1. NAME OF PROPERTY

Historic Name: SS *Badger* (Car Ferry)

Other Name/Site Number:

Designated a National Historic Landmark by the Secretary of the Interior, January 20, 2016

2. LOCATION

Street & Number: 700 S. William St. Not for publication: __

City/Town: Ludington Vicinity: __

State: Michigan County: Mason Code: 105 Zip Code: __

3. CLASSIFICATION

Ownership of Property	Category of Property
Private: X	Building(s):
Public-Local:	District:
Public-State:	Site:
Public-Federal:	Structure: X
	Object:

Number of Resources within Property

Contributing		Noncontributing	
buildings	0	buildings	0
sites	0	sites	0
structures	1	structures	0
objects	0	objects	0
Total	1	Total	0

Number of Contributing Resources Previously Listed in the National Register: 1

Name of Related Multiple Property Listing:

4. STATE/FEDERAL AGENCY CERTIFICATION

As the designated authority under the National Historic Preservation Act of 1966, as amended, I hereby certify that this ____ nomination ____ request for determination of eligibility meets the documentation standards for registering properties in the National Register of Historic Places and meets the procedural and professional requirements set forth in 36 CFR Part 60. In my opinion, the property ____ meets ____ does not meet the National Register Criteria.

Signature of Certifying Official Date

State or Federal Agency and Bureau

In my opinion, the property ____ meets ____ does not meet the National Register criteria.

Signature of Commenting or Other Official Date

State or Federal Agency and Bureau

5. NATIONAL PARK SERVICE CERTIFICATION

I hereby certify that this property is:

___ Entered in the National Register
___ Determined eligible for the National Register
___ Determined not eligible for the National Register
___ Removed from the National Register
___ Other (explain): _____

Signature of Keeper Date of Action

6. FUNCTION OR USE

Historic: Transportation Sub: Water, Rail and Road related

Current: Transportation Sub: Water and Road related

7. DESCRIPTION

ARCHITECTURAL CLASSIFICATION: Great Lakes car ferry

MATERIALS:
Foundation: Steel
Walls: Steel
Roof: Steel
Other:

Introduction

The SS *Badger* is significant as the final example of Great Lakes rail car ferry design; as the last vessel in operation powered by Skinner Unaflow steeple compound engines; and as the last Great Lakes car ferry to remain in operation. The ship, which retains an unusually high degree of historic integrity, is being nominated under National Historic Landmark Criteria 1 and 4 within the contexts established by Theme V, "Developing the American Economy" under the area of significance identified as "Transportation," and by Theme VII, "Expanding Science and Technology," under the area of significance identified as "Engineering." The *Badger* was listed in the National Register of Historic Places at the national level of significance on December 11, 2009.

Describe Present and Historic Physical Appearance.

The *Badger* is the final and, with her sister *Spartan*, largest example of the Great Lakes railroad car ferry.[1] *Badger*'s dimensions as given by the U.S. Coast Guard Vessel online documentation system at time[2] of nomination are 393.7 feet long; 59.7 feet wide; 20.3 feet depth of hull, and Gross Tonnage 4244.[2] (Gross tonnage is a measurement of volume of enclosed space calculated according to a formula. A gross ton is 100 cubic feet.) Overall length, taking into account the rake of the bow and curve of the stern, is 410 feet. The vessel is built of steel throughout, with metal and artificial fireproof materials used in finishing accommodation spaces.

Given the passage of fifty-six years between them, it is amazing how much like the original *Pere Marquette* of 1896 the *Badger* is. In many ways, it is fair to say that Robert Logan's design of 1896 was so well suited to the service that only minor refinements were needed throughout the history of the Lake Michigan car ferry. It seems likely that the two pioneering wooden ferries designed by Frank E. Kirby for the Ann Arbor Railroad provided Logan with examples from which both positives and negatives could be derived; for example, Kirby's two boats had bow propellers after the example of his pioneering icebreaking car ferry *St. Ignace* on the Straits of Mackinac. Logan originally intended *Pere Marquette* to have such a propeller, but it was omitted in the final design apparently because the technology, while very successful at the Straits, had not worked well in Lake Michigan ice. (The bow propellers were eventually removed from the Ann Arbor boats.)[3]

Pere Marquette and *Badger* share the same basic hull form: flat-bottomed with rounded bilges and some tumble-home. Both have a sloped section of bottom just behind the forefoot for icebreaking, something of a precursor of the Meyer-form bow. Both share the unusual form of stern, which appears to be a distorted version of a counter stern, the upward curvature adjusted to result in the necessary flat surface for mating with docking aprons. Neither ship has sheer; unlike *Pere Marquette*, *Badger* has no camber (the typical side-to-side curve in a ship's deck, higher in the center than at the sides), eliminating the need to mount the rails on supports whose unequal height was carefully calculated to result in level rails over a sloping deck. *Badger*'s lack of camber was apparently so unusual for the shipbuilders that the plans are marked on the midship section, just above the car deck, "no camber." Both ships also have deep web-framed double bottoms; *Badger* departs from *Pere Marquette*'s example in having deep web frames at the sides. The double-bottoms were useful in providing substantial ballast tanks, since the vessels were subject to considerable unequal weights on the car deck when loading and unloading and ballasting could assist in controlling the position of the vessel. Ballasting seems also

[1] George W. Hilton, *The Great Lakes Car Ferries* (Berkeley, CA: Howell-North Books, 1962), 254 *et. seq*. provides a complete set of fleet lists of all car ferry operations on the Great Lakes with data on each vessel. That data confirms *Badger* as the last, and the identical *Badger* and *Spartan* as the largest.

[2] United States Coast Guard, *Vessel Data Base*. The digital list replaces the *Merchant Vessels of the United States* which is no longer published in book form. https://www.fisheries.noaa.gov/foss/f?p=215:200::::::.

[3] Hilton, *Great Lakes Car Ferries*, 69 *et seq*. and 114 *et. seq*. contains a thorough discussion of these early design developments: 69 *et seq*. and 114 *et. seq*.

of great importance for a vessel that carries its freight entirely on the main deck, above the substantial hull volumes and above the surface of the water. *Badger*'s stronger framing seems likely to be in recognition of the extreme torsional forces that are placed on the hull in loading and unloading freight cars, particularly those with heavy bulk cargoes and the forces exerted on the hull in heavy weather. Since the hull spaces are not used for cargo, there is no functional reason to avoid deep web frames.[4]

The appearance is dominated by the hull, including the main (car) deck, bulky and slab-sided; it is completely lacking in sheer or camber in order to avoid placing railcars on sloping surfaces. The raked bow of the *Badger* has a slight irregularity where an eighteen inch vertical was inserted as part of the raising of the car deck. The main deck within the hull is open at the square stern, with a hinged "sea gate" that is raised for loading and lowered during operation to prevent following seas from washing into the car deck. At the top of the hull, a broad white stripe runs from bow to stern, surrounding the openings of the promenade surrounding the cabin deck, which has no sheer but does have slight camber. A small pilot house is placed right aft on the cabin deck, used when backing the vessel into the slips. Right at the bow is a vertical jackstaff; the flagstaff was originally mounted on the aft pilot house, but with later alterations has been moved to the deck above.

The boat deck cabinwork is set back from the side, leaving exterior space for three lifeboats on the starboard side and two lifeboats and a work or rescue boat on the port side. This deck originally stopped short of the stern, but has now been extended aft over the top of the after pilot house right to the aft end of the deck below. This extension was intended as deck space for automobiles, but it is now used as passenger seating area and in recent years the enclosure of the deckhouse has been extended aft to provide shelter. Atop the boat deck house is the very wide pilot house forward with its curved front, extending right to the sides of the ship. Attached to the pilot house on its after side is a small house containing the captain's stateroom and office and electrical equipment. The forward mast is mounted atop this house. Further aft, somewhat forward of amidships, is the stack or funnel, in a "modern" shape popularly referred to as a "teakettle" stack. The after mast lies further toward the stern.

The forward spaces within the hull, below the car deck, are devoted to holds and coal bunkers; the engine and boiler rooms are roughly amidships. Aft of the engine room the height below the main deck is divided by the lower deck, which houses crew quarters and, right aft, the steering engine. Below the lower deck are more holds and water tanks.

The main deck is a vast open space, broken only by narrow housings on the centerline containing staircases leading both up and down and the boiler uptakes. Originally, there were four tracks for railcars, two on either side of the central housings, each pair of which combined at the stern so that two tracks on the vessel would match the two tracks on the apron. New staircases have been built against the shipside right aft as part of the alteration to a vehicle-only carrier; that on the starboard side has a chair lift to take handicapped passengers to the cabin deck above. There are various hatches flush in the deck; the vessel was traditionally coaled by running a full railroad coal car onto the rails over the bunker hatches and then dropping the coal into the bunkers.

The cabin deck has the windlass room right forward and a few crew cabins aft of that. A narrow space aft of the crew rooms runs from side to side, containing deck winches for the steel mooring cables and fairleads in the shipside. From the line handling space to well aft of amidships, much of the deck was taken up by sixty staterooms, sixteen of which were "inside" rooms flanking the centerline and without outside exposure. These inside rooms have been removed in the 1992 renovation and a shop, museum and "quiet room," movie lounge,

[4] This paragraph is based on direct comparison of the plans for *Badger* as published in "Marine Engineering" and reduced copies of selected plans of the *Pere Marquette*, Historical Collections of the Great Lakes, Bowling Green State University, Ohio, which holds the original tracings.

and children's playroom now occupy the space.[5] Aft of those facilities, the central space is taken up with the stack casings and linen lockers, and aft of those spaces are the men's and women's rest rooms. All these facilities in the center are flanked by long narrow hallways giving access to those spaces as well as the forty staterooms located on the two sides of the house. All these spaces are characterized by the presence of equipment of obvious railroad origin; the staterooms have fold-down sinks exactly like those in Pullman cars and the door and window hardware is likewise typical of passenger rail cars. At the aft end of the outer rows of staterooms are the cruise director's office (formerly the purser's office) on the starboard side and a bar on the port side. The original main lounge lies aft of these facilities, and was reworked in 1992 to contain a food service facility. At the aft end of the original space airline seating has been installed facing televisions which receive satellite signals. Further enclosure for seating has been added aft of the original main lounge; this serves not only to shelter from the weather, but open decks aft on coal-fired steamers can be less than desirable for passengers' clothing.

