Great Lakes Maritime Research Institute

A University of Wisconsin - Superior and University of Minnesota Duluth Consortium

A Review of Great Lakes Shipbuilding and Repair Capability: Past, Present and Future

Final Report

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Executive Summary

The study presented addresses the research area of Economics and Development of the Great Lakes Marine Transportation System and specifically Concepts to Expand Great Lakes Ship Repair and Shipbuilding. The study's goal is to provide an analysis of past, present and potential capabilities for the ship repair and shipbuilding on the Great Lakes that will be useful for future ship repair and shipbuilding research and planning projects.

Preliminary findings have been mixed. The Great Lakes shipbuilding industry has a meaningful history, especially in WWII. Except in a few cases, such as the luxury yacht market, in recent years the Great Lakes has suffered from the same plight as the rest of the U.S. shipbuilding industry. There are only a few viable shipbuilding facilities and repair facilities still in business. Occasionally new companies try to enter the ship repair buisness without much success. Even with protective markets and government contracts, the low and unstable demand and more lucrative business opportunities for local governments the U.S. shipbuilding industry, including the Great Lakes, are not competitive in the international commercial shipbuilding market. To compete in this market significant investments would be needed in the facilities, technology, and people.

Another similarity between the Great Lakes shipbuilding when compared to the U.S. shipbuilding industry is the missed opportunities to gain market share in niche markets such as ferries, high-speed vessels, and unique non-steel vessels. The same factors that made U.S. shipbuilding noncompetitive also eliminated those possible opportunities for the Great Lakes.

From a facility capacity perspective, the Great Lakes region has potential excess capacity. Legacy piers, graving and floating dry docks, and general heavy industry infrastructure exist within the states surrounding the Great Lakes. The major issues that the researchers feel inhibit the viability of Great Lakes shipbuilding are the lack of the necessary skilled labor and technical engineering talent needed to either create a new market or compete in the existing general commercial market. Some have commented that the current U.S. Navy and Coast Guard needs could be used to "jump start" the Great Lakes shipbuilding industry recovery. The authors feel that this is a highly unlikely option given the fact that the government, for national security reasons, needs to focus on the currently operating US shipyards to make them more cost effective.

Even though the expansion of shipbuilding as a major industry within the Great Lakes does not look reasonable if no policy, legislation, or funding changes are made, the ship repair business seems to be viable, but again demand is currently met by existing facilities. As the Great Lakes fleet ages, ship owners are opting to convert and repair the vessels, including major machinery upgrades, instead of replacing the vessels. The skills required to maintain a ship repair business are vastly different than shipbuilding, and are better suited for the seasonally variable employee profile that currently exists in the region.

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1.0 Introduction

The presented study addresses the research area: Economics and Development of the Great Lakes (GL) Marine Transportation System (MTS) and specifically Concepts to Expand GL Ship Repair and Shipbuilding. This report provides a database and analysis of past, present and potential capabilities for the ship repair and shipbuilding business on the Great Lakes. The study will be useful for future ship repair and shipbuilding research and planning projects.

The University of Michigan team has completed a literature search to identify past and current Great Lakes ship repair and shipbuilding facilities. Additionally, they have compiled a list of currently active shipbuilding and ship repair facilities within the Great Lakes.

The final component of the study was the investigation of labor and market conditions within the Great Lakes region as well as the U.S. to analyze the future of Great Lakes shipbuilding and ship repair. Recommendations are given concerning the potential growth of ship repair and shipbuilding opportunities in the Great Lakes.

This research provided a report and a reference database for Great Lakes ship repair and shipbuilding capabilities that documents their past, present and future potential. The database will be provided to the GLMRI to make it available on their website to be accessible for all future research in the area of Great Lakes ship repair and shipbuilding.

2.0 Great Lakes Shipbuilding History

While the Indians surrounding the Great Lakes and its rivers undoubtedly built canoes and even larger boats, shipbuilding did not begin until the European settlers/explorers came to the shores of the Great Lakes. The early French explorers built larger flat bottom boats propelled by oars with auxiliary single sail (more like barges) to aid in their exploration, and the British colonists built small sailing ships.

Naval ships for the British Royal Navy were built in the Great Lakes before the American Revolution for operation on the Great Lakes. The Great Lakes shipbuilding industry contributed to both World Wars and has seen a sharp decline since the end of the last world war.

The following history presented in the remainder of this section from 1776 to 1935, is extracted from the Minnesota Marine Historical Society which was adapted from the National Register's Multiple Property Documentation (MPDF) "Minnesota's Lake Superior Shipwrecks A.D. 1650-1945" (19).

2.1 The Beginning

Sailing craft on the Great Lakes date to the first ships constructed on Lake Ontario in the 17th century. The first ships on the Lakes were built at Lake Ontario due to the natural barriers posed by the St. Lawrence River rapids and the falls at Niagara. Robert Sieur de La Salle built the 70-foot "galliot" GRIFFIN above Niagara Falls in 1679, inaugurating navigation on the upper Great Lakes. Louis Denis, Sieur de la Ronde, French Commandant at Chequamegon, built a sailing craft on Lake Superior around 1734 to exploit the copper of Keweenaw Point and Isle Royale. By the 1740s, the French had four ships on Lake Ontario. The British had begun shipbuilding there as well, in order to assert their influence over the lucrative and growing fur trade.

All the earliest Great Lakes' craft were brigs, schooners, or sloops of traditional European design. Naval personnel probably designed the ships in either France or England. Between 1756 and 1763, the British and French were involved in the Seven Years' War. Shipbuilding during that period followed Admiralty designs.

Not long after the French surrendered Canada in 1763, the British built two small schooners at Navy Island on the Niagara River. The HURON and MICHEGON, each of 80 tons, were the first British craft of any description on the upper Great Lakes. The British built two more schooners in 1766. For the next 19 years, Lakes navigation was restricted to British naval craft. Private enterprise was officially throttled. Merchants and traders were required to ship all their cargoes on government ships manned by the Royal Navy under the title of "Provincial Marine". The British licensed a limited number of privately owned ships, including a barge and a 40-ton sloop that had been built on Lake Superior in 1772 for an English copper-mining syndicate. In the early 1770s, there were only 16 vessels on all of the Great Lakes, including five operating on Lake Ontario and nine on Lake Erie. Others would soon follow despite the policies of the British government. By 1778, fur trader John Askins of Michilimackinac was operating the schooners MACKINAC and DEPEYSTER on Lake Superior between Grand Portage and the Sault Ste.

Marie. With the fur trade flourishing in the West and settlement spreading around Lake Ontario, British merchants protested the prohibition against merchant shipping.

2.2 American Revolution

The Lake Champlain Continental Navy fleet, one of the earliest U.S. fleets, was built during the American Revolution.

The 1812 conflict on the Lakes centered on the massive shipbuilding programs by both sides. Though square-rigged ships tended to be faster under the right conditions, they proved to be a disadvantage on the Lakes. Experience also demonstrated that shallow-draft vessels were as safe and efficient as the traditional deep-draft ships.

After the War of 1812, schooners became the predominant vessels on the Lakes. Most of the merchant ships between 1800 and 1830 were two-masted schooners of about 70 feet in length and 100 tons register. They carried approximately 150 tons or 1,500 barrels of cargo with a crew of three or four men. Brigantines combined the best features of both square and fore-and-aft rigs, and became popular in the 1830s and 1840s. They required crews of eight to ten men and were not as maneuverable as schooners. As a result, few brigs or brigantines were built after 1850 because they were too expensive to outfit and operate when compared with the simpler schooners. The most practical and profitable rig was the topsail schooner, designed for fast trips with heavy payloads (characteristic of square rig) and maneuverability with limited crew. As the rigs of Lakes craft became somewhat standardized in the 1830s and 1840s, a similar trend developed with the hulls. Hull form was determined by geographical conditions and by the configuration and dimension of navigation locks in places like the Welland Ship Canal. Sturdy ships were built with full shapes and flat bottoms to squeeze through the shallow spots and the locks with as much cargo as possible. They were invariably fitted with "centerboards" to improve their sailing qualities. With straight sides and box-like forms, they resembled canal boats and earlier coastal packets. The ships were the models for the early 20th century bulk freighters. The distinctive "canallers" were characterized by their shapes and their dimensions, which conformed to those of the locks themselves. The first Welland Canal, completed in 1832, had locks 100 feet long and 16 feet wide. The "Second Welland," opened in 1845, had 150-foot by 26-foot locks. Canallers built for the second Welland were probably the first distinctly "Lakes" vessel type. In the early 1860s there were reportedly more than 750 canal schooners on the Lakes out of a total of nearly 1,300 sailing craft. The canallers were the backbone of the Great Lakes fleet.

The 1840s and 1850s were prosperous times for the country and for the Midwest. Unfortunately, the great boom ended in the Panic of 1857, which prostrated the nation's economy for the next several years and ruined most of its financial institutions. The Civil War years marked the slow steady recovery from the terrible effects of the depression. With the 1860s, commerce shifted in the Great Lakes. Railroads had penetrated the West and cut into the profitable freight businesses. There were still enormous quantities of foodstuffs and raw materials to be transported by ships, but the lucrative package cargo had decreased. At the same time, bulk cargoes such as salt, grain, coal, and lumber were increasing.

One type of sailing vessel which became popular on the Lakes was the scow schooner. Scows were introduced around 1830. They were shallow craft with flat bottoms and hard chines (square bilges), although they varied in bow and stern configurations. Scows were simply designed and cheaply built. They were popular for the shallowest, poorest ports in the lumber, cordwood, tanbark, sand, or hay trades. A handful of scows were used on Lake Superior, but they were most common on Lake St. Clair, Lake Michigan, and on the Bay of Quinte on Lake Ontario. Some scows survived as late as 1920.

Before and after the Civil War, strong markets for grain and lumber resulted in a shipbuilding boom that began in the mid-1850s and lasted until the late 1860s. Several hundred schooners were built during this period. Many of these ships were 150 feet to 160 feet in length, with almost double the capacity of the canallers. Some of the larger craft built in the Civil War era were fitted out as barkentines, with square sails forward and schooner-rigged main and mizzen masts. These speedy ships were well suited to the competitive Buffalo and Lake Michigan grain trade, where several set records for fast passages. According to contemporary newspaper articles, they could make up to 15 miles an hour for short periods, though they generally averaged less than half that speed. A 15 day round trip from Buffalo to Milwaukee or Chicago and back was considered good time.

After 1880, many builders incorporated iron and steel into the fabric of wooden ships in the form of reinforcing rods and straps, brackets, or plates at critical locations in the hull. In general, ships grew larger as shipbuilding technology improved through the 19th century. The dimensions of Lakes vessels were always limited, however, by the shallow connecting channels and harbors. When the infamous shoals were dredged at the St. Clair Flats in the late 1860s, a whole fleet of large schooners was built for the grain and iron ore trades, including 200 big three-masters and a few four-masters. The new schooners, 200 feet in length and drawing 16 feet, were constructed between 1870 and 1874, until a financial panic ended the temporary boom. Only for a little while longer would the large capacities of the new schooners enable them to compete with the growing fleets of steam-powered freighters.

Very few full-rigged sailing vessels were built on the Lakes after 1880. The last large schooner was launched in 1889. Sailing craft built after that date were all rigged with short masts, and were intended as tow-barges. Some of those built after 1890 measured up to 300 feet in length. Some of the old schooners continued under sail into the 20th century, but few made any money. There was only a handful left after 1920. The schooners OUR SON and LYMAN M. DAVIS lasted into the 1930s. They were the last working survivors of nearly 25,000 of their type.

The first steamboat on the upper Lakes was the 338-ton WALK IN THE WATER. It was built at Black Rock (Tonawanda), New York, for the Lake Erie Steamboat Company. Its machinery was designed by Robert Fulton. Acceptance of steamboats was slow among Lakes vessel owners. Trade in the 1820s was not yet large enough to justify the large investment required to build steamers, so most vessel owners built and operated sailing craft. After completion of the Erie Canal in 1825, however, the commerce of the region grew. The burgeoning passenger traffic offered sufficient returns to justify the more costly steamboats. In the 13 years previous to the opening of the Canal, 25 steamboats had been constructed. In the four years after completion of the canal, 60 new steamboats were built, primarily at Lake Erie ports which connected directly with the Erie Canal.

By 1840, there were more than 100 steamers in service on the Lakes. Most were less than eight years old. About 40 of these craft operated as ferries or on short local routes out of the larger ports. The remainder, principally the larger boats, ran from Buffalo to upper Lakes ports or from Niagara and Toronto to lower Lakes or St. Lawrence River destinations. Most paddle-wheelers carried one, two, or even three masts until about 1850. These were often fitted with sails and jibs. The later screw propelled steamers continued to use sails until after 1870. Some screw freighters carried sails until almost 1900.

The advances in shipbuilding technology during the 1840s brought dramatic changes to the steamboat fleet. The first 1,000-ton steamer in the nation, the 260-foot EMPIRE, was built on the Lakes in 1844. The lavish vessel ushered in the era of "Palace Steamers," which was to last until 1855. Construction of such large craft was possible with the development of new fastenings for wooden hulls, the expanded use of ironwork for strengthening, and the introduction of "hogging-frames" and trusses. The magnificent Palace Steamers of the later 1840s and early 1850s were the most beautifully-appointed craft ever built on the Lakes. In all, there were 25 of them. Most were between 1,000 and 1,600 tons. The CITY OF BUFFALO, built in 1857, was the last and largest of them. It measured 350 feet in length and was 2,026 tons burthen. Most of the Palace Steamers ran from Buffalo to Detroit or Chicago. Only the smallest could fit through the Sault Locks when they were opened in 1855. The passenger business revived after the Civil War, but it was never again able to sustain ships as luxurious as the Palace Steamers. The steamers built for the post-war passenger trade were more modest in size and furnishings.

The development of side-wheel steamers was stemmed by the rapid ascendancy of screw steamers in the various trades. Though side-wheel steamers remained popular in the passenger trade for many decades, they would never again achieve the numbers of the 1830s and 1840s. Side-wheelers reached their zenith between 1845 and 1857 with the 300-foot Palace Steamers. A few paddle-wheel giants were built on the Lakes after 1900, including the 520-foot twins Greater Detroit and Greater Buffalo of 1924, which were the largest side-wheelers ever built. When they entered service, only 37 others were left. After 1950, they were all gone.

The 105-foot screw propelled INDEPENDENCE was brought to Lake Superior in 1845. It was the first steamer of any kind to sail that body of water. The INDEPENDENCE had been built two years earlier at Chicago, and like several other vessels, it was hauled around the falls at Sault Ste. Marie on rollers and launched into Lake Superior many years before the Sault Locks were built.

The number of screw propelled ships on the Lakes grew rapidly and revolutionized the carrying trades. Several companies organized around 1850 to build fleets of screw steamers to carry freight in connection with the Erie Canal, or with the various railroads running to the seaboard from the eastern end of the Lakes. Between 1840 and 1849, 81 propellers were built at Great Lake shipyards. During the next ten years, 133 more were added and during the 1860s another 88 were built, not including screw tugs.

Screw propelled steamers, including passenger ships and package freighters, grew in size during the 19th century, along with deepening channels and improvements in shipbuilding technology. The average size grew from 141 feet (337 tons) in 1845, to 182 feet (641 tons) in 1862 and 220 feet (1,300 tons) in 1877. Forty-five steam barges were built before 1870. Nearly 600 steam barges were built between 1870 and 1900.

While bulk freighters became more numerous in the 1880s and 1890s, other vessel types dwindled and eventually disappeared. Sailing craft were entirely displaced by steamers, except in the lumber trade, where they found a niche in later years as tow barges, though their rigging was cut away and their graceful bowsprits cut short. Steam barges lasted only as long as the lumber trade on the Lakes. When the lumber business moved to the Pacific coast around 1910, the use of steam barges on the Lakes declined sharply after that, although they became widespread along the California, Washington, and Oregon coasts. Most of the steam barges were simply abandoned and dismantled. Some steam barges were used to carry salt, coal, sand, and lumber products on the Lakes, but few survived past the 1920s.

After 1880, relatively few large screw propelled ships were built. Many of those were exclusively passenger ships, with limited cargo space or no freight capacity at all. Most of them were "day boats", excursion steamers with neither overnight accommodations nor cargo space. A dozen passenger ships survived the opening of America's highway networks in the 1930s, but the last of them succumbed to economic pressures and regulatory requirements and were laid up in the mid-1960s. The Georgian Bay Line steamer SOUTH AMERICAN was the last active representative of its type. It retired at the end of the 1967 season.

Iron was used experimentally to build ships' hulls in Scotland and England before 1800, but it was not readily adopted. The U.S. Navy and the Revenue Service ordered iron vessels in the early 1840s. Despite the advantages of iron hulls, however, Great Lakes shipbuilders did not begin iron shipbuilding until after 1860. The practice was not widely accepted until 1880. The first large commercial vessel built of iron on the Lakes was the MERCHANT, a 200-footer launched in July 1862 at Buffalo, New York. Other iron steamers came after 1868, when two firms ordered twelve large iron and package freighters within a few years. By 1885, several respected fleets owned iron ships and there were four fully-equipped iron shipbuilding firms in operation.

