beach Jumper Association 2016; West 2018:40, 45-46). The .50-cal machine guns were used to destroy enemy spotlights and shoot down flares to prevent the decoy from being revealed before it was too late. Once there was enough of a response from the enemy defense forces, typically in the form of machine-gun fire and artillery, the ARBs would go back out to sea under the smoke cover. Decoy missions happened night after night at different locations (West 2018:45-46). These decoys proved to be successful as German commanders kept at least one reserve division in place and created propaganda saying they repulsed major invasions at these decoy sites (U.S. Navy Beach Jumper Association 2016; West 2018:48). In 1944, the U.S. Beach Jumpers began operations in the Pacific and carried out their normal operations with two exceptions. The Beach Jumpers started creating fake communication broadcasts that includes mixed information about sea conditions, deploying boats, and maneuvering landing crafts (U.S. Navy Beach Jumper

Association 2016). Additionally, ARBs were painted black for special operations in the Pacific instead of dark gray (West 2018:41).

An unknown number of ARBs operated within PT-boat squadron RON-15 and Office of Strategic Services (OSS) Operational Group (OG) A were employed in operations in the Mediterranean in 1944. These operations included dropping off and retrieving infiltrating agents, raiding enemy coastlines, defending supply lines from enemy raiding, and supporting landing operations. During amphibious landing support operations, the boats were guides for beach landings and beacons for paratrooper operations. ARBs ferried troops and supplies to shore earning the nickname "Blood Bank Shuttles" and taking wounded soldiers back to hospital ships, as well as performing their standard air-sea rescue missions (Gray and Garn 2019:23-25).

In 1942 and 1943, Army Reserve Officer Walter Mess commanded a squadron of ARBs of various sizes in the China Burma India (CBI) theater. These vessels were modified with more powerful engines and silenced underwater exhausts to conduct special operations alongside OSS OGs, Secret Intelligence (SI), and Operational Swimmers (OS) teams. Mess' command boat P-564 would be the main vessel used by Dr. Lambertsen, the inventor of the pioneer re-breather American Lambertsen Amphibious Respiratory Unit (LARU), and American frogmen (SCUBA divers) to attack Japanese merchantmen. Until the squadron was disbanded in 1945, 36 official missions were conducted with OSS OGs and OS teams, and over 220 allied crewmen were rescued from territories occupied by Japanese forces (Gray and Garn 2019:25-26).

Post-War usage

By the end of the war, all boats over 45’ were considered excessive and sold or transferred to the U.S.C.G. or the U.S. Navy. The U.S. Navy took over fifteen 85’ ARBs, and eighty-seven of the 104’ ARBs, which received C-numbers, while the unknown number of ARBs received by the U.S.C.G. got CGAR-numbers (Friedman 1987:434; U.S. Crash Boats 2020a). One 104’ ARB was transferred to Cuba, and three to the Dominican Republic. Two 104’ ARBs were used for electronic warfare, one for testing and the other for training crews on electronic countermeasures (Friedman 1987:434). One of the most well-known 104’ ARBs was Merchant Vessel (M/V) *Christmas Seal* which was purchased by the Newfoundland Lung Association in 1947 from the U.S. Government to help fight the outbreak of tuberculosis (TB) that plagued the province from 1907 to 1976 (McPhal and Zymantas 2009:212-214). M/V *Christmas Seal* operated as a mobile x-ray room and would visit communities during the day to provide chest x-rays for individuals over 21 years old, while at night the doctors and technicians on board would provide talks to local teachers, health care professionals, and government officials about how to combat TB in their communities (McPhal and Zymantas 2009:215-216).

At the onset of the Korean War, the recently founded U.S. Air Force (U.S.A.F.) reconditioned sixteen ARBs of various sizes and formed the 22nd Crash Rescue Boat Squadron to rescue pilots in the coastal areas around the Korean Peninsula (West 2018:48; Gray and Garn 2019:38). As the vessels were replaced with a newer air-sea rescue craft, they once again were used for roles in special operations. These operations included recovery of the remains of a Mig-15 from the mudflats near Pyongyang, deploying and retrieving Korean marines and guerilla fighters in North Korea and special agents in North Korea and China, where submarines could not reach. These vessels were re-armed with quad .50-caliber machineguns, instead of the twin .50-caliber machineguns. Additionally, when the U.S. Navy Beach Jumpers were recommissioned for the Korean War, the U.S. Navy refurbished several ARBs for use in the same manner as they were in World War II. At the end of the Korean War, several crash boats were turned over to the South Korean Police for them to use. The last known combat operation ARBs were used in was by Central Intelligence Agency (CIA) backed Taiwanese raids on mainland China in the years after the Korean war (Gray and Garn 2019:38, 40). Of the ARBs remaining in the U.S. Navy, an unknown number of the 63' variants were used as torpedo retrievers and noise-measuring boats. The other variants were redesignated and used as Mark 34 seaborne powered targets (SePTars), to simulate Soviet missile boats. These boats were converted to fire BQM-34A drones to represent Soviet STYX (SS-N-2) missiles. These were all replaced with the Mark 35 boats in the mid-1970s (Friedman 1987:433).

Conclusion

The Air-Sea Rescue Boats developed by the U.S. Army Air Force proved to be an essential component to Allied naval aviation in World War II, by rescuing downed pilots in the waters around Europe, the Pacific, and even the United States. These vessels proved to be successful at more than just being able to rescue aircrews, however, as they were quickly adopted for use in submarine chasing, support vessels, and special operations. Curiously, ARBs fell into the cracks of history, and little is known about them. While the exact means is still unclear, one of the 104' ARBs ended up in the use in Alexandria, VA between 1959 and 1977. Today a similar 104' ARB exists just downstream of Alexandria as the Sea Scout Wreck and is in a state of near-complete disarticulation in the Burning Basin of Mallows Bay, MD. By knowing the common history of ARBs and the apparent use of this vessel before its abandonment, it is possible to understand the full scope of the formation processes acting upon the wreck.

CHAPTER FIVE: UNDERSTANDING SEA SCOUT

One of the keys to understanding the site formation processes that transform a ship into a shipwreck is understanding the vessel's use-life from its construction to its present state. By understanding the use-life of a vessel we can explain the presence or absence of material remains at an archaeological site, and further define the transformations that may have occurred. In the case of the Sea Scout Wreck, the process of identifying the vessel type, history, and potential transformations was challenging due to several of the previously mentioned limitations that were imposed on this research. This chapter highlights the results of overcoming those challenges. The first step was establishing the identity of the wreck which could establish its function. This was done by examining the vessel identities that had previously been recognized during the preliminary research phase and eliminating them based on contradictions between the historical record, archaeological record, and observations about the Sea Scout Wreck. When this candidate was established as the vessel type, it was possible to test a vessel identity that was discovered while conducting historical research into the type. This found that the 104' ARB built by the U.S.A.A.F. was the most probable candidate; however, further research and analysis using historical and archaeological data were needed to prove this hypothesis. Finally, a potential identity, a Sea Cadet vessel, possibly known as N.C.S. *Morris Springer*, was identified during the historical research of the Sea Scout Wreck. By examining the available archaeological and historical evidence, this chapter shows that the Sea Scout Wreck is a 104' ARB Design 235A, but that there is still limited supporting evidence that it represents the remains of the vessel used by the Sea Cadets in Alexandria, VA between 1959 and 1977.

Identifying the Sea Scout Wreck

During the early examination of the Sea Scout Wreck, it was essential to narrow down an approximate date range and a possible vessel type. The only information regarding the wreck initially was the oral traditions recorded by Donald Shomette in his inventory of Mallows Bay shipwrecks (Shomette 1996:426-427), photographs provided by Dr. Susan Langley (elec. comms. 2020, 2021), and the vessel's location in Mallows Bay. Given that the Sea Scout Wreck is located within the Burning Basin of Mallows Bay, it can be determined that the vessel was abandoned after the 1940s because the Burning Basin was built by Bethlehem Steel, a salvage corporation, during World War II to continue the reduction of the Emergency Fleet Corporation vessels for their metal components (Shomette 1996:273). According to Shomette, the last vessel reduced in the Burning Basin was U.S.S. *Nokomis*, a yacht converted into a subchaser in World War I that saw use again during World War II (Shomette 1996:275). This created the initial timeframe for the vessel's abandonment, as it could not have ocurred before 1945 but was recorded into Shomette's inventory in the 1990s; however, the exact date of when he inventoried the Sea Scout Wreck is not included. To narrow this time frame down, aerial photographs of Mallows Bay were downloaded from U.S. Geological Survey's Earth Explorer and examined in ESRI's ArcGIS Pro (U.S.G.S. 2021). These photographs revealed that the vessel was not present in Mallows Bay on March 24, 1977, but appears at its present location on March 27, 1980.

While it cannot be stated for certain if the intent was to abandon the vessel, as there appears to be an operational boat dock near the vessel's abandonment location, this establishes a narrow timeframe for the vessel's appearance in Mallows Bay. Measurements of the vessel taken from the aerial photographs give it an approximate overall length of 107' with a beam of 19'.

Due to the low spatial resolution of the images, which was not stated in the metadata but appears to be approximately 0.5 meters, an error allowance of 5 feet for either measurement was allowed. As the aerial photographs did not have a known spatial reference, they were manually georeferenced, and this estimate was created based on comparative measurements of visible features. Potential vessel types were evaluated by comparing their dimensions to the measurement ranges obtained from aerial photography. These vessels could also be compared to the photographs taken by Dr. Susan Langley in 1997 of the Sea Scout wreck.

Early Candidates

The first vessel examined through this study was based on previously mentioned oral traditions recorded by Shomette of the Sea Scout Wreck (Shomette 1998:426). The oral tradition he recorded states that it was a U.S. Navy (U.S.N.) patrol-torpedo (PT-) boat, a yacht used by the Sea Scouts before it was abandoned, and finally that it was fishing yacht (Shomette 1998:426). None of these leads are contradictory to each other as a decommissioned PT-boat could later be used by the Sea Scouts as well as for fishing. To evaluate the lead on PT-boats, Norman Friedman's *U.S. Small Combatants: Including PT-Boats, Subchasers, and the Brown-Water Navy* (1987) was consulted. The book found that while the hull shape may appear similar, the PT-boat was too small to be a candidate as there was only one experimental PT-boat built to be over 100' that was scrapped in 1968 (Friedman 1987:188-195; NavSource 2020a) (Figure 5.1). A new candidate, however, was revealed in his book. The SC-1 sub chaser built in World War I had a similar hull shape and was only 110 ft in overall length and a beam of 14 ft 9 in (Figure 5.2) (Friedman 1987:36; NavSource 2020b). While the hull shape and measurements of the SC-1 resembled the Sea Scout Wreck, the SC-1 did not have bulkheads such as those visible at the wreck site and has a different superstructure. This caused the leading hypothesis to be adjusted to an SC-1 subchaser that was later converted before being abandoned. To see if similar conversions had been undertaken, and to find more candidates, Friedman's book was consulted again (Friedman 1987:36-45), as well as the website NavSource, which contains an archive of images of U.S. military watercraft (NavSource 2020c). To identify possible SC-1's sold to the U.S. Coast Guard , works by Robert Scheina (1982, 1990) and James T. Flynn (2012, 2014), and U.S.C.G. Historian's Office website (U.S.C.G. Historian's Office 2021) were consulted as well. There was neither substantial information nor a number of pictures to determine if such a conversion could have occurred, leaving a converted SC-1 as the primary hypothesis for the Sea Scout Wreck's identity.

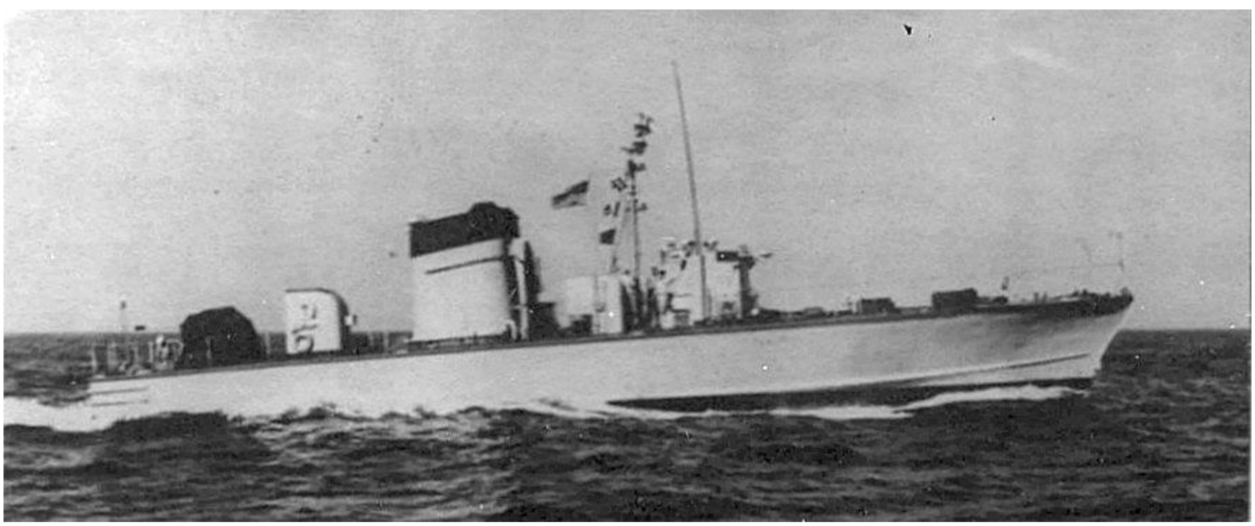

FIGURE 5.1 PT-812, the only PT-boat built over 100' in length (NavSource 2020a; U.S. Navy Collection of Steven Ribero and LCDR Robert Beveridge Photo 1043350, 1959)

FIGURE 5.2 SC-2 which has a similar hull shape to the Sea Scout Wreck (Naval History and Heritage Command photo NH 43601, N.D.)

Another candidate to be tested with this method came from an ESRI story map that suggested the Sea Scout Wreck was the U.S. Coast Guard Cutter (U.S.C.G.C.) *Chester* (ESRI n.d.); however, a search of the U.S.C.G. Historian's Office's website, as well as a search through the works of Robert Scheina (1982, 1990) and James T. Flynn's (2012, 2014) could not find a U.S.C.G.C. *Chester*, or any U.S.C.G. vessel named *Chester*; however, there were two U.S. Navy vessels named U.S.S. *Chester*, CL-1, and CL-27 were 423' 1" and 600' 3", making them significantly larger than the Sea Scout Wreck (Naval History and Heritage Command 2016a, 2017). Due to this, the suggested identity of the Sea Scout Wreck was rejected. Another Coast Guard vessel suggested in an online comment on Sometimes Interesting suggested the Sea Scout Wreck was a U.S.C.G. vessel known as *Morris Springer* (Sometimes Interesting 2013), but a review of the previously mentioned sources, and email dialogue with the U.S.C.G. Historian's Office, could not find a vessel in either the U.S. Coast Guard or the U.S. Navy that had this name

(Scheina 1982, 1990; Friedman 1987; Flynn 2012, 2014; NavSource 2020c; U.S.C.G. Historian's Office 2021; U.S.C.G. Historian's Office elec. comms. 2022).

104' ARB

During the search for SC-1 subchasers with similar conversions, the U.S.A.A.F. Aircraft Rescue Boat (ARB) built and used during World War II was discovered. The similarities between the ARB and SC-1 had previously been commented on in 2000 when the Lake Champlain Maritime Museum had identified "Wreck E" in their 1996 Lake Survey as a 104' ARB (Sabick et al. 2000:81). Research into ARBs found that they shared a construction method with U.S.N. Patrol Torpedo (PT-) boats, giving them a similar appearance (Grover 1987:149; U.S. Crash Boats 2020a). Additionally, ARBs were built with metal bulkheads and a superstructure like those visible at the Sea Scout Wreck site (Figures 5.3 and 5.4) (Haggin Museum Stephen Bros Photo Archive 2021, 104' ARB Design Documents). From an archaeological perspective, the features visible in photographs of the wreck when superstructure elements were still attached supported an emerging hypothesis that the vessel was not an SC-1, but a 104' ARB. When more recent photographs of the wreck were provided by Dr. Langley (elec. comm. 2020, 2021) and the watertight doors to the bulkheads were visible, it was discovered that the door latches were not U.S.N. or U.S.C.G. standard, suggesting the vessel was not built for either military branch (Figure 5.5 and 5.6). As the ARB had similar bulkheads, superstructure, and measurements to the Sea Scout Wreck, but lacked a 3D model, it was determined to focus on developing an understanding of the 104' ARB.

FIGURE 5.3 Photograph of bulkheads being installed on a 104' ARB (Probably a Design 235A based on the thin keel in the aft section) (Photo courtesy of Haggin Museum, 1942).

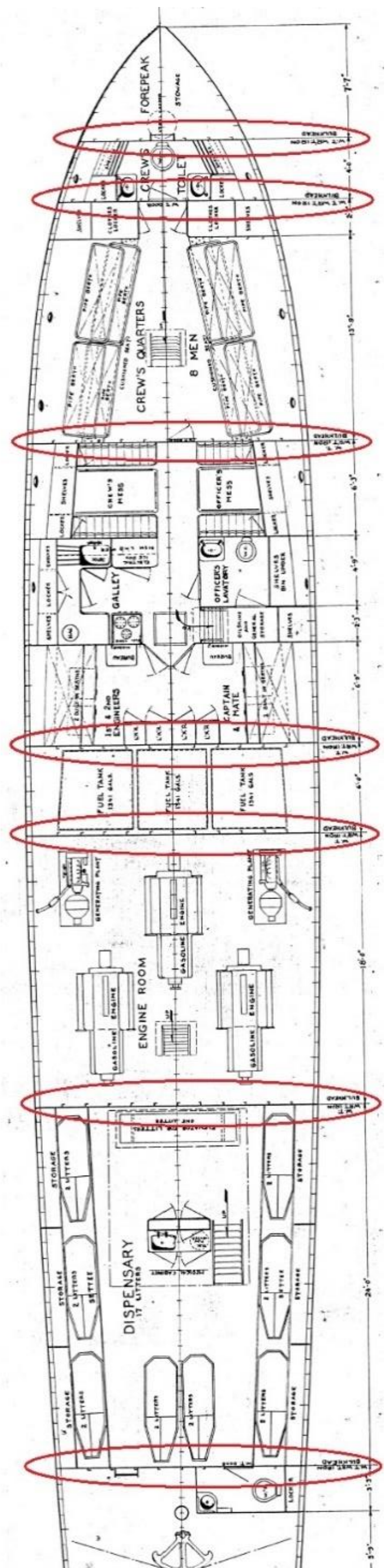

FIGURE 5.4 104' ARB Design 235A Internal Arrangement design document with watertight bulkheads highlighted in red (Document courtesy of Haggin Museum, 1942).

FIGURE 5.5 The Sea Scout Wreck with low water levels, revealing the bulkhead doors (circled in red) (Photo Credit: Frances Park, 2021).

FIGURE 5.6 Close up of watertight bulkhead door in Bulkhead 3 (the right circle in Figure 5.9), take during the 2021 archaeological field work (Photo Credit: Nathan Richards, 2021)

Once the design plans for the 104’s ARB were acquired from Haggin Museum and Lake Champlain Maritime Museum (LCMM), they were digitized into a 3D model. Immediately, many similarities and differences between the ARB model and the images provided by Dr. Langley were identified (Sometimes Interesting 2013; Chesapeake Conservancy 2020; Susan Langley 2020). From the pictures of the wreck in 1997 provided by Dr. Langley, notable superstructure features on the shipwreck that also appear in the model include the shape of the pilothouse, the location, and shape of the chart table, the position of the anchor davit and bitts, as well as location of hatches and vents appearing to be in the same position (Figures 5.7, 5.8 and 5.9). The two key features that are different from the model and the photos from 1997 are that there appears to be additional superstructure components aft of the pilothouse, and there is a speaker attached to the front of the pilothouse where a bell should be (Figures 5.10 and 5.11). Features that appear to be missing from the wreck include the weapons that a 104’ ARB would have been armed with during wartime. This would be consistent with the nature of the oral traditions recorded by Donald Shomette, and that the timeframe for the vessel’s abandonment was approximately 35 years after it would have been built and used by the U.S.A.A.F. during wartime. When the model was compared to more recent photos of the Sea Scout Wreck that show more of the internal structure of the wreck the location of the bulkheads on the wreck matched the location of the bulkheads in the 3D model (Figures 5.12, 5.13, and 5.14). While the aft-most bulkhead was not visible in the pictures of the wreck, it was detected by touch during the archaeological fieldwork.

FIGURE 5.7 Photo of the forward section of the Sea Scout Wreck with the similarities to the 104' ARB Design 235A circled in red (Photo credit: Susan Langley, 1997).

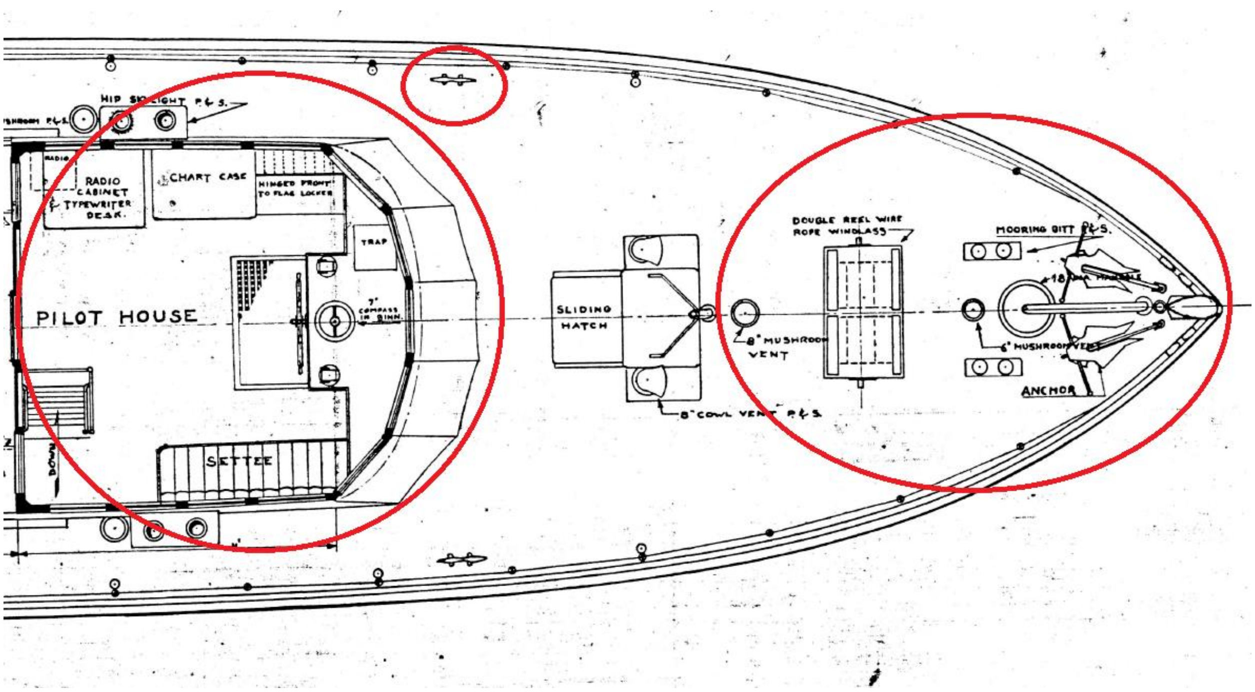

FIGURE 5.8 Forward section of the outboard arrangement of the 104' ARB Design 235A with features seen on the Sea Scout Wreck (Figure 5.11) highlighted in red (Document courtesy of Haggin Museum, 1942).