The boat deck house is almost entirely taken up with crew spaces. The boiler uptakes amidships and the house forward of it leave wide decks on either side to provide room for the lifeboats and davits. At the forward end, a wider rounded-front house (which supports the pilot house above) is divided into the stateroom and office for the chief engineer. Aft of that and forward of the boiler uptakes the space is given over to rooms for the mates, assistant engineers, and other crew, together with a crew recreation room. The house aft of the boiler uptakes is wider, and contains more crew rooms, the crew's and officer's messes, galley, and, right aft, the original passenger cafeteria space, now the "Upper Deck Café and Bar." The open deck aft of the original cafeteria is now enclosed and equipped with tables and chairs for more passenger seating protected from the weather and coal smuts.

As already noted, the top of the boat deck house supports the pilot house and masts. There is also a fan room atop the house, largely without openings; the stack sits atop that structure.

Such alterations as have been made to the vessel constitute sensitive adaptive re-use of a historic vessel. While *Badger* always carried passengers and their vehicles, her original function was to carry rail cars; passenger and vehicle services were a definite sideline. The auto space aft on the boat deck could carry a maximum of eighteen cars, depending on vehicle size. Additional autos could be carried on the car deck, especially if there was not a full load of rail cars. With the decision to carry road vehicles and passengers only, and especially with the addition of greater vehicle capacity in the form of the half-deck installed in the car deck, *Badger* was expected to carry far more vehicles than ever before (up to 180, again depending on size) and this meant far more passengers as well. Expansion of passenger seating and passenger services, especially food service, were essential in the vessel's new role.

Badger is powered by twin Skinner Unaflow engines of the type known as "steeple compound." These engines are usually said to have four cylinders, but this is incorrect; there are four piston rods, four connecting rods, and four cranks in the crankshaft, but each piston rod serves two cylinders, one atop the other. Therefore, there are eight cylinders. The upper four cylinders take steam at boiler pressure; when that steam has performed its work, it is exhausted and used to power the lower cylinders, which are of larger diameter to offset the reduced pressure resulting from the first use. This use of steam twice is referred to as "compounding" and the arrangement of one cylinder atop another in line and on the same piston rod is described by the term "steeple." Steam is provided by four type D boilers by the Foster-Wheeler Corporation, producing superheated steam at

[5] See accompanying plans of the passenger decks as altered in 1992, provided by The Lake Michigan Car Ferry.

500 psi. These are supplied with coal by an automatic stoking system. The engine room also contains many auxiliaries, including two large electric generators, and a number of pumps.[6]

The boilers are symmetrically arranged in the boiler room, two boilers on either side of the centerline. The boiler fronts face each other fore-and-aft on each side of the space, with the coal conveyor moving coal from the bunkers forward down the centerline between the two forward boilers. There is a forced draft fan associated with each boiler and machinery to eject the ash overboard.

Badger's machinery is particularly notable as the last surviving and intact power plant of its type.[7] The present owners have long had a strong commitment to the preservation in service of this unique propulsion system. In recent years, this has been particularly demonstrated by the expenditure of over two million dollars to re-tube all four original boilers and the condensers as well.

The *Badger* was refitted in two stages in 2014-15 to successfully meet modern, regulatory, pollution-reduction standards related to the disposal of coal ash from the ship. In 2014, a new, digital combustion-control system supplanted the ship's original mechanical combustion controls. This change ensured the retention, continued function, and significant improvement on the efficiency of the original, type-D Foster Wheeler boilers via the insertion of additional burner nozzles, the installation of new stokers and stoker front plates, and the retrofit of new fans to better control combustion-related airflow and fuel-air mix. These changes reduced the ferry's coal-burn rate and related airborne emissions in 2014 by 10 to 15 percent.[8] In 2015, a new "dry ash" conveyor/storage system was installed. The new system allows coal ash to be moved from the boilers to a set of four new containment bins installed along the port bow of the ferry's car deck, where it is stored while the ferry is in operation. Once the ferry is docked, the ash is off-loaded and carried away for use in the cement manufacturing process.[9] No modifications were made to the ferry's nationally significant Skinner Unaflow steeple compound engines (see "SS *Badger* Ash System Upgrades" in photo section). The refit will help ensure the ship's continued national significance as the last, operating Great Lakes car ferry. All of the work completed in the refit appears consistent with the general recommendations contained in the *Secretary of the Interior's Standards for the Treatment of Historic Properties.*

The *Badger* represents the final stage of development of the Great Lakes rail and auto passenger ferry. She combines the traditional functional design requirements of the Great Lakes car ferry with design and technical features typical of *Badger*'s period of construction.

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[6] Chavez, *SS* Badger: *The Lake Michigan Car Ferry* includes a complete set of diagrams of the engines copied from the booklet published by the engine builders in 1953, 120 *et seq*.

[7] American Society of Mechanical Engineers' *SS* Badger *Engines and Boilers* addresses not only the technical features of the power plant but also its status as a surviving example. Information on the present condition of *Spartan*'s engines obtained from direct communication with the vessel's owners.

[8] Steve Begnoche, "Full Steam Ahead on SS *Badger* Combustion Control System," Steaming into the Future, accessed November 5, 2015, https://ssbadger.com/blog/. Originally printed in the *Ludington Daily News* (Ludington, MI) on May 6, 2014.

[9] Steve Begnoche, "Lake Michigan Car ferry Prepares for SS *Badger* to Store Ash," *Ludington Daily News* (Ludington, MI), October 14, 2014, https://www.shorelinemedia.net/ludington_daily_news/news/local/article_9e65c1ea-5adc-11e4-94fb-a35ea07452d5.html.

8. STATEMENT OF SIGNIFICANCE

Certifying official has considered the significance of this property in relation to other properties:
Nationally: X Statewide:__ Locally:__

Applicable National Register Criteria: A X B__ C X D__

Criteria Considerations (Exceptions): A__ B__ C__ D__ E__ F__ G__

NHL Criteria: 1 and 4

NHL Theme(s): V. Developing the American Economy
2. Distribution and consumption
3. Transportation and communication
VII. Expanding Science and Technology
2. Technological applications

Areas of Significance: Transportation, Engineering

Period(s) of Significance: 1952–53

Significant Dates: 1952–53

Significant Person(s):

Cultural Affiliation:

Architect/Builder: Richard A. Stearn

Historic Contexts: XVI. Transportation
B. Ships, Boats, Lighthouses, and Other Structures
XVIII. Technology (Engineering and Invention)
B. Transportation

State Significance of Property, and Justify Criteria, Criteria Considerations, and Areas and Periods of Significance Noted Above.

Introduction

The SS *Badger* is significant as the final example of Great Lakes rail car ferry design, a type which influenced design of such vessels in other regions and around the world; as the last vessel in operation powered by Skinner Unaflow steeple compound engines; and as the last Great Lakes car ferry to remain in operation.

Built in 1952–52, the *Badger* together with *Badger*'s slightly older sister-ship *Spartan* were the last Great Lakes car ferries built. While their design reflects the times, with as much streamlining as the essentially boxy form could support, their basic design follows the example set by the *Pere Marquette* of 1897, the progenitor of the steel Great Lakes car ferry.[10] As Lake Michigan was the site of the first open-water crossing carrying rail cars on ships,[11] it is unsurprising that the design of these ferries influenced other, later, such ships in distant locations. The most obvious example, the Florida East Coast Car Ferry Company, built the *Henry M. Flagler* at Philadelphia in 1914 and the *Joseph R. Parrott* in 1916 for a service between Key West and Havana. That service ended when the rail bridges through the keys were badly damaged by a hurricane in 1938, and after World War II the *Flagler* and *Parrott* were operated by the West India Fruit and Steamship Company from Palm Beach, Florida to Cuba. The two vessels were so similar to Great Lakes car ferries that when demand exceeded capacity, the company simply purchased the Lake Michigan ferry *Grand Haven* of 1903.[12] Two later vessels were built for the company, and they also betrayed design origins in the *Pere Marquette* of 1897. In addition, there are reports of European visitors to the *Pere Marquette*,[13] and even a casual inspection of photographs of early rail ferries in regions like the Baltic makes the influence obvious.

The Unaflow engine represents the final stage of the historical development of the reciprocating steam engine, although further developments are being pursued in Europe at the time of this nomination. In an age when steam turbine and diesel propulsion were beginning to dominate the shipping scene, the more-efficient Unaflow and similar designs attempted to stem the tide away from reciprocating steam. In the United States, the Unaflow saw significant use, including ferries on Chesapeake Bay, the Navy's Casablanca class escort carriers, the Staten Island ferry, and a number of Great Lakes freighters, many of which were older ships repowered with Unaflow engines. Very similar technology, although not using the trademarked "Unaflow" name, was used in Europe as well, a surviving example being the three-cylinder inclined engine of the paddle steamer *Stadt Luzern* on Lake Lucerne in Switzerland.[14] The steeple compound version of the Unaflow was a very late innovation and not many examples were built as the development of the type roughly corresponded in time to the almost total dominance of turbine and diesel for maritime propulsion. One "simple" Unaflow remained in service on the Great Lakes in 2010 in the cement carrier *St. Mary's Challenger*. No examples of the steeple type remain in use except *Badger.* The exceptional technology of the steeple Unaflows in the *Badger*, together with the fact that hers were thought to be the last large coal-fired marine boilers built in the U.S., caused the American Society of Mechanical Engineers to name the *Badger's* power plant a Historic Mechanical Engineering Landmark in 1996.[15]

[10] Hilton, *Great Lakes Car Ferries,* 117.
[11] Ibid.*,* 70.
[12] Ibid.*,* 265.
[13] Chavez, *SS* Badger*,* 7.
[14] Josef Gwerder, Jürg Meister, and Erich Liechti, *Die Geschichte der Schiffahrt auf dem Vierwaldstättersee* (Lucerne, Switzerland, Maihof Verlag, 1999), 272.
[15] The American Society of Mechanical Engineers, *SS* Badger *Engines and Boilers* was published in 1996 to mark this occasion.