Iron proved to be a very practical medium for the construction of ship's hulls. It was far stronger pound-for-pound than the traditional white oak. A structural member made of iron reportedly had only three-eighths the weight and one-eighteenth the volume of its wooden counterpart. Iron hulls were more expensive to build, but they lasted longer than wood, were easier to repair, and were virtually maintenance-free. Mild steel was introduced in the mid-1880s. Though costlier than iron, it was tougher and more resilient. Steel became the standard for shipbuilding after 1885, though some builders continued to use wood until the turn-of-the-century. The last large wooden passenger and package freight steamers were built in 1892.

In Great Lakes shipbuilding, iron and steel came into general use after the popularity of sailing craft had begun to decline. As a result, there were no schooners built of those materials. During the mid-1890s, however, approximately 30 steel tow-barges were built for various fleets as consorts to modern steel freighters. Most of these barges were unpowered versions of the contemporary steam bulk freighters. Some were eventually given engines and converted into typical steamers. The use of tow-barges declined after 1920, though some of these direct descendants of the old schooners survived as late as the 1960s.

Captain Elihu M. Peck designed a variant of the steam barge in 1869 to meet the requirements of the iron ore and grain trades. Peck designed a double-decked vessel with plenty of space below decks for dry bulk cargo, fitted with wide deck hatches evenly spaced to match the 24-foot spacing of the loading chutes at Marquette's ore docks. His vessel had a capacity for 1,200 tons of ore and enough power to tow one or two loaded barges. The result was the 210-foot "bulk freighter", ROBERT J. HACKETT. Bulk freighters had their pilothouses mounted forward to maximize visibility. Their machinery, like that of the steam barges, was placed in the stern. Most bulk freighters had three or four tall masts. They carried sails until around 1890.

Bulk freighters were profitable because they carried large quantities of bulk commodities economically. Few bulk freighters measured less than 200 feet in length. These long, narrow shoal-draft steamers were characterized by very heavy longitudinal framing. From the time the ROBERT J. HACKETT was launched in 1869, until shipbuilding was suspended in the Panic of 1873, 47 bulk freighters averaging just over 1,000 gross tons were constructed. The V.H. Ketchum, built in 1874, was the largest in the fleet at 12,661 gross tons. When shipbuilding resumed again in 1880, even larger bulk freighters were launched. During the 1880s alone, 170 were built. Almost without exception, each had at least one consort barge built to run with it, usually of similar dimensions and tonnage. The typical bulk freighter built in 1890 was of 2,200 gross tons and averaged 260 feet in length. The growth in vessel size was facilitated by improvements to shipping channels and locks.

The first bulk freighter built of iron was the "monster" steamer ONOKO, a 287-foot giant, almost 30 feet longer than the largest wooden craft then afloat. The novel craft had double-bottoms with water-ballast tanks and was designed to carry 3,000 tons of ore on a 14-foot draft. It created quite a sensation. It was said that the ONOKO made money when few other craft in the industry could generate profits. It averaged $25,000 to $40,000 annually. For nearly ten years, the ONOKO carried the largest cargoes on the Lakes. The SPOKANE was built of mild steel in 1885. Soon afterward the industry adopted steel for all subsequent vessel construction.

From 1869 to 1902, the largest wooden bulk freighters grew from 210 feet to 310 feet in length. Iron and steel freighters grew from the 287-foot ONOKO in 1882, to the 400-foot VICTORY in 1894, the 500-foot JOHN W. GATES in 1900, and numerous 600-footers by 1906.

After 1894, the shipbuilding industry began producing steel tow-barge consorts for the powerful new steamers. The barges were copies of the steam bulk freighters, often with the same dimensions, though not fitted with boilers or engines. Like their wooden forebears, they were towed up and down the Lakes. Thirty of these barges were constructed between 1894 and 1902, ranging from 350 to more than 500 feet in length. Some steamers towed barges in the grain trade as late as 1965. A few of the big barges were ultimately fitted with engines and converted into powered freighters.

Steel ships continued to grow after the turn-of-the-century with improvements in technology and changes in the methods of hull-framing. The earliest iron and steel ships had transverse (crosswise) framing, not unlike wooden ships, but spaced at wider intervals. The standard since 1920 has been a system of longitudinal framing on the deck and bottom, with transverse framing in the sides. This system, with its particular emphasis on longitudinal strength, has enabled vessels to grow in size to 640 feet during the Second World War, 730 feet in 1958, and, with the construction of enormous new locks at Sault Ste. Marie, to 1,000 feet by 1973.

The introduction of small craft into Minnesota's North Shore was concurrent with the earliest settlement. Virtually all of the pioneer settlers came to the North Shore in water craft. Canoes and Mackinaw boats carried settlers from Superior City and Duluth. Others arrived in the large steamboats plying Lake Superior from Sault Ste. Marie. After 1880, when coasting steamers ran up the shore from Duluth, fewer travelers used small craft for long-distance trips. Small boats were employed locally and in commercial fishing.

Small, 12-foot to 16-foot skiffs were locally built at Duluth and North Shore settlements after 1870. Boat-builders are mentioned at Grand Portage and Grand Marais in the 1880s, and at Hovland, Cross River, Tofte, and Grand Marais in the 1890s. Although there are few descriptions of these boats, surviving photographs show plank-built, flat-bottomed rowing skiffs with Scandinavian characteristics and clinker built, round-bottomed boats in the more protected waters. The earliest builders were Frenchmen. After the 1880s, however, most builders were Norwegian immigrants.

A few yachts, principally sailing boats, are mentioned in Duluth newspapers in the 1880s. Occasional steam yachts were also noted. Most ranged from 20 feet to 30 feet, though one or two of the more luxurious craft ranged up to 70 feet in length. The growth of boat clubs in the 1880s and 1890s fostered the development of pleasure boating, particularly in the Twin Ports. Extensive clubhouses, warehouses, docks, and bleachers were constructed to accommodate Club members. Frequent regattas and competitions were scheduled.

Standardized "one design" sailboats appeared soon after the turn-of-the-century. Intended for amateur racing, they included a broad range of designs. Many were very modest boats. The one-design classes originated not only to maximize and regulate competition between boats, but also to minimize the cost of designing and building them. The system made boating more affordable to many people. Dozens of sailboat designs resulted from the movement. Some classes were more suitable than others for specific areas. There were few large one-design sailing boats around western Lake Superior, but the less-pretentious 22-foot Star-class, 28-foot and 38-foot Bilge board Scows ("Pancakes"), and 21-foot Shore Bird sloops were fairly common. Although these boat types originated around 1910, they did not appear in the Twin Ports until the mid-1920s. Similar craft were brought to nearby inland lakes in the 1930s.

Steam and naphtha launches appeared in the 1890s. Gasoline launches followed not long afterwards. These were open boats with awnings, measuring from 20 to 35 feet in length. The Pearson Boat Works was organized at Duluth in 1895 to build small powerboats. It became an important source for such boats for 20 years.

The Great Lakes did not suffer from foreign competition because it was land locked. In 1888 and 1889 Great Lakes shipbuilders were building over half (101,000 GT, 225 ships) of the U.S. merchant ship tonnage but this was as much due to the decline in seaboard construction from a high of 505,000 Gross Tons (1,624 ships) to 110,000 (700 ships) as the increase in the Great Lakes. The Great Lakes shipbuilders were also responsible for some of the significant improvements in shipbuilding at that time, including the mechanism of some of the processes and the application of the assembly line to shipbuilding. The Great Lakes shipbuilders had their maximum output of 505,000 GT (317 ships) in 1919 at which time the total U.S. output was 3,326,000 (1,953 ships). They even resorted to creative solutions for ships larger than could transit the canal system at that time by building the ships in parts and joining them after they had passed the Welland Canal.

Table 2.2.1: Great Lakes Shipyard Activity 1900 to 1944 (25)

Yard and location	Years during which each shipyard was able to deliver steel merchant ships, or actually delivered large size naval vessels* as indicated below																																													
	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940	1941	1942	1943	1944	1945
American Shipbuilding Co., Buffalo, N. Y. (1)	x	x	x	x	x	x	x	x	x	x								x	x	x																										
American Shipbuilding Co., Cleveland, O.	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
American Shipbuilding Co., Lorain, O.	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
American Shipbuilding Co., Wyandotte, Mich. (2)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x																						
American Shipbuilding Co., Superior, Wis. (3)			x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x																										
American Shipbuilding Co., Chicago, Ill. (4)		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x																									
W. I. Babcock, Chicago, Ill.	x																																													
Walter Butler Shipbuilders, Inc., Duluth, Minn. (5)																			x	x	x																						x	x	x	
Walter Butler Shipbuilders, Inc., Superior, Wis. (6)																	x	x	x	x																							x	x	x	
Defoe Shipbuilding Co., Bay City, Mich. (7)																																				x	x	x	x	x	x	x	x	x	x	
James Davidson, West Bay City, Mich.			x	x																																										
Cargill, Inc., Savage, Minn.																																											x	x	x	
Dravo Corp., Pittsburgh, Pa.																				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		
W. E. Fitzgerald, West Bay City, Mich.	x	x																																												
Froemming Bros., Milwaukee, Wis.																																											x	x	x	
Globe Shipbuilding Co., Superior, Wis.																																											x	x	x	
Great Lakes Engineering Works, Ashtabula, O.													x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Great Lakes Engineering Works, River Rouge, Mich. (8)					x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Great Lakes Engineering Works, St. Clair, Mich. (9)						x	x	x	x	x	x																																			
Jenks Shipbuilding Co., Port Huron, Mich.	x	x	x	x																																										
Manistee Shipbuilding Co., Manistee, Mich.																				x	x																									
Manitowoc Shipbuilding Corp., Manitowoc, Wis.																				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Saginaw Shipbuilding Co., Saginaw, Mich.						x	x	x	x	x	x																																			
Leathem D. Smith Shipbuilding Co., Sturgeon Bay, Wis.																				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Sturgeon Bay Shipbuilding & Dry Dock Co., Sturgeon Bay, Wis. (10)																									x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Toledo Shipbuilding Co., Toledo, Ohio (11)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Robert M. Wallace, West Bay City, Mich.			x																																											
West Bay City Shipbuilding Co., West Bay City, Mich.		x	x	x	x	x	x	x	x																																					
Louis Williams, West Superior, Wis.	x	x	x	x																																										

* Merchant ships: Steel, self-propelled, 2000 gross tons minimum.
Naval ships: Battleships, aircraft carriers, cruisers, destroyers, destroyer escorts, frigates, gunboats, submarines.

(1) Includes Buffalo Dy Dock Company, Buffalo, N. Y.
(2) Includes Detroit Shipbuilding Company, Wyandotte, Mich.
(3) Includes Superior Shipbuilding Company, Superior, Wis.
(4) Includes Chicago Shipbuilding Company, Chicago, Ill.
(5) Includes McDougall-Duluth Shipbuilding Company and Barnes-Duluth Shipbuilding Company.
(6) Includes Lake Superior Shipbuilding Company: Globe Shipbuilding Company and Whitney Bros. Towing and Wrecking Company.
(7) Formerly Defoe Boat & Motor Works. Firm in business since 1920.
(8) Includes Great Lakes Engineering Works, Ecorse, Mich.
(9) Includes St. Clair Engineering Works, St. Clair, Mich.
(10) Includes Riebolt, Walter Company, Sturgeon Bay, Wis.
(11) Includes Craig Shipbuilding Company, Toledo, O., (1900-1905).
Source: Shipbuilders Council of America, 21 West Street, New York, N. Y.

2.3 World War I

During Word War I the Great Lakes shipbuilders were very active. They produced many support vessels as well as smaller military ships. Great Lake States were also suppliers of machinery and equipment for the whole of the U.S. shipbuilding industry as can be seen from Table 2.3.1 on the following page.

Table 2.3.1: Machinery Supplied by Great Lakes to U.S (25)

	Machinery	Structural iron and steel	Lumber, cork and rubber	Metal fixtures, fittings and valves	Electrical equipment	Brass, lead and zinc	Paint and interior decoration	Insulation, deck-covering and tiling	Galley and pantry outfit	Furniture	Bedding linen and drapes	Hardware and tools	Fire prevention and interior communication	Life saving equipment	Blocks and rigging	Navigating outfit
Alabama		★	★								★					
Arizona	★					★		★								
Arkansas			★								★					
California	★	★	★				★	★					★	★	★	★
Colorado				★		★										
Connecticut	★			★					★			★	★			
Delaware	★	★						★	★					★		
Florida			★				★									
Georgia								★		★	★					
Idaho			★			★										
Illinois	★			★								★				
Indiana	★		★		★											
Iowa								★		★						
Kansas	★					★			★							
Kentucky			★				★		★						★	
Louisiana			★				★				★				★	
Maine	★		★													
Maryland		★				★		★							★	
Massachusetts	★			★			★				★	★	★	★	★	★
Michigan	★			★	★			★				★				
Minnesota		★	★								★					
Mississippi			★				★				★					
Missouri	★					★										
Montana						★		★			★					
Nebraska						★		★			★					
Nevada						★			★							
New Hampshire	★							★	★							
New Jersey	★						★			★			★	★		★
New Mexico						★	★				★					
New York	★				★				★	★		★	★	★		★
North Carolina			★			★				★	★					
North Dakota							★	★			★				★	
Ohio	★	★		★					★							★
Oklahoma						★	★		★							
Oregon			★							★						
Pennsylvania	★	★		★			★							★	★	★
Rhode Island	★			★	★							★				★
South Carolina	★						★				★					
South Dakota						★	★				★					
Tennessee	★	★	★								★					
Texas			★				★	★			★					
Utah						★		★			★					
Vermont	★			★				★				★				
Virginia	★	★				★	★				★					
Washington	★		★				★			★					★	
West Virginia	★	★					★									
Wisconsin	★	★	★			★										
Wyoming		★				★	★	★			★					

FIG. 8.—SOME PRINCIPAL MATERIALS FURNISHED BY VARIOUS STATES IN SHIPBUILDING

In 1918 in the Great Lakes, the maximum number of shipyards (29) and building berths (153) in comparison to the total for the U.S. shipyards (243) and building berths (1202). In 1944, of the Great Lakes shipyards, 23 were capable of building ships up to 300 feet, 23 up to 400 and 14 over 500 feet. This was a 200% increase over what was in existence in 1939. Of these over half were graving docks and there were only 4 small floating docks. Table 2.3.2 gives details of the Great Lakes shipyard building/launching methods and capacities during that time.

Table 2.3.2: Dry Docks and Marine Railways (200' or more) in Private Ship Repair Yards
MR designates marine railways; G, graving docks; F, floating docks (2)

Great Lakes and Rivers

Company and location	Type and No.	Lifting capacity, tons	Length, ft	Width, ft	Depth, ft	Notes
American Bridge Co., Ambridge, Pa.	MR	300	200	40	4	
American Shipbuilding Co., Buffalo, N. Y.	G No. 1	.....	470	59	13	
	G No. 2	.....	630	71	14	
	G No. 3	.....	401	49	14	
American Shipbuilding Co., Chicago, Ill.	G No. 1	.....	569	52	15	
	G No. 2	.....	727	78	15	
American Shipbuilding Co., Lorain, O.	G No. 1	.....	586	60	14	
	G No. 2	.....	736	75	14	
American Shipbuilding Co., Superior, Wis.	G No. 1	.....	609	61	16	
	G No. 2	.....	620	61	19	
Davis Boat Co., Trenton, Mich.	MR*	200	250	24	9	
Dravo Corp., Pittsburgh, Pa.	MR	3,600	300	375	10	Side haul
Erie Concrete & Steel Supply Co., Erie, Pa.	MR*	400	544	26	..	Side haul
A. Gilmore, Toledo, O.	G	.....	240	55	9	Not in use
Great Lakes Engineering Works, Ashtabula, O.	G	...	630	72	16	
Great Lakes Engineering Works, River Rouge, Mich.	F	8,000	627	87	16	
Hillman Barge & Construction Co., Alicia, Pa.	MR*	900	256	40	9	
Ingalls Shipbuilding Corp., Decatur, Ala.	MR	600	200	60	..	
Kewaunee Shipbuilding & Engineering Co., Kewaunee, Wis.	MR*	600	300	16	..	
Koppers Co., Paducah, Ky.	MR	1,800	400	375	8	Side haul
	MR	800	300	60	6	
Madison Marine Ways, Madison, Ind.	MR	2,000	250	60	10	Side haul
Manitowoc Shipbuilding Co., Manitowoc, Wis.	F	6,000	603	88	15	
Mound City Shipyard & Dock Co., Mound City, Ill.	MR	1,600	300	56	10	Side haul
Nashville Bridge Co., Nashville, Tenn.	MR	300	200	36	5	
	MR	300	200	36	5	
State of New York, Lyons, N. Y.	G	.....	370	150	12	
Odenbach Shipbuilding Corp., Rochester, N. Y.	G*	.....	1,400	50	10	
Peterson Boat Works, Sturgeon Bay, Wis.	MR*	150	500	9	12	
	MR*	50	250	9	6	

	MR*	70	250	9	8
Rochester Boat Works, Rochester, N. Y.	MR*	90	500	7	22
St. Louis Shipbuilding & Steel Co., St. Louis, Mo.	MR*	1,200	220	50	9
	MR*	1,200	220	50	9
	MR*	1,200	220	50	9
Toledo Shipbuilding Co., Toledo, O. (now Delta Shipbuilding Co.)	G No. 1	.....	649	90	14
	G No. 2	.....	560	80	13
Wheeling Steel Corp., Steubenville, O.	F*	500	219	37	12

* Indicates facilities added after 1939.