FIGURE 5.9 104' ARB (1942) model that show similarities to the Sea Scout Wreck circled in red (isometric view) (Model created by Taylor Picard).

FIGURE 5.10 Photo of the Middle section of the Sea Scout Wreck with the difference to the 104' ARB Design 235A circled in red (Photo credit: Susan Langley, 1997).

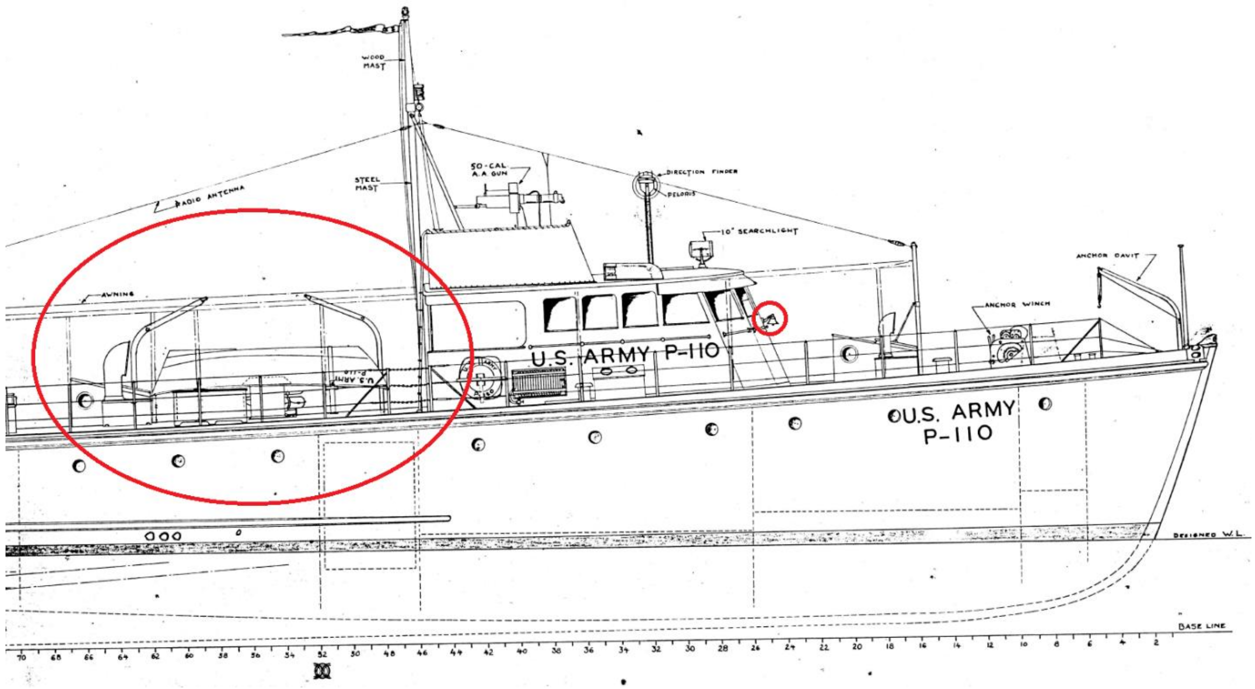

FIGURE 5.11 Profile view of the forward and middle sections of the outboard arrangement of the 104' ARB Design 235A with features different from those seen on the Sea Scout Wreck (Figure 5.14) highlighted in red (Document courtesy of Haggin Museum, 1942).

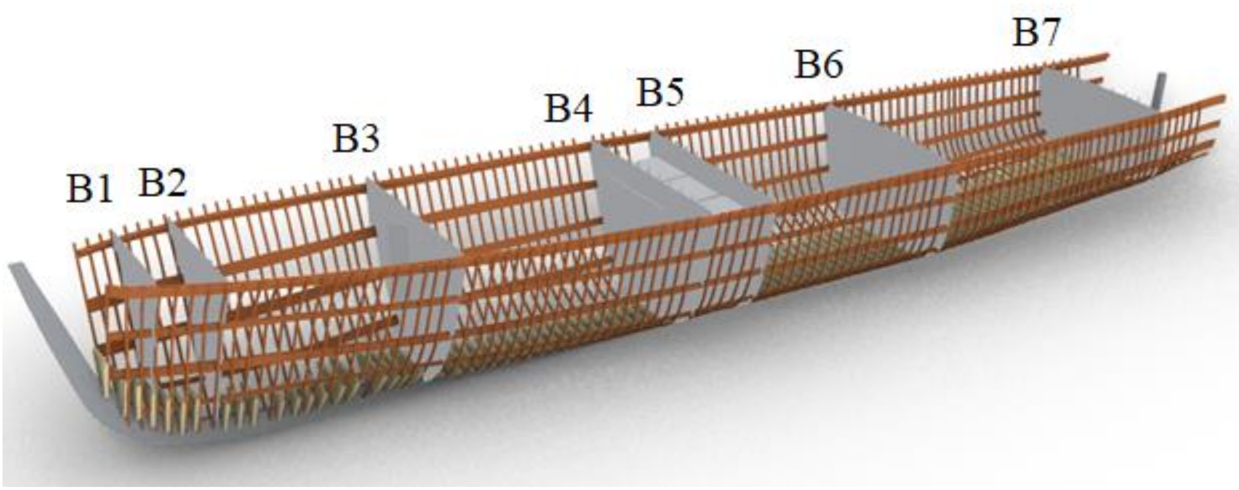

FIGURE 5.12 104' ARB (1942) model showing position of bulkheads labeled B1 through B7 (isometric view) (Model created by Taylor Picard).

FIGURE 5.13 Picture of the Sea Scout Wreck showing the locations of bulkheads B1 through B6, B7 is present at the site but is not visible in this image (Photo credit: Frances Park, 2021).

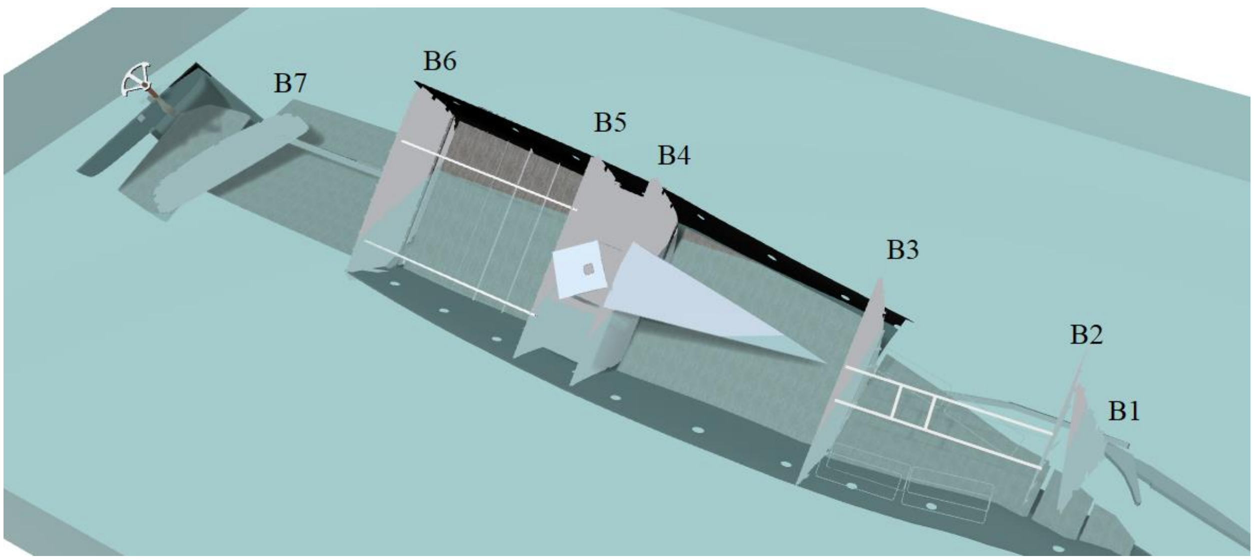

FIGURE 5.14 Sea Scout Wreck (2021) model showing the position of bulkheads B1 through B7 based on the archaeological field work conducted in May 2021 (isometric view) (Model created by Taylor Picard).

Documenting the Sea Scout Wreck

The archaeological fieldwork conducted on May 7 and 8 of 2021 focused on documenting the results of the formation processes impacting the Sea Scout Wreck, but it had the additional benefit of collecting data that could also be used to verify the vessel type. During this fieldwork, measurements taken of features found at the site were later used to compare against measurements taken from the 104’ ARV (1942) model and information known about 104’ ARBs, to establish if the Sea Scout Wreck was a 104’ ARB. As mentioned in Chapter 3, this was done by creating five proforma to record specific information related to 104’ ARB, and a blank proforma was prepared to record information found at the site that did not correspond with known features of 104’ ARB. The overall site length, including the debris field fore and aft of the wreck, was recorded as 106’ 7”, and features of the site included seven bulkheads, three fuel tanks, a generator plant, a plaque made of plastic material, a pipe berth, a single rudder post, and several PVC pipes. Several artifacts were found on a shelf in the engine room including battery terminals, a fuse, the head of a hammer, a chain wrench, socket spanner components, and a pulley. While water depth measurements were not taken, the team noted that there was sediment accumulation between the east berm of the Burning Basin and the port side of the wreck. On the starboard side of the vessel, a depression in the sediment had formed along the length of the wreck. The vessel is listing into this depression, and cultural material has collected there. As shown in Table 5.1, the position and angle of the list for all the bulkheads were measured and recorded. Bulkhead 1 (B1) has fallen towards its aft face and is currently leaning again Bulkhead 2 (B2). This appears to be the only reason Bulkhead 1 is above the waterline. When measured, the distance between the base of Bulkhead 1 and Bulkhead 2 was found to be 4’ 2.5” and was listing to starboard 75^{o}. Bulkhead 2 is secured to Bulkhead 3 by two sets of I-beams that are 3/16” thick but show signs of corrosion in the form of rust and holes forming in them. The distance from the base of Bulkhead 2 and Bulkhead 3 is 16’ 1.25” and is listing to starboard 65^{o}. Bulkhead 3 is 21’ 1.25”, from Bulkhead 4 and is currently listing 57^{o}. Bulkheads 4 and 5 are connected by the three fuel tanks between them as well as some PVC pipes and metal bars; however, there is still a portion of the deck over this section so the exact number could not be counted. The distance between the two bulkheads is 6.0’ and the pair of bulkheads are leaning slightly forward; this gives Bulkhead 4 a 40^{o} list to starboard, while Bulkhead 5 is only lists to starboard by 32^{o} degrees. Bulkheads 5 and 6 are connected by two 3/16” I-beams, but the starboard I-beam had broken just before it connects to Bulkhead 6. The distance between the two bulkheads is 18.0’, but Bulkhead 6 has developed a list of 35^{o} to starboard. Bulkhead 7 has fallen completely onto its front face so that it now rests below the waterline. The distance from Bulkhead 6 to the base of Bulkhead 7 is 23’ 0.6”. Aft of Bulkhead 7 is a single rudder post that leans forward into the wreck. At the time of recording little of the wooden hull or deck remained. The port side hull was the only section still above water and showed deterioration around the waterline. At the time of recording, it was only still connected to the rest of the wreck at Bulkhead 6. The rest of the hull was sloping into the water. The only section of the deck still present is a small, detached section between Bulkheads 4 and 5 that was resting on top of the fuel tanks, and a section that is sloping into the water between Bulkheads 3 and 4. Like the hull, the deck shows signs of disintegration around the waterline. Both the hull and the deck have plant growth between the high and low water levels. Finally, a portion of the aft section of the vessel rests on its side just port of the rudder post. For all these wooden sections, the high-water level is visible by a transition from a light brown color below the high-water level to a light grey color above it.

For the comparison between the Sea Scout Wreck and a 104’ ARB, the two most important factors for the determination process were that the overall site length narrowly exceeds the 104’ ARB by approximately 2.6% and that the same number of bulkheads were found in approximately the same location. Even after this change in their position, the distance from the point of contact for the base of the bulkhead and the keel to the next bulkhead was only off by a few inches in most cases (between 0.06 to 2.25 inches) and up to 1.1 feet at most (between B3 and B4) (Table 5.1). While none of the artifacts proved useful in determining if the Sea Scout Wreck was a 104’ ARB, the features at the site did. The position of the features and artifacts in the Sea Scout Wreck indicated that its layout matches the layout of rooms in the 104’ ARB (Figures 5.15). The generator plant and plastic plaque were found in Sea Scout’s engine rooms, the three fuel tanks were found between two bulkheads fore of the engine room, the pipe berth was found in the fore section of the ship that corresponds with the crew quarter. A review of the operation manuals for the engines used on 104’ ARBs found that the Delco Remy generator plant was a close match in shape and configuration to the generator plant located in the engine room of the Sea Scout Wreck (Figure 5.16 and 5.17), although the diagram was low quality and only showed one side of an x-ray profile view (War Department 1944:70). The generator plant was also found in the same location it would have originally been found on an ARB. While the plastic plaque that was found in the engine room of the Sea Scout Wreck was illegible, it corresponds with the fact that the U.S. Army put builder’s plates made of bakelite in the engine room of their ARBs (Figure 5.18) (U.S. Crash Boats 2020a). The pipe berth matches those that are shown in the diagrams of the 104’s ARBs and on P-520, a floating museum of an 85’ ARB (Figures 5.19, 5.20, and 5.21) (*Chesapeake Magazine* 2021). Additionally, the style of the rudder post matched those used by the 104’ ARB Design 235A which had three propellers, with a single brass rudder adjacent to the center propeller (Figures 5.22, 5.23, 5.24, and 5.35). Finally, the thickness of the hull is 1.5” with a fabric material between the planks of the outer hull and the bulkhead, and the hull planks are fastened to the frames with cupreous screws (Figure 5.26) (Sabick et al. 2000:80; U.S. Crash Boats 2020a). While this work confirmed the hypothesis that the Sea Scout Wreck was a 104’ ARB, no significant evidence of the vessel’s identity was located at the site.

TABLE 5.1 Comparison of bulkhead distances of a 104’ ARB Design 235A and the Sea Scout Wreck.

Bulkhead Numbers	Distance of bulkheads of 104’ ARB in Feet and Inches	Distance of bulkheads of the Sea Scout Wreck in Feet and Inches	Difference in feet and inches	Difference as a Percentage
Length Overall	104’ 9”	106’ 7”	+ 1’ 10”	+2.59%
Bulkhead 1 (B1) to Bulkhead 2 (B2)	4’ 0”	4’ 2.5”	+ 0’ 2.5”	+4.76%
Bulkhead 2 (B2) to Bulkhead 3 (B3)	16’ 0”	16’ 1.25”	+ 0’ 1.25”	+0.62%
Bulkhead 3 (B3) to Bulkhead 4 (B4)	20’ 0”	21’ 1.25”	+ 1’ 1.25”	+5.21%
Bulkhead 4 (B4) to Bulkhead 5 (B5)	6’ 0”	6’ 0”	0’ 0”	0.00%
Bulkhead 5 (B5) to Bulkhead 6 (B6)	18’ 0”	18’ 0”	0’ 0”	0.00%
Bulkhead 6 (B6) to Bulkhead 7 (B7)	24’ 0”	23’ 0.6”	-0’ 11.4”	-4.12%

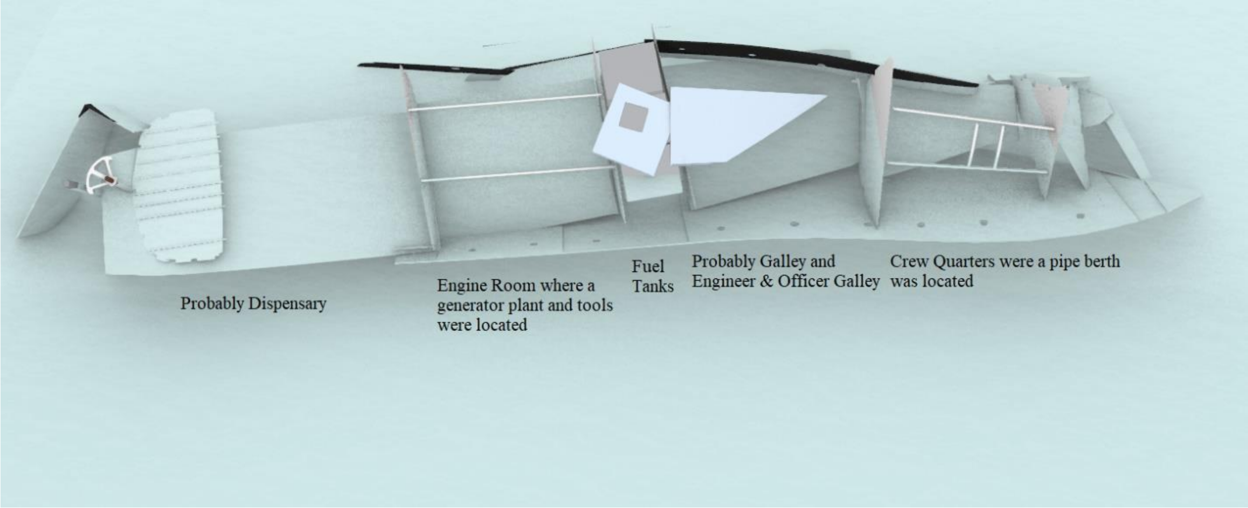

FIGURE 5.15 Sea Scout Wreck (2021) model showing the probable room layout of the site (isometric view) (Model created by Taylor Picard).


FIGURE 5.16 Generator plant found in the engine room of the Sea Scout Wreck (Photo Credit: Nathan Richards, 2021).

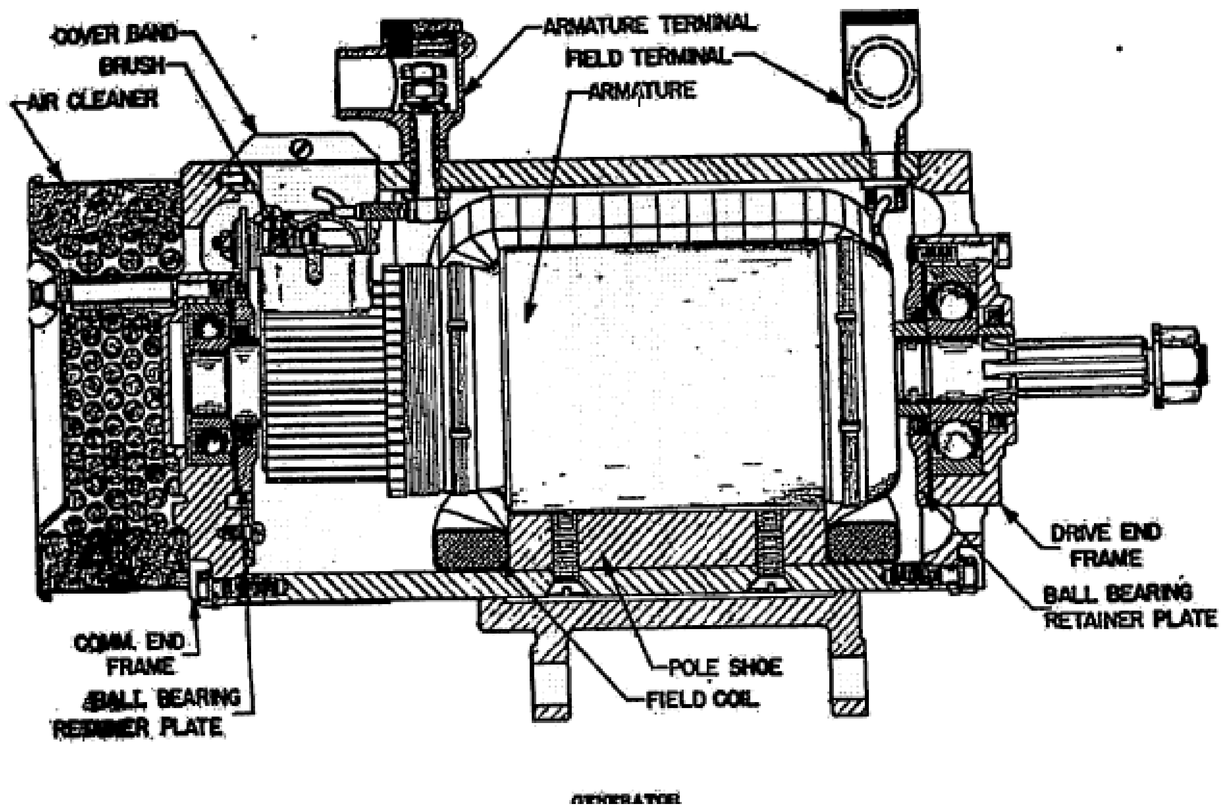

FIGURE 5.17 Diagram of Delco Remy generator which would be inside the generator planet like the one found on the Sea Scout Wreck (War Department 1944:70).