With the consolidation of railroads and rising operational costs for the car ferries, cross-lake services were abandoned. The last in service, *Badger* made her last trip as a rail car ferry in November, 1990[16] and there was no cross-lake service of any kind in 1991. *Badger* resumed service for passengers, cars, and trucks in 1992 and remains in that service today.[17]

Developmental History/Additional Historic Context.

It is obvious that the inter-relationship of rail and water transport was extremely important in the 19th century, when these were the only practical long-distance transport. Trains could not cross major bodies of water and ships could not sail on land. Inevitably, the industrial revolution found ways for these two to cooperate.

The relationship could be as simple as rails on a pier so that transshipment was simple. Railroads might operate "break-bulk" steamers or barges, requiring cargo to be transferred from railcar to vessel. At the other extreme, railcars could be carried short or long distances over water by rolling them onto tracks mounted on a vessel. The carriage of railcars on vessels can be generally subdivided into two types of operation: one, the carriage of railcars over water for further travel on the rails; and two, the transport of railcars over water to put them adjacent to a ship for transfer of cargo.

Water crossings inevitably were an issue in the development of transcontinental rail routes. The Mississippi-Missouri river system and the Great Lakes taken together effectively divide the nation into two parts; transcontinental rail must cross one or the other.

Hilton observed that in the mid-19th century it was "...common for railroads...to transship at junctions, rather than to permit their freight cars to travel off the home line."[18] So long as this attitude prevailed, car ferries would be limited to moving cars to a transshipment point unless they connected a single railroad's tracks across water. Indeed, it is reasonable to speculate that the changing policies of railroad interaction and eventual consolidation directly influenced the Great Lakes car ferries introduction, growth, and decline.

Hilton has also recorded that the Great Lakes' first car ferry operation was intended to be of the transshipment type and followed by less than ten years the world's first vessel to carry railroad cars on tracks, the *Leviathan* of 1849 on Scotland's Firth of Forth.[19] Not quite on the lakes, but within their system, the sidewheeler *John Counter*, built in 1853 at Kingston, Ontario, was intended to bring railcars from the Watertown & Rome Railroad at Cape Vincent, New York, to Kingston; the cars would not be offloaded at Kingston, however, but the cargo would there be transshipped. Hilton does note that although "it is certain that the *John Counter* was designed as a car ferry, there is no assurance that she actually carried railroad cars during her brief period of operation."[20]

Not many years later, in 1858, the *International* entered service on the Niagara River between Black Rock, Buffalo, and Fort Erie, Ontario. Again, her role was to avoid the cost of break-bulk transshipment, which had been served by non-car ferries since 1853. Actual exchange of railcars between the American and Canadian systems was at that time prevented by the Canadian use of wide gauge. In 1872, the Grand Trunk Railway of Canada decided to convert its system to the same gauge as in the USA, allowing for exchange of cars. By late

[16] Chavez, *SS* Badger*,* 88.
[17] Ibid., 91.
[18] Hilton, *Great Lakes Car Ferries,* 2.
[19] Ibid.*,* 1.
[20] Ibid.*,* 245.

1873, a bridge had been built, idling *International*. Bridges (and tunnels) have been the typical replacement for cost-intensive train ferry operations world-wide.[21]

Other river car ferries on the Great Lakes followed, especially at Detroit and Port Huron, Michigan.

The Lake Michigan car ferries provided a connecting link in the northern tier of transcontinental services, but, as noted, river crossings were necessary as well. A chart published in the *Railroad Gazette* for 1897 and later republished in the journal "Transfer" gives an excellent idea of the extent of railroad water crossings shortly after the establishment of the Lake Michigan services. The Southern Pacific, for example, operated steam-powered "transfer boats" at New Orleans, thus connecting its western lines to other lines in order to provide transcontinental service. Likewise, the Missouri Pacific had a similar service at St. Louis, another link in a transcontinental service more or less in the center of the nation. North-south routes seem to be less intensively developed; certainly the one crossing of Lake Erie and the one on Lake Ontario closed operations long before the Lake Michigan lines. Today only two services carry railcars across water: a car float operation in New York harbor and a service from Seattle to Alaska to connect the Alaska Railway with the national railroad grid in the lower forty-eight states; both use barges making *Badger* the last self-propelled U.S. car ferry in operation.

The Lake Michigan Car Ferries

For a period of about a century, railroad car ferries extended rail lines across three of the Great Lakes, especially Lake Michigan. During that period on Lake Michigan, competing railroad interests, the difficulty of arranging track age rights on other roads, the distance around the southern end of the lake, and congestion in the rail yards at Chicago all made the carriage of railcars across the lake both efficient and economic.

The Flint and Pere Marquette Railroad (later the Pere Marquette) reached the Lake Michigan port of Ludington, Michigan in 1874. In order to connect to points west, the railroad began steamer service across Lake Michigan in 1875, using chartered tonnage. In 1882, desiring to operate its own ships, the company had two steamers built by the Detroit Dry Dock Company which were named *F. & P.M. No. 1* and *F. & P.M. No. 2*. About 145' long as built, these were typical "upper lakes" steamers of the time with freight carried in the hold and on the main deck and one deck of passenger accommodation above; the reciprocating machinery and the boilers were placed aft. The two proved too small and were almost immediately lengthened. Over time, the company acquired three more such steamers. All were "break bulk" vessels: that is, freight (and passengers) had to be transferred from the railcars to the vessel and then transferred to railway equipment at the other side of the lake.[22]

This practice was inherently inefficient. Passengers could easily move themselves from one mode of transportation to the other, but the freight had to be handled by staff, which cost both time and money. In 1892, the Ann Arbor Railroad, with its Lake Michigan terminal at Elberta (Frankfort), Michigan, ordered two wooden car ferries to be designed by the important naval architect Frank E. Kirby and built at the Craig yard in Toledo, Ohio. Kirby was chosen as the designer, no doubt, because of his success with the pioneering icebreaking train ferry *St. Ignace*, built four years before for the crossing at the Straits of Mackinac. *Ann Arbor No. 1*, the first ferry in the world to carry railroad cars across open water, entered service in November, 1892.[23] She and a sister-ship established the basic form of the Lake Michigan car ferry; whereas *St. Ignace* loaded railroad cars across her open bow, for Lake Michigan's open water the bow was built high and strong and car loading placed at the stern, requiring the car ferries to back into their slips.

[21] Hilton, *Great Lakes Car Ferries,* 2.
[22] Ibid., 111-112.
[23] Ibid., 70-71.

The Pere Marquette must have observed Ann Arbor's new ships with interest, given the efficiency of simply loading the railcars on the vessel. After negotiating connecting arrangements with the Wisconsin Central Railroad, the Pere Marquette in 1895 ordered a steel-hulled car ferry to be designed by Robert Logan of Cleveland and built by F. W. Wheeler & Co. of West Bay City, Michigan. *Pere Marquette* entered service from Ludington on February 17, 1897.[24]

Pere Marquette established the design of the cross-lake car ferry for several decades to come; indeed all the roughly thirty car ferries built thereafter for service on Lakes Michigan, Erie, and Ontario followed her general pattern, as did many rail ferries in other waters.[25] With a length of 337 feet, she was only about 55 feet shorter than the final pair of ferries, *Spartan* and *Badger* of 1952–3. Her breadth of 57.58 feet was determined by the space necessary for four lengthwise railroad tracks divided on the centerline by narrow uptakes, companionways, and ventilation trunks. All of *Pere Marquette*'s successors shared her boxy hull form; the lack of sheer (bow-to-stern curve of the deck, higher at the ends) emphasized the rectangularity of the hulls. This provided maximum space on the main deck for rail cars, the level character of the nearly flat deck being necessary for safe handling and stability of the railcars. The visible square stern was designed to fit the necessary slips and aprons and mesh with the shoreside tracks used to load and unload railcars; a small after pilot house was provided for use during docking. Although *Pere Marquette* did not have a sea gate to protect the after end of the main deck from high seas, she and all the steel ferries on Lake Michigan eventually had them installed or included when built.[26] Unlike many of the later ferries, *Pere Marquette* had only very limited passenger spaces on the deck above the car deck, as it was then assumed that passengers would continue to be carried by the break-bulk steamers already in service.[27] She was powered with a pair of compound reciprocating engines turning twin screws supplied with steam from scotch boilers. The twin-screw configuration was of great value given the constricted harbors used and the need to turn and back into the slips. This early period of car ferry design and construction is represented today only by underwater resources such as the *Pere Marquette 18* (the first of the name) of 1902 which sank in 1910 and *Milwaukee e*x *Manistique-Marquette & Northern No. 1* of 1903, which foundered in 1929; both are in Lake Michigan.[28]

Perhaps the design established by *Pere Marquette* reached its best examples in several nearly identical car ferries of the 1920s.[29] The final example of these was *City of Milwaukee* (NR, NHL), built in 1931 for the Grand Trunk, although by 1931 her design was already a bit anachronistic, more modern design elements and propulsion systems having already appeared in the Pere Marquette fleet.