2.4 World War II

During World War II the Great Lakes shipyards increased its number of workers 15 times that of the pre war effort. This is shown in Figures 2.4.1 and 2.4.2. The WWII achievements of Great Lake shipyards was significant, though not as spectacular as other new Maritime Commission shipyards as can be seen from the Table 2.4.1. Table 2.4.1 shows the delivery of self propelled ships from 1939 to 1945. During that time period the Maritime Commission established seven new shipyards in the Great Lakes region. The locations of those yards are shown in Figure 2.4.3.

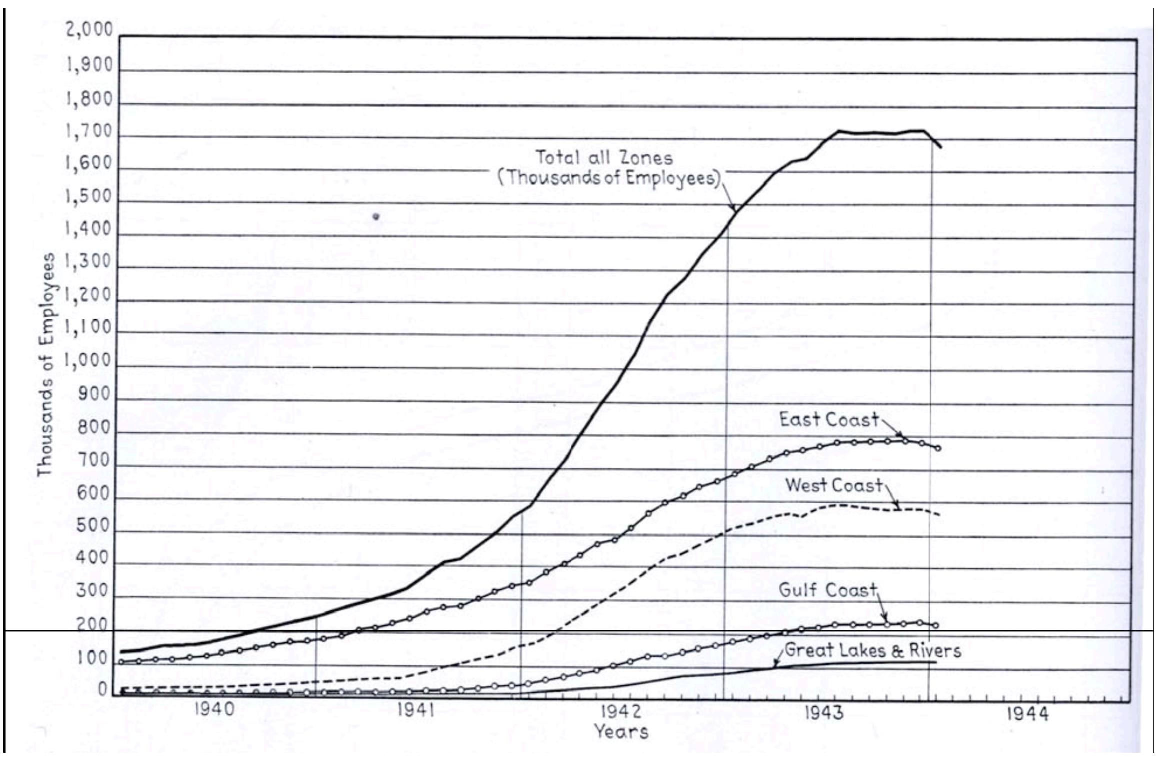


Figure 2.4.1: Employment in Private and Naval Shipyards (20)

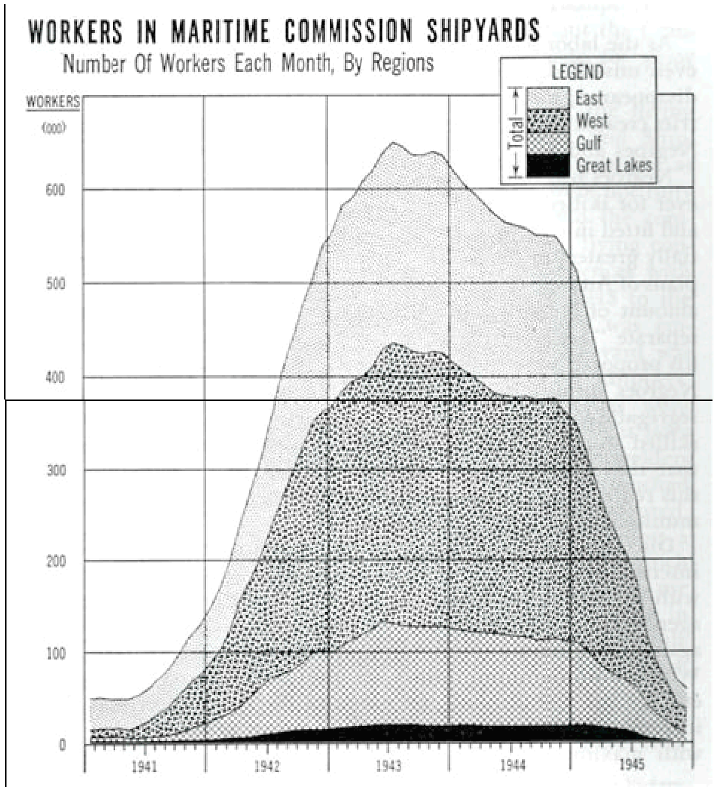


Figure 2.4.2: Manning Levels at the Shipyards by Region. (20)

Table 2.4.1: Merchant Ship Construction in WWII (20)

Number and gross tonnage of steel self-propelled merchant ships over 2,000 gross tons each constructed in the United States during 1939-1945, inclusive

State or Zone	Years	Total		Cargo		Tanker		Passenger & cargo	
		No.	Gross tons	No.	Gross tons	No.	Gross tons	No.	Gross tons
Alabama	1940–45	161	1,418,708	57	366,564	104	1,052,144	...	......
California	1940–45	1,593	11,674,897	1,394	9,811,642	108	1,031,861	91	831,394
Delaware	1942–45	19	97,166	19	97,166	...	....	...	......
Florida	1940, 43–45	211	1,396,791	201	1,364,171	10	32,620	...	......
Georgia	1943–45	197	1,335,334	197	1,335,334	...	....	...	......
Louisiana	1942–45	196	1,352,720	164	1,121,744	32	230,976	...	......
Maine	1941–45	278	1,992,384	278	1,992,384	...	....	...	......
Maryland	1939–45	576	4,377,663	503	3,657,328	67	672,476	6	47,859
Massachusetts	1939–42	20	167,551	8	53,888	9	83,600	3	30,063
Michigan	1942–43	9	85,224	9	85,224	...	....	...	......
Minnesota	1941, 43–45	26	99,713	18	68,490	8	31,223	...	......
Mississippi	1941–45	68	565,108	61	481,288	...	....	7	83,820
New Jersey	1939–45	87	786,071	66	489,399	10	100,693	11	195,979
New York	1940–41	6	36,334	5	33,989	1	2,345	...	......
North Carolina	1942–45	232	1,780,286	232	1,780,286	...	....	...	......
Ohio	1942–43	12	109,364	12	109,364	...	....	...	......
Oregon	1941–45	603	4,861,895	456	3,326,067	147	1,535,828	...	......
Pennsylvania	1939–45	289	2,941,801	40	379,699	249	2,562,102	...	......
Rhode Island	1943–45	43	272,824	43	272,824	...	....	...	......
Texas	1942–45	309	1,952,217	295	1,907,977	14	44,240	...	......
Virginia	1939–45	31	330,093	7	52,233	16	186,583	8	91,277
Washington	1941–45	61	517,812	47	349,034	...	....	14	168,778
Wisconsin	1944–45	64	243,520	64	243,520	...	....	...	......
East Coast	1939–45	1,960	15,392,435	1,537	11,043,335	395	3,983,922	28	365,178
Great Lakes & rivers	1940–45	112	540,166	103	105,598	9	33,568	...	......
Gulf Coast	1940–45	762	5,408,271	639	4,342,939	116	981,512	7	83,820
West Coast	1940–45	2,257	17,054,604	1,897	13,486,743	255	2,567,689	105	1,000,172
Total United States	1939–45	5,091	38,395,476	4,176	29,379,615	775	7,566,691	140	1,449,170

Source: Shipbuilders Council of America, 21 West Street, New York 6, N. Y.

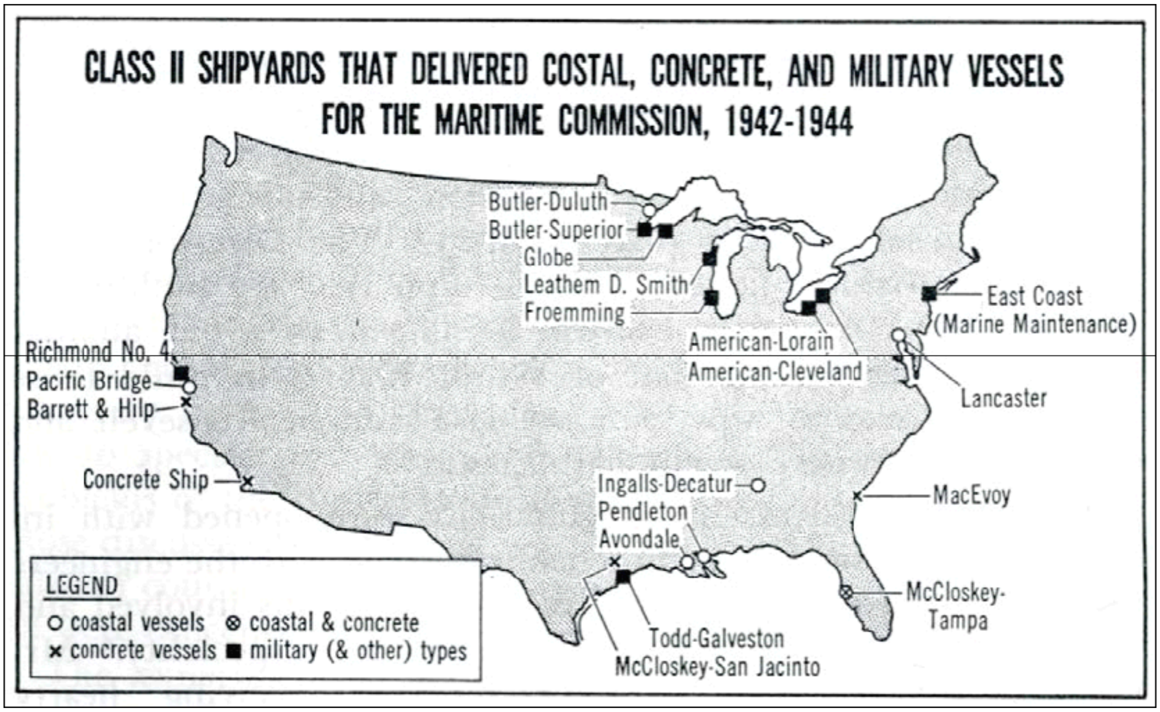


Figure 2.4.3: Location of Maritime Commission Shipyards in the Great Lakes Region (20)

Interestingly the Great Lakes shipyards were the most productive of all the regions; as seen from Figure 2.4.4. The Great Lakes shipyards began their involvement in WWII shipbuilding by building small cargo ships (N3) and tugs and barges for the British. In fact throughout the war and especially after the U.S. had joined, the British continually pressed for more shipbuilding in the Great Lakes. In April 1941 the British mission was increasing its demand for small ships and suggested that the Great Lakes shipbuilding potential be tapped to meet this new demand.

Because of manning problems with the Maritime Commission shipyards in the South from lack of available trained management and workers, and because the required LIBERTY ships could not pass through the then existing locks, American Ship Building Company was asked to operate the new (DELTA Shipbuilding Company) shipyard in New Orleans.

The demand for steel resulting in the massive increase in wartime shipbuilding resulted in the need for more Great Lakes ore carries, and in October 1941 the Maritime Commission awarded a contract for 16 new ore carriers to Great Lakes shipyards. In 1943 the Maritime Commission placed orders for C1-M-AVI 5000ton deadweight cargo ships with Great Lake shipbuilders. Frigates and Submarines were also built at Great Lakes shipyards between 1939 and 1945

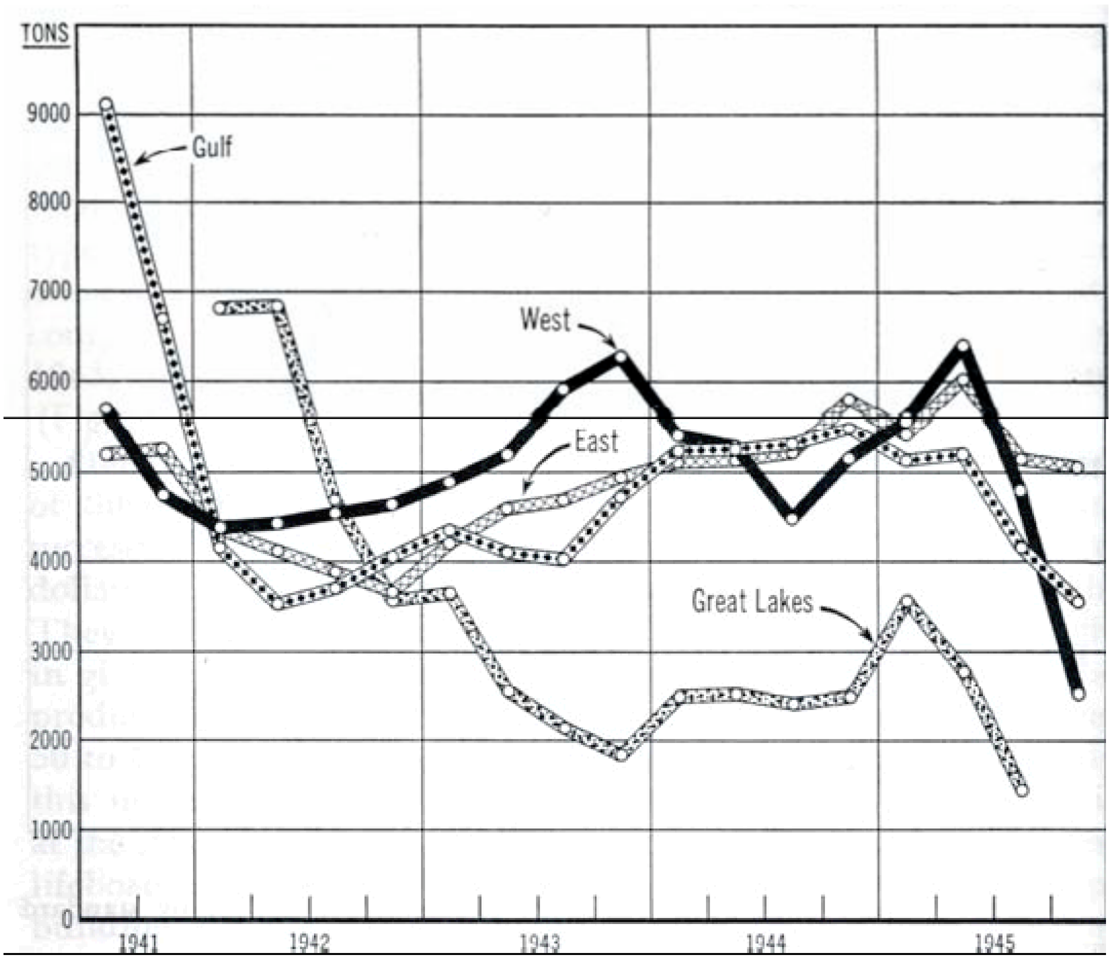


Figure 2.4.4: Labor Productivity in Maritime Commission Shipyards (20)

2.5 Assembly Line Approach

The fact that the wartime shipyards would be producing many ships in short time periods required a change from the traditional building approach and the resulting approach was the adaptation of the mass production approach used by automobile manufacturers, namely the assembly line. Many shipyards only used the assembly line approach to its shops, all leading to the ship being erected on the building berth, but some included prefabrication of hull blocks as an assembly line. A number of shipyards set up special assembly lines for building the deckhouses for their ships. Finally, some shipyards did have a full assembly line in which the ship was moved down it as it was being assembled. The layout of a Great Lakes Maritime Commission shipyard is shown in Figure 2.5.1 and the layout of the famous EAGLE Boat Yard at Rouge River, a full assembly line approach, are shown in Figure 2.5.2.