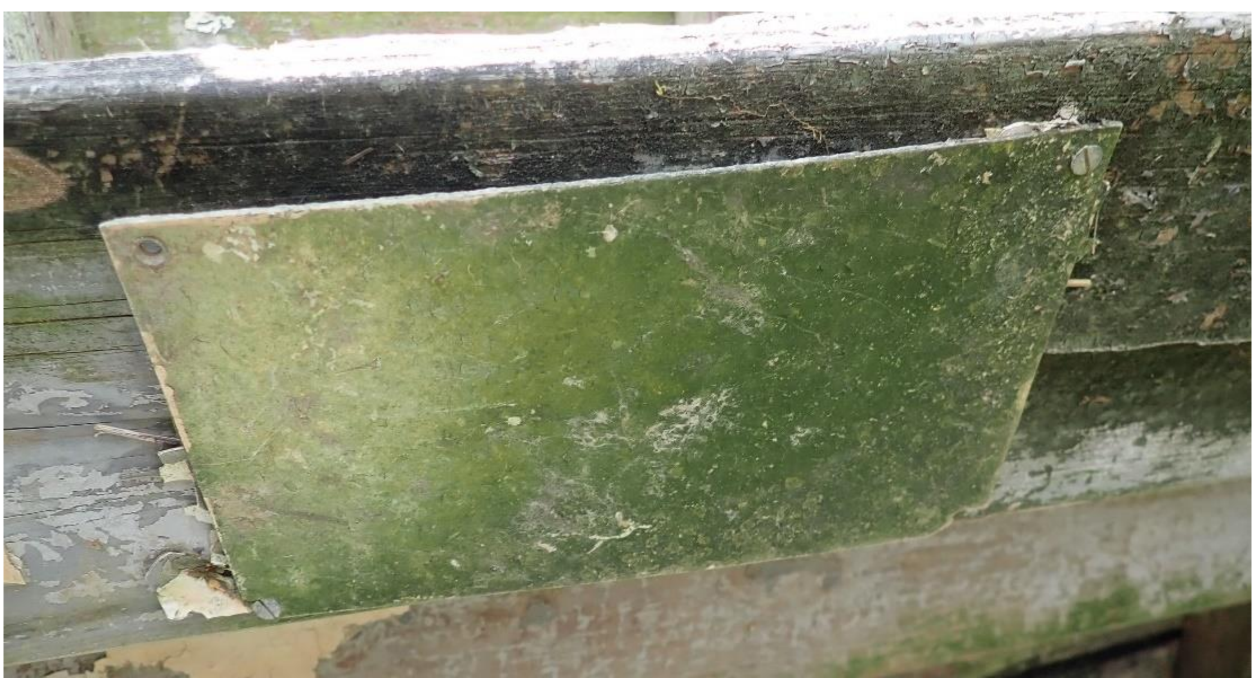

FIGURE 5.18 Plaque made of a plastic material, possibly bakelite, found in the engine room of the Sea Scout Wreck (Photo Credit: Nathan Richards, 2021)

FIGURE 5.19 Pipe Berth found in the crew quarters of the Sea Scout Wreck (Photo Credit: Nathan Richards, 2021).

FIGURE 5.20 Pipe Berth from P-520, an 85' ARB that now operates as a floating museum (*Chesapeake Magazine*, 2021).

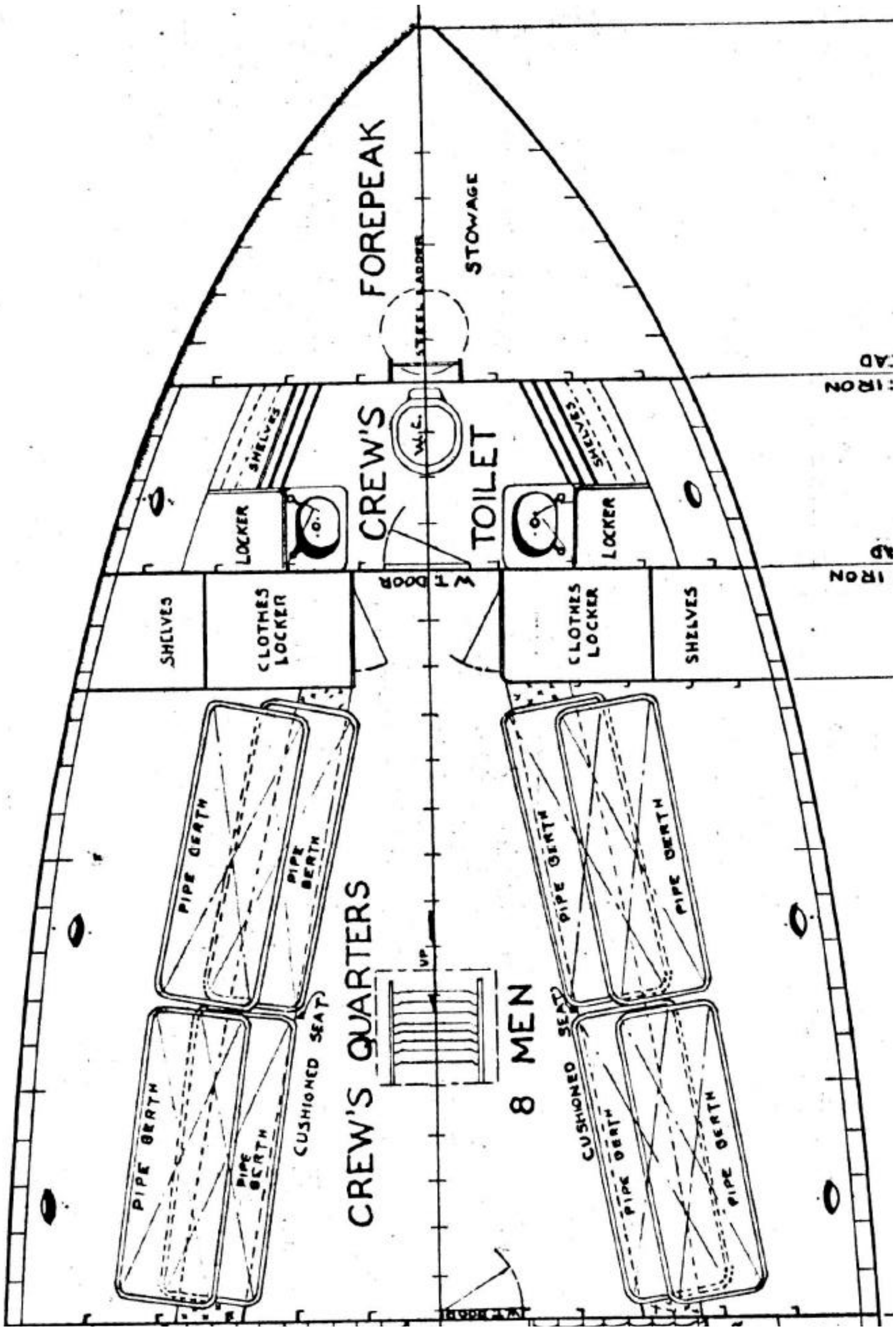

FIGURE 5.21 Crew Quarters of 104's ARB Design 235A showing eight pipe berths in the same section where the one on Sea Scout Wreck was located (Document courtesy of Haggin Museum, 1942).


FIGURE 5.22 Rudder Post found at the aft end of the Sea Scout Wreck (Photo Credit: Nathan Richards, 2021).

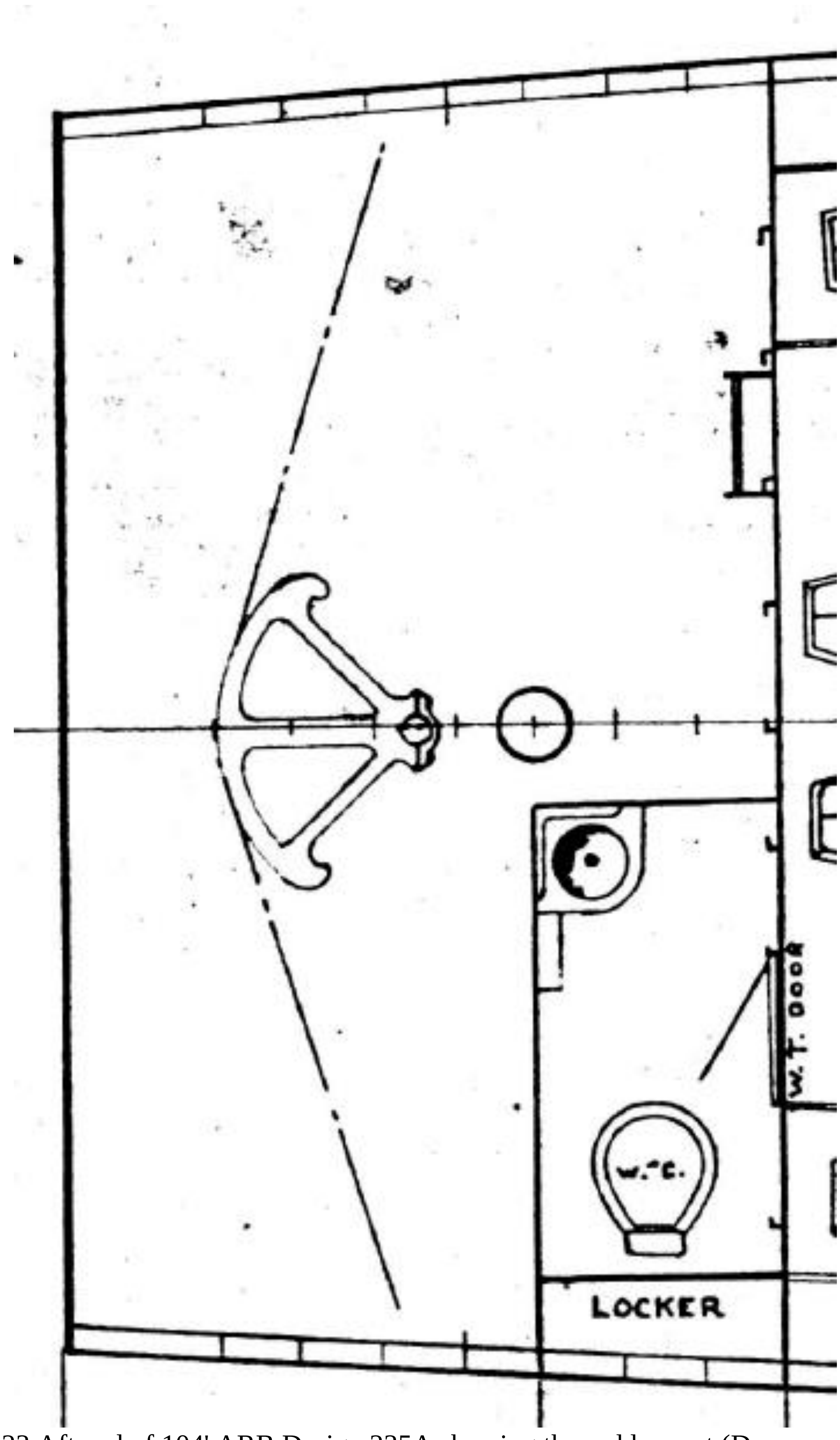

FIGURE 5.23 Aft end of 104' ARB Design 235A showing the rudder post (Document courtesy of Haggin Museum. 1942).

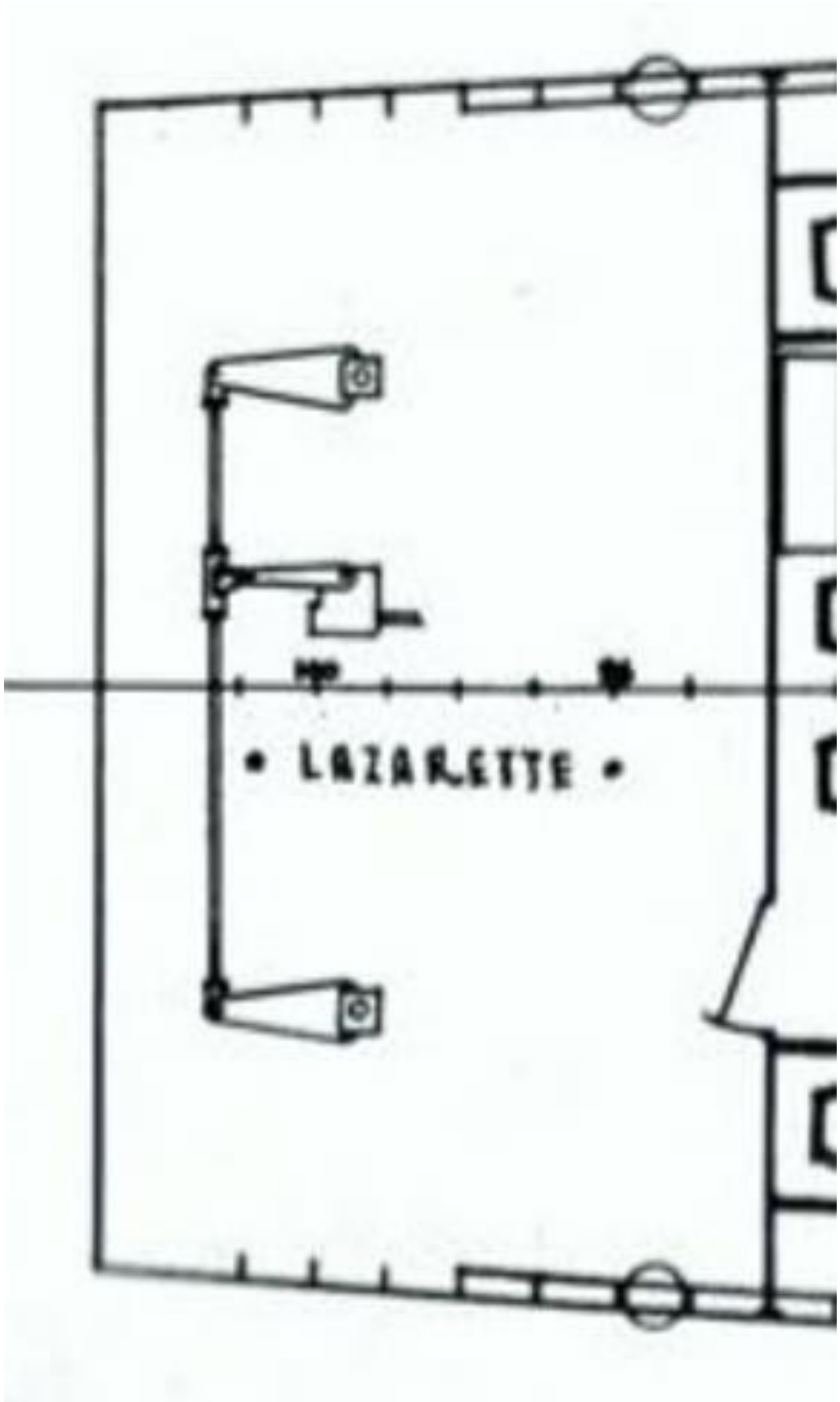

FIGURE 5.24 Aft section of 104' ARB Design 235C showing a dual rudder system different from the one found on the Sea Scout Wreck (U.S. Crash Boats 2020c, Document ownership: National Archives).

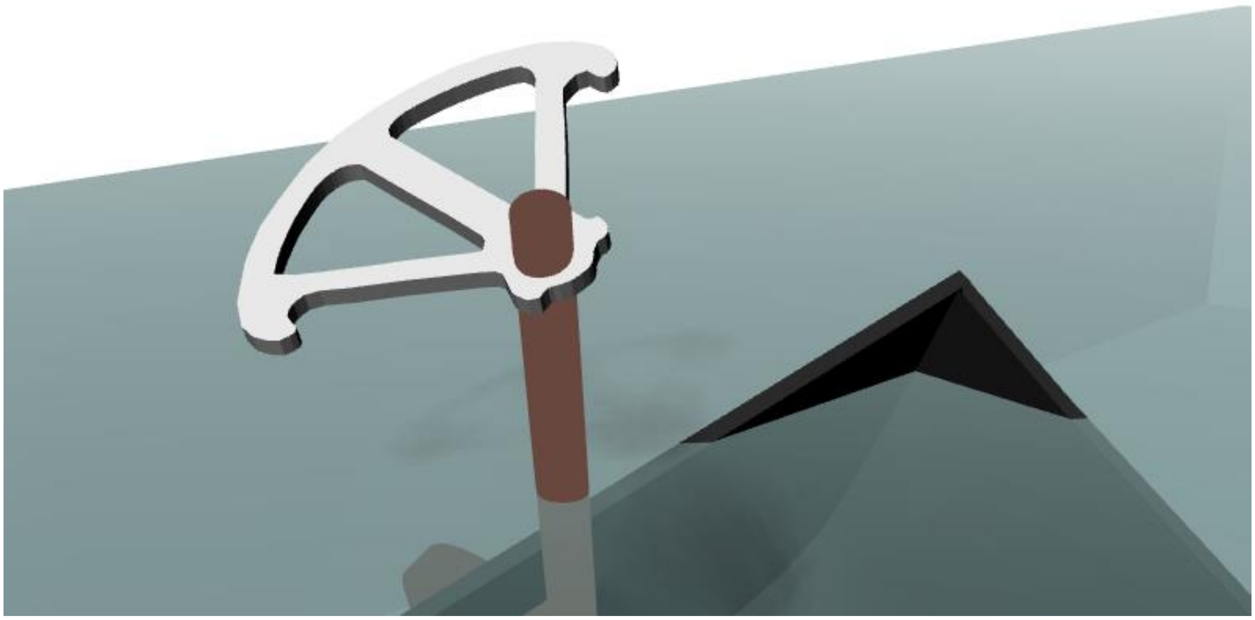

FIGURE 5.25 Rudder on the Sea Scout Wreck (2021) model based on Design 235A design documents (Figure 5.28) and positioned based on 2021 archaeological field work (isometric view) (Model created by Taylor Picard).

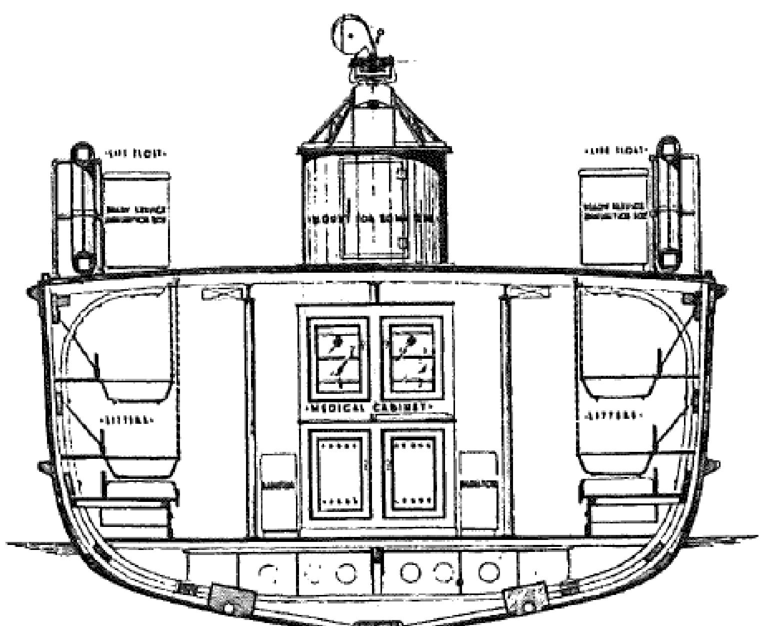

FIGURE 5.26 Cross section of 104' ARB Design 235C showing hull thickness (Sabick et al. 2000:80; Document ownership: National Archives).

Investigating The Sea Cadet Vessel

During the early stages of research on the Sea Scout Wreck, the comment by Tim Chester on the travel website “Sometimes Interesting” (2013) suggesting the identity of the Sea Scout Wreck as U.S.C.G. vessel *Morris Springer* was located. As described above, while the statement regarding the vessel being in the U.S.C.G. while known as *Morris Springer* appears to be inaccurate, the comment also stated that the vessel was used by a Sea Scout unit in Alexandria, VA. While looking for information about ARBs, a comment left by Jack Marsett on the “Log Book” page of the AVR Society stated that he was a Sea Cadet that trained on a 104’ ARB in Alexandria, VA from 1968 to 1973 named N.C.S. *Lexington,* later N.C.S. *Morris Springer* (AVR Society 2016). The comment contained contact information for Jack Marsett (AVR Society 2016) and in 2020 he was contacted about the vessel he on which served when in the Sea Cadets. His response indicated that his unit was a joint organization between the Sea Scouts and the Naval Cadet League (Sea Cadets) and that the vessel he on which served was owned by Ralph Mancill, who abandoned it in Mallows Bay in the mid to late-1970s (Jack Marsett 2020, elec. comms.). While searching for records of ship ownership for Ralph Mancill, an obituary webpage was found for him on which another member of the Sea Cadet unit, Brian Hodgson, commented about his time in the program and that East Carolina University students were working on tracking down the ship (Darlington Cremation and Burial Service 2019). Brian Hodgson was contacted using the email provided in his comment, and he expanded on the information provided by Jack Marsett (Brian Hodgson 2021, elec. comms.).

According to the oral history, during the late 1950s or early 1960s, a 104’ ARB was provided to the Naval Cadet Corps started by Alexandria Businessman Morris Springer and other local businessmen (corroborated in *The Washington Post* 1964:B17). The vessel was transferred to the Naval Cadet Corps at the naval base in Little Creek, VA, and renamed Naval Cadet Ship (N.C.S.) *Lexington*. At its peak, the unit had approximately 100 cadets and several vessels including N.C.S. *Lexington*; however, Morris Springer passed away in 1964 and the unit began to shrink in size (see Kasperick 1963:20; *The Washington Post* 1964:B17; Jack Marsett 2020, elec. comm.). At some point in the vessel's history, the pilothouse was extended towards the aft of the vessel, and the three engines and two generator plants were replaced with new fuel-efficient Gray Marine engines and generator plants, although this does not appear to be accurate. In 1966, the Lexington Division in Alexandria, VA was merged with the Dahlgren Division at the Washington Navy Yard and N.C.S. *Lexington* was placed off-limits. The N.C.S. *Lexington* had a frequent leak in one of the propeller shafts that caused it to sink at the dock next to the Alexandria Torpedo Factory (Jack Marsett 2020, elec. comms.).