The Pere Marquette's original cross-lake route used Manitowoc as the Wisconsin terminus, but over the years Milwaukee[30] and Kewaunee[31] were added on the west shore of the lake. A service was briefly operated from Ludington to Manistique, Michigan by the Manistique, Marquette and Northern Railroad, which was then under the control of the Pere Marquette.[32]

The standard of design for car ferries set by *Pere Marquette* was maintained until 1929–30 when the Pere Marquette built two new ferries, *City of Saginaw 31* and *City of Flint 32*.[33] These vessels had a single, more robust stack and replaced reciprocating steam machinery with turbo-electric. Another departure came in 1941

[24] Ibid., 114.
[25] Ibid., 117.
[26] Ibid., 87 & 134.
[27] Ibid., 262.
[28] Ibid., 262 & 265.
[29] Ibid., 138-139.
[30] Ibid., 128.
[31] Chavez, SS *Badger*, 133.
[32] Hilton, *Great Lakes Car Ferries,* 166-167.
[33] Ibid., 143.

when *City of Midland 41* appeared with as much streamlining as the boxy hull would allow and a second deck of passenger accommodation above the car deck, reflecting the increasing importance of passengers and their vehicles in the business of the ferries. She also had a large open area on the upper deck aft intended for use by automobiles, which would be loaded via a lengthy ramp. *City of Midland 41* was also the first of the car ferries to be fitted with Skinner "Unaflow" reciprocating steam machinery.[34]

The "Unaflow" engine is a variant of the reciprocating steam engine which uses the steam in a single direction and avoids the back pressure resulting from the piston pushing used steam to its outlet when the piston is being powered from the other end. It was not a new concept, but its practical application in marine engines in North America came from the Skinner Engine Company of Erie, Pennsylvania in the 1920s. It brought an improvement in thermal efficiency over standard reciprocation steam power.[35]

Late in the 1920s, the *Pere Marquette* came under the control of the Chesapeake & Ohio Railroad. The C&O was a coal-hauling railroad, with easy access to coal and a desire to please its customers. Therefore, diesel engines or oil-burning boilers were not considered for the car ferries. In addition, maneuvering in restricted harbors and backing into slips meant that the engines had to be quickly responsive to orders from the bridge. Direct-drive air-start diesels, the most common type at the time, could not meet this criterion. Steam turbines are notorious for taking time to reverse and having relatively little power in reverse. This explains the late-1920s experiment with turbo-electric propulsion, which could use coal in the boilers but had easily-controlled electric motors for propulsion. It also explains the choice of less-expensive Unaflow engines for the final three steamers at a time when reciprocating steam was becoming obsolete.[36]

In 1947 the Pere Marquette Railway was absorbed by the Chesapeake and Ohio, which had controlled it since 1929. The car ferry service was still a major asset for the railroad and in 1952–53, a new (and final) pair of ferries was built. Richard A. Stearn of Sturgeon Bay, Wisconsin was the naval architect for the new ships, and they were built at the Christy Corporation, also of Sturgeon Bay.[37]

The first vessel was launched on January 4, 1952, without being named. On September 6, 1952 her twin sister was launched and named *Badger* for the athletic teams of the University of Wisconsin; that same day the first vessel was given her name, *Spartan*, the mascot of University of Michigan athletics. With these ships, the railroad abandoned the practice of adding a numeral to a ship's name, but *Spartan* and *Badger* have always been unofficially referred to as number 42 and number 43 respectively. The *Badger* made her maiden trip from Manitowoc to Ludington on March 21, 1953.[38]

The new ships were not the last improvements to the Pere Marquette fleet. In 1953, *Pere Marquette 22* was sent to the shipyard and lengthened forty feet. She was also re-engined with new compound Skinner Unaflow engines and given a more modern "teakettle" stack. When she was back in service, her sister *Pere Marquette 21* received the same treatment, which gave the older sisters a speed of eighteen miles per hour, equal to that of the newer ships. Auto traffic continued to grow, and in 1955 the C&O installed the ramps necessary for utilization of the upper deck car space on *City of Midland 41* at Ludington and Manitowoc. By 1960, auto traffic on the Milwaukee route, served by *Spartan* and *Badger*, increased enough that a ramp was built at Milwaukee and a

[34] Ibid., 151 *et. seq.*
[35] American Society of Mechanical Engineers, *SS* Badger *Engines and Boilers*; "*Skinner Compound Unaflow Marine Steam Engines*" (promotional brochure) (Erie, PA: Skinner Engine Company, 1953).
[36] Hilton, *Great Lakes Car Ferries,* 142.
[37] Ibid., 157 *et seq.*
[38] Ibid., 160-161.

second ramp at Ludington to move cars onto an upper deck space aft on the sisters.[39] That area, originally intended as outdoor eating space, was extended nearly to the stern and over the after pilot house.[40]

By 1964, the development of "high-cube" railcars proved a problem for the car ferries, whose overhead height in the car deck would not accommodate them. *Badger* was sliced horizontally, and the height of the car deck raised eighteen inches.[41]

By then, there were signs that the car ferry era was destined to end. Services on Lakes Erie and Ontario, never as busy as Lake Michigan services, were gone by 1958. On Lake Michigan, the Grand Trunk car ferry service was abandoned in 1978 while the Ann Arbor's ships ceased trading in 1982. The last years of the Pere Marquette routes were more complex. One distant warning was the purchase of control of the Baltimore & Ohio Railroad (B&O) by the C&O. The B&O had track age rights through Chicago, something which the Pere Marquette/C&O had never had. Those track age rights made the car ferries much less essential to the C&O.[42]

In 1970, the C&O announced the termination of service into Kewaunee, Wisconsin; the Ann Arbor retained service to that port but agreed to drop service to Manitowoc, thus providing each railroad with a competition-free route.[41] In 1975, the C&O petitioned the Interstate Commerce Commission for permission to abandon all cross lake service, thus beginning the longest railroad abandonment proceeding in U.S. history.[43] In spite of widespread protests, in June, 1978 the "Kewaunee Plan" was adopted, which permitted the immediate abandonment of service to Milwaukee, the abandonment of Manitowoc service within two years, and the abandonment of Kewaunee service at the end of five years if the single-port service did not improve the C&O's income from the car ferries. Milwaukee service ended in October, 1980, although the Michigan Department of Transportation subsidized an unsuccessful attempt to revive sailings to Milwaukee in the summer of 1981. Service to Manitowoc ceased in January, 1982. Ludington-Kewaunee was now the only cross-lake car ferry route on the Great Lakes. One of the results of this diminution of service was that *Spartan* went into layup on September 10, 1979. She has not operated since.[44]

With the end of the five-year period, C&O took immediate action to divest itself of its remaining ferries. *City of Midland 41*, *Spartan*, and *Badger* were sold at one minute past midnight on July 1, 1983, to the newly-organized Michigan-Wisconsin Transportation Company (MWT) which assumed some C&O obligations, including the labor contracts. Agreements between the companies provided the new owners with use of the C&O's car ferry docks and maintenance shops at Ludington, and even a modest subsidy. There was also a six-year contract for the MWT to carry the C&O's railcars across the lake.[45]

Milwaukee service was revived again in 1984 but failed to attract sufficient business. In April 1985, termination of Milwaukee service was again announced, and Kewaunee again became the sole western port. In 1989, when the six-year agreement with C&O expired, the railroad was no longer obligated to assist the car ferry operation. The expiration of the agreement also ended the MWT's access to the Ludington dock, ticket office, shops and rail lines. The property was purchased by MWT.[46]

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[39] Hilton, *Great Lakes Car Ferries,* 137-138.
[40] Chavez, *SS* Badger, 60.
[41] *Ludington's Car Ferries*, 32.
[42] Ibid., 32, 34, 36.
[43] Ibid., 5.
[44] Ibid., 32 *et seq*.
[45] Ibid., 38 *et seq.*
[46] Ibid., 39.

The 1990 season, however, was dampened by bad weather and the financial results were negative. On November 14, 1990, MWT announced the indefinite suspension of service, and on November 16, *Badger* made her last run as a train ferry.[47]

In July 1991 the remaining three vessels were purchased by Charles Conrad of Ludington for his Lake Michigan Car ferry Service. Conrad, whose father had been a chief engineer on Pere Marquette steamers, had himself served as assistant purser on *City of Saginaw 31* in 1936. Conrad intended to refurbish *Badger* and use her for passenger, auto, and truck traffic from Ludington to Manitowoc; renovations on board *Badger* were begun. Complications arose when Glen Bowden of MWT declared bankruptcy and the court, asserting that the vessels were Bowden's assets, voided the sale. In February 1992, however, the court awarded the vessels to Conrad. The work on *Badger* was completed and she made her first sailing to Manitowoc as a passenger and auto ferry in May 1992.[48]

Demand proved that Conrad's decision to eliminate railcars reflected the market. In 1996, a half-deck with ramps was installed in *Badger*'s car deck, leaving the full height at the stern unencumbered for taller vehicles.[49] This provided space for an additional forty-two cars, an important improvement since the ship's passenger capacity was well in excess of that required by the passengers from vehicles carried. Passenger accommodations continued to be improved, as well.

During the 1990s, there was talk of a sale of *City of Midland 41* and *Spartan*. Nothing happened, however, until 1997, when *City of Midland 41* was taken to a shipyard and cut down to a barge; nothing remains above her main (car) deck.[50] She was also renamed *Pere Marquette 41.*

Spartan has now been laid up at Ludington for thirty-two years,[51] her engine room serving as a parts source for *Badger*'s machinery. Given the incomplete state of her engines, operation would almost certainly require repowering, probably with diesels. Three other Lake Michigan car ferries survive but are inactive. *City of Milwaukee*, built for the Grand Trunk in 1931, is in static museum use at Manistee, Michigan, having last operated in 1981. She is a National Historic Landmark. *Arthur K. Atkinson* ex *Ann Arbor No. 6*, built in 1917, is in layup at Detour, Michigan in a state of considerable decline. Profoundly altered in a complete rebuilding and repowering with diesels in 1959, she last operated in April, 1982. *Viking I* ex *Viking* ex *Ann Arbor No. 7* of 1925 was similarly rebuilt in 1965 and has not operated in revenue service since 1982, although she has moved under her own power in a series of ill-fated and ill-advised proposals to use her. She has not moved under her own power since 2001. *Viking I* was sold to owners in Menominee, Michigan in 2002 for reduction to a barge, but remains intact at the time of writing.