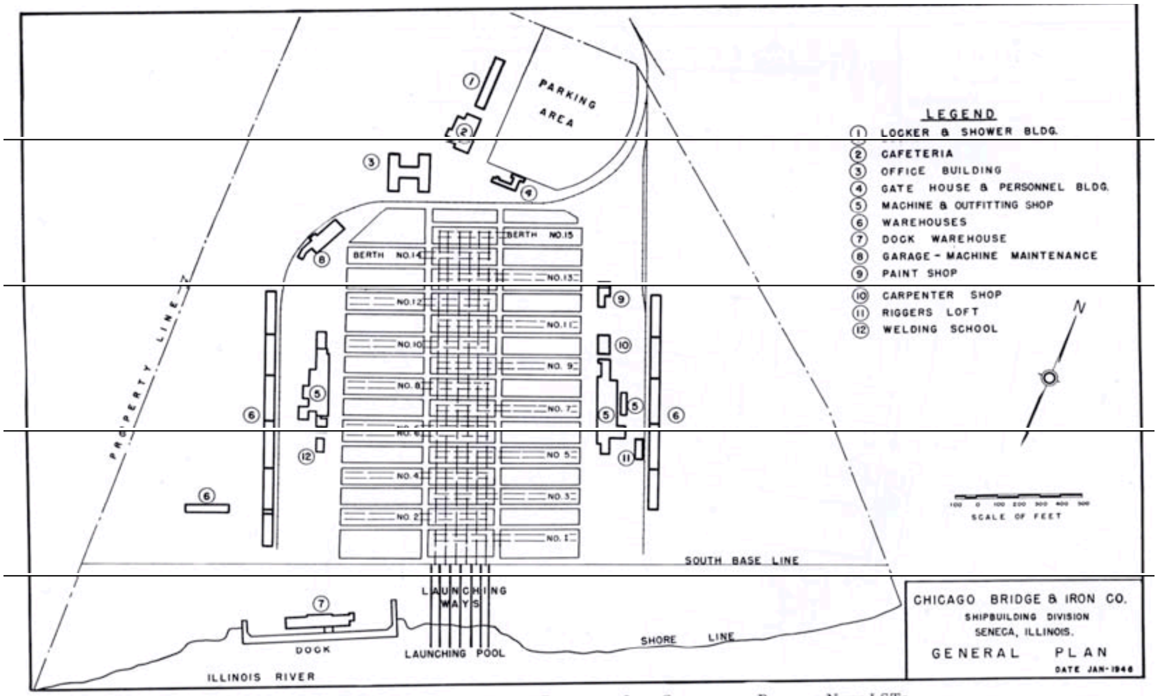


FIG. 4.—SENECA PLANT OF THE CHICAGO BRIDGE AND IRON COMPANY FOR BUILDING NAVY LSTs

Figure 2.5.1: Layout of a Great Lakes Maritime Commission Shipyard (20)

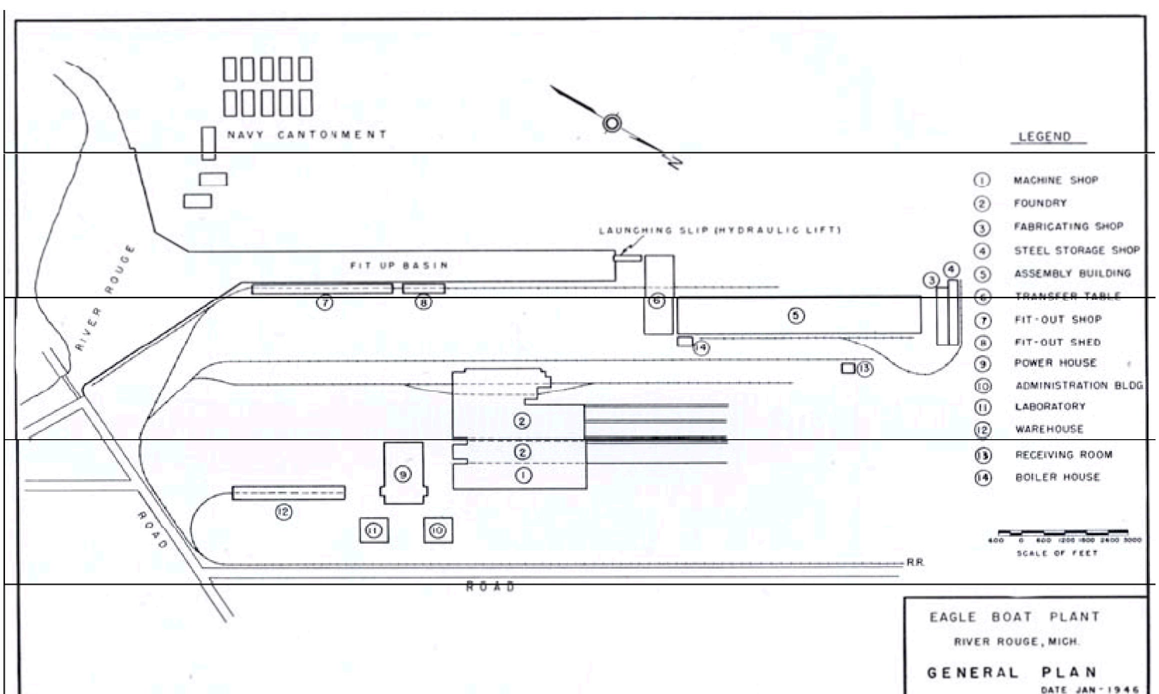


FIG. 3.—RIVER ROUGE PLANT ON THE GREAT LAKES FOR BUILDING EAGLE BOATS

Figure 2.5.2: Layout of EAGLE Boat Yard at River Rouge (20)

2.6 Post Wartime

After 1945 the Great Lakes shipyards ceased to build ships for international commerce, concentrating instead on the building of new bulk carriers to take advantage of the improvements to the lock system and dredging. Because the Great Lakes are fresh water, the Great Lakes ships have very long lives since the adverse impact of seawater corrosion on the ships hulls and machinery are almost eliminated. Many of the bulk carriers built during WWII are still in operation today. This adversely impacted Great Lakes shipbuilding because the real demand was very cyclical and the average demand was unable to sustain continuous shipbuilding for even one yard. Add to this that many ship owners decided to replace worn out cargo hulls by building new mid bodies and re-using the bows and sterns, including machinery; and the demand is further reduced. Figure 2.6.1 shows the decline of U.S. shipbuilding from 1940 to 1990. The Great Lakes history is similar to the U.S. shipbuilding industry.

By the late 1960s most of the Great Lakes shipyards had closed, though a new shipyard for Great Lakes Bulk carriers had just been constructed in Erie, PA by Litton Industries, which used a revolutionary shipbuilding approach. Also, the wooden shipbuilding yard in Marinette Wisconsin that closed was bought and reopened as a steel boatbuilding yard. In the late 1980s a new shipyard was opened in Lake Superior, the Upper Peninsular Shipbuilding Co., to build the tugs for a number of integrated tug/barges that were to operate between Milwaukee and Muskegon, but the venture was prone with problems and the shipyard closed (9). The remaining yards involved in new construction were Bay Shipbuilding and Petersen Builders; both of Sturgeon Bay Wisconsin.

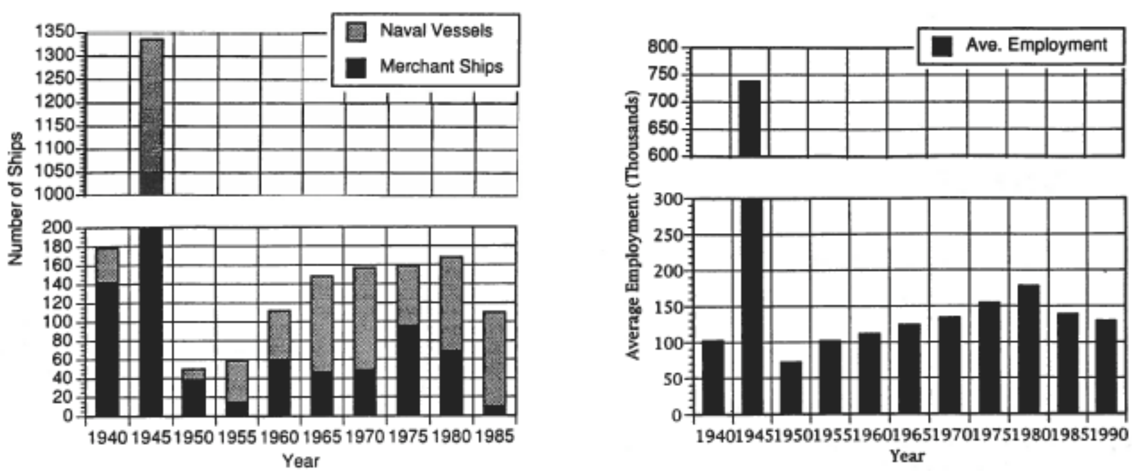


Figure 2.6.1: Number of U.S. Ships Ordered and U.S. Employment from 1940 – 1990 (25)

From 2000 until 2005 a number of U.S. shipyards that belonged to U.S. Great Lakes Shipping companies closed. Also, the Manitowoc Marine Group decided to cease its operation in the leased facility in Toledo. Today only a few U.S. shipyards in the Great Lakes are building large steel ships. Two facilities that do well are Bay Shipbuilding and Marinette Marine who both belong to the Manitowoc Marine Group, which is part of the larger Manitowoc Company. In 2006, two new companies took over old facilities that had been involved in repair of the Great Lakes bulk carrier fleets, with the stated intention to get into new construction.

3.0 Great Lakes Shipbuilding: Past and Present Yard Profiles

The following profiles are the collection of information gathered about the current and previous shipyards in the Great Lakes region that the researchers were able to locate. Many have been renamed through new ownership or merged with other companies and are listed under their current or most recent names. The gathered information includes the kinds of ships the yard builds or repairs, how many employees work for the company, and if the location of the shipyard provides possibility for future growth. Information concerning the company's facilities such as sizes and conditions was requested. Building practices information is intended to provide information about the level of technology and effectiveness of the building process. Production organization section should be used to explain what kind of methods and organization are used in the design and implementation during building or repairing for a given company.

One aspect to establish the viability of shipbuilding on the Great Lakes is the availability of resources for both the currently operating yards and yards that are currently closed. The reality of the closed yards re-opening and becoming part of a future Great Lakes shipbuilding industry is dependent on the state of the facilities, proximity to rail, availability of outsource labor, availability of an industry supply base, and availability of engineering talent. All of these things need to be accounted for when evaluating the possibility of expanding shipbuilding.

One interesting fact that came out of the investigation of Great Lakes current shipyards was the disparity of consistent information between "sources" of shipbuilding statistics information. One example of this is the MARAD Report on Survey of U.S. Shipbuilding and Repair Facilities (21). This report defines Active Major Shipyards and Other Major Shipyards with Building Positions as:

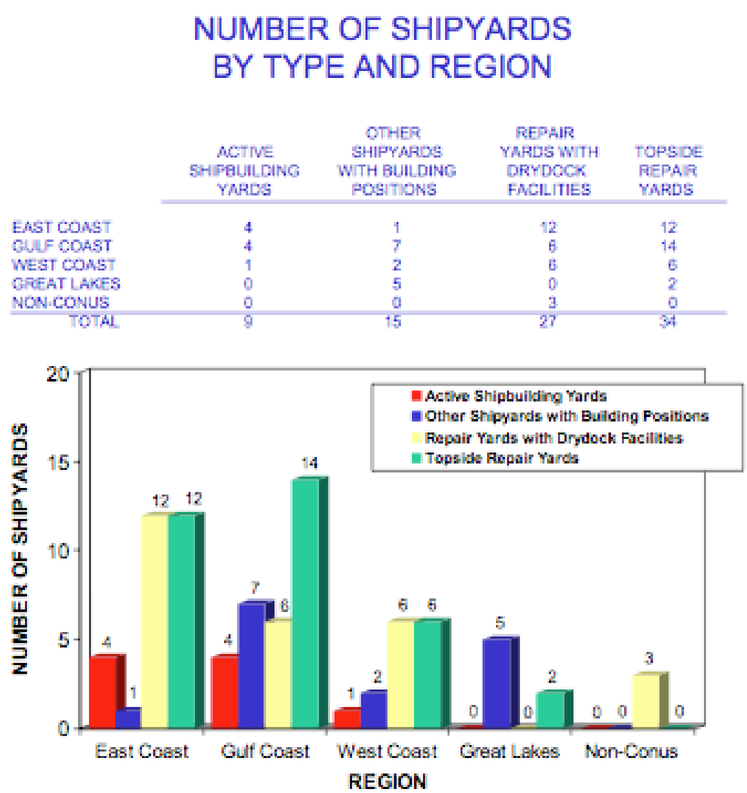
> **Active Shipbuilding Yards**
> The Active Shipbuilding Yards are comprised of privately owned U.S. shipyards that are open, having at least one shipbuilding position capable of accommodating a vessel 122 meters (400 feet) in length or over. In addition, these shipyards must own or have in place a long-term lease (1 year or more) on the facility in which they intend to accomplish the shipbuilding work, there must be no dimensional obstructions in the waterway leading to open water (i.e., locks, bridges), and the water depth in the channel to the facility must be a minimum of 3.7 meters. The Active Shipbuilding Base, as identified by the U.S. Navy and MARAD, consists of those shipyards identified as Active Shipbuilding Yards.
>
> **Other Shipyards with Building Positions**
> Other Shipyards with Building Positions are those privately owned shipyards/facilities that are open with at least one building position capable of accommodating a vessel 122 meters in length and over, and that have not constructed a naval ship or major oceangoing merchant vessel in the past two years.

The report also defines Medium and Small Size U.S. Shipyards as:

Boatbuilding and Repair Companies
Boatbuilding and Repair Companies are those privately owned shipyards capable of building and/or repairing maritime vessels less than 122 meters (400 feet) in length.

Vessel Repair Companies
Vessel Repair Companies are those facilities that only provide repair services, either repair with dry-docking or topside repair, to maritime vessels less than 122 meters (400 feet). These companies must have their own waterfront facilities.

The report states that the Great Lakes have zero active shipbuilding yards as seen in Figure 3.1. Marinette Marine is classified as a "Major" shipyard in this report. Marinette has built both Navy and Coast Guard vessels. Marionette's latest completion is the Navy's Littoral Combat Ship (LCS) vessel. The LCS is the Navy's next generation combatant with a length of 379 feet. The LCS's length is 11 feet smaller than the MARAD required 400-foot requirement. Does this 11-foot difference mean the Great Lakes is not an active shipbuilding region? Additionally if Marinette is constructing vessels under the 400-foot requirement but it can build ships up to 450 feet why is it not an active major shipbuilding yard? Other discrepancies were found within the MARAD report in addition to other errors in other Great Lakes shipbuilding reports.


NUMBER OF SHIPYARDS BY TYPE AND REGION

	ACTIVE SHIPBUILDING YARDS	OTHER SHIPYARDS WITH BUILDING POSITIONS	REPAIR YARDS WITH DRYDOCK FACILITIES	TOPSIDE REPAIR YARDS
EAST COAST	4	1	12	12
GULF COAST	4	7	6	14
WEST COAST	1	2	6	6
GREAT LAKES	0	5	0	2
NON-CONUS	0	0	3	0
TOTAL	9	15	27	34

Figure 3.1: Excerpt for MARAD Report (21)

3.1 A.A. Turner

A.A. Turner operated from 1866 to 1873. It was located in Trenton Michigan near Detroit.

3.1.1 Product Range

N/A

3.1.2 Number of Employees

N/A

3.1.3 Location Opportunities

N/A

3.1.4 Facilities and Dimensions

N/A

3.1.5 Condition of Facilities

N/A

3.1.6 Satellite Image

N/A

3.1.7 Building Practices

N/A

3.1.8 Production Organization

N/A

3.1.9 Performance

In the company's existence of 7 years, it produced 36 ships.

3.1.10 Contact Information

N/A

3.2 Advance Boiler and Tank Company

Advance Boiler & Tank Company is currently open and functional.

3.2.1 Product Range

Advance Boiler & Tank Co. specializes in building ASME Pressure Vessels and plate fabrication. They also can solve power house/steam problems - drawing from experience on a variety of steam power equipment - marine, commercial, industrial, and utility types.

3.2.2 Number of Employees

The company has up to 50 employees, labor and management.

3.2.3 Location Opportunities

Because the yard is located in Milwaukee, there is a populated region for additional workers as well as technical universities for engineers and technical workers. Also in the area are many industrial supply companies.

3.2.4 Facilities and Dimensions

Advance Boiler & Tank Company was constructed in 1919.

Storage/Warehouse area: 31,000 sq. ft.
Total Shop Area: 52,700 sq. ft.
Shop Cranes - (2) 50T, (1) 25 T, several smaller auxiliary cranes (10/15T)

3.2.5 Condition of Facilities

Condition information not provided by company.

3.2.6 Satellite Image

Advance Boiler has a pier at the Port of Milwaukee. The pier is used for ship repair and transportation of its large pressure vessels via barge.