N.C.S. *Lexington* was recovered months later when Ralph T. Mancill gathered former Sea Cadets along with new interested youth to revive the Lexington Division. Using his connections at the Navy Salvage Diving School at the Washington Navy Yard, he was able to persuade the divers into taking on the project of refloating the vessel. Once refloated, it was up to the cadets to clean the mud and dead fish that had accumulated in the vessel during its months of inundation. The equipment, motors, generators, and engines were taken apart and cleaned with fresh water to remove the mud and other debris (Jack Marsett 2020, elec. comm.). Everything was dried, repaired, and reassembled over 18 months; the vessel was operational again and renamed N.C.S. *Morris Springer* in honor of the division's founder. After the vessel was raised, only one of the engines was still operational and the entire area aft of the engine room was deemed unsuitable for use (Brian Hodgson 2020, elec. comm.). In 1971, the Lexington Division became affiliated with the Boy Scout's Sea Explore Program (Sea Scouts), and it became Sea Explorers Ship 609. In 1974, the City of Alexandria began to convert the torpedo factory on the city's waterfront into an art center and pushed to have the vessel moved (Jack Marsett 2020, elec. comm.). According to Jack Marsett, the vessel was run aground in 1975 by Ralph Mancill, who intended to return and refloat it when funding was available; however, most of the cadets did not have the means to travel the 50 miles from Alexandria to Mallows Bay (Brian Hodgson 2020, elec. comm.; Jack Marsett 2020, elec. comm.). This eventually led to the vessel sinking again in its current location within the Burning Basin of Mallows Bay and becoming known as the Sea Scout Wreck (Brian Hodgson 2020, elec. comm.; Jack Marsett 2020, elec. comm.).

This oral history was evaluated to determine if the Sea Scout Wreck was used by the individuals and organizations mentioned. The key component to this evaluation was locating primary sources regarding the vessels, and their owners or operators. The first stage of this involved examining historical aerial photographs of the torpedo factory in Alexandria, VA from 1950 to 1980. This activity found that as early as November 9, 1959, to as recently as March 16, 1977, a vessel matching the measurements of a 104' ARB was docked at the torpedo factory (Figures 5.27 and 5.28) (U.S.G.S. 2021). While the spatial resolution was not a high enough quality to establish if the vessel was 104' ARB, the 1976 report by Eugene Pandula on the Alexandria Torpedo Factory Art Center included two pictures of the vessel that verify that it is a 104' ARB (Pandula 1976:41,52). The image quality is too low, however, to make out the vessel's name or registration number. Correspondence with library staff at George A. Smathers Library at the University of Florida has revealed that the digital copy of the report was created as a part of a student project, but it is unknown where the original copy may be located (Ann Lindell elec. Comms., 2022). The administrative staff of the Alexandria Torpedo Factory Art

Center was contacted regarding the report but have not yet responded. A search of the Alexandria Library databases did not locate a copy of the report. While the dates for the vessel's appearance in Alexandria, VA do not match the dates provided by Jack Marsett exactly, this discrepancy seems to occur because Jack Marsett was no longer affiliated with the organization by 1975, as he was attending California State University Maritime Academy at the time (Jack Marsett 2020, elec. comms.).

A major issue has arisen with the oral history regarding documentation of the vessel, as well as the historical evidence of the Sea Cadet's 104' ARB. Research into available newspapers and articles regarding the vessels described in the oral history revealed that the Lexington Division of the Naval Cadet League had an ARB in 1963 known as N.C.S *Lexington*, but the article describes an ARB as a "battle damage repair ship" (Kasperick 1963:20). This is probably due to a misunderstanding as ARB was the U.S. Army designation for the crash boats, but for the U.S. Navy, ARB is the designation for battle damage repair ships. As the battle damage repair ship was 328' in length and had a beam of 50' it would seem unlikely that this vessel would have been used by the Sea Cadets nor a potential candidate for the Sea Scout Wreck (Naval History and Heritage Command 2016b). Another article stated that Ralph Mancill headed Sea Explorer Post 145 which used an undescribed vessel known as *Morris Springer* (The Danville Register 1975:3-B). Despite these articles acknowledging a review of the *Merchant Vessels of the United States* (M.V.U.S.) could not locate any vessels owned by Morris Springer, Ralph Mancill, or any relevant organizations (Boy Scouts, Naval Cadet League, Sea Cadets, Sea Explorers, or Sea Scouts) that operated in Alexandria, VA (U.S. Treasury Department 1945-1952, 1955-1966, 1968-1979, 1981). An article from the *Washington Post* dated February 28, 1954, describes a 75-foot vessel previously used by a Sea Scout unit in Alexandria, VA. In the article the vessel is said to carry "...a certificate for undocumented vessel made out to 'Morris Springer, skipper.'" (The Washington Post 1954:M13); however, communications with U.S.C.G. Historian's Office historians have raised doubts regarding the authenticity of this type of certificate existing and the M.V.U.S. lists vessels that are exempt from being registered, but none were found for Morris Springer (person or vessel) during this time.

Another major contradiction between oral history, historical evidence, and archaeological evidence have occurred regarding the engines and generators of the vessel. In Marsett's oral history, he stated that the engines and generators were replaced with Gray Marine generators (Jack Marsett 2020, elec. comms.), while Hodgson's version is that the vessel had only one engine and no generators or battery power, which caused it to sink in the first place (Brian Hodgson 2021, elec. comm.); however, an article from 1965 describes a 65-foot vessel provided to Ralph Mancill by the U.S. Coast Guard that had the engines replaced with the Gray Marine engines (Gilliam 1965:A1). No engines were located on the Sea Scout Wreck to confirm the number or model of engines on the vessel when it was abandoned. The generator plant that was found appears to be an original Delco Remy generator plant the vessel would have on board when built in the 1940s. Additional historical research to link the oral history to either the 104' ARB seen at the torpedo factory in Alexandria, VA, or the Sea Scout Wreck has not yet found any to prove or disprove a connection (see Table 5.2). Until more information becomes available establishing a positive identity for the Sea Scout Wreck as the same vessel used by the Sea Cadet unit in Alexandria, VA is not possible. Available circumstantial evidence, however, suggests that the 104' ARB seen at the torpedo factory could be the same vessel that became the Sea Scout Wreck.

FIGURE 5.27 Alexandria Torpedo Factory on November 9, 1959, the first time a vessel matching the size of a 104' ARB is first seen (Exposure number 1736) (U.S.G.S. 2021).

FIGURE 5.28 A vessel with measurements matching a 104’s ARB, probably N.C.S. *Morris Springer*, at Alexandria Torpedo Factory on March 16, 1977 (Exposure number 3-116) (U.S.G.S. 2021).

TABLE 5.2 Historical Sources and Repositories reviewed or contacted regarding 104' ARB described in the Oral History.

Sources Viewed	Search/Keywords	Results
Merchant Vessels of the United States 1945-1952, 1955-1965, 1968-1979, 1981	Present Name: P-#, Q-#, S.E.S. (NAME), S.S.S. (NAME) Former Name: P-#, Q-# Managing Owner: Boys Scouts of America, Lexington Division, Morris Springer, Naval Cadet League, Ralph Mancill, Sea Cadets, Sea Explorers, Sea Scouts Lost Vessels: P-#, Q-#, S.E.S. (NAME), S.S.S. (NAME) Removed or Exempted Vessels: P-#, Q-#, S.E.S. (NAME), S.S.S. (NAME)	No vessels matching the description of N.C.S. *Lexington*, or N.C.S. *Morris Springer* No vessels belonging to Morris Springer, Ralph Mancill, or related organizations in Alexandria, VA.
U.S.C.G. Historian's Office: U.S.G.S. List of Vessels, Correspondence with U.S.G.S. Historians	104' Aircraft Rescue Boat, Vessels provided to Morris Springer, Naval Cadet League, Ralph Mancill, Sea Cadets, Sea Explorers, Sea Scouts	No vessel matching the description of 104' ARB, records of vessels being provided to Sea Scouts or Sea Cadets in Alexandria, nor records of exemptions being provided to Morris Springer or Ralph Mancill
Alexandria Library Databases	Lexington Division, Morris Springer, Naval Cadet League, Sea Cadets, Sea Explorers, Sea Scouts, Ralph Mancill	The Washington Post 1954:M13, 1964:B17
George A. Smathers Library at the University of Florida	A higher-quality copy of the Pandula Report	Report scanned as a student project and is unavailable at the library
Alexandria Torpedo Factory Art Center	Copy of Pandula Report	No Reply
Naval Diving and Salvage Training Center	Report on efforts to raise Sea Cadet's 104' ARB.	All records before the move to Panama City Beach. FL is stored at the National Archives.
National Archives	Records of Naval Diving and Salvage Training Center	The branch closed due to Covid (December 2021); the Current order is in processing (March 2022).

From Alexandria to Mallows Bay

On March 24, 1977, just eight days after the aerial photograph of the Alexandria Torpedo Factory was taken, an aerial photograph of Mallows Bay was taken. In this photograph (Figure 5.39) there are no vessels located in the Burning Basin. The next available aerial photograph of the area was taken on March 27, 1980, and shows a vessel with measurements matching a 104' ARB in the location now occupied by the Sea Scout Wreck (Figure 5.30). The next available aerial photograph that clearly shows the Alexandria Torpedo Factory was taken on April 2, 1981 (Figure 5.31). It shows that the 104' ARB is no longer docked there. This seems to support the current hypothesis that the Sea Scout Wreck is the same vessel docked at the torpedo factory in Alexandria, VA, that was moved sometime in the late 1970s, or early 1980; however, this only establishes that it was moved, and a 104' ARB was moved into the Burning Basin in Mallows Bay at approximately the same time. When examining the photographs of the Sea Scout Wreck provided by Dr. Susan Langley, there is additional material laying across the deck aft of the pilothouse that cannot have been produced from 104' ARB without modified deck features (Figure 5.32) (Susan Langley 2020, elec. comms.).

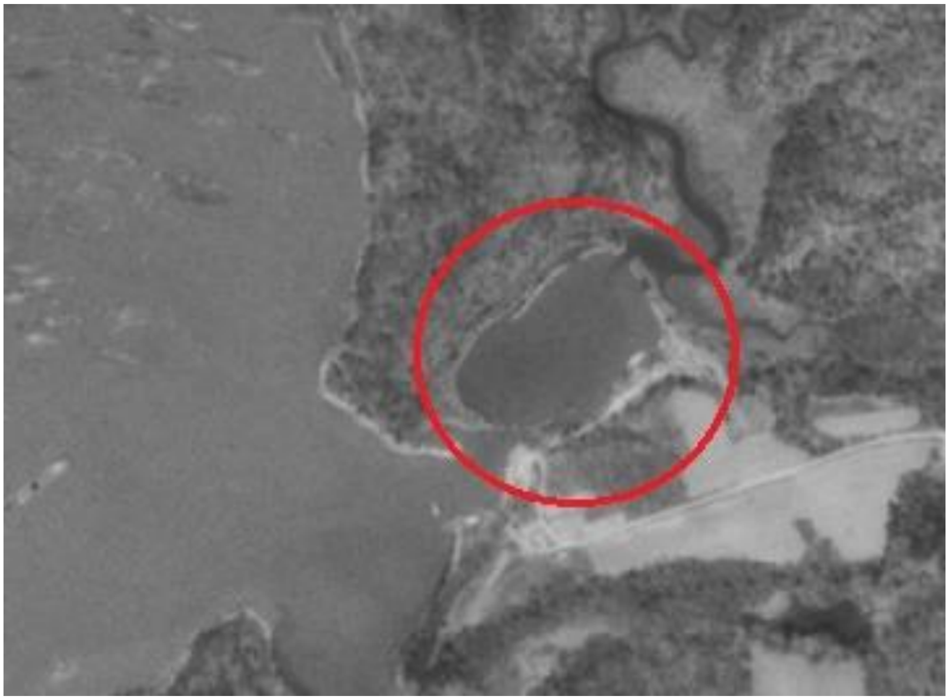
FIGURE 5.29 Aerial photograph of Mallows Bay March 24, 1977, with no ships occupying the Burning Basin circled in red (Exposure number 4-49) (U.S.G.S. 2021).


FIGURE 5.30 Aerial Photograph of Mallows Bay March 27, 1980, with a vessel that has measurements that match a 104' ARB occupying the present location of the Sea Scout Wreck (Exposure number 17-186) (U.S.G.S. 2021).

FIGURE 5.31 Aerial photograph from April 2, 1981 of Alexandria Torpedo Factory circled in red, showing the 104’ ARB no longer docked there (Exposure number 439-21) (U.S.G.S. 2021).

FIGURE 5.32 Photograph showing the excess deck material that could not be attributed to a standard 104' ARB Design 235A (Photo courtesy of Susan Langley, 1997).

As described in Chapter 3, the Alexandria 104’ ARB (1976) model was made and compared to the 1997 photographs. The extended cabin of the Alexandria 104’ ARB appears to correspond with the additional superstructure features that appear in photographs. Due to this similarity, the Alexandria 104’ ARB (1976) model was used as the foundation for the Sea Scout Wreck (1997) model which represents the wreck as it appeared in the 1997 photographs (Figure 5.33). By simply moving and rotating the components found in the Alexandria 104’ ARB (1976) model, the new 3D model closely matches the photos of the Sea Scout Wreck (Figure 5.34). Additionally, the debris field created from the components that are missing from photos corresponds to the debris field encountered by the team while documenting the Sea Scout Wreck in 2021. Furthermore, considering that only 36 of all 104’ ARB Design 235As built have unknown fates (Table 5.3) suggests that the possibility of two 104’ ARBs operating on the Potomac River at the same time to be very low, but not impossible. In combination with the previous evidence of the aerial photographs and similarities between the superstructure features seen in the 1997 photographs and those modeled on the Alexandria 104’ ARB (1976) model creates a collection of circumstantial evidence which suggests that the Sea Scout Wreck was the 104’ ARB seen at the torpedo factory in Alexandria, VA and helps to establish a possible history for the vessel in the years before its deposition.

TABLE 5.3 List of the 36 Design 235 A 104' ARBs with Unknown Fates (See full list in Appendix 1) (U.S.G.S. 1945-1952, 1955-1965, 1968, 1970-1979, 1981; Shipbuilding History 2017; U.S. Crash Boats 2020d)

Builder	**Location**	**P-#**	**Other Army Designations**
Casey BB	Fairhaven, MA	P-90	
Casey BB	Fairhaven, MA	P-91	
Casey BB	Fairhaven, MA	P-92	
Casey BB	Fairhaven, MA	P-93	
Dooley's Basin	Fort Lauderdale, FL	P-94	
Dooley's Basin	Fort Lauderdale, FL	P-95	
Dooley's Basin	Fort Lauderdale, FL	P-96	
Dooley's Basin	Fort Lauderdale, FL	P-97	
Dachel-Carter SB	Benton Harbor, MI	P-99	
Ventnor Boatworks	Atlantic City, NJ	P-107	
Ventnor Boatworks	Atlantic City, NJ	P-108	
Ventnor Boatworks	Atlantic City, NJ	P-109	
Stephens Bros.	Stockton, CA	P-111	
Stephens Bros.	Stockton, CA	P-112	
Manteo BB	Manteo, NC	P-117	Q-125
Brownsville SB	Brownsville, TX	P-120	
Stephens Bros.	Stockton, CA	P-141	Q-174
Dooley's Basin	Fort Lauderdale, FL	P-150	
Stephens Bros.	Stockton, CA	P-209	
Sagstad SY	Seattle, WA	P-214	Q-182
Hillstrom SB	North Bend, OR	P-219	Q-176
Dooley's Basin	Fort Lauderdale, FL	P-221	
Dooley's Basin	Fort Lauderdale, FL	P-222	
Dooley's Basin	Fort Lauderdale, FL	P-224	
Dooley's Basin	Fort Lauderdale, FL	P-233	
Dooley's Basin	Fort Lauderdale, FL	P-235	
Dooley's Basin	Fort Lauderdale, FL	P-236	
Dooley's Basin	Fort Lauderdale, FL	P-237	
Brownsville SB	Brownsville, TX	P-242	
Brownsville SB	Brownsville, TX	P-243	
Brownsville SB	Brownsville, TX	P-244	
Casey BB	Fairhaven, MA	P-249	
Casey BB	Fairhaven, MA	P-250	Q-170
Manteo BB	Manteo, NC	P-255	
Casey BB	Fairhaven, MA	P-276	
Casey BB	Fairhaven, MA	P-278	

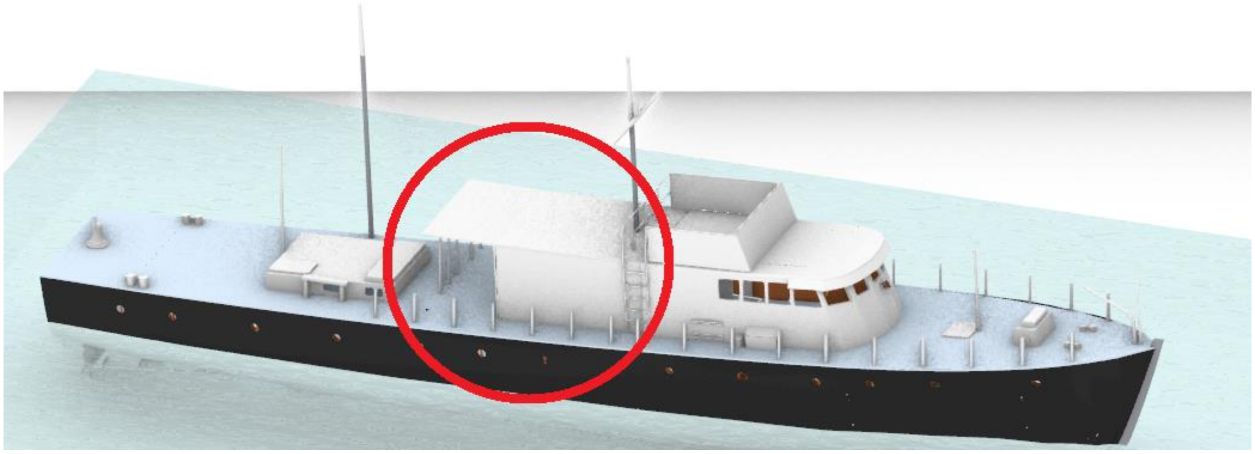

FIGURE 5.33 Alexandria 104’ ARB (1976) model showing the cabin extension that could contribute to the excess material found in Figure 5.37 (isometric view) (Model created by Taylor Picard).

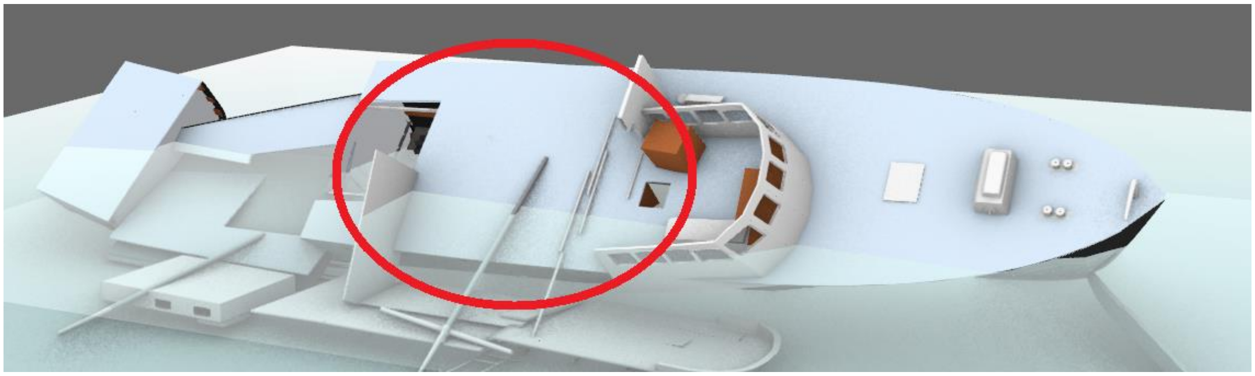

FIGURE 5.34 Sea Scout Wreck (1997) model showing excess deck material possibly created from the cabin extension to the Alexandria 104’ ARB (1976) model (isometric view) (Model created by Taylor Picard).

Conclusion

Through combined archaeological and historical work it is possible to establish the Sea Scout Wreck as a 104’ Aircraft Rescue Boat built for and used by the U.S.A.A.F. The process of coming to this determination relied on eliminating a list of suggested identities that were located early on in this research to make sure they were not valid candidates. Once this was complete, the oral history suggesting that the Sea Scout Wreck is the same 104’ ARB used by the Sea

Cadets of Alexandria, VA in the 1960s to 1970s was examined. While it was not possible currently to draw a direct connection between the two, the combined evidence of the comparison of historical aerial photographs, evidence found in the 3D modeling process, and the low probability that two of the remaining 36 Design 235A ARBs with unknown fates were operating on the Potomac River at the same time suggests that the Sea Scout Wreck may have been the 104’ ARB docked at the torpedo factory in Alexandria from 1959 to the 1970s.

Chapter Six:

From Shipyard to Shipwreck: The Formation Processes of the Sea Scout Wreck

The goal of this research was to answer the question "What is the disintegration process of the Sea Scout Wreck, and how does it compare to known processes of other composite ships?" This question can be answered by examining the Sea Scout Wreck through the lens of site formation theory, which requires an examination from the beginning of the vessel's use-life. From there, it is possible to examine many of the changes that have occurred at various periods in the vessel's life. During this process, it becomes possible to answer the secondary question "What are the factors that have contributed to the current state of preservation of the Sea Scout Wreck, and what factors are likely to drive its future archaeological site formation?" Answering this can help to answer the other secondary question "What management strategies could help preserve the Sea Scout Wreck?"

This chapter answers these questions by analyzing archaeological and historical data collected during this study and examining it in a timeline from construction to current condition categorized into three sections: pre-deposition (~1942 to ~1977), deposition (~1977 to ~1980), and post-deposition (~1980 to 2021). The pre-depositional section examines the use-life of the vessel from when it was built to when it was abandoned in Mallows Bay and includes the many changes it would have undergone. The deposition section discusses whether the vessel was intentionally abandoned based on available historical and archaeological evidence. The post-depositional section discusses the disintegration process once the Sea Scout Wreck was abandoned. Finally, the chapter presents a hypothetical future model of the Sea Scout Wreck once it reaches a point of being almost completely submerged.