Badger remains in summer service between Ludington and Manitowoc. Although financial results of the closely-held company are not released, it appears that she remains economically viable and the company has publicly committed to the retention of her unique machinery; she is now apparently also the largest coal-fired passenger steamer in the world.[52] Currently, however, the propulsion system is under threat from a ruling by the Environmental Protection Agency that *Badger* must stop dumping her coal ask into Lake Michigan by 2012. It is unclear how this mandate might be met. The options include conversion to oil firing, which would destroy part of the historic coal-delivery system and significantly increase operating costs. An expensive alternative is to install diesel propulsion units aft of the present machinery spaces, leaving the historic machinery intact but

[47] Chavez, *SS* Badger*,* 88.
[48] *Ludington's Car Ferries*, 41.
[49] Chavez, *SS* Badger, 105.
[50] Ibid., 5.
[51] Ibid., 61.
[52] Alistair Deayton, *Directory of the World's Steamships* (Stroud, U.K., Tempus, 2007), 336.

unused. Retention of the coal ash on board for on-land disposal presents almost insurmountable obstacles given the limited space available for storing red-hot material in the already crowded boiler room.

The combination of her heavy hull, built for ice service, and the non-corrosive character of fresh water should keep her structurally sound for decades. So long as cars and passengers appear on the dock and income exceeds expenses, *Badger* will sail on. In her pilot house, the wheel and the binnacle both obviously come from some older ship. The brass stand for her wheel bears the inscription “Wheeler,” referring to the Bay City shipyard where the first *Pere Marquette* was built. More than history connects the first and the last of the Pere Marquette/C&O car ferries. The wheel that set the course for *Pere Marquette* in 1897 apparently guides *Badger* today.

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Previous documentation on file (NPS):

__ Preliminary Determination of Individual Listing (36 CFR 67) has been requested.
_X_ Previously Listed in the National Register.
__ Previously Determined Eligible by the National Register.
__ Designated a National Historic Landmark.
__ Recorded by Historic American Buildings Survey: #
__ Recorded by Historic American Engineering Record: #

Primary Location of Additional Data:

_X_ State Historic Preservation Office
__ Other State Agency
__ Federal Agency
__ Local Government
__ University
__ Other (Specify Repository):

10. GEOGRAPHICAL DATA

Acreage of Property: less than 1 acre

UTM References:	**Zone**	**Easting**	**Northing**
	16	544030	4866130

(The UTM reference marks *Badger's* midpoint while at her Ludington dock.)

Verbal Boundary Description:

The boundaries are limited to the ship itself as it is located at its docks in Michigan and Wisconsin.

Boundary Justification:

The boundary of the SS *Badger* is the external dimensions of the ship as it is located at the Ludington, Michigan dock, as it traverses Lake Michigan, and as it is located at its Manitowoc, Wisconsin dock.

11. FORM PREPARED BY

Name/Title: William M. Worden, maritime historian

Address: 1020 Iroquois Avenue
Detroit, MI 48214

Telephone: 313-824-9503

Date: June 2011

Edited by: Kevin Foster
National Park Service
Park History Program
1849 C St. NW (2280)
Washington, DC 20240

J. Paul Loether
National Park Service
National Historic Landmarks Program
1849 C St. NW (2280)
Washington, DC 20240

Telephone: 202-354-2003

NATIONAL HISTORIC LANDMARK



Portion of USGS Map with SS *Badger* (Car Ferry Location



Badger departing Ludington, Michigan, on May 23, 2009 at about 9:15 a.m. View of starboard side heading roughly west. Photo by William M. Worden.



Badger on trials March 16, 1953. Unknown location and direction in Lake Michigan. From a postcard distributed during the ship's first year of service. Photographer and location of negative unknown. Photo courtesy of Lake Michigan Trans-Lake Shortcut, Inc.



Badger's main lounge from a photo taken for publicity purposes when the ship was new. View from forward port corner looking starboard and aft. Photographer and location of negative unknown. Photo courtesy of Lake Michigan Trans-Lake Shortcut, Inc.



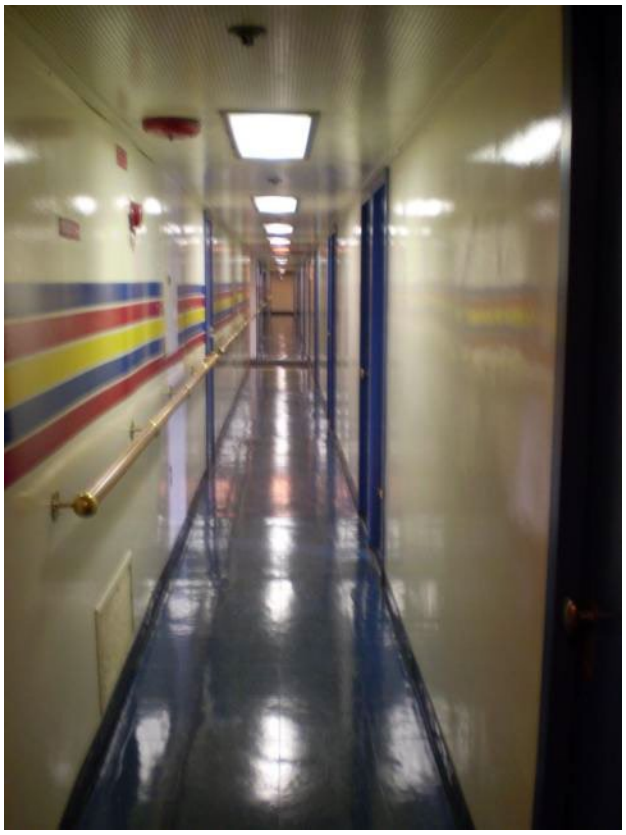
Badger's car deck as built for railroad service. View looking forward; the dock apron is in the foreground; the ship's deck begins at the end of the railing on either side. Date, photographer, and location of negative unknown. Photo courtesy of Lake Michigan Trans-Lake Shortcut, Inc.



Badger's car deck after adaptation to automobile service. View forward showing the passenger stairways installed on either side, and on the right (starboard) side the ramp to the upper auto deck installed in the forward section of the car deck. Note that rails are still present embedded in asphalt. Photograph by William M. Worden, May 22, 2009.



Badger's main lounge, view from port side forward looking to starboard and aft. Photography by Kari Karr, Lake Michigan Trans-Lake Shortcut, Inc., May 2008.



Starboard stateroom hall on *Badger* looking forward. Unaltered except for brightly-colored, painted graphics. Photo by Kari Karr, Lake Michigan Trans-Lake Shortcut, Inc., May 2008.



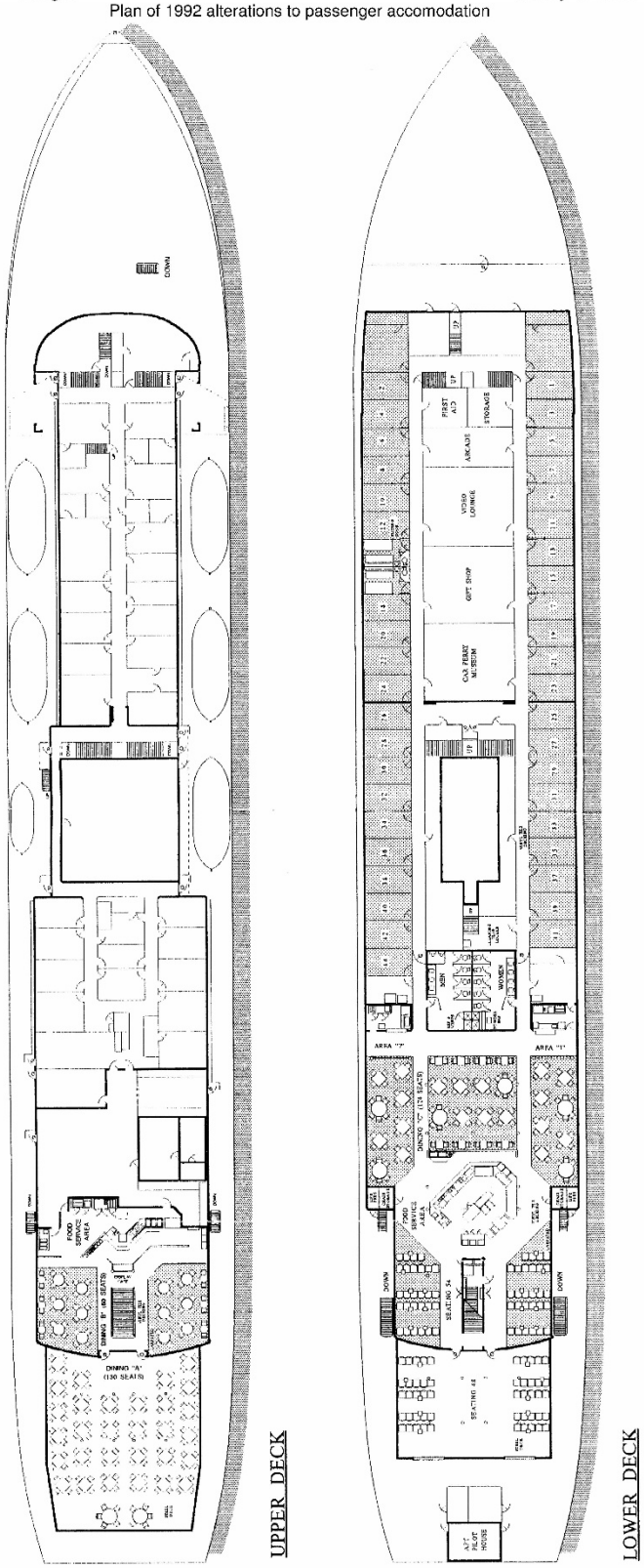
Badger departing Ludington, Michigan on May 23, 2009, at approximately 9:15 a.m. Stern view of starboard side, vessel heading roughly west. Photo by William M. Worden.