3.2.7 Building Practices

Information not provided by company.

3.2.8 Production Organization

Information not provided by company.

3.2.9 Performance

Information not provided by company.

3.2.10 Contact Information

Website:
http://www.advanceboiler.com

Contact:	Address:	
Inside sales/project manager	1711 S. Carferry Drive	P: 414-475-2120
rbauer@advanceboiler.com	Milwaukee, WI 53207	F: 414-475 2129

3.3 American Shipbuilding, Chicago

Before being named the American Shipbuilding Company, it was Chicago Shipbuilding, opening in 1891. The yard closed around 1920.

3.3.1 Product Range

Over its thirty-year existence, the yard produced steamships, barges, Lakers, and cargo ships.

3.3.2 Number of Employees

N/A

3.3.3 Location Opportunities

Located in Chicago, there are many industrial supply companies. It is a very populated region and has multiple technical universities in the area for engineers and technical workers. There is a large population for other additional workers.

3.3.4 Facilities and Dimensions

The shipyard closed around 1920.

(2) Graving Docks:	569 ft
	727 ft

3.3.5 Condition of Facilities

N/A

3.3.6 Satellite Image

The old docks and piers are used for bulk material offload locations, repair, and other industrial supply loading and offloading.

3.3.7 Building Practices

N/A

3.3.8 Production Organization

N/A

3.3.9 Performance

During its peak production, the shipyard was able to produce 22 cargo ships in 2 years.

3.3.10 Contact Information

N/A

3.4 American Shipbuilding, Detroit

American Ship Building Company in Detroit was formerly known as Detroit Shipbuilding, Detroit Dry Dock Company, and Campbell & Owen. The yard, then Campbell & Owen, began in 1852. The yard closed as American Ship Building Company after WWI in 1920.

3.4.1 Product Range

Over the life of this shipyard, it produced steamers, tugs, barges, ferries and freight ships.

3.4.2 Number of Employees

N/A

3.4.3 Location Opportunities

Being in Detroit, there are many industrial supply companies. There is a populated region for workers as well as technical universities in the area for engineers and technical workers.

3.4.4 Facilities and Dimensions

N/A

3.4.5 Condition of Facilities

N/A

3.4.6 Satellite Image

3.4.7 Building Practices

N/A

3.4.8 Production Organization

N/A

3.4.9 Performance

At Detroit Shipbuilding's peak, between 1918 and 1919, over 50 cargo ships at over 4,000 tons DWT were constructed.

3.4.10 Contact Information

Website:
http://www.coltoncompany.com/shipbldg/ussbldrs/prewwii/shipyards/inland/amshipdetroit.htm

Previous Address:
1801 Atwater
Detroit, MI 48207

3.5 American Shipbuilding, Lorain

Built in 1898, the Lorain Ohio shipyard served as the main facility of the American Shipbuilding Company after WWII. The yard closed in 1984 after a series of labor disputes. The land is now being redeveloped as an upscale housing development.

3.5.1 Product Range

N/A

3.5.2 Number of Employees

N/A

3.5.3 Location Opportunities

N/A

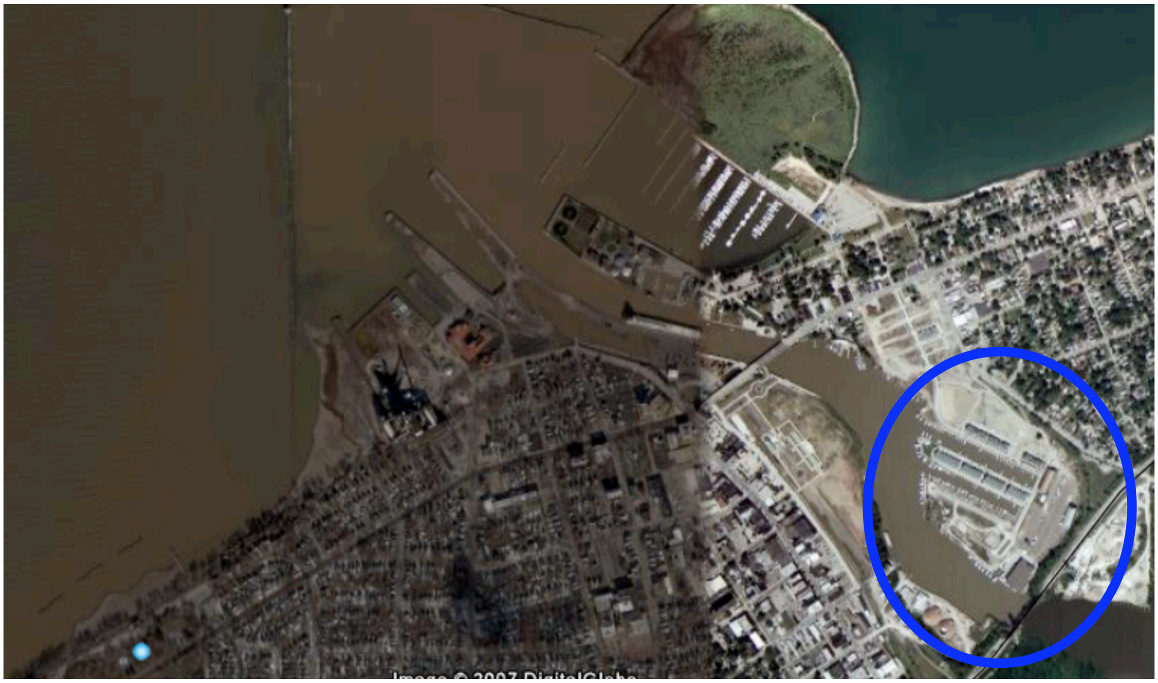
3.5.4 Facilities and Dimensions

During operation, the shipyard had (2) 1,000 ft dry docks.

3.5.5 Condition of Facilities

N/A

3.5.6 Satellite Image



3.5.7 Building Practices

N/A

3.5.8 Production Organization

N/A

3.5.9 Performance

The Lorain yard is credited with hundreds of launches including five of the 13 Great Lakes 1,000 ft ore carriers.

3.5.10 Contact Information

Previous Address:
400 Colorado Avenue
Lorain, OH 44052

3.6 Basic Marine

Basic Marine is currently open and operational.

3.6.1 Product Range

Basic construction such as barges and repair.

3.6.2 Number of Employees

Information not provided by company.

3.6.3 Location Opportunities

Because the yard is located in the Upper Peninsula of Michigan, there is not a populated region for more workers. Some industrial supply companies are in the area. There are technical universities in the area for local skilled engineers but they are at a distance.

3.6.4 Facilities and Dimensions

The following is information about facility dimensions and conditions of those facilities.

Total Covered Shop Area:	67,300 sq ft Includes: Fully equipped fabrication, shop and warehouse facilities
Building Docks/Berths:	1000 ft dock space 500 ft pier
Repair Docks:	160 ft x 65 ft - 2300 T floating dry dock

3.6.5 Condition of Facilities

Information not provided by company.

3.6.6 Satellite Image

3.6.7 Building Practices

Information not provided by company.

3.6.8 Production Organization

Information not provided by company.

3.6.9 Performance

Information not provided by company.

3.6.10 Contact Information

Website:
http://www.basicmarine.com/

Contact:	Address:	
Info@basicmarine.com	440 North 10th Street	P: 906-786-7120
	Escanaba, MI 49829	F: 906-786-7168

3.7 Bay Shipbuilding Company (BSC)

Currently operational, Bay Shipbuilding Company is part of the Manitowoc Marine Group. This division of MMG specializes in large ship construction projects. Before its current name, BSC used to be Christy Corporation, which before named that was Leathem D. Smith Shipbuilding Company. BSC has a second shipyard very close to the first, previously named Peterson Builders.

3.7.1 Product Range

BSC is the U.S. builder of Great Lake Bulkers. It's product range includes OPA-90 vessels, dredges, dredging support equipment such as scows, deck barges, tugs, etc, and bulk cargo self unloading solutions.

3.7.2 Number of Employees

MMG employs 3500 people.
Employment for BSC is 632 and goes up in the winter to accommodate winter repair.

Management:	78
Production Workers:	554

3.7.3 Location Opportunities

Located in Sturgeon Bay, BSC has access to some industrial supply companies. Sturgeon Bay is a somewhat populated region and has one technical university. However, the city is close to Green Bay which has a large population for additional workers and many universities for engineers and technical workers.

3.7.4 Facilities and Dimensions

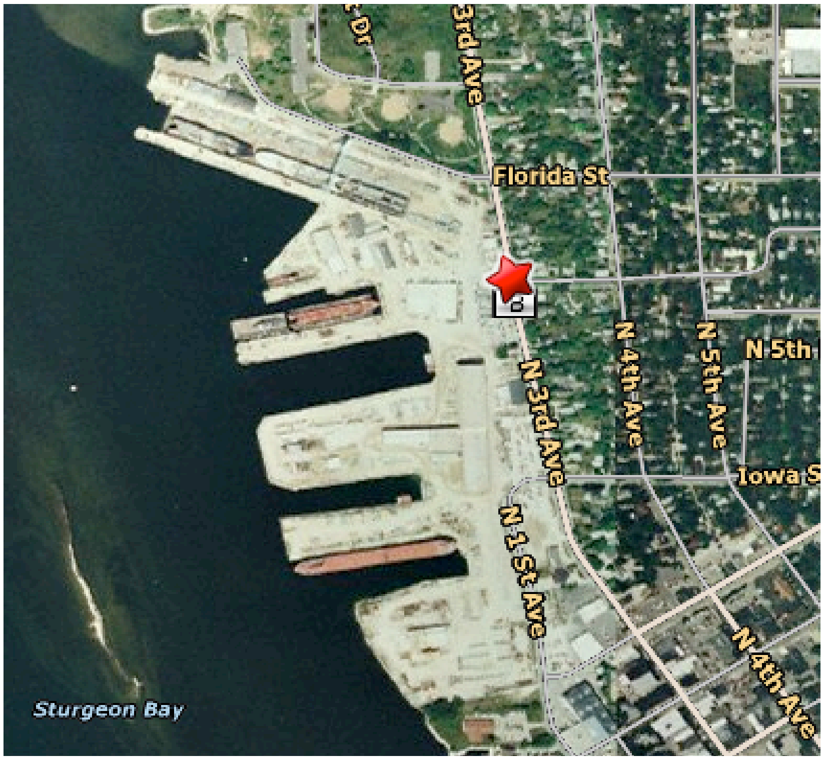
Bay Shipbuilding Company was reconstructed in 1968. Bay has a fully enclosed preparation and paint facility that can handle large sections in addition to automated blast and prime equipment for smaller plate and shape parts.

Total Area of Shipyard:	50 acres
Fabrication Shop Area:	95,515 sq ft
Machine Shop Area:	8,200 sq ft
Pipe Shop Area:	14,812 sq ft
Building & Repair Docks:	1,154 ft x 140 ft graving dock
	200 ft x 39 ft graving dock
	600 ft x 70 ft floating dock
Berth/Dock Crane:	200 T overhead gantry crane

3.7.5 Condition of Facilities

The shipyard looks newer than it is. The buildings are well maintained inside and out.

3.7.6 Satellite Image



3.7.7 Building Practices

Other than the lack of robotic use, this shipyard has a high building practice technology level. It uses Mitsubishi's shipbuilding software MATES and its own developed production control system based on ARTEMUS. Planning is manual. The total building time from start of fabrication until delivery is 15 months. For a new design, it is 2 years.

3.7.8 Production Organization

BSC's production approach utilizes block construction and advanced outfitting.

3.7.9 Performance

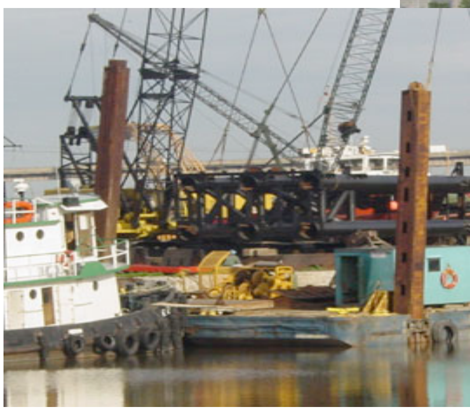
It is a very productive shipyard with productivity estimated to be 6 man hours/CGT.

3.7.10 Contact Information

Website:
www.manitowocmarine.com

Contact:	Address:	
Todd Thayse	605 N. 3rd Avenue	P: 920-743-5524
Manager - Contract Services	P.O. Box 830	F: 920-742-2371
todd@bscmmg.com	Sturgeon Bay, WI	

3.8 BIDCO Marine Group

The Buffalo Shipyard, a division of the BIDCO Marine Group, specializes in haul out service, new barge construction and ship repair. Previously, this shipyard used to be called Union Dry Dock Company as well as American Shipbuilding Company.

3.8.1 Product Range

Haul out service, new barge construction and topside repairs for ships, tugs, barges, tour boats and other floating structures.

3.8.2 Number of Employees

Information not provided by company.

3.8.3 Location Opportunities

Buffalo is a highly populated region which provides possibility of more workers. There are technical universities in the area which can provide technical workers and engineers. In the region, there are multiple industrial supply companies.

3.8.4 Facilities and Dimensions

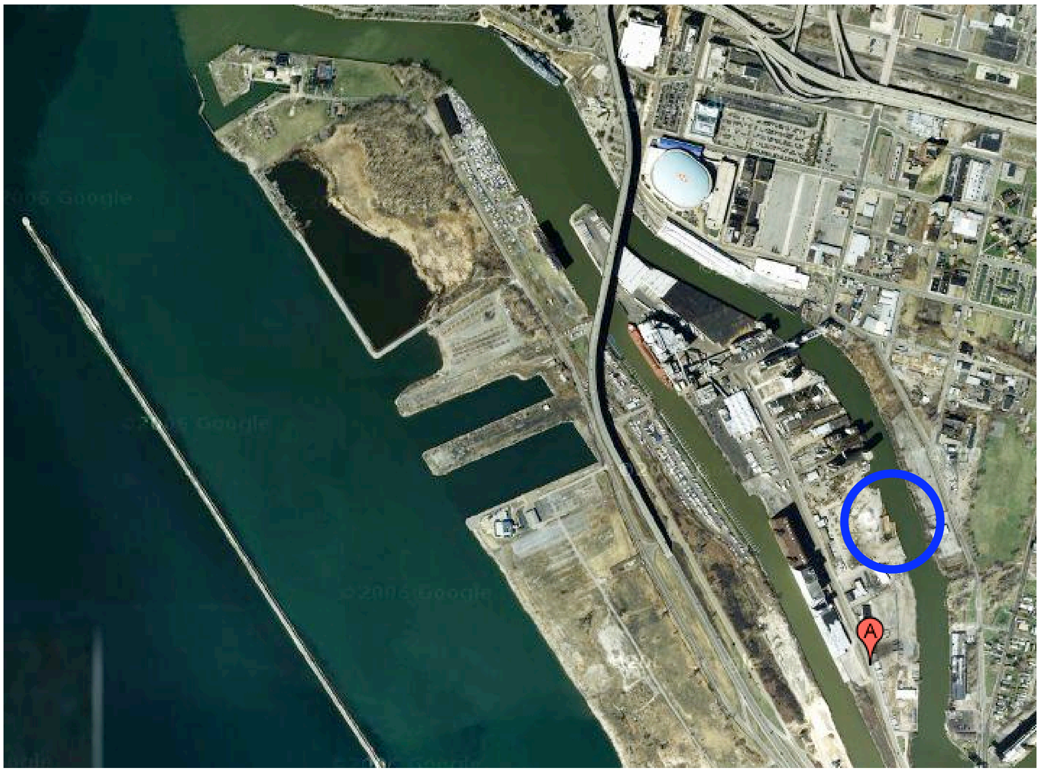
Because BIDCO Marine Group is made up of five divisions it is difficult to determine the actual dedicated ship production and ship repair facilities. What is known are the specifications of the past shipyard before it was purchased by the BIDCO group.

Total Previous Shipyard Area: 12 acres
As American Shipbuilding Company, this shipyard had three graving docks from 400 to 630 ft long.

3.8.5 Condition of Facilities

Information not provided by company.

3.8.6 Satellite Image



3.8.7 Building Practices

Information not provided by company.

3.8.8 Production Organization

Information not provided by company.

3.8.9 Performance

Information not provided by company.

3.8.10 Contact Information

Website:
www.bidcomarine.com

Address:
201 Ganson Street
Buffalo, NY 14203

P: 716-854-1041

3.9 Burger Boat

Burger Boat is currently open and functioning.

3.9.1 Product Range

Burger Boat Company designs and builds custom motor yachts ranging in size from 100 to 200 feet.

3.9.2 Number of Employees

The company has almost 500 workers.

3.9.3 Location Opportunities

Manitowoc is a populated region which can provide workers. There are technical workers in the area which can supply engineers and technical workers. Industrial supply companies are plentiful in the region.