Pre-Deposition (~1942 to ~1977)

As previously shown, the evidence establishes that the Sea Scout Wreck is a 104' ARB Design 235A but does not definitively prove that it was a vessel used by the Sea Cadets of Alexandria, VA, possibly known as N.C.S. *Morris Springer*. Although there is no absolute evidence establishing an identity, nor any evidence to establish the exact P- number, which was the original designation of the vessel. The historical record does provide insight into the construction of this vessel. Photos of the Stephen Bros. Ship Building Company show 104' ARBs being constructed in a manner that is traditional with wooden ships (Figure 6.1). In the photos, it is visible that the keel was initially laid down, then the floor timbers were attached. Next, the bulkheads were added followed by the frames and stringers (Figure 5.3). Then the strakes making up the outer hull of the vessel were attached. Once this initial structure was laid out, the internal components would have been added to the vessel.

FIGURE 6.1 Construction of P-112, a 104' ARB Design 235A, at Stephen Bros. Ship Building Company, show a process that is consistant with construction of wooden vessels (Photo courtesy of Haggin Museum, 1942).

By examining the internal components and arrangement in the 3D model created from the design plans of the 104’ ARB with the history of these vessels discussed in Chapter 4, the initial function of a 104’ ARB is established. The two separate crew and officer quarters show that ARBs were operated by a crew of twelve, made up of two officers, two engineers, and eight crewmembers. The presence of the three 1341-gallon fuel tanks, a full galley, individual bunks, showers, and lockers suggests that these vessels were built for long-range, multiday missions that required the crew to live on board. Additionally, roughly a third of the ship was built for the vessel's primary purpose, which was, as the name of the vessel type implies, to rescue pilots and aircrew of crashed aircraft (Figure 6.2).

Evidence of this initial function is also visible on the deck of the vessel, as ARBs were equipped with a 2-ton derrick at the aft of the ship for towing or carrying aircraft wreckage, one lifeboat, and two life rafts to rescue pilots and aircrews. To aid in locating these survivors, 104' ARBs were equipped with two large spotlights – one on the roof of the pilothouse, and another mounted to the top of the derrick. The historical record states that these vessels had a longer range but were not as swift as their smaller variants as their intended purpose was not speed but distance. This was due to their primary mission focusing on supporting medium to long-range missions undertaken by U.S. Army Air Force bomber planes (Friedman 1987:431). To carry out this mission the infirmary could hold seventeen survivors at a time.

The Sea Scout Wreck appears to be built to the specifications of Design 235A, an early variant of the 104' ARB, making it impossible to determine where this vessel would have operated during World War II without identifying it. Regardless of the theater of war, these vessels were often placed in a position of peril that required self-defense. The Design 235A ARBs only had three mounted .50-caliber machines initially but were later upgraded to include 20mm cannons (Design Documents of 235A and 235C). While it is not known if the Sea Scout Wreck would have received these upgrades, it is important to consider the possibility.

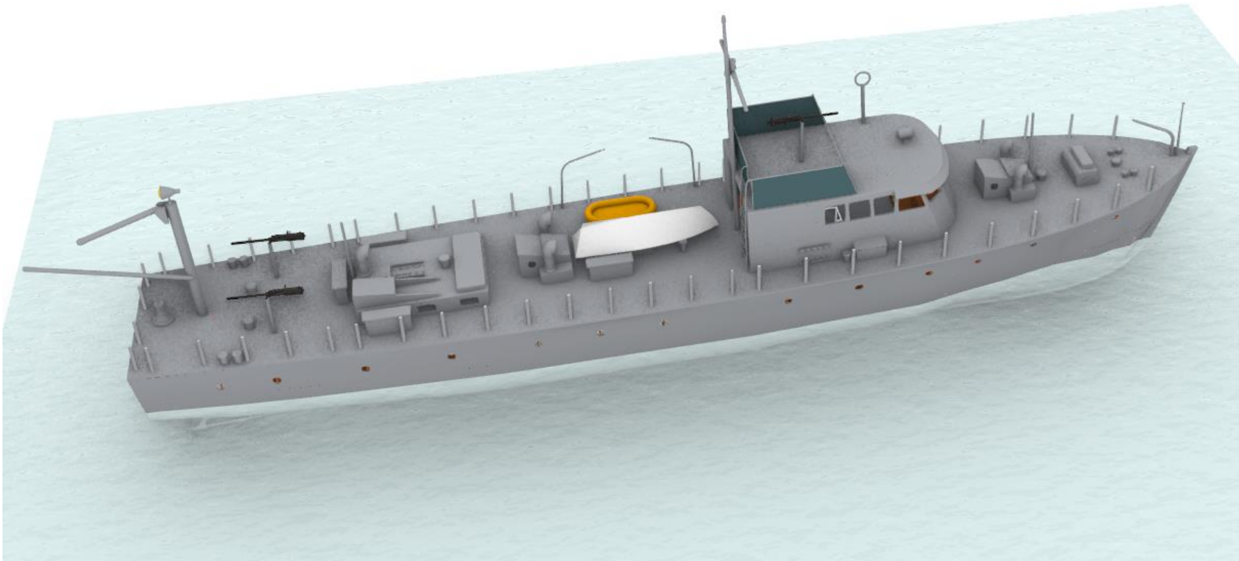

FIGURE 6.2 104' ARB (1942) model showing the original design 235A lay out the Sea Scout Wreck would have launched with (Model created by Taylor Picard).

The fact that the Sea Scout Wreck was built as a 104’ ARB Design 235A indicates that it was built early in the United States’ involvement in World War II (1942 to 1943) (Grover 1987:150-151). This means would have been used for its intended purpose of supporting long-range and naval aviation missions. This establishes that the Sea Scout Wreck had a primary function phase (discussed in Chapter 2), as it would have operated in support of U.S.A.A.F. missions. As the history discussed in Chapter 4 shows, the vessel could have undergone a change in function to support other U.S. Army missions. At this time the designation of the vessel would have changed to Quick Supply boat. This would see a change in the intended function of the vessel, but its form would have stayed the same with only minor changes in the arrangement of objects above and below deck (Grover 1987:149-151). These modifications would have simply been a change of the dispensary to a cargo hold. The lack of features and artifacts in this section of the Sea Scout Wreck could be evidence of this change in function.

Post-War Lateral Cycling (~1945 to 1959)

According to the oral history of the Sea Scout Wreck, the vessel was sold to the Sea Cadet unit in Alexandria by the U.S. Navy (Jack Marsett 2020, elec. comm.). This means at some point during or after World War II, this vessel was sold or given to the U.S. Navy by the U.S. Army. While it is currently not possible to determine the reason this happened, it is not uncommon for military branches to sell off wartime assets during peacetime; however, it is impossible to say if any changes were made as part of either of these lateral cycles, but ARBs probably underwent some reclamation as they no longer needed wartime equipment. To understand this process, the 3D model of the 104' ARB (1942) was modified by removing wartime features, primarily the pintle-mounted .50-caliber machine guns, as well as the 2-ton derrick (Figure 6.3 and 6.4). Additionally, it is suspected that the U.S. Army or U.S. Navy would have kept the lifeboats and life rafts as they could be reused on other vessels. This change from one military branch to another, if it did occur, would see the Sea Scout Wreck undergo *Lateral Cycling* (Schiffer 1987:29). Additionally, if it had not already experienced a change in function before, it was probably after the lateral cycling transferred to the U.S. Navy as they did not have the same need for long-range rescue boats as the U.S. Army. This presents a second explanation for the lack of cultural materials between Bulkheads 6 and 7 of the Sea Scout Wreck.

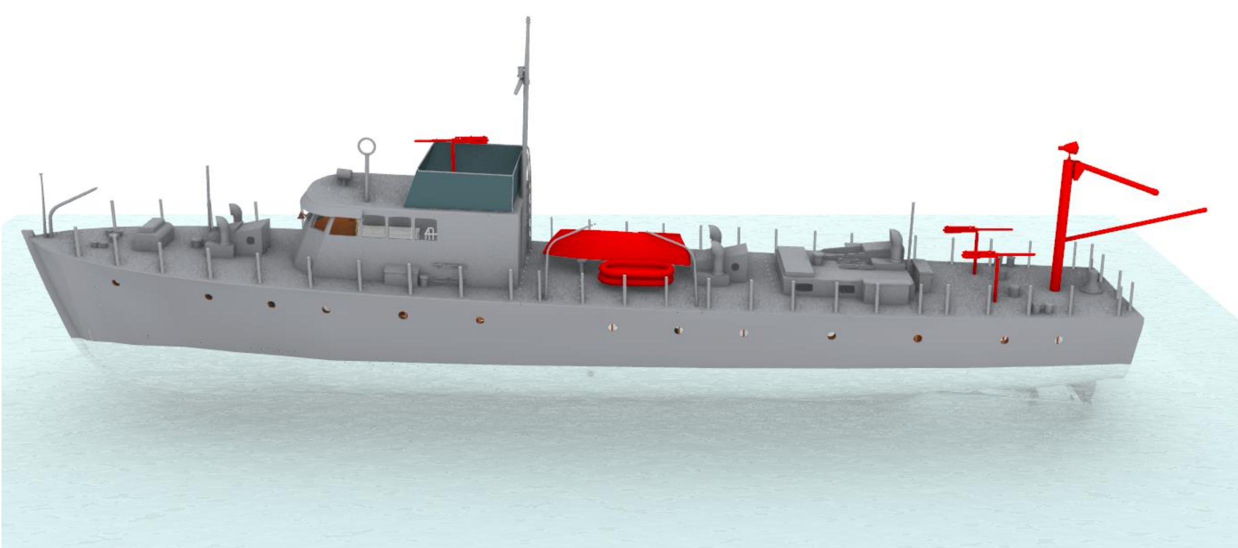

FIGURE 6.3 104' ARB (1942) model showing the features that were removed for the Postwar 104' ARB (1945) model colored red (Model by Taylor Picard).

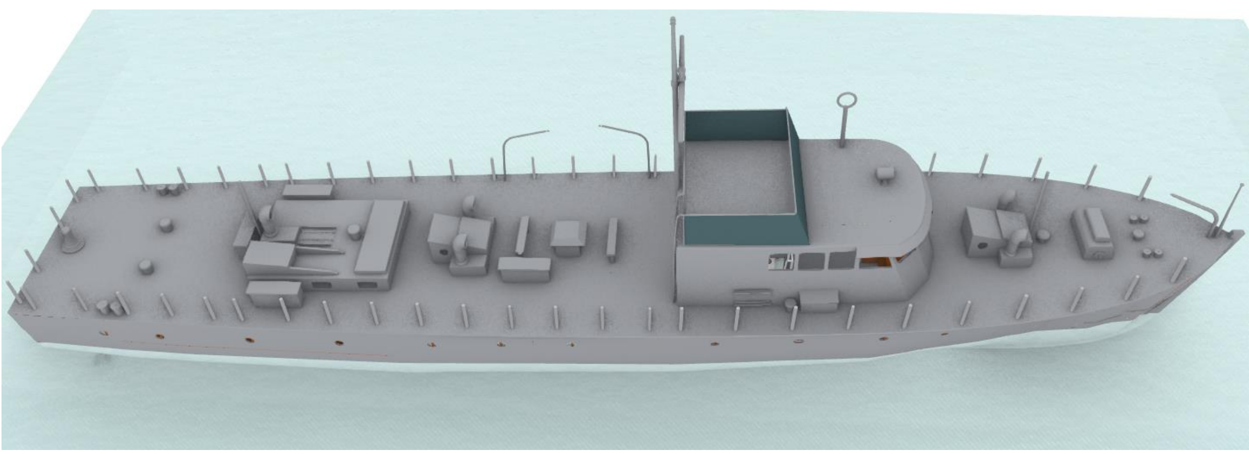

FIGURE 6.4 Postwar 104' ARB (1945) model after the changes were made to the vessel would have undergone during lateral cycling from the U.S. military to private ownership(isometric view) (Model created by Taylor Picard).

As a Civilian Vessel (1959 - ~1977)

While the order of events is uncertain, following the lateral cycling of the ARB from military service to civilian service, the vessel appears to be to have undergone conversion and retrofitting (Pandula 1976:42, 51; Jack Marsett 2020, elec. comm; Brian Hodgson 2021, elec. comm.; U.S.G.S. 2021). The first time a 104' ARB is visible at the Alexandria Torpedo Factory is in 1959 (U.S.G.S. 2021). As previously mentioned, the model of Alexandria 104' ARB (1976) used the images found in Pandula's report to show that various conversions occurred to the ARB after it was acquired by a civilian entity (Figure 6.5) (Pandula 1976:41, 52).

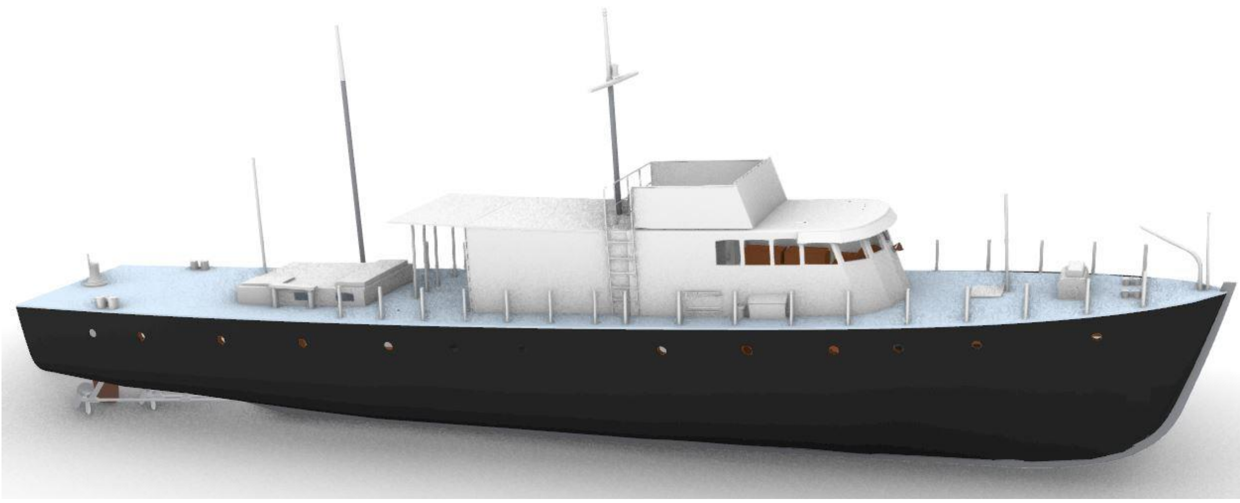

FIGURE 6.5 Alexandria 104' ARB (1976) model representing the 104' ARB in Alexandria, VA based on photographs in Pandula's1976 report (41,52) (isometric view) (Model created by Taylor Picard).

Changing the superstructure

The most noticeable conversion is the 20-foot extension made to the aft side of the pilothouse (Pandula 1976:52). This extension of the pilothouse required the adjustment in the position of other superstructure components (Figure 6.6). The most notable change was the shift of the ladder from the aft side of the pilothouse to its starboard side, and metal supports to hold an overhang aft of the pilothouse (Figure 6.7 and 6.8) (Pandula 1976:52). While it is difficult to say for certain due to the quality of the pictures of 104' ARB, it appears that the top of the ladder's left rail is not attached to any supports at the top of the pilothouse (Pandula 1976:52). Through the 3D modeling process, it was revealed that the mast would have also been shifted further aft to make room for this extension. In the photos, it appears that the mast had a mounting plate on top of the pilothouse (Pandula 1976:52). This could mean that the mast was cut down to make the extension, or that this piece was added for structural support, stability, or simply to prevent moisture from flowing down the mast into the pilothouse. The extensive amount of material visible in the 1997 photos provided by Dr. Langley seems to support that the mast was not cut down and that this plate serves one of the latter suggested purposes (Dr. Susan Langley 2020; elec. comms.). A less noticeable change also revealed in the modeling process was the removal of the mushroom vent cover for the engine room ventilation system, as this would be within the pilothouse. Other notable changes visible in the pictures were added to the 3D model of the Alexandria 104’ ARB. These include the addition of a second mast-like beam on the port side of the vessel aft of the pilothouse, removal of several of the beams for the deck railing, changes in the style of vent covers (which could not be modeled due to missing dimensions), and an overhang attached aft of the pilothouse that is supported by five metal beams (Pandula 1976:52). While the reason for the additional mast structure is unclear, the modification of the pilothouse seems to suggest that the Alexandria 104’ ARB would have operated with a larger crew, or needed more storage on deck; however, evidence from the Sea Scout Wreck shows that there were no structural changes that would alter the vessel’s length or tonnage, meaning the vessel could support up to 28 individuals at one time if all the original pipe berths were left in place (8 in the crew quarter, 4 in the officer and engineer quarters, and 16 in the dispensary).

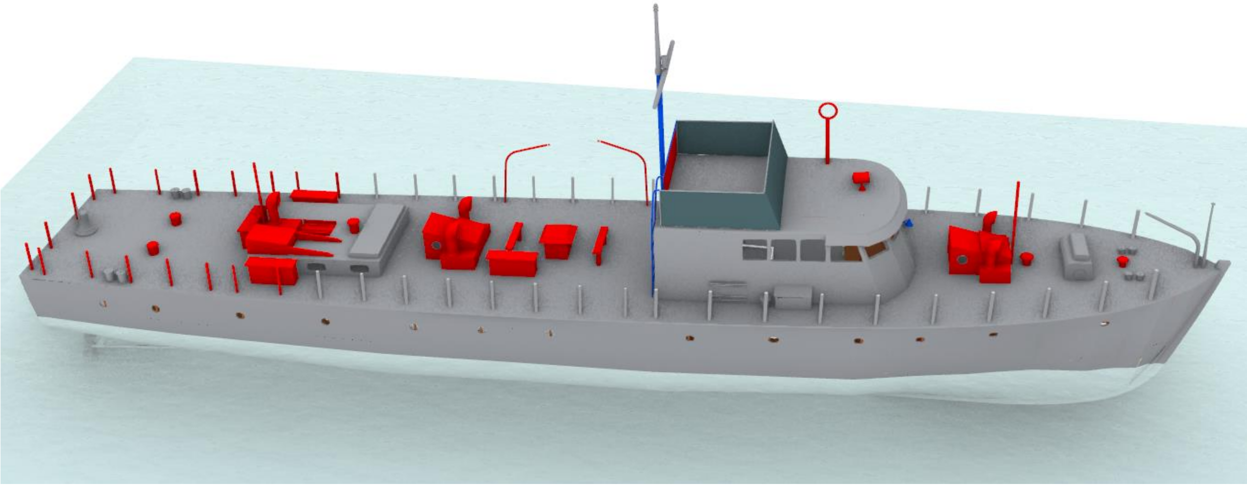

FIGURE 6.6 Post-War 104' ARB (1945) showing features that were removed for the Alexandria 104’ ARB (1976) in red and features that were altered in blue (Model created by Taylor Picard).

FIGURE 6.7 Alexandria 104’ ARB (1976) showing the features that were altered in blue and added in red (Model created by Taylor Picard).

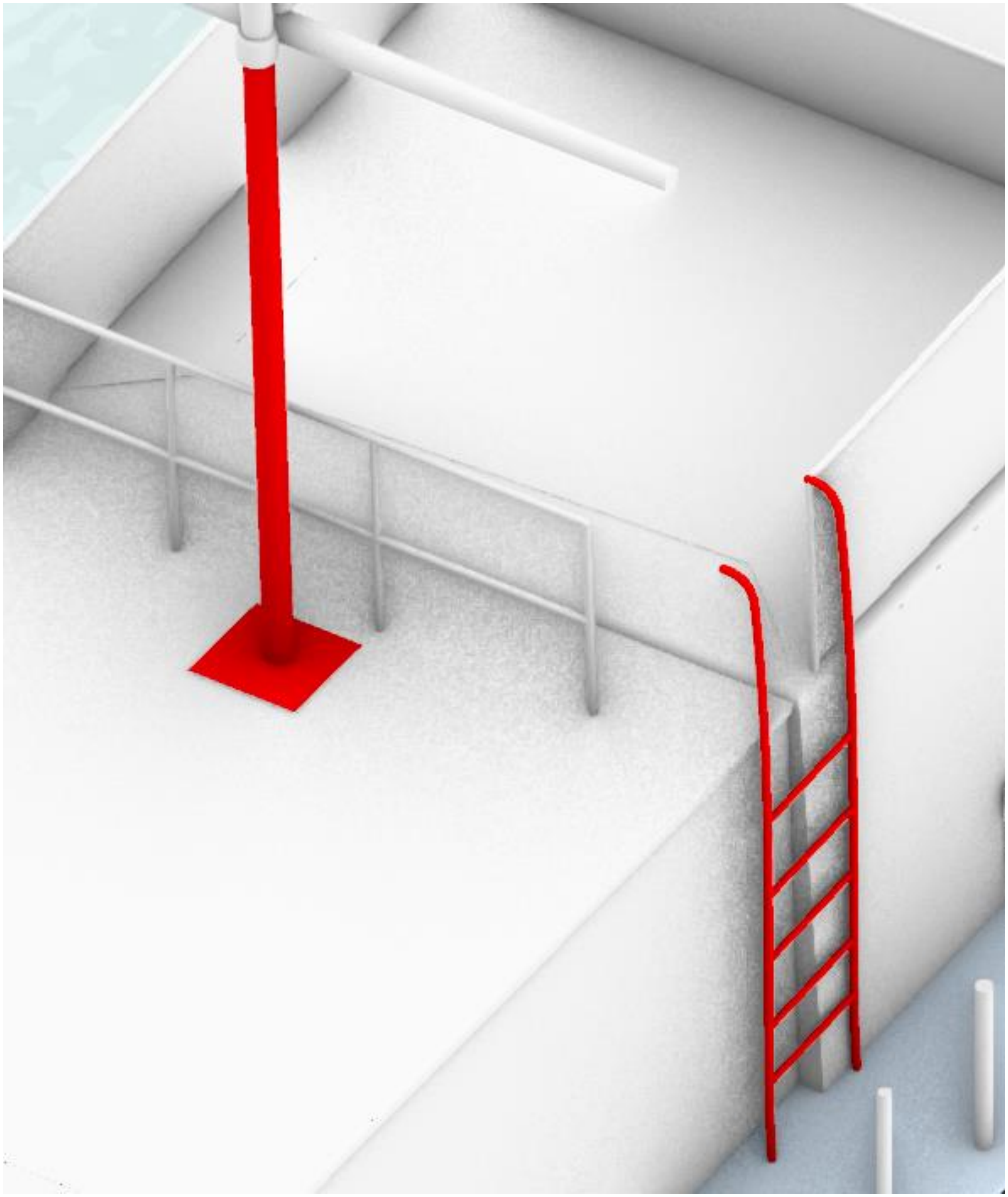

FIGURE 6.8 Close up of the ladder, mast, and metal plate supporting the mass (colored in red) modeled on the Alexandria 104’ ARB (1976). Note that the left side of the ladder does not connect to a railing (Model by Taylor Picard).