Badger at the Chicago & Northwestern Railroad car ferry slip in Manitowoc, Wisconsin, in 1953. Photographer unknown. Photo courtesy of Lake Michigan Trans-Lake Shortcut, Inc.

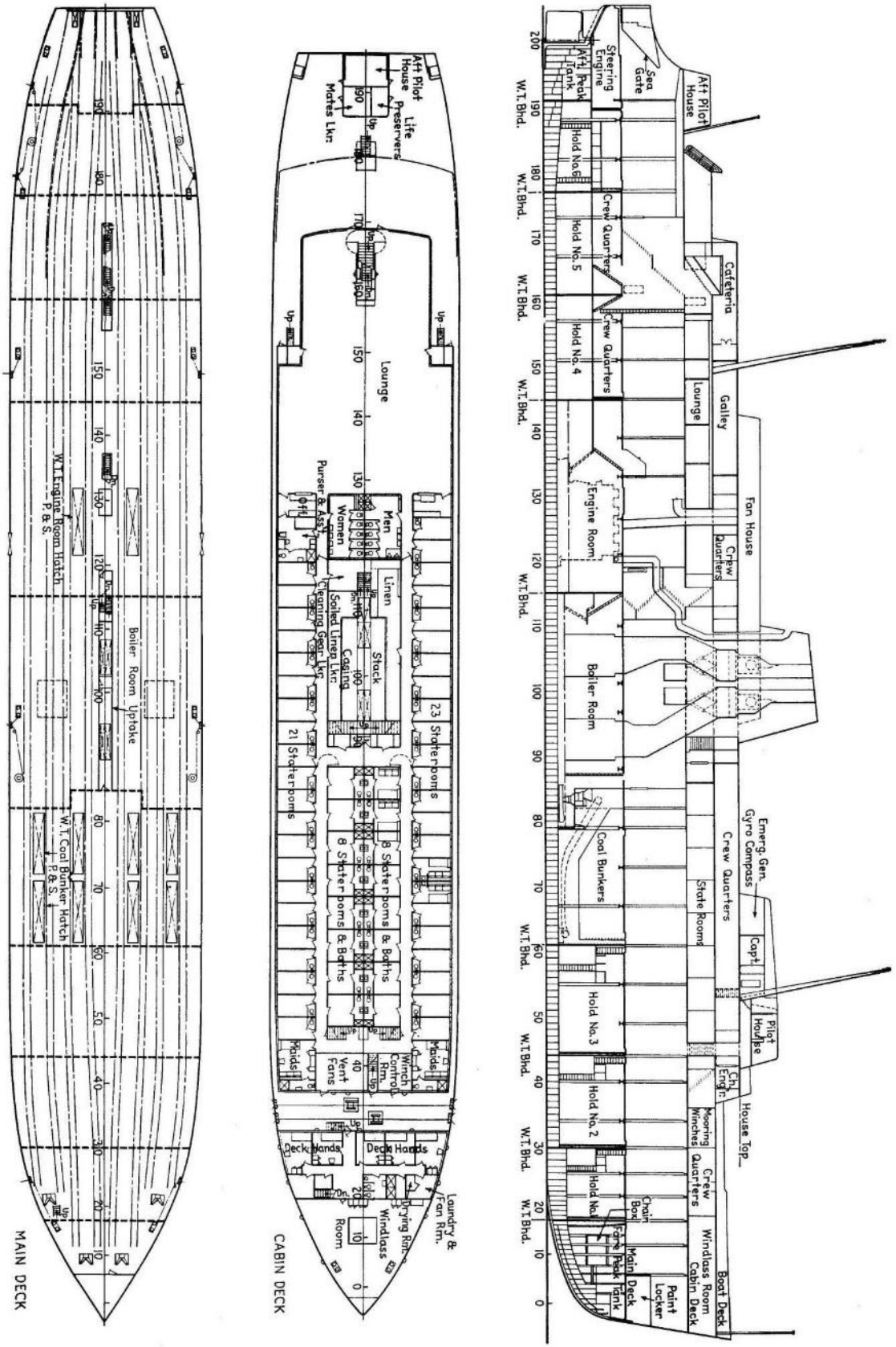
Name of property : S.S. *Badger* County & State: Mason, Michigan

Plan of 1992 alterations to passenger accomodation



Name of Property : S.S. *Badger* County & State: Mason, Michigan

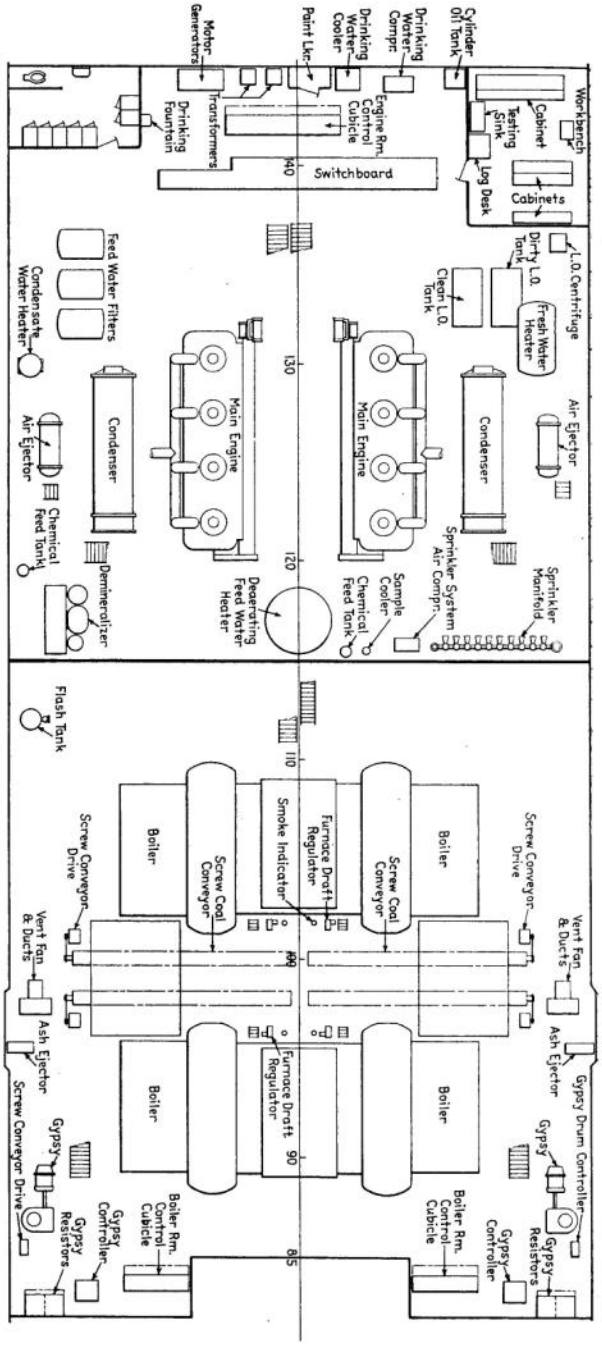
Original plans as published in *Marine Engineering*, March, 1953.



Inboard profile and arrangement plans of cabin and main decks

Name of Property : S.S. *Badger* County & State: Mason, Michigan

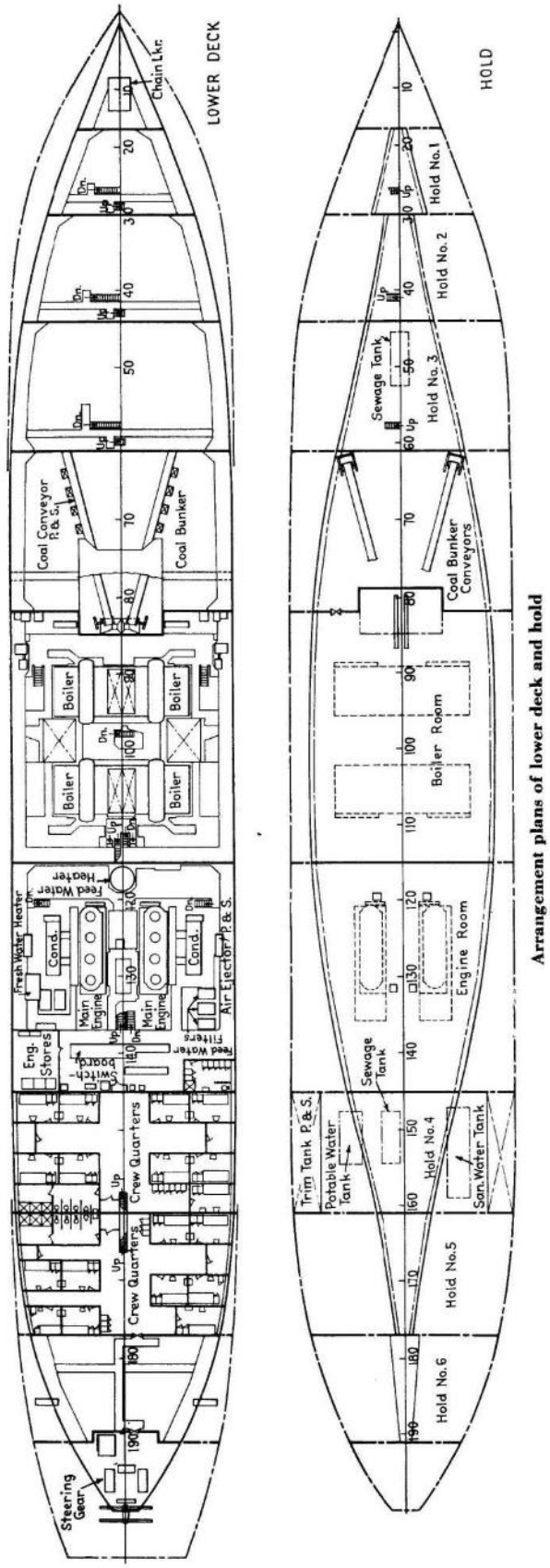
Original plans as published in *Marine Engineering*, March, 1953.