3.9.4 Facilities and Dimensions

- 36,000 sq ft covered building containing
  - 2 150 x 50 ft bays
  - 2 175 x 60 ft bays
- 42,000 sq ft covered building containing
  - 2 100 x 210 ft bays

Each of the above facilities have overhead bridge cranes full width and length of all bays
70 ft height at peak of 42,000 sq ft building

- 40,000 sq ft offsite facility
- 500 metric ton Marine Travel-lift
- 40,000 sq ft corporate headquarters

3.9.5 Condition of Facilities

Information not provided by company.

3.9.6 Satellite Image

3.9.7 Building Practices

Burger specializes in aluminum construction. Burger also has experience with ultra-high strength alloys, which require specialized manufacturing and engineering skill.

3.9.8 Production Organization

Information not provided by company.

3.9.9 Performance

Information not provided by company.

3.9.10 Contact Information

Website:
http://www.burgerboat.com/

Contact:	Address:	
info@burgerboat.com	1811 Spring Street	P: 920-684-1600
	Manitowoc, WI 54220	F: 920-684-6555

3.10 Cleveland Ship Repair

Cleveland Ship Repair is currently part of the Manitowoc Marine Group. Before its current ownership, Cleveland Ship Repair was called American Shipbuilding Company, Cleveland Shipbuilding Company, and Globe Iron Works.

3.10.1 Product Range

Cleveland Ship Repair specializes in all types of voyage and topside marine repair.

3.10.2 Number of Employees

MMG employs 3500 people.
Cleveland Ship Repair has a total of 13 employees.

Shipyard Total:	11
Management:	2
Design/Engineering:	1
Planning:	1
Production:	11
Use of Subcontractors:	Yes
Use of Design Agents:	Yes

Cleveland Ship Repair is a large repair shop, not much engineering and designing employment is needed. When it is, Bay Shipbuilding provides engineering support.

3.10.3 Location Opportunities

Located in Cleveland, Cleveland Ship Repair has access to many industrial supply companies. Cleveland is a very populated region and has multiple technical universities in the area for engineers and technical workers. There is a large population for other additional workers.

3.10.4 Facilities and Dimensions

Because it does not have an actual yard where they perform repairs, they rent pier / dock space or other facilities to perform these projects.

Total Area of Shipyard:	3 acres
Stockyard Area:	.25 acres
Total Covered Shop Area:	11,200 sq ft
Repair Dock:	400 ft
Shop Cranes:	(5) 5T, 3T
Berth/Dock Cranes:	35T mobile crane

3.10.5 Condition of Facilities

Information not provided by company.

3.10.6 Satellite Image

3.10.7 Building Practices

Information not provided by company.

3.10.8 Production Organization

Information not provided by company.

3.10.9 Performance

Because the yard is a repair yard, no ships are created. The annual tons of steel used is 3000.

3.10.10 Contact Information

Website:
http://www.manitowocmarine.com/Facilities/ClevelandShipRepair.asp

Contact:	Address:	
Kyle Fries	1847 Columbus Rd.	P: 216-621-9111
General Manager	Cleveland, OH 44113	F: 216-621-4885
kfries.csc@sbcglobal.net		

3.11 Edward E. Gillen Company, Inc.

Edward E. Gillen Company no longer builds or repairs ships.

3.11.1 Product Range

The company now designs and builds dock walls/structures, bluff stabilizations, breakwaters, and does dredging.

3.11.2 Number of Employees

Information not provided by company.

3.11.3 Location Opportunities

The location is suitable for shipbuilding.

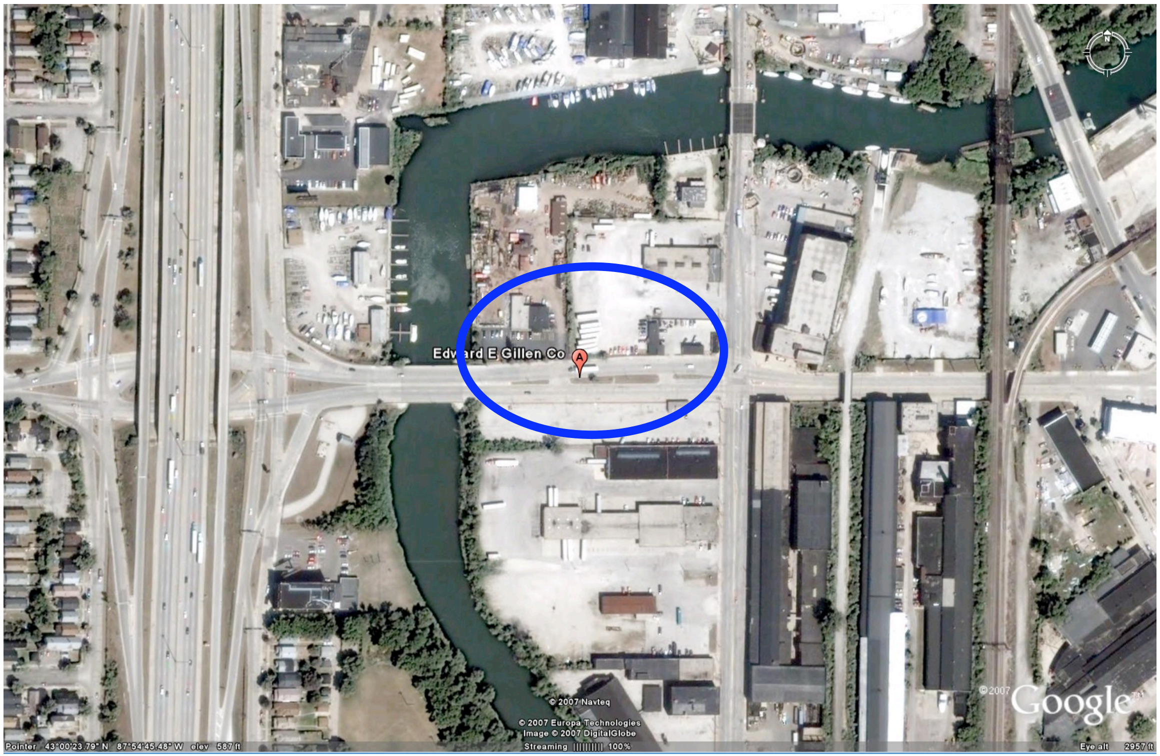
3.11.4 Facilities and Dimensions

Information not provided by company.

3.11.5 Condition of Facilities

Information not provided by company.

3.11.6 Satellite Image



3.11.7 Building Practices

Information not provided by company.

3.11.8 Production Organization

Information not provided by company.

3.11.9 Performance

Information not provided by company.

3.11.10 Contact Information

Website:	Address:	
http://www.gillenco.com/	218 W. Becher Street	P: 414-769-3120
	Milwaukee, WI 53207	F: 414-769-3135

3.12 Erie Shipbuilding

Erie Shipbuilding is currently open and a working facility. It was established in 2005. Prior to becoming Erie Shipbuilding, the facility was the Litton Industries Shipyard and Dry Dock, Erie Marine Enterprises, and Metro Machine Corp.

3.12.1 Product Range

The goal of Erie Shipbuilding is to engage in large scale general steel and aluminum fabrication and assembly with the intended purpose of building, converting, dry-docking and repairing ships. Erie's current projects consist of a dump scow and deck barges.

3.12.2 Number of Employees

Information not provided by company.

3.12.3 Location Opportunities

Erie is a populated region that may provide workers if needed. Also, there are technical universities in the area for engineers and technical workers. Many industrial supply companies are in this region.

3.12.4 Facilities and Dimensions

Total Area of Shipyard:	44 acres
Stockyard Area:	12 acres
Steel Processing Shop Area:	45,000 sq ft
Steel Fabrication Shop Area:	35,000 sq ft
Machine Shop Area:	3,000 sq ft
Pipe Shop Area:	3,000 sq ft
Storage/Warehouse Area:	32,000 sq ft
Total Covered Shop Area:	130,000 sq ft

Building and Repair Docks:	130 ft x 1,250 ft dry dock (2) 140 ft x 1150 ft piers with 4,000 ft pier space
Shop Cranes:	ranging 20T - 100T overhead
Berth/Dock Cranes:	ranging 20T - 450T

3.12.5 Condition of Facilities

Information not provided by company.

3.12.6 Shipyard Image

3.12.7 Building Practices

Maximum block size Erie Shipbuilding is capable of is 40' x 90' and maximum block weight can be up to 100 tons.

3.12.8 Production Organization

Information not provided by company.

3.12.9 Performance

Information not provided by company.

3.12.10 Contact Information

Website:
http://erieshipbuilding.com/index.html

Contact:	Address:	
John Chapman	220 E. Bayfront Parkway	P: 814-452-0330
VP of Operations	Erie, PA 16507	F: 814-461-7225
chap@erieshipbuilding.com		

3.13 Fraser Shipyards, Inc.

Fraser is currently open and functional. Before its current ownership as Fraser Shipyards Inc., the shipyard was called American Steel Barge Company and also Superior Shipbuilding Company.

3.13.1 Product Range

Fraser can and has designed and built all types of commercial ships, including bulk carriers, oil tankers, product tankers, car carriers, OBO's, dredgers, and ferries. Currently, the product range is bulk carriers, product carriers and special commercial marine equipment such as barges.

3.13.2 Number of Employees

Similar to other Great Lakes repair yards, the work force is seasonal; in the summer there is not a large available work force in the area and it would be difficult to increase their employment.

Shipyard Total:	varies 40 to 150
Management:	6
Design/Engineering:	2
Planning:	1
Production:	up to 140
Use of subcontractors:	Yes
Use of design agents:	Yes

3.13.3 Location Opportunities

Located in Superior, WI, there is a populated region for workers. There are universities in the area for engineers and technical workers. Industrial supply companies are in the area to provide services for the shipyard.

3.13.4 Facilities and Dimensions

The facilities were constructed in 1890.

Total Area of Shipyard:	60 acres
Steel Processing, Fabrication, Machine Shop, and Pipe Shop Area: 69,000 sq ft	
Storage/Warehouse Area:	16,000 sq ft
Total Covered Shop Area:	100,000 sq ft
Building Docks:	628 ft x 60 ft graving dock
	831 ft x 80 ft graving dock
Repair Berths:	(4)
Shop Cranes:	various
Berth/Dock Cranes:	(6) Heavy lifting cranes ranging from 44-175T

3.13.5 Condition of Facilities

The buildings are well maintained externally with no signs of deterioration.

3.13.6 Satellite Image

3.13.7 Building Practices

Information not provided by company.

3.13.8 Production Organization

Fraser Shipyards approach is to be as flexible as possible as it can respond to whatever opportunity arises. They have a very lean organization and simple approach.

3.13.9 Performance

The throughput is not consistent. Work consists mainly of repairing the Great Lakes bulk carriers and tugs. Fraser will build special craft such as the 70 foot double hull barge for the U.S. National Park Service (completed in 2004). Previous to that, however, the last new construction was a tug built in 1967.

3.13.10 Contact Information

Website:
frasershipyards.com

Contact:	Address:	
Trevor White	3rd and Clough Avenue	P: 715-394-7787
Vice President and General Manager	P.O. Box 997	F: 715-394-2807
twhite@frasershipyards.com	Superior, WI 54880	

3.14 Great Lakes Engineering Works

The yard in Ashtabula Ohio was started in 1912 and closed in 1960.

3.14.1 Product Range

Ashtabula created Lakers, cargo ships, tugs, ferries, bulkers, barges, and military ships.

3.14.2 Number of Employees

N/A

3.14.3 Location Opportunities

Located near Cleveland, there are many industrial supply companies and multiple technical universities in the area for engineers and technical workers.

3.14.4 Facilities and Dimensions

Graving Dock:	630 ft

3.14.5 Condition of Facilities

N/A

3.14.6 Satellite Image

N/A

3.14.7 Building Practices

N/A

3.14.8 Production Organization

N/A

3.14.9 Performance

N/A

3.14.10 Contact Information

Website:
http://www.coltoncompany.com/shipbldg/ussbldrs/postwwii/shipyards/inactive/inland/greatlakes.htm

3.15 Great Lakes Towing Shipyard

Great Lakes Towing is currently open and functioning. Great Lakes Towing Shipyard is part of The Great Lakes Group Company.

3.15.1 Product Range

The Great Lakes Towing Company specializes in all types of marine repair service for tugboats, supply boats, ferries, barges, cruise boats, large yachts, and many other types of vessels. GLT is also embarking on a new tugboat shipbuilding venture.

3.15.2 Number of Employees

Company Total:	125
Shipyard Total:	26
Management:	1
Design/Engineering:	2
Planning:	1
Production:	23
Use of Subcontractors:	Yes
Use of Design Agents:	Yes

3.15.3 Location Opportunities

Located in Cleveland, Great Lakes Towing has access to many industrial supply companies. Cleveland is a very populated region and has multiple technical universities in the area for engineers and technical workers. There is a large population for other additional workers.

3.15.4 Facilities and Dimensions

Rebuilt in November 2006 with future plans for a 40,000 sq ft building facility with a 300-ton Travelift.

- Total Area of Shipyard: over 5 acres
- Total Covered Shop Area: 11,400 sq. ft.
    - Includes: Steel Processing Shop Area, Steel Fabrication Shop Area, Machine Shop Area, Pipe Shop Area, Storage/Warehouse Area
- Building Docks/Berths: 300T floating dry dock

Repair Docks:	1000 ft of wet berth
Shop Cranes:	10T gantry
Berth/Dock Cranes:	45T crawler
	30T hydraulic

3.15.5 Condition of Facilities

New

3.15.6 Satellite Image

3.15.7 Building Practices

Basic block construction.

3.15.8 Production Organization

Information not provided by company.

3.15.9 Performance

Annual throughput is 2 tugs and 20 truckable barges.

3.15.10 Contact Information

Website:
http://www.thegreatlakesgroup.com/index.php

Joseph P. Starck, Jr.
Vice President - Engineering
jps@thegreatlakesgroup.com

Address:
4500 Division Avenue
Cleveland, OH 44113

P: 216-621-4854
F: 216-621-0069

3.16 H. Hansen Industries, Inc.

H. Hansen is currently open and functioning. The company is located in the Port of Toledo.

3.16.1 Product Range

Ship repair, fabrication, machining and propeller repair.

3.16.2 Number of Employees

Information not provided by company. MARAD lists 60 employees in 2004.

3.16.3 Location Opportunities

Being in Toledo there are many industrial supply companies. There is a populated region for possible workers as well as multiple technical universities in the area for engineers and technical workers.

3.16.4 Facilities and Dimensions

Machine Repair Shop with 20-ton crane
450 ft of total pier length

3.16.5 Condition of Facilities

Information not provided by company.

3.16.6 Satellite Image

3.16.7 Building Practices

Information not provided by company.

3.16.8 Production Organization

Information not provided by company.

3.16.9 Performance

Information not provided by company.

3.16.10 Contact Information

Bob Ossovicki,
Superintendent
Hansen_ind@msn.com

Address:
2824 Summit Street
Toledo, OH 43611

P: 419-729-1621
F: 419-729-0715

3.17 Ironhead Marine Inc.

Before its current ownership, Ironhead Marine Inc. used to be called American Shipbuilding Company, Steelhead Marine Company, Toledo Ship Repair, Craig Shipbuilding Company, and Toledo Shipbuilding Company.

3.17.1 Product Range

Dry-docking and marine repair services.

3.17.2 Number of Employees

15-40 employees depending on season and workload

3.17.3 Location Opportunities

Being in Toledo, there is a highly populated region with many potential workers. There are also many technical universities in the area for engineers and technical workers. In Toledo, there are many industrial supply companies.

3.17.4 Facilities and Dimensions

Site: 14 acres

Graving Docks:	800 ft x 70 ft
	550 ft x 70 ft

Currently building 20,000 sq. ft. High Bay Fabrication shop.

3.17.5 Condition of Facilities

Other than the new high bay fabrication shop there are no other building on the site other than a 100 year old pump house.

3.17.6 Satellite Image

3.17.7 Building Practices

Information not provided by company.

3.17.8 Production Organization

Information not provided by company.

3.17.9 Performance

Information not provided by company.

3.17.10 Contact Information

Tony LaMantia	Address:	
President of Company	2245 Front Street	P: 419-698-8081
tony@ironheadfab.com	Toledo, OH 43605	F: 419-698-9066

3.18 Marinette Marine Corporation

Marinette Marine Corporation is open and functioning as part of the Manitowoc Marine Group. It was founded in 1942 to meet the growing need for naval construction. MMC is a full service shipyard with in-house capabilities to design and construct complex vessels. It has earned an international reputation for its ability to build technologically advanced ships.

3.18.1 Product Range

Product range covers special purpose small technically advanced ships/platforms for the U.S. Government such as the USCG Icebreaker, USCG Buoy Tender, Mobile Landing Causeway, and the new monohull Littoral Combat Ship, as well as ferries like the Staten Island Ferry and tugs for private customers. MMC is currently looking at a car carrier in the 400 foot length range.

3.18.2 Number of Employees

MMG employs 3500 people. At MMC there are a total of 1000 workers. This is about the maximum available in the region around the shipyard.

3.18.3 Location Opportunities

Marinette is a populated area so workers could be available if needed. There are technical universities in the area to supply engineers and technical workers. Industrial supply companies are present in this region.