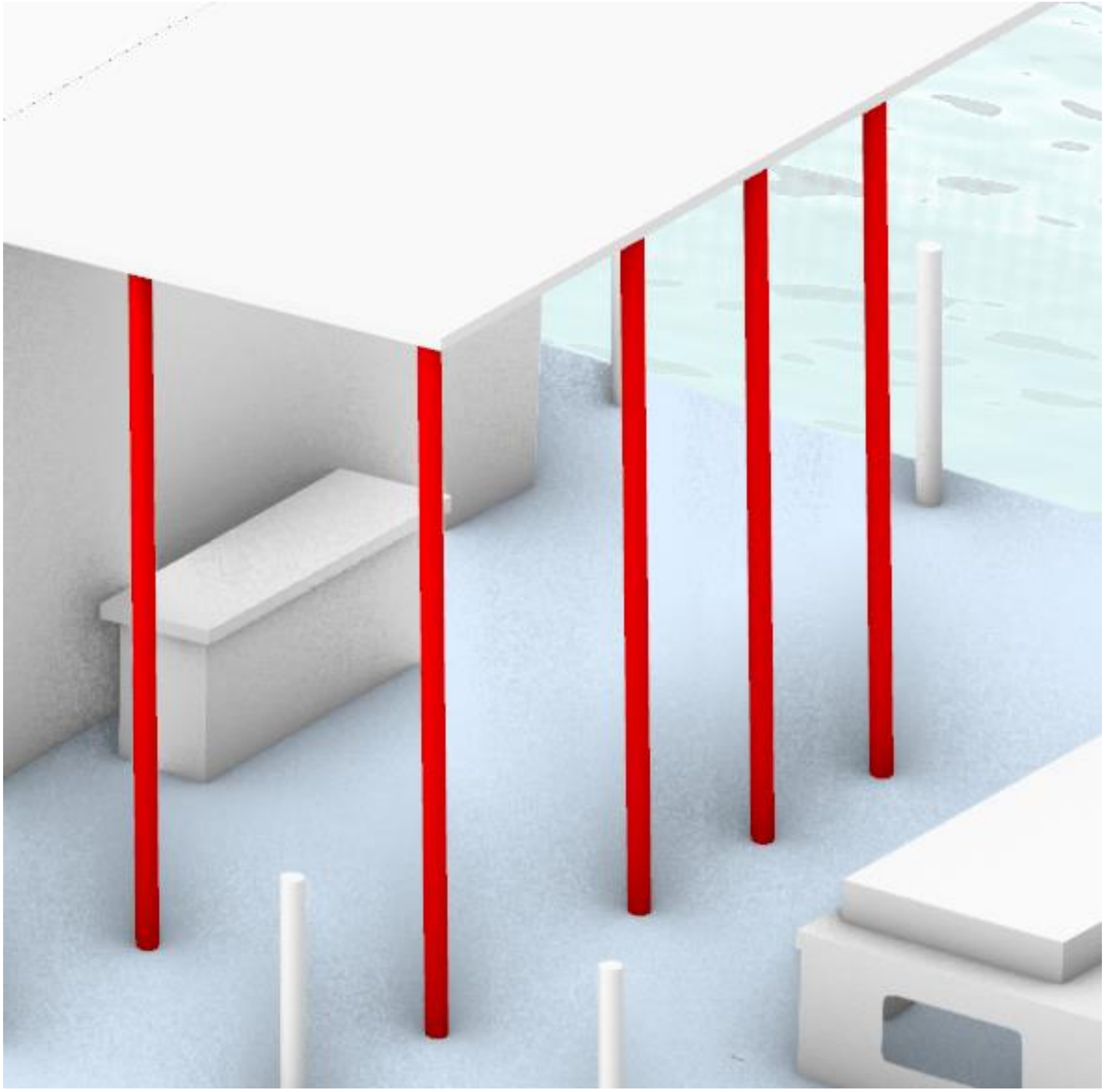

FIGURE 6.9 Close up of the metal beams (colored in red) that support the extended overhang modeled on the Alexandria 104’ ARB (1976) (Model created by Taylor Picard).

Upgrading the interior

The archaeological evidence of the Sea Scout Wreck shows that the generator plants were not retrofitted, as a generator plant similar in shape to a Delco Remy generator plant, was found at the site, but no engines were located at the site to determine if they were the original. There is evidence of retrofit in the engine room concerning the ventilation system that was documented during the 2021 archaeological fieldwork of the Sea Scout Wreck (Figure 6.11). At the time of the fieldwork, it was assumed this was the original ventilation system as it is not displayed on any of the design plans; however, the process of making the 3D model for the Alexandria 104' ARB (1976) revealed that the ventilation must have changed to accommodate the extension of the pilothouse and to prevent potentially hazardous levels of exhaust and fumes from collecting in the pilothouse. This change appears to be venting out at a spot that would be on the port side of the pilothouse instead of the center of the vessel; however, little is known about the original ventilation system at present, so it cannot be determined how much of it remains and how much would have undergone retrofitting. Other minor retrofits documented during the 2021 fieldwork include capping electrical sockets in the bulkhead (Figure 6.12), and using PVC tubes to replace any necessary electrical paths (Figure 6.13). Additionally, pipes leading from the deck to the fuel tanks appear to have been upgraded to PVC pipes (Figure 6.14). While PVC pipes saw some use before World War II, they were not widely used until the 1950s and 1960s (Walker 1990). A NEMA 5-15 AC outlet with a rubber insulated cable was installed, although the purposed for this remains unclear (Figure 6.15 and 6.16). The NEMA company was founded in 1926, although the exact date for when they developed the 5-15 power socket is difficult to determine (NEMA 2022); however, 3-prong receptacles were required for all electrical circuits by 1962 (Dani 2006). While these regulations were intended for residential buildings, the decrease in the chance for an electrical shock or fire is sensible on a wooden vessel. As for the wiring connected to the cable, synthetic alternatives to rubber were not discovered until 1933, but the most common alternative, Ethylene Propylene Rubber (EPR) did not become commonly available until the early 1960s (Matto 2008:9-10; Zuidema et al. 2011:47-48). Another alternate method of insulating electrical wire was a jacket made of thermoplastic PVC. Introduced in the early 1960s, PVC insulation rapidly gained popularity until it replaced most of the nonmetallic-sheathed cable by 1970 (Dani 2006). The metal components of the wire appear to be single-strand aluminum wires. This is consistent with the timeframe of the synthetic rubber insulated cable as the aluminum wire was considered a cost-effective alternative to copper wiring in the 1960s. In 1970 it was discovered that aluminum wires were a serious fire hazard and new standards were implemented in 1971 and 1972 that required aluminum wires to be an aluminum alloy was that was considered less popular than copper (Schatzberg 2003:253-254). Except for the generator plant, these modifications appear to be efforts to retrofit the interior of the vessel using modern alternatives that would have been more cost-effective. The limited window of time for the use of single-strand, aluminum indicates that the modifications were made sometime during the 1960s. When considering the hypothesis that the vessel was used by the Sea Cadets of Alexandria, VA, installing aluminum wire could be the result of having to remove the original electrical system due to the vessel sinking at the dock in the 1960s.

FIGURE 6.10 The ventilation shaft in the engine room of the Sea Scout Wreck. This appears to have originally lined up with the mushroom vent that would have been removed when the pilot house was extended (Photo Credit: Nathan Richards, 2021).

FIGURE 6.11 Original electical paths in Bulkhead 6 of the Sea Scout Wreck that are capped or fitted with PVC pipes (Facing south) (Photo Credit: Nathan Richards, 2021).

FIGURE 6.12 PVC pipe (circled in red) for electrical wire going through Bulkhead 6 of the Sea Scout Wreck (Facing northeast) (Photo Credit: Nathan Richards, 2021).

FIGURE 6.13 PVC pipe mounted to the top of the starboard fuel tank of the Sea Scout Wreck (Photo Credit: Nathan Richards, 2021).

FIGURE 6.14 NEMA 5-15 AC electrical socket mounted to a hanging knee in the engine room of the Sea Scout Wreck (Photo Credit: Nathan Richards, 2021).

FIGURE 6.15 Insulated single strand aluminum electrical wire connected to the NEMA 5-15 socket seen in Figure 6.12 (Photo credit: Nathan Richards, 2021).

Deposition of the Sea Scout Wreck (1977 - 1980)

As previously mentioned, the historic aerial photographs of Mallows Bay on March 24, 1977, and March 27, 1980, establish that the vessel was deposited sometime during these three years (U.S.G.S. 2021). It is difficult to determine if this was abandonment, and if so, how it would be categorized as the vessel appears to have been moored in the bay initially and was eventually abandoned. The lack of intention beyond that stated in the oral histories has made it difficult to determine if there were plans to return to the site of the Sea Scout Wreck (Jack Marsett 2020, elec. comm; Brian Hodgson 2021, elec. comm.). Given that the vessel was moored in a shallow water area of the bay, it appears that the abandonment was an attempt to mothball it in a region that would prevent it from sinking into a state that made it unrecoverable or become a navigational hazard. Regardless of the intent stated in the oral histories and reality, this shallow water location appears to serve as placement assurance (Richards 2008:162-163). Additional evidence to support the location of the ARB's mooring was intended as placement assurance is that the anchors do not appear on the deck of the vessel in the 1997 photographs while several other deck features are still present. The final evidence of placement assurance relates to the vessel's parallel orientation to the Burning Basin's eastern berm which would help block environmental factors that might cause the vessel to break its mooring and drift into the bay, or beyond. Along with the evidence of placement assurance, the presence of tools on the shelf located in the engine room of the Sea Scout Wreck during the 2021 archaeological investigation is consistent with the pattern of de facto refuse of long-term abandonment (Schiffer 1987: 89-91). The distance from Alexandria, VA to Mallows Bay, MD may have made the cost of transporting the materials necessary for the repairs too high, thus leading to its abandonment. On the other hand, the tools found in the engine room could have been considered too specialized or expendable due to low replacement cost and left to be abandoned with the vessel (Schiffer 1987:92-93). Unfortunately, the extensive disintegration of the site has disrupted any other patterns of de facto refuse that could have further illuminated the intentions of this abandonment. Regardless of Mancill's intention to recover the vessel, it is clear the vessel was eventually abandoned as it has never been moved from its original location of deposition.

Post-Depositional (1980 to 2021)

Once the Alexandria 104' ARB was deposited in Mallows Bay, it appears to have quickly experienced several transforms. Most of these appear to be noncultural transforms rather than cultural transforms. By the time Donald Shomette finished his inventory, and the pictures of the Sea Scout Wreck were taken in 1997, large holes were forming in the port side of the vessel aft of the engine room, and it was listing 45º to starboard (Shomette 1998:426; Susan Langley 2020, elec. comms.). Due to this listing, much of the superstructure was falling away from the vessel, which has been modeled to help establish an approximate debris field. The 2021 archaeological fieldwork was essential in establishing which types of transforms caused these effects and for making the hypothetical debris field of the Sea Scout Wreck in 1997.

Evidence of Noncultural Transforms

During the initial evaluation of the pictures of the Sea Scout Wreck that were taken in 1997, it was suspected that the listing and damage to the hull may have been caused by cultural transforms, particularly efforts to salvage the engines of the vessel. This early belief was caused by a lack of environmental information regarding the site. During the 2021 archaeological investigation of the site, it was revealed that the eastern edge of the burning basin that the Sea Scout Wreck sits against has degraded, causing fine sediment to accumulate under the port side of the Sea Scout Wreck. Additionally, the depression encountered during the 2021 archaeological fieldwork appears to be evidence of scouring on the starboard side of the vessel, as there is a significant drop in water depth that the wreck's debris field has collected in the depression. The degradation of the eastern bank of the Burning Basin and the scouring of the sediments on the port side of the wreck appear to be caused by a combination of tidal activity and wave action caused by wind. Both factors were noticeable during the time of the investigation, as the tidal level shifted several inches during the day, and even minor wind caused mild wave activity at the site. In shallow water environments such as these, even relatively small waves with short periods can be the dominant factor for sediment transportation (Quinn et al. 2016:81-83; Nelson and Fringer 2018:6997). This would have easily shifted the very fine sediment found at the site, causing the starboard side of the vessel and the debris field starboard of the vessel to sink into the sediments being suspended by wave and tidal forces. This shows similarities to beach wrecks where there is the erosion of sediments without replacement (Jones 2018:150-151). In the same manner as beached wrecks, the cause of the sediment erosion is the wave activity pulling the sediments away from the Burning Basin's eastern berm.

From 1997 to 2021, there has been a major shift in the positions of all the bulkheads of the Sea Scout Wreck (Figure 6.17, 6.18, and 6.19). The Bulkhead 1 has fallen aft onto Bulkhead 2 and has listed to starboard 75° (Figure 6.20). Bulkhead 2 has not fallen backward, as it is attached to the Bulkhead 3 by a steel I-beam, but has listed to starboard 65° (Figure 6.21).

Bulkhead 3 has only listed 57º to starboard (Figure 6.22). Despite these bulkheads being attached, it appears that Bulkhead 3 was attached to the vessel at the keel, while Bulkhead 2 was attached at the stem. In the 1997 photos of the Sea Scout Wreck, it appears that the stem had already fallen away from the vessel. This would have allowed Bulkhead 2 to list further to port than Bulkhead 3. Bulkhead 4 is not attached to Bulkhead 3, and as a result it has only listed 40º to starboard (Figure 6.23). Bulkheads 4 and 5 are attached by the three fuel tanks between the two bulkheads, as well as two I-beams and several pipes welded to both bulkheads; however, Bulkhead 5 has only listed 32º to starboard (Figure 6.24). Bulkheads 5 and 6 are attached by two I-beams. Bulkhead 6 has listed 35º to starboard despite this, and the starboard side I-beam appears to have broken in two near Bulkhead 6 (Figure 6.25). As the I-beam has a bend around the breakpoint, it appears that the break was caused by a twisting force on the already corroded beam. This is evidence that the beam broke due to the different listing angles of Bulkheads 5 and 6. Bulkheads 6 and 7 do not appear to have an I-beam connecting them,despite this section having the largest cap (24'). In these photos, it is possible to see that the stern collapsed inward, causing the port aft section of the hull and deck to lean against Bulkhead 7. This appears to have pushed Bulkhead 7 forward towards Bulkhead 6, causing the hull, and deck in this section to collapse with it sometime after 1997. By 2021, most of this material appears to have disintegrated or sunk into the sediment under the Sea Scout Wreck, as Bulkhead 7 is laying almost completely flat on its fore face. As seen with other wrecks, the compromised hull and the weight of the machinery and metal components that have a longer disintegration process have secured the wreck in place and created stability at the site (Riley 1988:191; Delgado 2021:466). This assured a placement location that prevented the hull from floating away into the bay or the Potomac River in the manner that the EFC vessels periodically did (Shomette 1996:275-276;

Richards 2008:162); however, this could be a potential explanation as to why the hull of the vessel has experienced much more disintegration compared to EFC wrecks. The EFC hulls have filled with sediment that serve as a placement assurance and created an anoxic environment inside the wreck that has helped preserve them (Shomette 1996:283-284, 2013:114-115).

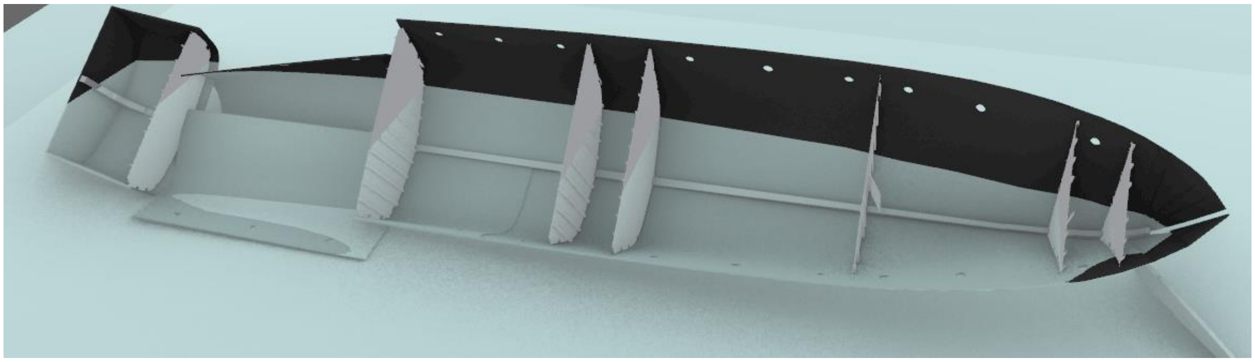

FIGURE 6.16 Sea Scout Wreck (1997) model showing the approximate location of the bulkheads (isometric view) (Model by Taylor Picard).

FIGURE 6.17 Photogrammetric Model of Sea Scout showing the most accurate positions of the bulkhead of the Sea Scout Wreck (isometric view) (Model created by Nathan Richards).

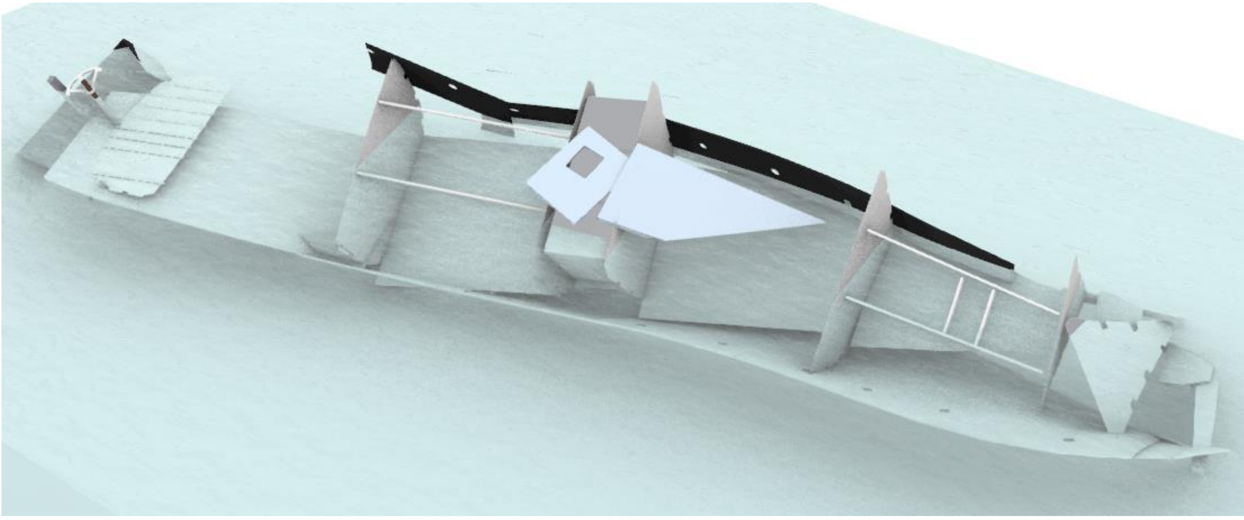

FIGURE 6.18 Sea Scout Wreck (2021) model showing the bulkheads of the Sea Scout Wreck including Bulkhead 7 which is completely submerged and not visible in Figure 6.17 (isometric view) (Model created by Taylor Picard).

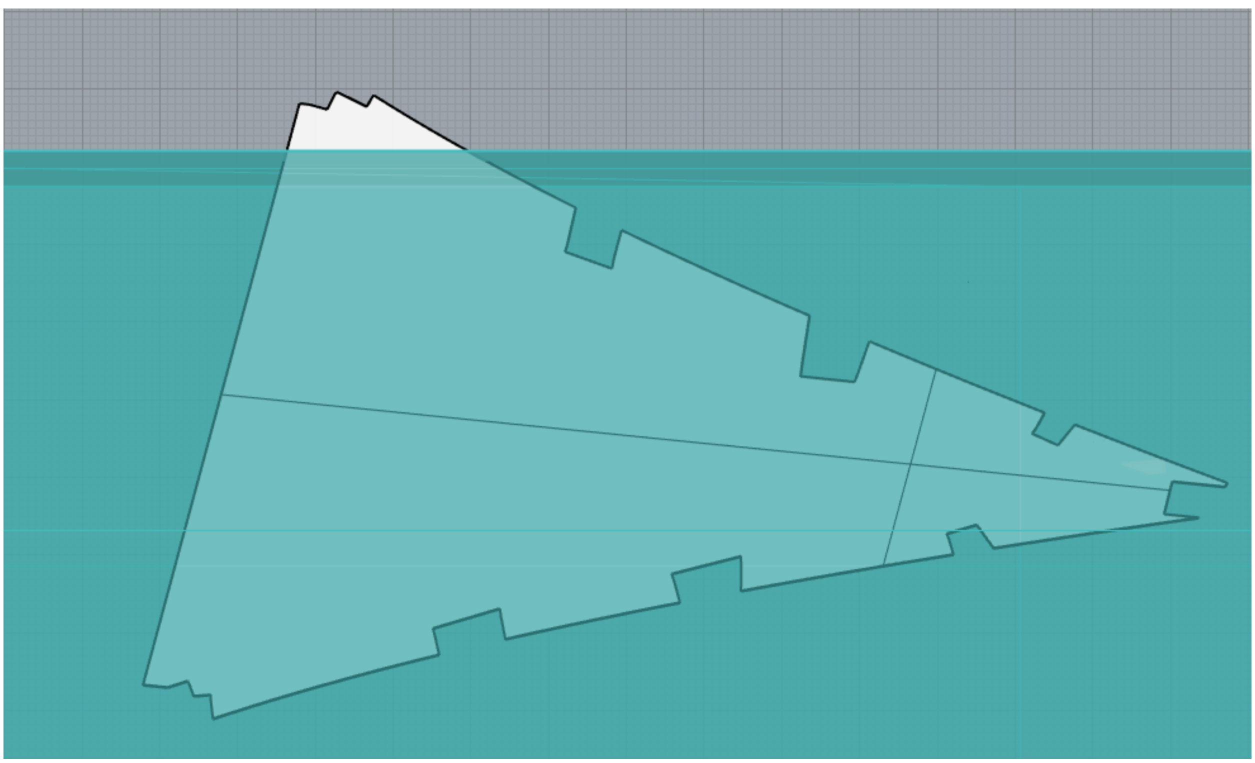

FIGURE 6.19 Bulkhead 1 from Sea Scout Wreck (2021) showing the 75º list to starboard (front view) (Model created by Taylor Picard).