Engine and boiler room plan at lower deck level.

Name of Property : S.S. *Badger* County & State: Mason, Michigan

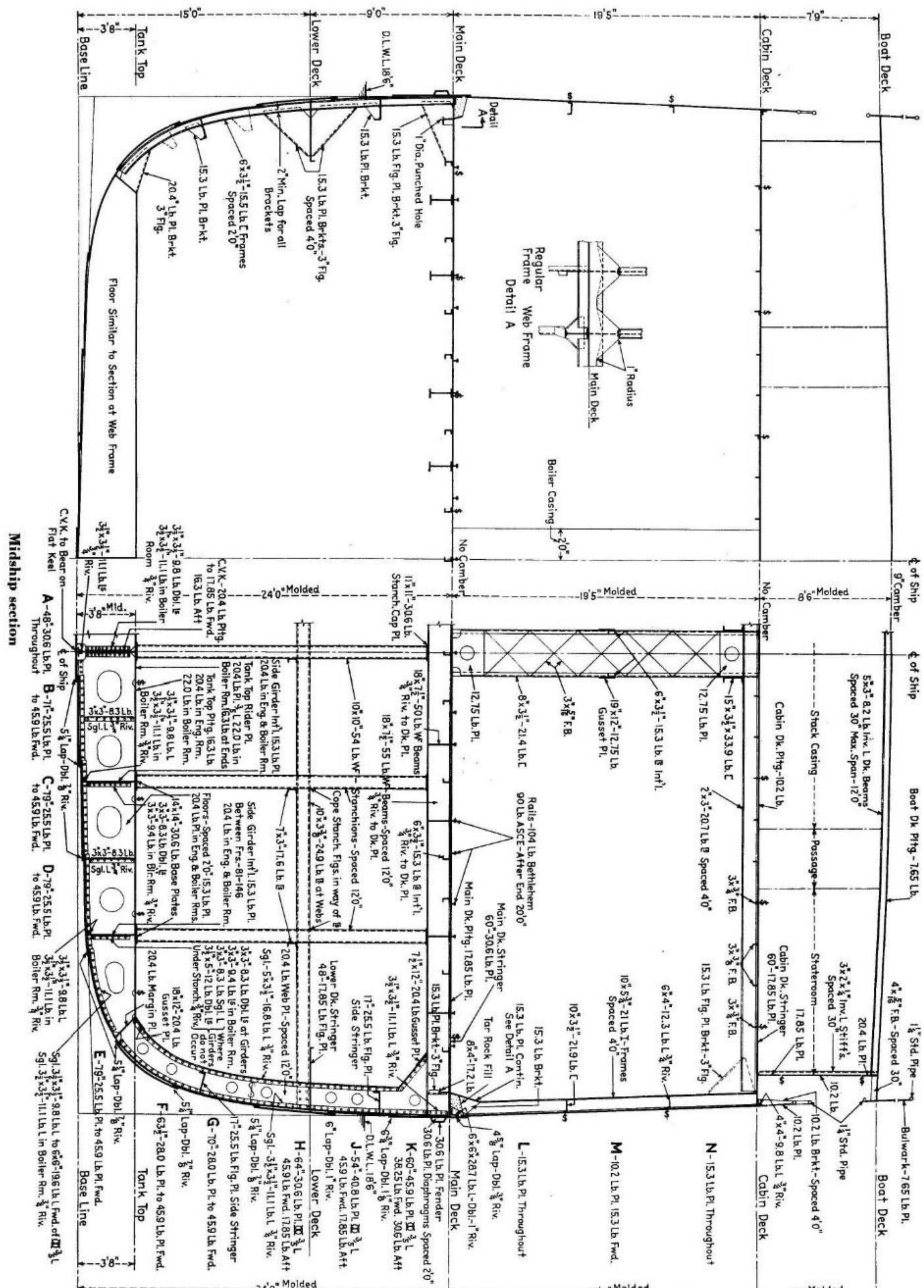
Original plans as published in *Marine Engineering*, March, 1953.



Arrangement plans of lower deck and hold

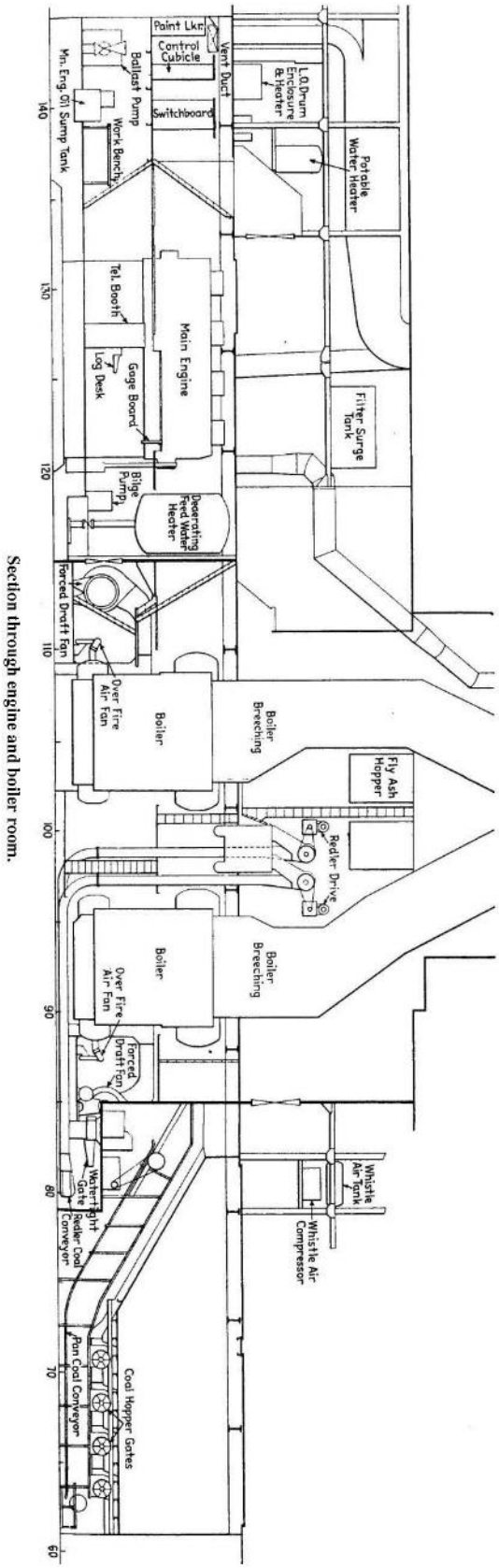
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Original plans as published in *Marine Engineering*, March, 1953.