3.18.4 Facilities and Dimensions

MMC was constructed in 1942.

Total Area of Shipyard:	60 acres
Total Shop Area:	300,000 sq. ft.
Shop Cranes:	40 tons
External Cranes:	40 ton, 100 ton, and 275 ton
Side Launchways:	2,500 long ton and 450 ft limit
Ship Transport system:	ships or blocks up to 1,600 tons
Module movers:	160 ton

3.18.5 Condition of Facilities

Information not provided by company.

3.18.6 Satellite Image

3.18.7 Building Practices

MMC uses the block and advanced outfitting approach to production. They move as much work as possible as far up the production line. MMC can produce both steel and aluminum structures.

3.18.8 Production Organization

Ships are typically around 90% complete when launched. They have separate shops for steel processing, subassemblies, panels, bow, and stern blocks, block outfitting, and painting. Panel and block construction are all a fixed work station.

3.18.9 Performance

Since opening, MMC has built more than 1,300 vessels. MMC will build half an LCS, two tugs, and many parts of the mobile causeway in a year. If MMC was concentrating on small commercial ships they could build up their throughput to three ships per year.

3.18.10 Contact Information

Website:
http://www.manitowocmarine.com/Facilities/MarinetteMarine.asp

Contact:	Address:	
Floyd R. Charrier, Jr.	1600 Ely Street	P: (715) 735-9341 ext. 6528
Vice President Sales & Marketing	Marinette, WI	F: (715) 735-3516
fcharrier@marinettemarine.com	54143-2434	

3.19 MCM Marine Inc.


MCM Marine is currently open and operational.

3.19.1 Product Range

MCM Marine is capable of river and harbor improvements, environmental dredging and capping, maintenance dredging, break walls and retaining walls, sheet, steel and wooden pile driving, dock installation and repair, crane services, sandblasting, certified welding, marine construction, beach nourishment, dry docking and boat repair.

3.19.2 Number of Employees

Information not provided by the company.

3.19.3 Location Opportunities

Being in Sault Ste. Marie there are many industrial supply companies. There is a populated region for possible workers. However, technical universities are in the area for engineers and technical workers but at a distance.

3.19.4 Facilities and Dimensions

MCM Marine opened in 1984.

Build and Repair Berths/Docks: 2000 T floating dry dock

3.19.5 Condition of Facilities

Information not provided by the company.

3.19.6 Satellite Image

3.19.7 Building Practices

Information not provided by the company.

3.19.8 Production Organization

Information not provided by the company.

3.19.9 Performance

Information not provided by the company.

3.19.10 Contact Information

Website:
www.mcmmarine.com

Contact:
jmccoy@mcmmarine.com

Address:
1065 East Portage Avenue
Sault Ste. Marie, MI 49783

P: 906-632-4316
F: 906-6327766

3.20 Michigan Limestone Ship Repair Shop

Michigan Limestone Ship Repair Shop is no longer open and does not currently build or repair ships.

3.20.1 Product Range

N/A

3.20.2 Number of Employees

N/A

3.20.3 Location Opportunities

Being in Rogers City there are hardly any industrial supply companies. There is not a populated region for workers nor are there technical universities in the area for engineers and technical workers.

3.20.4 Facilities and Dimensions

N/A

3.20.5 Condition of Facilities

N/A

3.20.6 Satellite Image

3.20.7 Building Practices

N/A

3.20.8 Production Organization

N/A

3.20.9 Performance

N/A

3.20.10 Contact Information

Previous Address:
1035 Calcite Road
Rogers City, MI 49779

P: 517-734-2131
F: 517-734-4979

3.21 Nicholson Terminal and Dock Company

Nicholson Terminal is currently open and functional. Before its current ownership, this shipyard was known as Great Lakes Engineering Works.

3.21.1 Product Range

Nicholson Terminal & Dock Company offers vessel repair services including a small yet full functioning dry dock that can range from minor to major repair jobs. The yard regularly performs maintenance on tugs, barges, cargo handling vessels, and passenger carrying vessels. NT&D offers two shipyards, both with a variety of services including truck, rail car and barge loading/unloading, container stuffing and stripping, securing, cargo sorting, cargo assembly, and short and long term storage.

3.21.2 Number of Employees

Information not provided by company.

3.21.3 Location Opportunities

Being in Ecorse, MI, near Detroit, there are many industrial supply companies. There is a populated region for workers as well as technical Universities in the area for engineers and technical workers.

3.21.4 Facilities and Dimensions

Nicholson Terminal & Dock Company has two terminals: Detroit and Ecorse. The Detroit Terminal is for loading/unloading and storage; it has thirty forklift trucks with capacities of 5,000 - 80,000 lbs as well as two bobcat wheel loaders for transporting cargo. There is also a riverside rail system for load cranes.

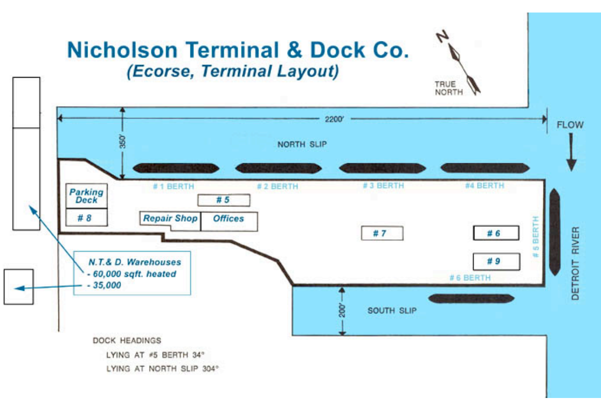
Storage/Warehouse Area:	50 acres, 185,000 sq ft covered
Repair Docks:	3,400 ft repair dock and a small floating dry dock
Shop Cranes:	(2) overhead 20-25 T

3.21.5 Condition of Facilities

Information not provided by company.

3.21.6 Satellite Images

The top screen shot is the Detroit Terminal. The lower shot is the Ecorse Terminal and Repair Shop.



3.21.7 Building Practices

Information not provided by company.

3.21.8 Production Organization

Information not provided by company.

3.21.9 Performance

Information not provided by company.

3.21.10 Contact Information

Website:
http://www.nicholson-terminal.com/

Contact:
psutka@nicholson-terminal.com

Address:
P.O. Box 18066
River Rouge, MI 48218

P: 313-842-4300
F: 313-843-1091

3.22 Palmer Johnson Yachts

Palmer Johnson is currently open and producing vessels.

3.22.1 Product Range

Palmer Johnson builds semi-custom sports yachts between 120 feet and 150 feet in length. They are currently expanding their facilities through internal funds and state government support to be able to produce yachts up to 200 feet.

3.22.2 Number of Employees

Palmer Johnson's current workforce is 300 with an anticipated number of 500 when the new facilities are completed.

3.22.3 Location Opportunities

Located in Sturgeon Bay, Palmer Johnson has access to some industrial supply companies. Sturgeon Bay is a somewhat populated region and has one technical university. However, the city is close to Green Bay that has a large population for additional workers and many universities for engineers and technical workers.

3.22.4 Facilities and Dimensions

Current facility is 67,000 square feet. Palmer Johnson has secured funding through the Sturgeon Bay Shipbuilding Cluster Plan, which is currently building new facilities for Palmer Johnson. The new facilities consist of a 15,000 square foot expansion of the current facility, a 12,000 square foot paint facility and an additional 20,000 square foot production facility. The Shipbuilding Cluster Plan also includes a new boat launch system.

3.22.5 Condition of Facilities

New

3.22.6 Satellite Image

3.22.7 Building Practices

Since Palmer Johnson makes semi-custom vessels they are able to implement modular assembly and other advance manufacturing processes.

3.22.8 Production Organization

Information not provided by company.

3.22.9 Performance

Palmer Johnson should be able to produce 8-12 ships per year with the new facilities.

3.22.10 Contact Information

Website:
www.palmerjohnson.com
Contact:
Mike Kelsey
mkelsey@itol.com

Address:
128 Kentucky Street
Sturgeon Bay, WI 54235

P: 920-743-4412

3.23 T.D. Vinette

T.D. Vinette is not currently open and functional.

3.23.1 Product Range

This shipyard used to be a small repair shop, capable of docking Panamax size vessels.

3.23.2 Number of Employees

N/A

3.23.3 Location Opportunities

Because Escanaba is in Michigan's Upper Peninsula, there are limited resources available.

3.23.4 Facilities and Dimensions

N/A

3.23.5 Condition of Facilities

N/A

3.23.6 Satellite Image

N/A

3.23.7 Building Practices

N/A

3.23.8 Production Organization

N/A

3.23.9 Performance

N/A

3.23.10 Contact Information

Previous Address:
1212 19th North Avenue
P.O. Box 416
Escanaba, MI 49829

P: 906-786-1884
F: 906-789-1089

4.0 Factors That Impact Great Lakes Shipbuilding

There are several factors unique to the Great Lakes region that will impact the success or failure of shipbuilding and repair on the Great Lakes. These factors include:

- Saint Lawrence Seaway system constraints
- Labor considerations
- Facility and environmental considerations
- National Cost of Production considerations

Each factor has impact on the Great Lake's shipbuilding viability within certain markets as well as long-term sustainable shipbuilding business. Shipbuilding and repair is more than dry-docks and dreams. It is a heavy industrial manufacturing and engineering business that is no different than any other heavy industry. Volume, market, cost and other business metrics matter in all the same ways as in other heavy industry sectors.

4.1 Saint Lawrence Seaway

An important component to the maritime business within the Great Lakes is the Saint Lawrence Seaway. These seaways impact the maximum size of vessels that can transit in and out of the Great Lakes and thus impacting the market segments available for shipbuilding. Additionally the winter closures of the seaway system will impact the delivery schedule and capacity utilization of shipbuilders within the Great Lakes region as well as the volume of ships entering the Great Lakes.

The St. Lawrence Seaway is a system of canals that allows ocean-going vessels to travel from the Atlantic Ocean to the Great Lakes through the St. Lawrence River. To control flooding in the area and lake levels, there are a series of 19 locks along the longest route (14).

4.1.1 How the Locks Work

Used in rivers with a significant change in water level, locks provide a way for ships to travel through them by essentially creating a ship elevator. When a ship comes to a lock it goes into a watertight chamber connecting the two different heights of water. The ship is then raised or lowered to match the height of water it is traveling to; this occurs when water is pumped into the chamber to raise the ship or draining the water to lower it. Once the chamber holding the ship is the same water level as the river, the gates open and the ship continues on.

4.1.2 Lock Dimensions

Vessels allowed to travel through the St. Lawrence River are limited by the size of the locks which are 766 feet (233.5 m) long, 80 feet (24 m) wide, and 30 feet (9.1 m) deep. Therefore, the maximum size of a ship passing through must be slightly smaller at 740 feet (225.5 m) long, 78 feet (23.7 m) wide, 26.5 feet (8.08 m) draft, and 116.5 feet (35.5m) height above water; this is informally known as Seaway-Max. Larger vessels can be built inside the Great Lakes but cannot travel down the seaway. The size restriction does not eliminate the involvement of Great Lakes yard in the construction of large vessels. There are no reasons why able yards could not produce large sections of ships, such as deckhouses and engine rooms, and barge those sections to an integrating yard outside of the Great Lakes. A business practice like this is feasible and was done during the World Wars, but Great Lakes yards would find it difficult to provide value and savings in today's market. This type of business strategy is currently being done in Europe and Asia. Figure 4.1.2.1 below shows where the locks are located along the Seaway.

Figure 4.1.2.1: Map of Seaway Locks

4.1.3 Cost of Travel Through Seaway

By routing through Great Lakes ports, steel shippers save anywhere from $3-50 per ton. Transportation studies show that Great Lakes ports have lower port costs than competing ocean ports for the handling, wharfage, dockage, and stevedoring of grain, iron ore, steel coils, and machinery. Table 4.1.3.1 shows toll charges for different cargo measured in US $ per metric ton.

Table 4.1.3.1: 2007 Seaway Tolls (US $ per metric ton) (11,13)

Cargo Tolls	**Montreal**	**Welland**
Bulk Cargo	.958086	.634832
Grain	.588612	.634832
Coal	.565645	.634832
General Cargo	2.30851	1.01588
Steel Slab	2.08928	.727272
Containerized Cargo	.958086	.634832
Government Aid	0	0
GRT Charge	**Montreal**	**Welland**
Loaded Ballast -OR-	.092440	.150047
Vessel carrying new cargo or a vessel returning ballast after carrying new cargo	0	N/A
Minimum charge per ship per lock transited for full or partial transit of Seaway	23.9234	23.9234
Lockage Charge (per lock)	**Montreal**	**Welland**
Loaded Vessels -OR-	N/A	506.976
Vessel Charge per Gross Registered Ton (for a vessel carrying new cargo)	N/A	.149377
Ballast Vessels -OR-	N/A	374.574
Vessel Charge per Gross Registered Ton (for a vessel returning in ballast after carrying new cargo)	N/A	.109473

4.1.4 Duration of Travel Through Seaway

Getting through a lock takes about 45 minutes due to the incredibly quick dumping and filling of water which is approximately 24 million gallons in just 7 to 10 minutes per lock. The Welland Canal takes about 12 hours to completely travel through. The Montreal/Lake Ontario region takes about 5 hours.

Appendix A contains charts of Great Lakes port distances from each other and also to some overseas ports. The charts estimate an average sailing time of 12mph (10.4 knots).

4.1.5 Seaway Closing Information

The only entrance to the Great Lakes is through the Saint Lawrence Seaway, which due to ice can become dangerous and must be closed in multiple locations for a portion of the winter. The locks along the seaway are made up of the Welland Canal, Lake Ontario region, and Sault Ste. Marie region.

According to the Great Lakes St. Lawrence Seaway Notices (15) for the past 6 years, the locks at Sault Ste. Marie close on or around January 15, while the remaining areas close between December 20 and 29 depending on the severity of weather conditions for the year. The Sault Ste. Marie locks reopen on March 25, the others open between March 21 and 31. This is shown in Tables 4.1.5.1.

Winter closure impacts Great Lakes shipbuilding in two ways:

1. The closure of the seaway affects the shipyard required capacity needs as well as its new ship delivery schedule. Since the shipyard has a condensed new ship delivery schedule it will need to have additional capacity to maintain an equivalent throughput when compared to gulf coast yards. It will also need to negotiate with customers who would require delivery of a ship during the closure months. It may also be difficult to engage in the partial build scenario discussed earlier. The winter closure may cause scheduling and sequencing issues with the final vessel integrator.

2. The closure also affects ship repair opportunities by decreasing the number of ships that enter the Great Lakes as well as eliminating the opportunity of capturing possible repair work during the closure months. International short sea shipping possibilities are also lost due to the winter closure thus eliminating possible increase repair opportunities.

Table 4.1.5.1: Seaway Closings and Openings From 2001 – 2006 (15)

SEAWAY REGION 2001	DATE OPENED	DATE CLOSED
Welland Canal	3/23	12/24
Lake Ontario	3/23	12/20
Sault Ste. Marie	3/25	1/15

SEAWAY REGION 2002	DATE OPENED	DATE CLOSED
Welland Canal	3/26	12/24
Lake Ontario	3/26	12/20
Sault Ste. Marie	3/25	1/15

SEAWAY REGION 2003	DATE OPENED	DATE CLOSED
Welland Canal	3/31	12/24
Lake Ontario	3/31	12/20
Sault Ste. Marie	3/25	1/15

SEAWAY REGION 2004	DATE OPENED	DATE CLOSED
Welland Canal	3/23	12/26
Lake Ontario	3/25	12/20
Sault Ste. Marie	3/25	1/15

SEAWAY REGION 2005	DATE OPENED	DATE CLOSED
Welland Canal	3/23	12/26
Lake Ontario	3/25	12/20
Sault Ste. Marie	3/25	1/15

SEAWAY REGION 2006	DATE OPENED	DATE CLOSED
Welland Canal	3/21	12/26
Lake Ontario	3/23	12/20
Sault Ste. Marie	3/25	1/15

4.1.6 Transportation Options for Seaway Region

Having to go through a series of locks in the Saint Lawrence River slows the transit of a ship. However, depending on the destination, this path of travel may still be significantly faster than transporting cargo by railway, truck, or another mode of transportation.

4.2 Labor Considerations

A commonly expressed viewpoint shared by Midwest shipbuilders and owners is the difference between the labor environments in the Midwest compared to the Gulf Coast. The common belief is that labor rates, cost of living differences, labor practices, and union influences hinder Great Lakes shipyards ability to be competitive within the U.S. markets. This section will address those concerns.

4.2.1 Right to Work

All Great Lakes states are forced-unionism states while all southeastern states are right to work states, as shown in Figure 4.2.1.1. This translates to differences in average labor rates and labor practices between the regions. All states that do not force unions generally have lower and more competitive wages and thus lower ship prices than unionized states. The right to work issue may keep the Great Lakes from being as competitive as the Gulf Coast states.