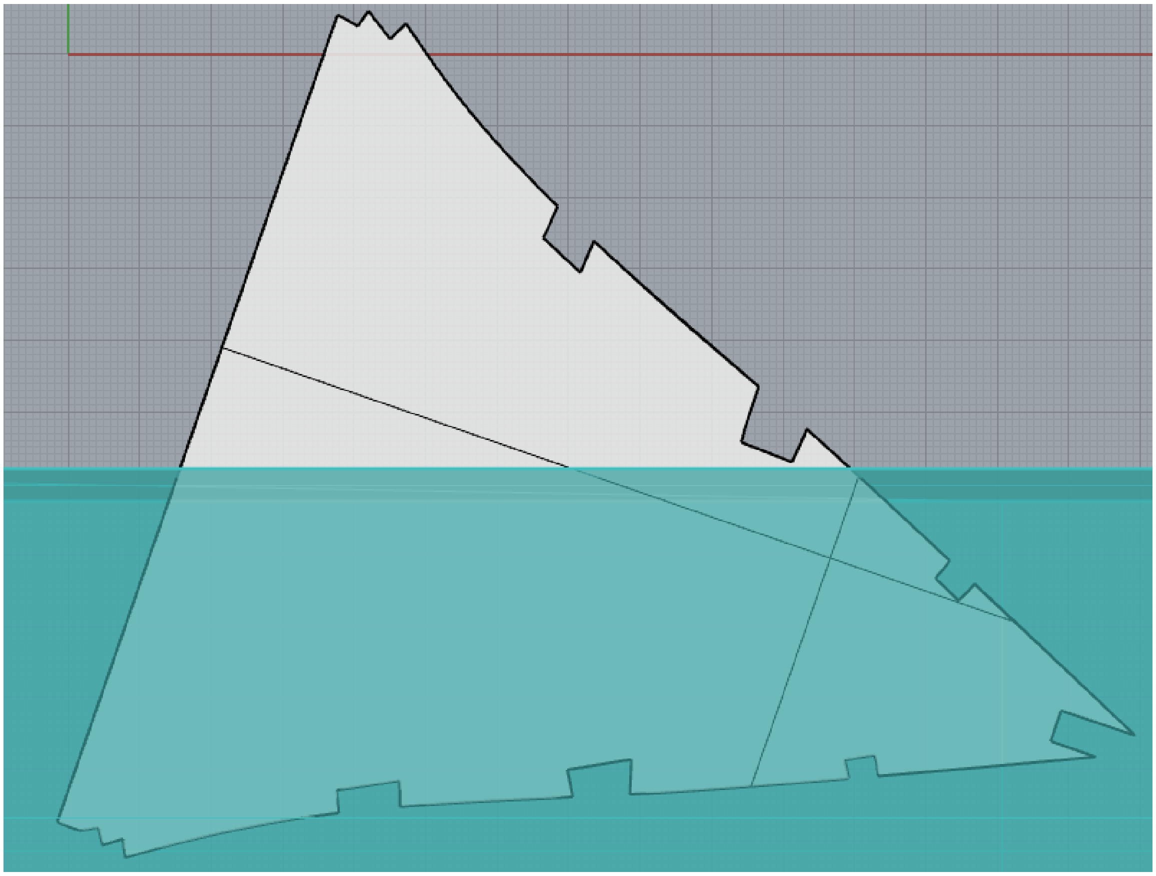

FIGURE 6.20 Bulkhead 2 from Sea Scout Wreck (2021) showing the 65º list to starboard (front view) (Model created by Taylor Picard).

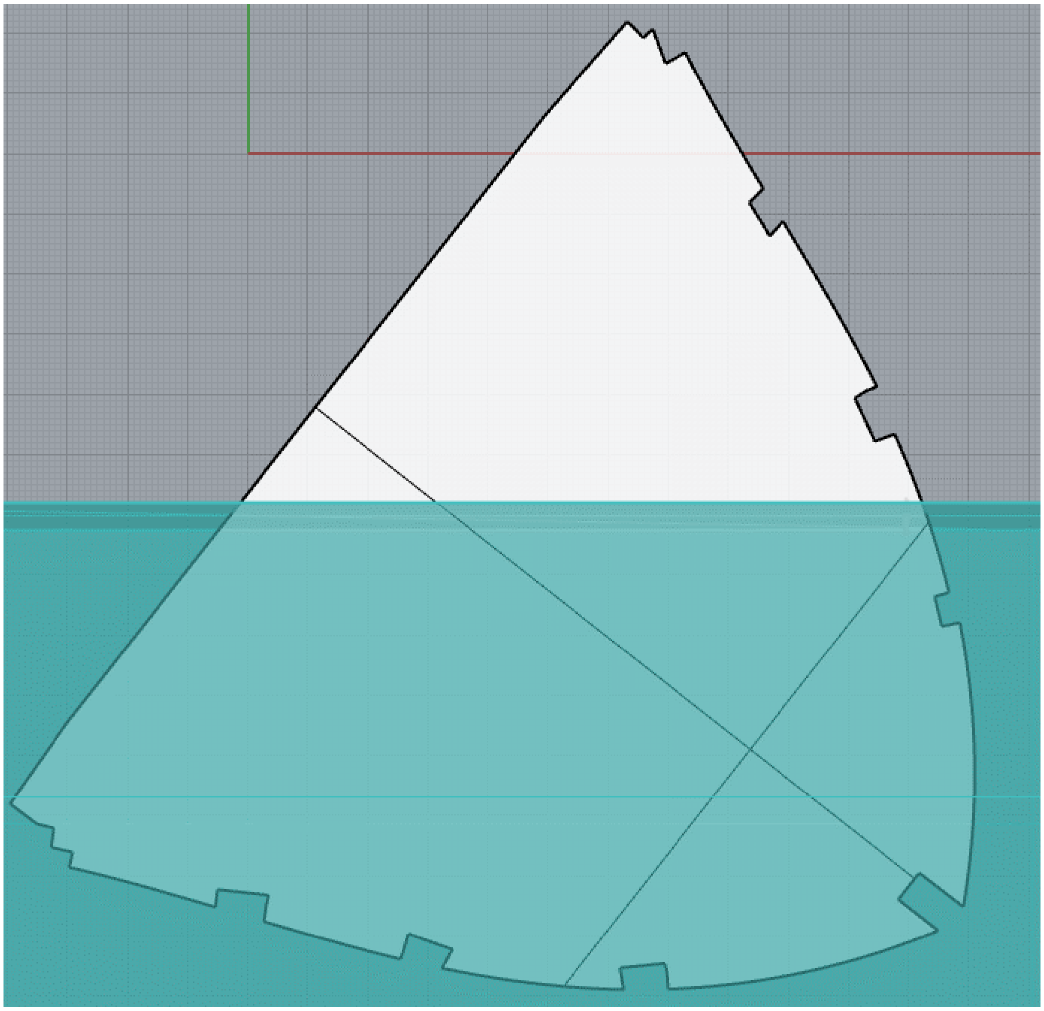

FIGURE 6.21 Bulkhead 3 from Sea Scout Wreck (2021) showing the 57º list to starboard (front view) (Model created by Taylor Picard).

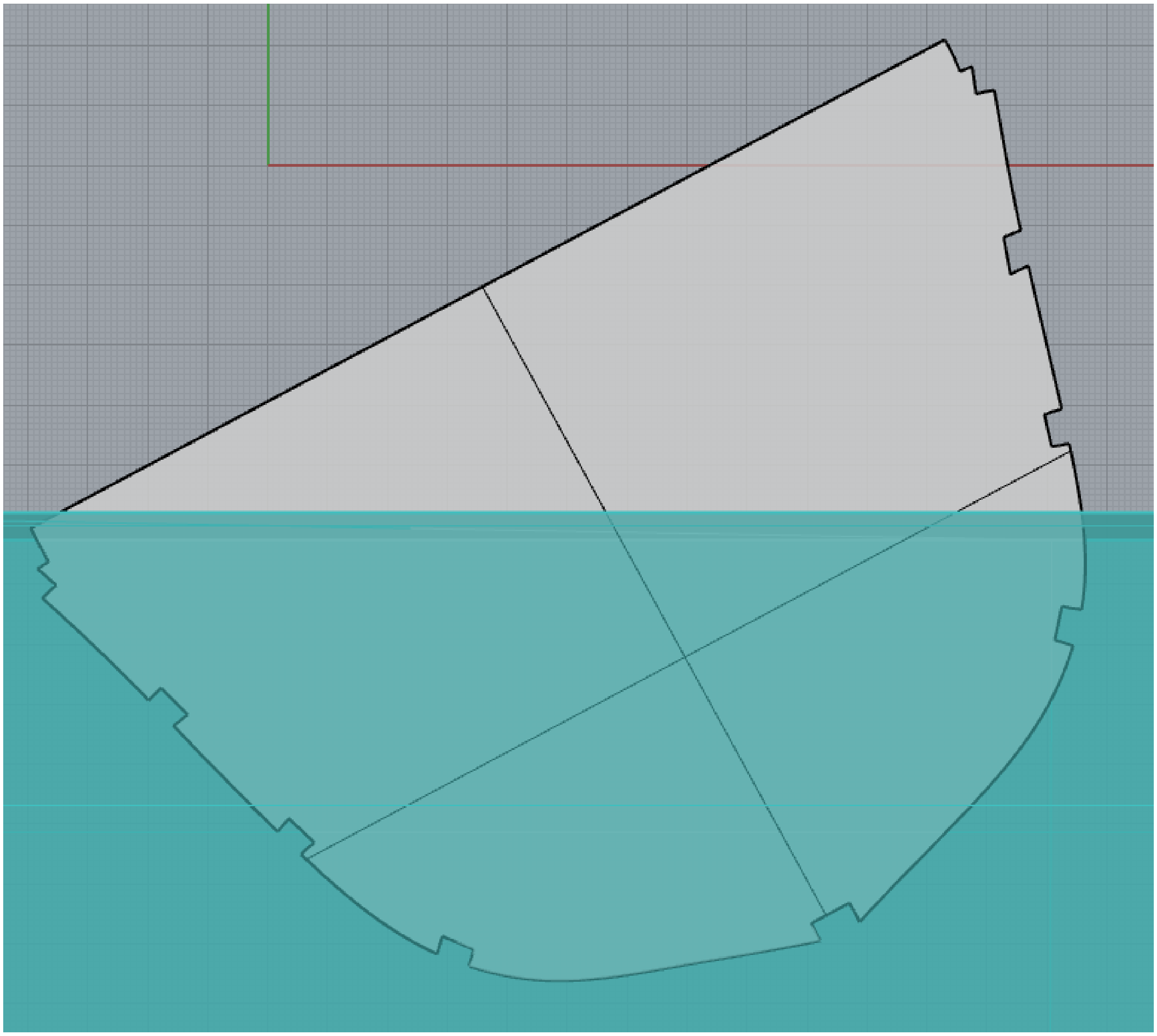

FIGURE 6.22 Bulkhead 4 from Sea Scout Wreck (2021) showing the 40° list to starboard (front view) (Model created by Taylor Picard).

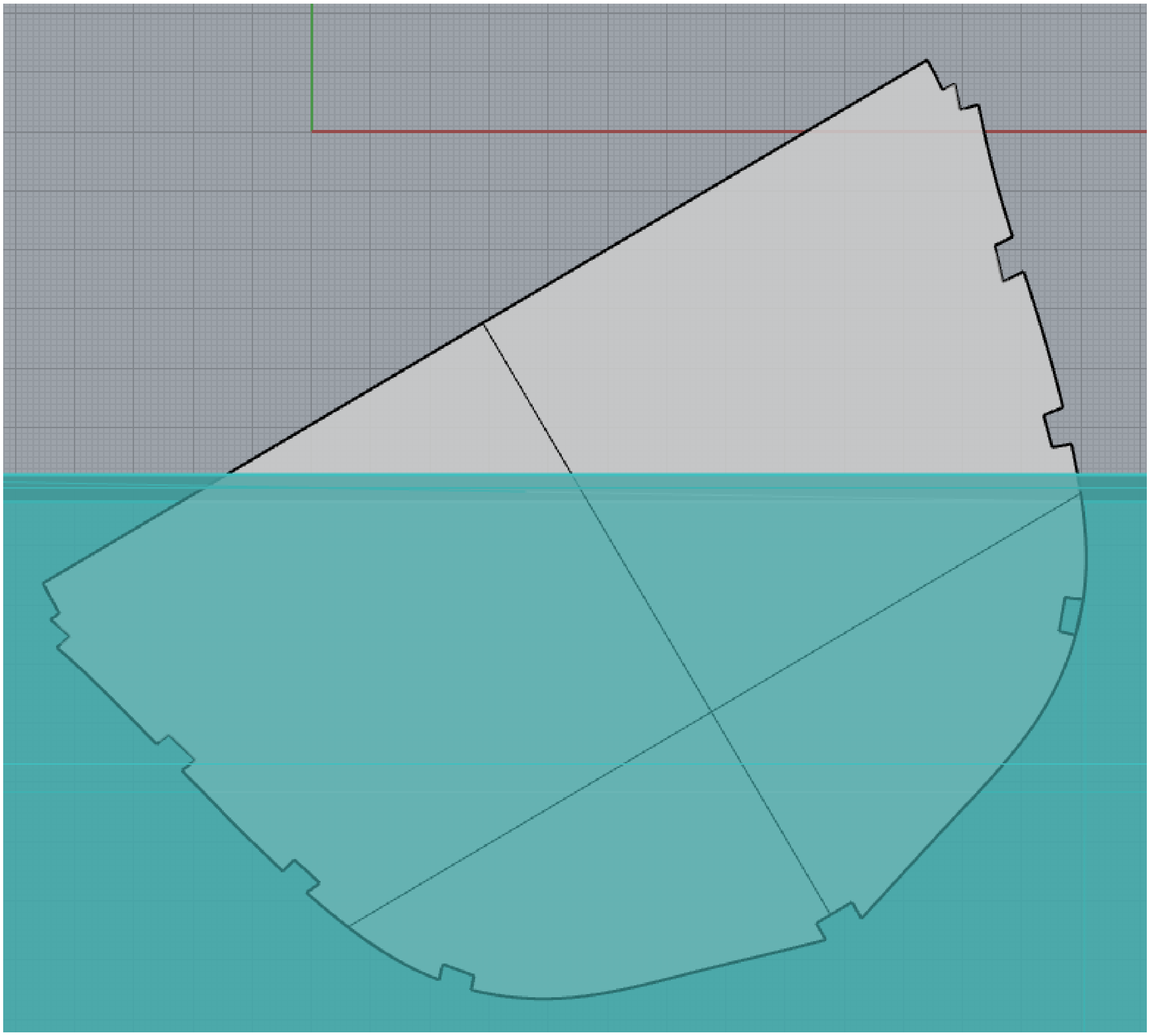

FIGURE 6.23 Bulkhead 5 from Sea Scout Wreck (2021) model showing the 32º list to starboard (Model created by Taylor Picard).

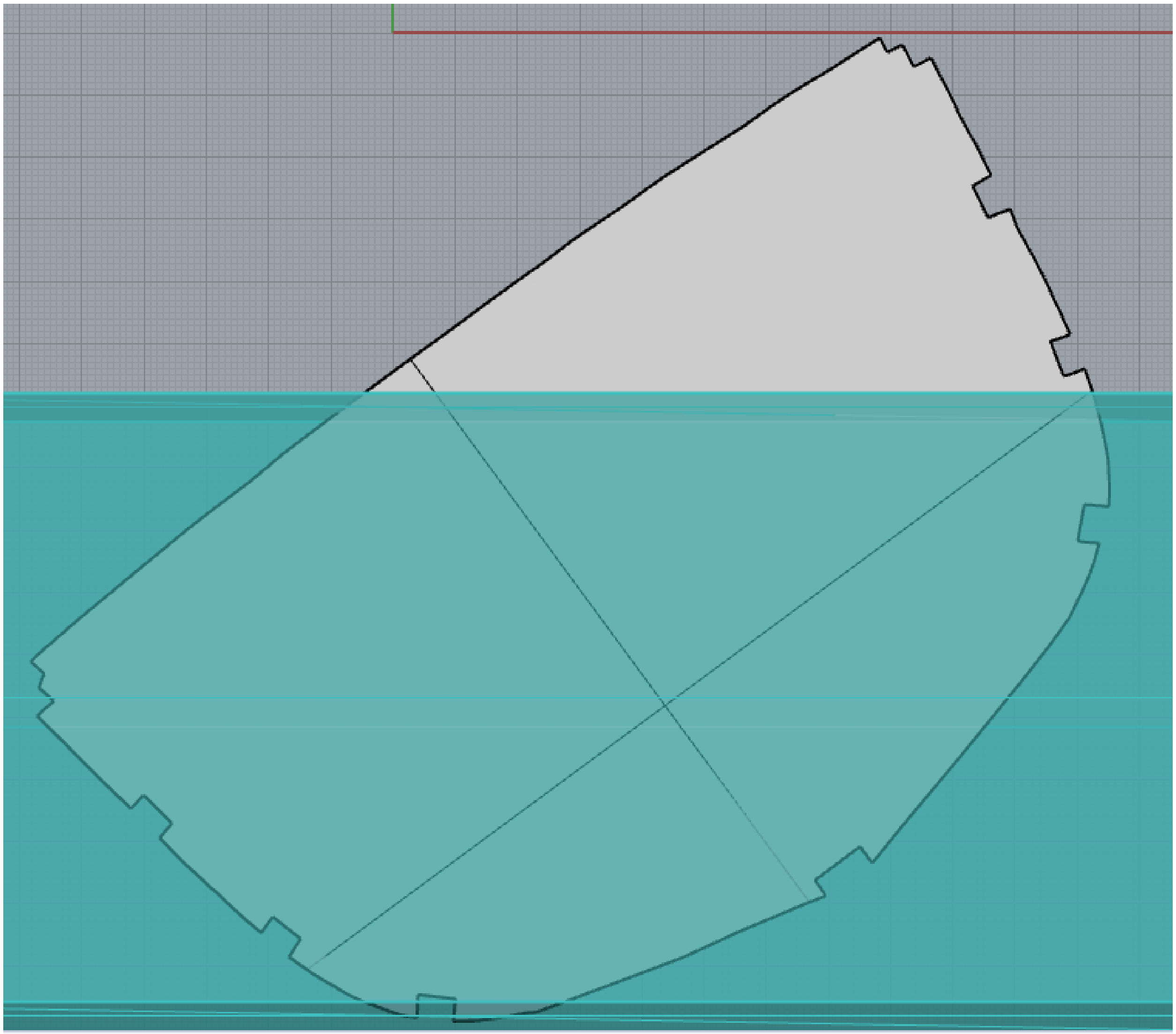

FIGURE 6.24 Bulkhead 6 from Sea Scout Wreck (2021) showing the 35º list to starboard (Model created by Taylor Picard).

While the Sea Scout Wreck contains significantly less sediment than the EFC vessels, it appears that the sediments that have collected within its hull have created a protective barrier for the lowest sections of the wooden hull, as well as the backbone (keel, stem, and stern) of the vessel; however, the 2021 archaeological fieldwork revealed that the section of the hull above the sediment level and below the low tide water level has completely disintegrated. As a partially submerged site in a shallow water environment, the Sea Scout Wreck does not benefit from the protective nature of sediment erosion near the site. This means that, unlike sites that are also partially submerged in shallow water environments, the Sea Scout Wreck does not experience periods of burial that help reduce the speed of deterioration. Recent research supports the supposition that the burial of wooden components by sediment greatly reduces the amount of disintegration caused by bacteria and fungi. Meanwhile, the exposed sections are attacked by bacteria and fungi that cause an increase in sulfur and iron accumulation (Bjordal and Fors 2019:40-41).

Another key difference that separates the Sea Scout Wreck from other wooden hull vessels is that it is made of marine plywood which has a high absorption rate of water when in an environment with a moisture content of <25%. This aids in the breakdown of the lignins in the wood promotes fungal attack, thus weakening the wood's structure (Schiffer 1987:179). As there were no examples of wood below the low water level and above the sediment that could be examined visually, the possibility of fauna or bacterial attack could not be ruled out; however, the complete saturation of the wood causing it to weaken with the added stress of the vessel's listing are key transforms that can be confirmed as processes that have contributed to the disintegration process. The highest strakes of the port side hull that are above the low tide water level are frequently exposed to either water or air. This has caused the wood of the strakes to form long cracks along the grain. This has caused sections of the hull that are unsupported by the steel bulkheads to warp and buckle downwards, which caused sections under too much strain to break. This trend has been previously noted at sites of wooden hull vessels that are listed or were deposited on their side (Riley 1988:195). In the cracks of the hull strakes, plants have begun to grow. This process is visible in the 1997 photos of the Sea Scout Wreck, indicating that the vessel was already experiencing these transforms at that time (Figure 6.26). As the roots of these plants penetrate the wood, they would have allowed water to penetrate deeper, thereby helping to accelerate this process. A major factor affecting almost all wood at the site and causing it to become more susceptible to these processes is the fact that the wreck is completely exposed to sunlight at all times of the year. The silver-grey appearance of the hull indicates that the sunlight has caused the lignin in the wood to break down, as well as made the extractives in the wood water-soluble, which greatly decreases resistance to water permeation (Figure 6.27) (Schiffer 1987:179). Only small patches on the underside of the hull aft of the engine room appear to still retain their lignin, but this area is seeing more algae growth than any other (Figure 6.28). As the species of algae growing here was not identified, it is unclear how it is affecting the site. There was no evidence of any macrofauna activity on the exposed sections of the wood; however, without the use of a microscope, it is not possible to determine if there was any microfauna activity that could be accelerating the wood's disintegration.

FIGURE 6.25 Port side of the Sea Scout Wreck in 1997 showing plant grown on the hull (circled in red) at the water level (Photo courtesy of Susan Langley, 1997).