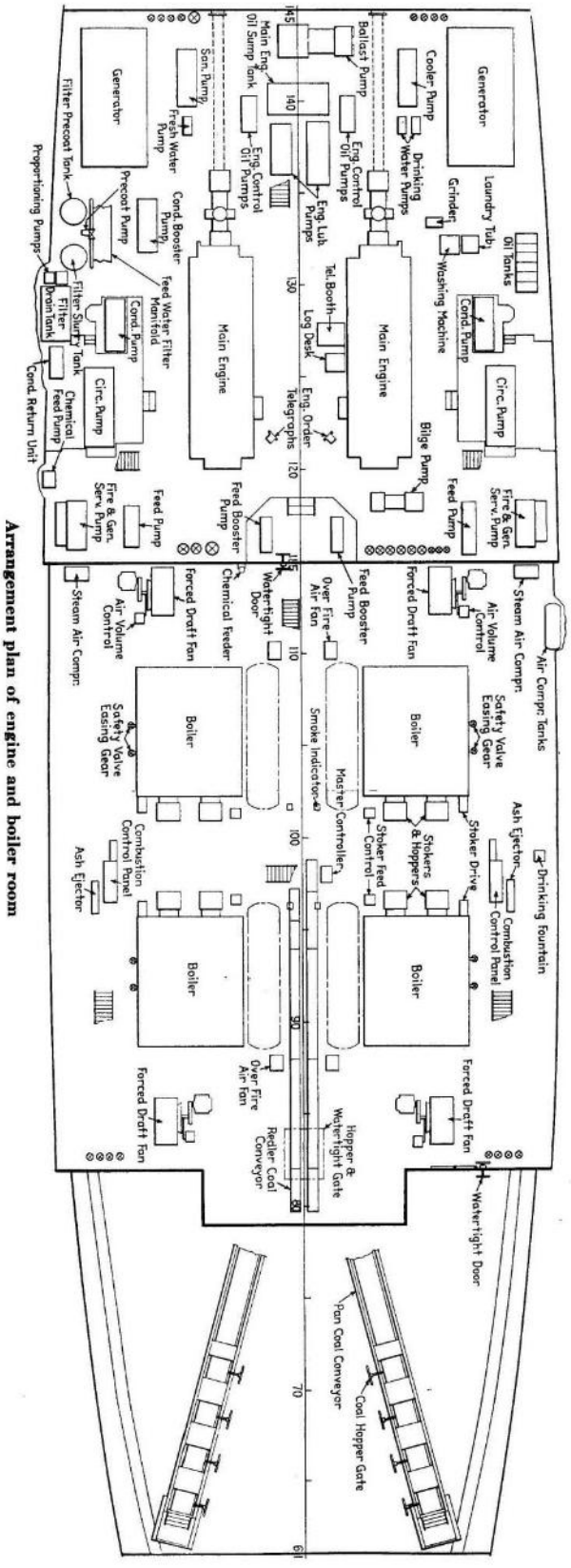


Name of property : S.S. *Badger* County & State: Mason, Michigan

Original plans as published in *Marine Engineering*, March, 1953



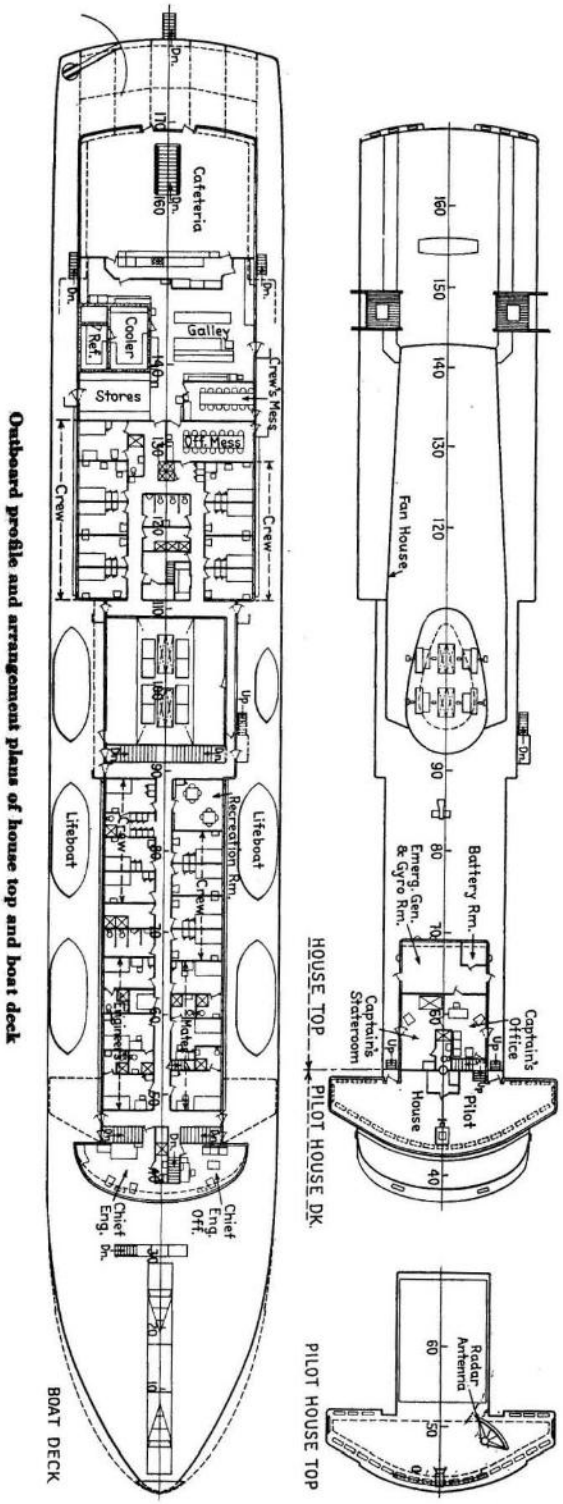
Section through engine and boiler room.



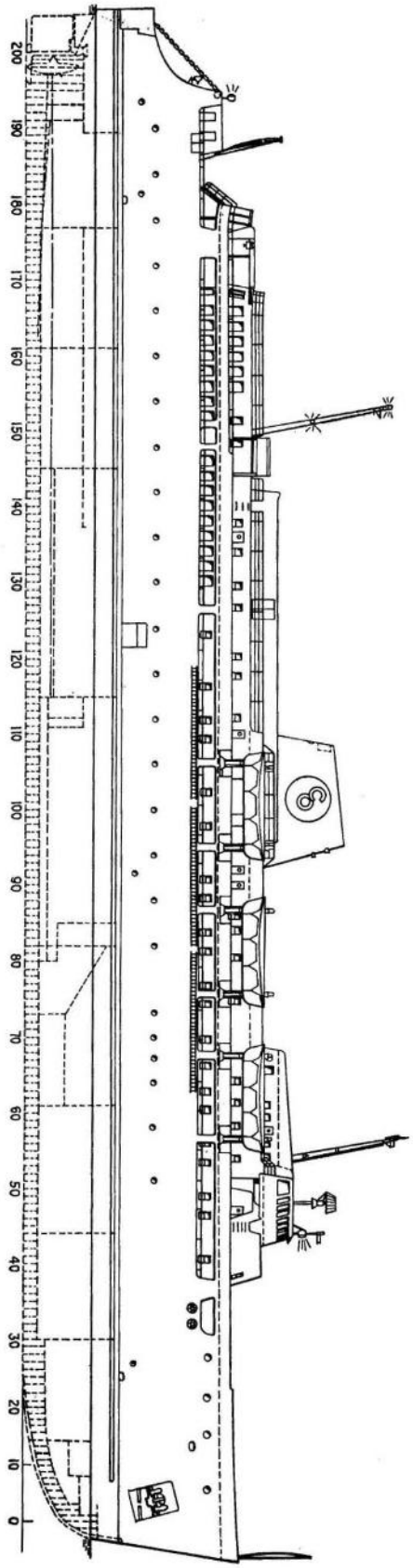
Arrangement plan of engine and boiler room

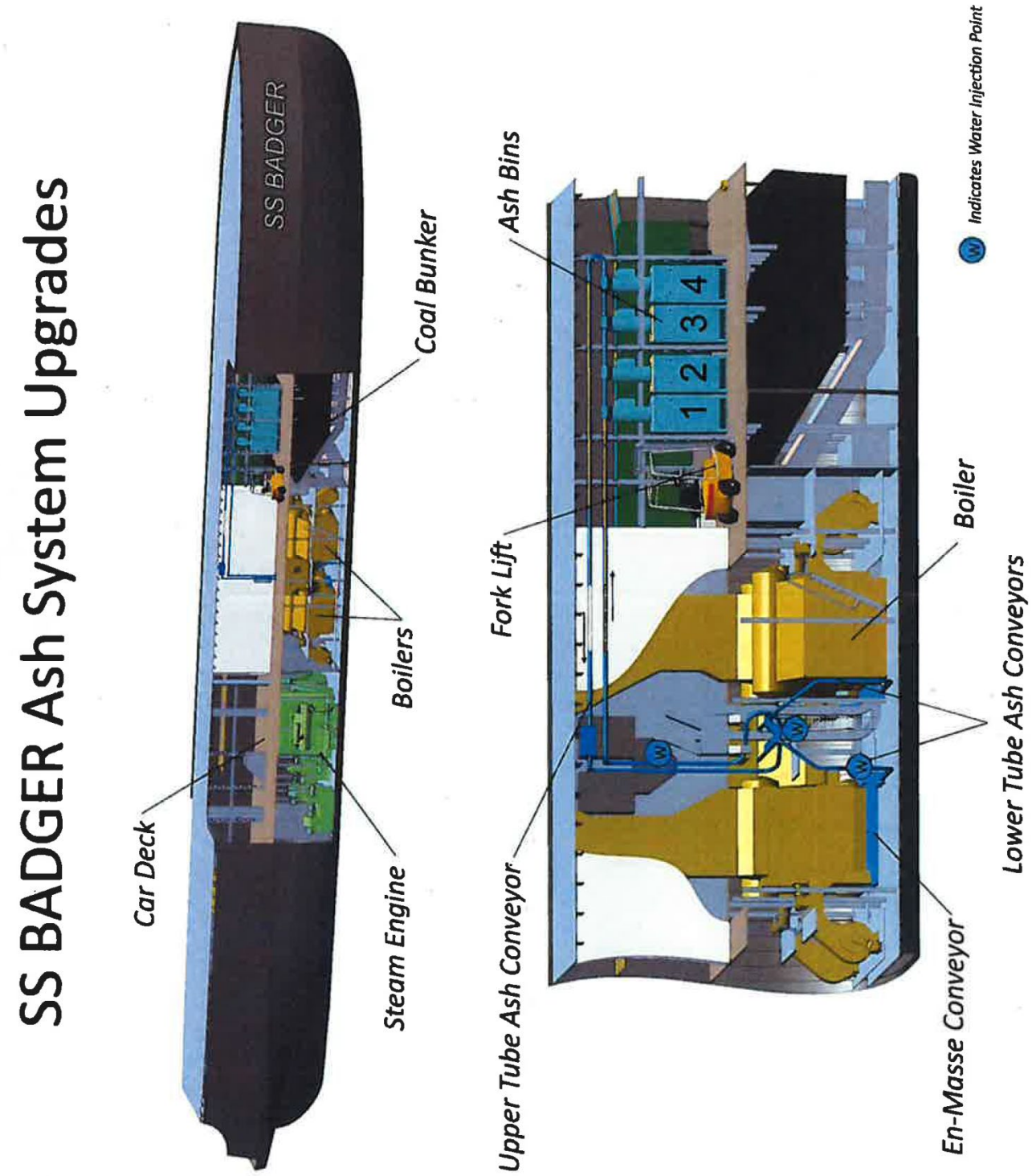
Name of Property : S.S. *Badger* County & State: Mason, Michigan

Original plans as published in *Marine Engineering*, March, 1953.



Outboard profile and arrangement plans of house top and boat deck




SS BADGER Ash System Upgrades
SS BADGER
Coal Bunker
Boilers
Car Deck
Steam Engine
Ash Bins
Fork Lift
Upper Tube Ash Conveyor
1
2
3
4
Indicates Water Injection Point
Boiler
Lower Tube Ash Conveyors
En-Masse Conveyor