FIGURE 6.26 The port side hull of the Sea Scout Wreck in 2021 showing the grey-silver discoloration associated with the breakdown of lignin in the wood (Photo credit: Nathan Richards, 2021).

FIGURE 6.27 The interior of the outer hull planking behind Bulkhead 6 of the Sea Scout Wreck showing areas where the lignin in the wood has not yet broken down, but algae growth is present (Photo Credit: Nathan Richards, 2021).

The seven metal bulkheads and other metal components located during the 2021 archaeological fieldwork appear to be in much better condition than the wooden hull of the vessel; however, their presence in a shallow freshwater environment leaves them exposed to air, and the degradation of their supporting wooden components has had an effect. All the metal components at the site are currently showing signs of disintegration through the presence of rust, patina, and holes (Figure 6.29). This indicates that they are being impacted by chemical agents. As the Sea Scout Wreck rests in a body of fresh water in a temperate environment, the primary chemical agent affecting the metal components appears to be dissolved oxygen in the water. While all the metal components at the site are showing signs of chemical agents disintegrating them, not all the components are submerged underwater. Metal components above water appear to be undergoing this disintegration due to acids and dissolved oxygen found in rain (MacLeod 2016:92-93).

Based on the 2021 fieldwork, there do not appear to be any artifacts or features that are made up of multiple metal types where leeching would occur, but as it was difficult to access the inner portions of the wreck, this may be occurring. The decision was made not to access the inner portions of the wreck due to the large amounts of sharp rusted metal objects below the water's surface and hanging overhead. This decision made it impossible to determine how sediments are affecting these metal components. It is possible that the fine sediments being suspended in the water and being moved against the wreck by wave and tidal forces have a mechanical weathering effect on the metal components in the layers of suspended sediments (Ford et al. 2016:18-20; Keith and Evans 2016:51-53; Nelson and Fringer 2018:7000). The only noticeable biological agents affecting the metal components of the site appear to be algae growing on them in the intertidal region and above. In areas above the high tide water level, the algae appear to have dried out and caked on to the metal. This could be creating a barrier for these metal components that protects them from the acids and dissolved oxygen in rain, which has caused their current disintegrated state. The previously mentioned study by Bjordal and Fors in 2019 did not have iron bolts or nails in the wood, but it can be hypothesized that the increase of sulfur in the wood resulting from bacterial attack could contribute to the disintegration process of iron components in contact with the wood (Macleod 2016:95-96; Bjordal and Fors 2019:40).

FIGURE 6.28 Metal cross bar showing extensive rust and formation of holes (Photo Credit: Nathan Richards, 2021).

Evidence of Cultural Transforms

Since the debris field in and around the site was not disrupted to preserve the site's condition, it is not possible to determine the full extent of cultural transforms that have occurred. Although the inability to locate the engines at the site could be due to the engines being buried under debris, removal is still a possibility as there is evidence of salvaging the electrical system. As there is no visible evidence of salvaging in the engine room in the 1997 photos of the Sea Scout Wreck, it seems that the engine, or possibly engines, was taken after 1997, and could be evidence of a possible pattern of long-term salvaging at the site. The wiring found in the engine room has a clean cut, approximately 18" before connecting to the AC outlet. The AC outlet shows evidence of salvage as a corner of the outlet is bent forward, which could be evidence of an attempt to disconnect the wiring from the outlet before it was cut. Salvaging of the electrical wire was probably the cause for the cuts made to the PVC pipes going through the bulkhead which would have housed the cable.

While conducting the fieldwork in 2021, Mallows Bay Park Ranger Frances Park mentioned that the deck of the Sea Scout Wreck was often a hang-out spot in the bay, particularly during holidays (Frances Park 2021, pers. comms.). While there is no visible evidence of this activity, there is evidence of boats being tied off to parts of the wreck as there was a broken rope hanging from one of the I-beams (Figure 6.30). Considering that the rope was broken as opposed to cut, this suggests that the boat tied to the wreck broke away, possibly during a storm. The force of a boat being pulled away from its attachments to the Sea Scout Wreck would have caused significant damage to the site and may be the reason the I-beam is broken in this section.

FIGURE 6.29 Taylor Picard holding up a length of broken rope attached to starboard I-beam between Bulkheads 5 and 6; note break in the I-beam on the right (Photo Credit: Nathan Richards, 2021).

Sea Scout Sinking into the Future

It seems that the present condition of the Sea Scout Wreck has caused much of the potential evidence of the formation processes to be wiped away; however, it is possible to use the transforms identified to examine a possible future for the Sea Scout Wreck (Figure 6.31). In its current state, the remaining parts of the wooden hull will probably continue to disintegrate due to the breaking down of lignin in the wood, causing water to permeate and weaken it. The first section most likely to disintegrate in this way is the submerged wood hull sitting near the rudder post. Next, the section of the port side hull that is sitting on the listing bulkheads appears to be sliding down into the water, causing it to slowly disintegrate. At the same time, the section of the hull between Bulkheads 5 and 6 is warping into the space between the bulkheads. This is further straining the break in the hull found at Bulkhead 4, where the hull slid between Bulkheads 4 and 3. Once this break goes all the way through the hull, each section will probably slide down the bulkheads into the water on the port side of the wreck. Given the various positions and patterns of corrosion around each of the bulkheads, most of them will break away from each other and fall into the water, where their disintegration will probably accelerate until covered by sediment. Once the I-beams between Bulkheads 2 and 3 break apart, Bulkhead 2 will fall aft with Bulkhead 1 laying on top of it. Currently, Bulkhead 3 is leaning to the fore section of the vessel, and the weakest parts of the I-beams between Bulkheads 2 and 3 are closer to Bulkhead 2. This suggests that Bulkhead 3 will begin to fall towards its forward face but will be propped up by the I-beams and watertight door that will continue to disintegrate, slowly lowering the bulkhead into the water over time. Bulkhead 6 appears to be leaning towards the aft section of the wreck, suggesting that it will eventually fall that way; however, as the incline is minor, this could change. As Bulkheads 4 and 5 are firmly secured around the fuel tanks, it would seem this section would maintain stability in its current position, but the bulkheads are leaning towards the aft of the wreck. If Bulkhead 6 continues to fall aft, Bulkheads 4 and 5, as well as the fuel tanks, will slowly fall into the water. As the starboard I-beam between Bulkheads 5 and 6 has already broken near Bulkhead 6 and there is structural weakening around the joint between Bulkhead 6 and the port I-beam, Bulkhead 6 may break away and fall onto its aft face. It appears that, like Bulkhead 3, Bulkheads 4 and 5 will be propped up by slowly disintegrating I-beams. Due to the size of the fuel tanks, this section will be the last to fall below the waterline. Additionally, this will likely mean that this section will experience the most disintegration as it will be the last to be buried by the nearby sediment. Any areas of the debris field trapped underneath any of these collapsing bulkheads will experience an increase in preservation as the bulkheads trap sediment around them, creating an anaerobic environment. The rest of the site will continue to disintegrate until covered by sediment.

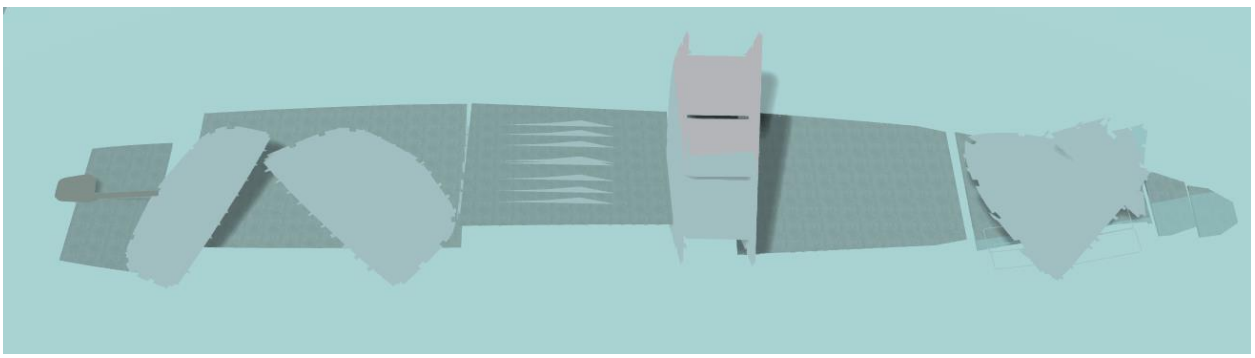

FIGURE 6.30 Sea Scout Wreck (Future) model, a hypothetical model that represents a possible future for the Sea Scout Wreck once it has nearly become completely submerged (isometric view) (Model created by Taylor Picard).

Chapter 7: Conclusion

This study attempted to understand the formation processes of the Sea Scout Wreck from the general period of its construction in the 1940s to its present condition in 2021. As shown through the creation of 3D models, the Sea Scout Wreck has undergone an extensive site formation process that involved many different factors. The models created represent the different stages of this process starting from when the Sea Scout Wreck would have first been launched as a 104' Aircraft Rescue Boat, its transfer into civilian use, the modifications made before it was deposited in Mallows Bay, and two snapshots (1997 and 2021) of the results of the disintegration process after. By modeling the results of the site formation process it is possible to better understand how this disintegration process is occurring.

Historical and archaeological data helped to identify the Sea Scout Wreck as a 104' ARB developed that used by the U.S. Army Air Force during World War II, thus establishing the intended purpose of the vessel. This identification was essential to the understanding of modifications that occurred before it was abandoned. By documenting these changes and categorizing them into a site formation timeline as pre-depositional or post-depositional, the types of transforms that occurred can be explained. There is very limited circumstantial evidence, both historical and archaeological, suggesting that the Sea Scout Wreck's former identity was the 104' ARB used by the Sea Cadet of Alexandria, VA. Future research into this oral history may find more evidence to prove or disprove this hypothesis.

Chapter 2 discussed near-shore vessels, such as the Sea Scout Wreck, which can experience a variety of conditions caused by humans and the environment that affect their disintegration process. By understanding the signatures left as a result of these processes an archaeologist can interpret the changes they have caused; however, in cases of extensive disintegration, these signatures can be erased from the site, leaving no evidence of processes that had previously occurred. Through understanding the processes at a site and combining that information with the archaeological and historical evidence related it, it becomes possible to predict future disintegration patterns.

By modeling the 104’ ARB based on the historical research conducted, it was possible to configure the model to represent the key stages of the Sea Scout Wreck’s formation process using archaeological and historical data collected by this study as described in Chapter 3. While the model served its intended purpose well, a more exact model created from the builder’s plans rather than design documents would have further enhanced the understanding of changes made to the vessel during pre-deposition, deposition, and post-deposition. While these plans are known to exist, they were not available, but the obtainable design documents were sufficient when combined with data collected from archaeological fieldwork conducted on the Sea Scout Wreck in May of 2021.

Through historical research, Chapter 4 established the history and uses of ARBs and the many uses they had during World War II and after. This informed the analysis of the early pre-depositional stage of the Sea Scout Wreck’s formation process and established a probable late pre-depositional state of the vessel before it was abandoned in Mallows Bay. As the chapter describes, relatively few changes were made to ARBs after they served their intended purpose, as they could fill a variety of roles with minimal modifications. This is seen on the Sea Scout Wreck, which retained most of its shape after it was deposited.

Chapter 5 showed the result of this work by using the data collected to establish the Sea Scout Wreck as a 104’ ARB Design 235A. This required a thorough examination of both the historical and archaeological evidence available to evaluate the wreck. Additionally, the available historical and archaeological data do not yet support nor discredit the possibility that the vessel was used by the Sea Scout Wreck as being the same vessel used by the Sea Cadets before it was abandoned in Mallows Bay. While it cannot be confirmed at present, if true, this could be the reason for the current name of the site.

Finally, Chapter 6 presented the analyses of all these data in a timeline of the site formation process from construction to present and answered the question: “What is the disintegration process of the Sea Scout Wreck, and how does it compare to known processes of other composite ships?” The first half of the question is answered using the 3D models showing the different stages the vessel would have undergone during its use-life and illustrates results of the disintegration process after being deposited in Mallows Bay. The second part of the question is answered by establishing that the site shows the expected disintegration that would be expected of any near shore, partially submerged site. A secondary question this research attempted to answer was “What management strategies could help preserve the Sea Scout Wreck?” The answer to this question was shown through a hypothetical future model of the Sea Scout Wreck showing the remains of the wood hull becoming completely disintegrated and the I-beams breaking away from the bulkheads they are holding together causing the wreck to become almost completely submerged. This suggests that the best possible solution may be to let the wreck continue to disintegrate until it is submerged where can become buried by sediment and continue to educate the public about the damage people have caused to vulnerable shipwreck sites.

The final question this research attempted to answer was “What management strategies could help preserve the Sea Scout Wreck?” Given the complex environment of the site as it rests in approximately 5 feet of water, but raises approximately 6 feet above the waterline, this site presents limited in situ options. Unlike completely submerged sites, the Sea Scout Wreck cannot be buried, either culturally or environmentally, to create an anoxic environment. While conducting research for this thesis, another option may have presented itself. In 2011, in Pensacola, Florida, two vessels, the B Street Barge and B Street Schooner, were buried with sand and rock during the creation of a wetland mitigation project. While these vessels were fully submerged before the wetland mitigation project was completed and allowed to become completely buried (Perrine 2012:23-25), the important concept from this project is that it created stability for the shipwrecks. In the case of the Sea Scout Wreck, a similar project could be constructed by creating a shallow retaining wall around the south side of the Burning Basin’s West Gate and along the Sea Scout Wreck’s eastern extent. The area inside the retaining wall could then be filled to create a wetland area around the West Gate and the Sea Scout Wreck. The shallow water plant life that would grow in this area would serve to reduce the impact of wave activity on the site, prevent further erosion of the Burning Basin’s western berm, create an anoxic environment for the submerged materials at the site, and stabilize the bulkheads from further collapse. As a wetland, the shipwreck would still be an asset for the public but prevent future damage caused by foot or watercraft traffic. Finally, a cathodic protection system such as those used on SS *Xantho*, HMS *Sirius*, and HMVS *Cerberus* sites could reduce the speed of corrosion seen on the bulkheads (MacLeod and Steyne 2011:347). This would ensure the protection of the Sea Scout Wreck in accordance with the objective of the Mallows Bay-Potomac River National Marine Sanctuary.

While this study answered the research questions it initially posed, there are still many more left unanswered. At present little is known about Aircraft Rescue Boats, particularly the 104’ variant, as the research materials are inaccessible. Once these documents become available, it will become possible to understand the changes that occurred to these vessels as World War II progressed, and other roles these vessels may have served. Additionally, as the Sea Scout Wreck continues to disintegrate the site may become more accessible for future researchers and allow them to access more of the wreck which could locate more artifacts that could confirm or deny the vessel as the 104’ ARB used by the Sea Cadets of Alexandria, VA, or reveal evidence of salvaging that was not identified during this study.

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APPENDIX 1: List of 104' ARB Design 235A

Builder	Location	P-#	Army Other	Notes[1,2,3]
Casey BB	Fairhaven MA	P-90		
Casey BB	Fairhaven MA	P-91		
Casey BB	Fairhaven MA	P-92		
Casey BB	Fairhaven MA	P-93		
Dooley's Basin	Fort Lauderdale FL	P-94		
Dooley's Basin	Fort Lauderdale FL	P-95		
Dooley's Basin	Fort Lauderdale FL	P-96		
Dooley's Basin	Fort Lauderdale FL	P-97		
Dachel-Carter SB	Benton Harbor MI	P-98		*Poraco VII*; British flag in 1957
Dachel-Carter SB	Benton Harbor MI	P-99		
Dachel-Carter SB	Benton Harbor MI	P-100		*Sis*; *Last One*; *Star Quest*
Dachel-Carter SB	Benton Harbor MI	P-101		*William J Regan Jr*; *Vivi*; *Mission IV* (1980)
Casey BB	Fairhaven MA	P-102		*Christmas Seal*; Sank 1976
Casey BB	Fairhaven MA	P-103		*Benjamin Bros. III*; *Little Fellow*
Casey BB	Fairhaven MA	P-104		*Liki Tiki Tu*
Casey BB	Fairhaven MA	P-105		*Sealark II*
Ventnor Boatworks	Atlantic City NJ	P-106		*Silver Star*; *Rocket II; Miss Beverly*
Ventnor Boatworks	Atlantic City NJ	P-107		
Ventnor Boatworks	Atlantic City NJ	P-108		
Ventnor Boatworks	Atlantic City NJ	P-109		
Stephens Bros.	Stockton CA	P-110		Damaged 20 Sept 1944 in Guadalcanal
Stephens Bros.	Stockton CA	P-111		
Stephens Bros.	Stockton CA	P-112		
Stephens Bros.	Stockton CA	P-113		*Kalmana Hila*; Dismantled 1957
Stephens Bros.	Stockton CA	P-114		*Pacific Rescue*; *Valkyure* (1984)
Stephens Bros.	Stockton CA	P-115	Q-177	*Principia*; *Lower Light*; *Empress*

Builder	Location	P-#	Army Other	Notes[1,2,3]
Manteo BB	Manteo NC	P-116		*Capt. Paul Michael*
Manteo BB	Manteo NC	P-117	Q-125	
Brownsville SB	Brownsville TX	P-118		*Equator*
Brownsville SB	Brownsville TX	P-119		*Thunderbird* (1960)
Brownsville SB	Brownsville TX	P-120		
Brownsville SB	Brownsville TX	P-121		*Phyllis Bamsu* (1978)
Stephens Bros.	Stockton CA	P-141	Q-174	
Stephens Bros.	Stockton CA	P-142	Q-178	*San Marcos*
Stephens Bros.	Stockton CA	P-143	Q-175	*Monsoon* (1947); Scrapped 1974
Stephens Bros.	Stockton CA	P-144	Q-179	*Bright Star*; *Bonanza*; *Shauna*; *Sage* (1980)
Stephens Bros.	Stockton CA	P-145	Q-180	*Pacific Towboat* of Long Beach, CA; *Blue Dolphin* (1980)
Stephens Bros.	Stockton CA	P-146	Q-181	*Rainbow III*
Manteo BB	Manteo NC	P-147		*Loafer*; *Rada* (To Cuban Flag, 1952)
Manteo BB	Manteo NC	P-148		*Benjamin Bros. II*
Dooley's Basin	Fort Lauderdale FL	P-149		*Wasp*
Dooley's Basin	Fort Lauderdale FL	P-150		
Stephens Bros.	Stockton CA	P-209		
Stephens Bros.	Stockton CA	P-210		*Queen of Sheba* (2008)
Stephens Bros.	Stockton CA	P-211		*Celeste*; *Gerry Ann*
Brownsville SB	Brownsville TX	P-212		*Sea Hornet*
Brownsville SB	Brownsville TX	P-213	Q-207	*Bebeco*
Sagstad SY	Seattle WA	P-214	Q-182	
Sagstad SY	Seattle WA	P-215		*Evangel*
Sagstad SY	Seattle WA	P-216	Q-221	*Pamatomige*; *Freedom II*; Foundered 31 July 1963
Sagstad SY	Seattle WA	P-217		*Black Prince*; *Carta*; Sank from neglect at Los Angeles in 1991
Hillstrom SB	North Bend OR	P-218		*Brass Queen*, based in San Francisco, CA
Hillstrom SB	North Bend OR	P-219	Q-176	
Hillstrom SB	North Bend OR	P-220		*Hattie D*

Builder	Location	P-#	Army Other	Notes[1,2,3]
Dooley's Basin	Fort Lauderdale FL	P-221		
Dooley's Basin	Fort Lauderdale FL	P-222		
Dooley's Basin	Fort Lauderdale FL	P-223		Ran aground Belize May 1943
Dooley's Basin	Fort Lauderdale FL	P-224		
Dooley's Basin	Fort Lauderdale FL	P-225		*Texas Explorer*
Dooley's Basin	Fort Lauderdale FL	P-233		
Dooley's Basin	Fort Lauderdale FL	P-234		*Tremont*
Dooley's Basin	Fort Lauderdale FL	P-235		
Dooley's Basin	Fort Lauderdale FL	P-236		
Dooley's Basin	Fort Lauderdale FL	P-237		
Brownsville SB	Brownsville TX	P-241		*Roanoke* (1947); Foundered in Gulf of Mexico 23 July 1952
Brownsville SB	Brownsville TX	P-242		
Brownsville SB	Brownsville TX	P-243		
Brownsville SB	Brownsville TX	P-244		
Casey BB	Fairhaven MA	P-249		
Casey BB	Fairhaven MA	P-250	Q-170	
Casey BB	Fairhaven MA	P-251		*Queen of Texas*
Casey BB	Fairhaven MA	P-252		Bell of the P-252 was removed from a boat along the Gulf of Mexico in the 1980s; possibly an oil rig supply boat. Later became *Poraco VI*; *Crowley* (1960)
Manteo BB	Manteo NC	P-253		Triple C (1948) (253143) (Listed as 108.4; operated by Cutcher Canning Co.) (Out of Documentation 1951)
Manteo BB	Manteo NC	P-254		Lone Star (1950) (258767) (Listed as 99.6'; operated by Pirl E. Steagall) (Lone Star Boat & Transportation Co. (1951)) (Burned in 1952 in Galveston Bay. 2,600 feet SW of Black Can Buoy #45)
Manteo BB	Manteo NC	P-255		
Casey BB	Fairhaven MA	P-274		*Angelos*; Burned 8 Jun 1956 in the Gulf of Mexico

Builder	Location	P-#	Army Other	Notes[1,2,3]
Casey BB	Fairhaven MA	P-275		*Halide*
Casey BB	Fairhaven MA	P-276		
Casey BB	Fairhaven MA	P-277		*Mary Anne*; *Galaxie*; To Venezuelan Flag 1958
Casey BB	Fairhaven MA	P-278		
Casey BB	Fairhaven MA	P-279		*Poraco V*

[1] - U.S. Treasury Department 1945, 1946, 1947, 1948, 1949, 1950, 1951, 1952, 1955, 1956, 1957, 1958, 1960, 1961, 1962, 1963, 1964, 1965, 1968, 1970, 1971, 1972, 1973, 1974, 1975, 1976, 1977, 1978, 1979, 1981

[2] - Shipbuilding History 2017

[3] - U.S. Crash Boats 2020d