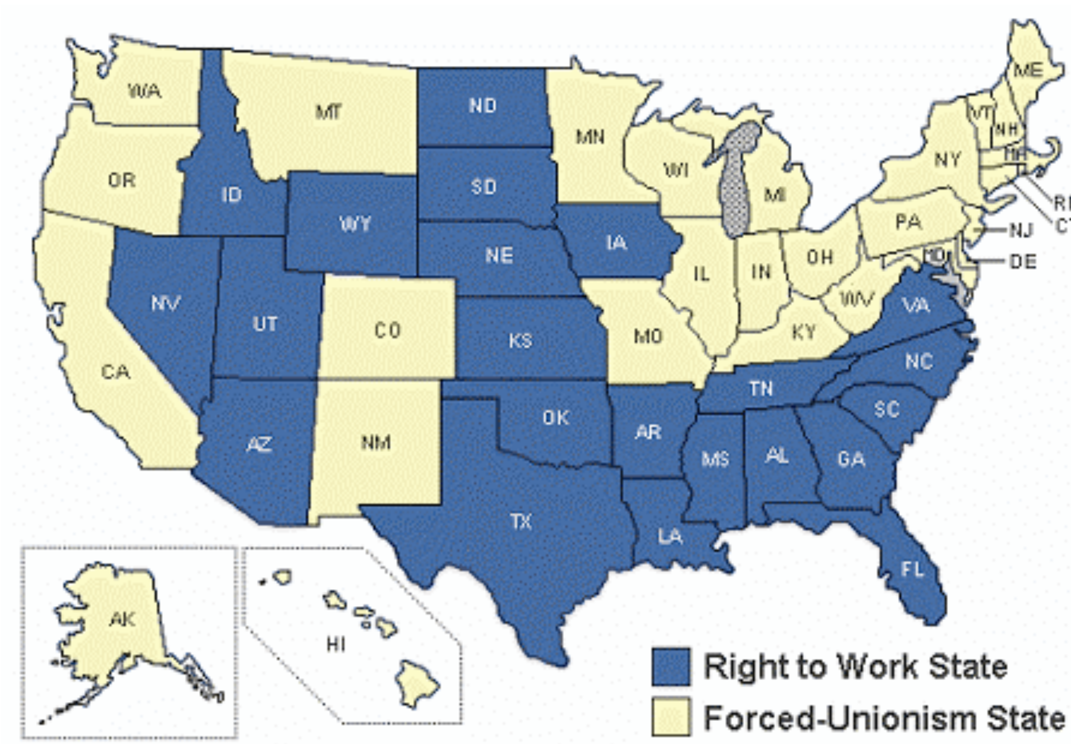


Figure 4.2.1.1: Right to Work and Unionized States

4.2.2 Wage rates comparison

Regional wage rate data was gathered from the U.S. Department of Labor Bureau of Labor Statistics (BLS) database system. The supporting information can be found at www.bls.gov.

The BLS splits the country into census divisional data. The three divisions evaluated and their included states are presented in Table 4.2.2.1 while the wage rates for each region are presented in Table 4.2.2.2.

Table 4.2.2.1: BLS Census Divisional Data

Census Divisions Name	States Included
East North Central Census Division (ENC)	Michigan, Ohio, Indiana, Illinois, Wisconsin
East South Central Census Division (ESC)	Kentucky, Tennessee, Alabama, Mississippi
West South Central Census Division (WSC)	Texas, Louisiana, Arkansas, Oklahoma

Table 4.2.2.2: Wage Rates for Each Region

Area	Occupation	Year	Hourly Rate
ENC	All occupations, excluding sales	2005	$19.09
ENC	White collar occupations	2005	$22.93
ENC	Blue collar occupations	2005	$16.83
ENC	Welders and cutters	2005	$16.15
ESC	All occupations, excluding sales	2005	$14.83
ESC	White collar occupations	2005	$18.51
ESC	Blue collar occupations	2005	$14.64
ESC	Welders and cutters	2005	$14.58
WSC	All occupations, excluding sales	2005	$16.62
WSC	White collar occupations	2005	$20.52
WSC	Blue collar occupations	2005	$13.78
WSC	Welders and cutters	2005	$13.87

The data gathered shows that the average blue-collar worker in the Midwest makes $2-$3 more per hour than the average blue-collar worker in the Gulf States. Additionally, white-collar workers in the Midwest make an average $2-$5 more per hour than white-collar workers in the Gulf States. Labor cost are a significant part of overall shipbuilding cost thus the labor differences between the Midwest and the Gulf is a barrier to the success of the Great Lakes shipbuilding business.

4.2.3 Cost of Living Comparison

For this study, the BLS Consumer Price Index (CPI) is used as the basis for comparing the cost of living difference between the different geographic regions. Even though the CPI is not a cost-of-living index it does measure the average change over time in prices paid by consumers in a region for a market basket of consumer goods and services. The cost of goods does correlate to the salary requirements needed to sustain a workforce within that region.

The CPI data presented is for two areas and three class sizes within those two areas. Class A population size class represents all metropolitan areas over 1.5 million; B/C represents mid-sized and small metropolitan areas (fewer than 1.5 million); and D, all non-metropolitan urban areas. The CPI values for different regions are presented in Table 4.2.3.1.

Table 4.2.3.1: CPI Data

Region	Consumer Type	CPI Value 2006
Midwest – Size Class A	Urban Wage Earners and Clerical Workers	188.5
Midwest – Size Class A	All Urban Consumers	194.0
Midwest – Size Class B/C	Urban Wage Earners and Clerical Workers	122.5
Midwest – Size Class B/C	All Urban Consumers	122.8
Midwest – Size Class D	Urban Wage Earners and Clerical Workers	185.2
Midwest – Size Class D	All Urban Consumers	187.1
South – Size Class A	Urban Wage Earners and Clerical Workers	194.8
South – Size Class A	All Urban Consumers	195.7
South – Size Class B/C	Urban Wage Earners and Clerical Workers	122.5
South – Size Class B/C	All Urban Consumers	123.5
South – Size Class D	Urban Wage Earners and Clerical Workers	195.2
South – Size Class D	All Urban Consumers	193.7

The CPI data disproves the belief that there is cost of living difference between the Midwest and Gulf Coast regions. Given certain cities within each region may have a higher or lower cost of living, in general the two geographic regions are the same with regards to buying power of residence in those regions.

4.2.4 Workforce Age Issues

In a recent RAND study (1) that investigated the reasons to why the cost of Navy ships have raised several national workforce issues were presented. The issues that exist in the naval construction shipyards also exist in the Great Lakes region. The two issues are the aging workforce and the "green labor". The national shipbuilding workforce is split between workers who are more than 45 years of age with more than 20 years of experience and workers who are less than 35 years of age with less than 5 years of experience (24).

What does this mean for Great Lakes shipbuilding? The consequence of this age gap is that the industry will see a large number of retirements within the next decade. This will leave rather inexperienced labor to take the place of the experienced labor. If you add the fact that shipbuilding is a challenging and tough work with unstable demand young potential laborers will most likely choose high-tech or other service industries with better compensation and better working conditions.

The southern region of the US has established industry, state, and federal funded shipyard labor development and outreach programs. If the Great Lakes region wanted to expand its shipbuilding base such ventures will be needed to create the needed workforce.

4.3 Facility and Environment Considerations

Environmental conditions impact shipbuilding in many ways ranging from speed of production, quality, and the introduction of advance manufacturing equipment. A 1974 National Shipbuilding Research Program (NSRP) study titled "Cost effectiveness study of weather protection for shipbuilding operations" concluded that in colder environments covered, heated working areas are cost effective and improve production times, quality and enable the introduction to advance manufacturing equipment. The study concluded that productivity improvements to cold weather shipyards ranged from 20% - 30%. Even though the referenced NSRP study is rather old, one could argue that the productivity savings today would be substantially greater given the reality of robotic welding and other automation technology that is now available compared to 1974. These types of equipment cannot be used unless they are placed in a temperature and weather controlled environment. The Great Lakes region is a cold environment. If new shipbuilding opportunities are going to take place, modern covered, environmentally controlled facilities will be needed.

4.4 Cost of production

For this study, the BLS Producer Price Index (PPI) will be used as the basis for evaluating the cost of producing ships within the United States. Since a large number of ships built within the US are governmental cost plus contracts the PPI is a good indicator of the relative cost of ship production given that the government sets the percentage of profit available to the producing ship yards.

Table 4.4.1: Producer Price Index

Business Sector	PPI in 2001	PPI in 2006	% Change
Ship and Boat Building	152.6	181.4	18.87%
Ship Building and Repairing	140.1	169.9	21.27%
Military New Construction		165	
Nonmilitary New Construction	160.9	211.9	31.70%
Ship Repair Military	146.2	174.2	19.15%
Ship Repair Nonmilitary	137	163.2	19.12%
Ship Building and Repairing Primary Products	141	171.5	21.63%
Boat Building	186.3	214.1	14.92%
Boat Building Outboard Motorboats, Commercial and Military	192.2	232.8	21.12%
Boat Building Inboard Motorboats, Commercial and Military	190.4	209.4	9.98%

The PPI data in Table 4.4.1 shows that the cost of shipbuilding has increase at a rate grater than inflation over the past 5 years. This is due to the large increase in raw material costs as well as energy cost over the past 5 years. Military vessel costs have increased an average annual rate of 10% per year for the last 50 years. The cost of vessel increase, must match the revenue opportunities of the ship owners. If revenue opportunities do not increase then new vessels created within the Great Lakes region will need to be sold at a rate that will limit the profit opportunities of the shipyard or may even require the shipyards to take a small loss.

5.0 Shipbuilding and Ship Repair Market Opportunities

In order to justify increasing the shipbuilding capacity within the Great Lakes one must look at the possible markets that will provide potential revenue to justify the investments. The industry of shipbuilding and ship repair is a worldwide market. To secure contracts and jobs that will keep its yards functional, the Great Lakes shipyards must be competitive with the rest of the nation and the world. Currently, the Great Lakes region is losing a lot of its market to other U.S. shipyards and to foreign countries. The Gulf of Mexico region has right to work laws, warmer environment, lower wage rates, and a similar cost of living and therefore have better opportunities to capture shipbuilding contracts due to the decreased labor costs and facility requirements. The U.S. has plans to increase both its military and commercial fleets but it will be difficult for the Great Lakes shipyards to get this business due to more appealing yards in other parts of the country. On the international scale, the U.S. has high labor costs that keep international business in foreign countries.

5.1 Short Sea Shipping Market

Short Sea Shipping (SSS) has many advantages including relieving highway and border congestion, and reducing greenhouse gas emissions. In the past decade, SSS in Europe has experienced significant growth and the European Commission wishes to transfer all freight growth in the coming years to non-highway modes.

SSS should be viewed as complementary to, rather than competing with, truck and rail. There are benefits of SSS for trucks and rail such as addressing driver shortages, helping retain drivers, or overcoming heavily congested corridors. Other benefits include financial advantages due to carrying more cargo at once, reduced energy consumption, fewer vehicle emissions, traffic accidents, and less need to build road and rail facilities. There will also be increased investment and employment in shipbuilding and inter-modal transportation services.

Expansion of SSS within the Great Lakes as well as from the east coast of North America through the seaway to Midwest ports should have positive impacts to the shipbuilding and repair business within the Great Lakes.

5.1.1 International Cargo

A Short Sea Shipping Market Study conducted by MariNova Consulting Ltd. (7), found that a short sea service based purely on international cargo is not financially viable. The MariNova study evaluated the scenario of a foreign ship that calls to the Port of Halifax, at the mouth of the St. Lawrence Seaway, and reloads onto a short-sea shipping vessel to travel into the Great Lakes at its final destination of Hamilton, past the majority of the locks.

Two major issues contributed to the study's conclusions. The first issue dealt with winter service container and general cargo service. Due to the fact that the Saint Lawrence Seaway closes for a few months in the winter season, ships have no other option but to call to ports outside the Great Lakes and rail to their final destinations. If short sea shipping is to be successful, the industry must have a way of keeping their customers during these months. The possibility of providing the continuation of container shipping using truck or rail during the winter months is not possible. Shifting transportation methods is not advantageous to shippers. Shippers depend on predicable, dependable service. This type of service is guaranteed via long term contracts with rail companies and trucking companies. If shipping companies, especially container shippers, wanted to take advantage of the Seaway's time and cost savings the Seaway would need to be opened year round.

The second issue that led to the conclusions of the study is the restrictive Canadian and US policy and regulatory conditions that cause a barrier to entry. These barriers increase vessel construction and operational cost thus making the start-up phase when cargo is building not economically feasible.

An additional issue not addressed in the study is the lack of container terminal infrastructure within the Great Lakes region. Winter navigation is not solely a seaway lock issue but the shallow depths of some of the ports, lack of needed equipment to keep piers open during winter, and the lack of container infrastructure are also barriers to entry for short sea shipping. Either state and/or federal funds will be needed to remedy these constraints, or a unique ship type will be needed to work around the problem. Great Lakes self un-loaders are example of a ship type that provides an infrastructure workaround.

5.1.2 Domestic Cargo

Recent completed studies (6,18) evaluated domestic short sea shipping as a more viable option for the Great Lakes region compared to international cargo because it can be performed year round since it does not require access to the locks in the St. Lawrence Seaway. These studies concluded that there are two distinct markets for short sea shipping on the Great Lakes: the longer-distance bulk commodity market and the short-distance RO/RO market for trucks and containers. Table 5.1.2.1 shows the current Great Lakes domestic cargo-carrying ships.

Table 5.1.2.1: The Great Lakes Domestic Cargo-Carrying Ship Fleet (18)

Vessel Type	Number of Ships
Bulk Carriers	27
Self Unloaders	85
General Cargo Ships	15
Tankers	16
RO/RO Ships	2
Container Ship	0
Small-Cargo Vessel	11
Subtotal	**156**
Dry-Cargo Barges	53
Liquid-Cargo Barges	29
Tug Boats	412
Total	**650**

With the current Great Lakes domestic cargo-carrying ship fleet short sea shipping must, at least in the short run, focus on the bulk commodity market. Already existing, the bulk market requires changes in the form of smaller quantity shipments and reduced lockage fees for small vessels. While tugs and barges can be domestically supplied through re-builds, larger Ro/Ro ships capable of handling truck-competitive times may have to be imported from outside Canada and the U.S. These larger Ro/Ro ships may have to include passengers and automobiles to make the trips economical and to therefore offer a sufficient number of trips per day to be time-competitive.

Just like anywhere else, the conditions necessary for short sea shipping success on the Great Lakes include schedule reliability, fast loading/unloading and transshipment, and competitive times and costs.

5.1.3 Scenario London to Cleveland: Seaway vs. Train

When transporting goods into the U.S. that have a destination past the East Coast, the Great Lakes provide a quicker route to the middle of the country. There are two options when transporting goods to the Midwest region of the U.S. from overseas; ship from port to port through the St. Lawrence Seaway, or ship to coastal port and transport to final destination with rail. Table 5.1.3.1 shows the travel times between both scenarios.

Table 5.1.3.1: Ship vs. Ship & Train (12, 22)

Transportation	**Start**	**End**	**Speed**	**Distance**	**Duration**
Ship	London	Cleveland	16 knots*	3544 nautical mi	9d 6h
Ship &	London	Newark	20 knots	3224 nautical mi	6d 17h
Rail	Newark	Cleveland	Unknown	Unknown	7d 22h

* 20 knots estimated ocean going; through seaway, 10.4 knots is average (Seaway Facts).
Appendix B & C have visuals for distance of both paths.

The table above shows that for quicker delivery it is beneficial to use the St. Lawrence Seaway; saving about 4 days of travel time, in addition to time spent unloading the ship and loading the train.

5.1.4 Scenario Madison to Detroit: Short Sea Shipping & Truck vs. Truck

When a body of water stands between your current location and destination, a method of quicker transportation is short-sea shipping that saves travel time. In this scenario, loaded trucks coming from Madison Wisconsin drive to Milwaukee Wisconsin where they load onto a Ro/Ro ship to Muskegon Michigan; from there they continue driving to their final destination Detroit Michigan. The other possibility is to truck from Madison to Detroit via highway.

Table 5.1.4.1: Truck vs. Ship & Truck (6)

Transportation	Start	End	Distance	Duration
Truck	Madison	Detroit	432 mi	9.5h
Truck & Ship & Truck	Madison Milwaukee Muskegon	Milwaukee Muskegon Detroit	Total: 303mi	Total: 7.5h

Shipping across Lake Michigan is faster than driving the entire way because the Ro/Ro allows the trucks to drive right into it at a quick loading and unloading rate. Avoiding the longer distance of driving around the lake saves 2 hours, excluding traffic delays, in this scenario as seen in Table 5.1.4.1

5.1.5 Benefits of Shipping in Great Lakes

A ship's typical capacity of 25,000 metric tons requires an equivalent of 225 rail cars and 870 trucks to carry the same amount of cargo. In this respect, keeping cargo onboard a ship as long as possible compared to removing cargo far from the final destination and continuing on rail or truck is more economical from an economy of scale perspective in addition to the additional economical advantage by the reduction of road damages. These advantages become more significant when you look at the heavily congested ports and highways in the east and west coast.

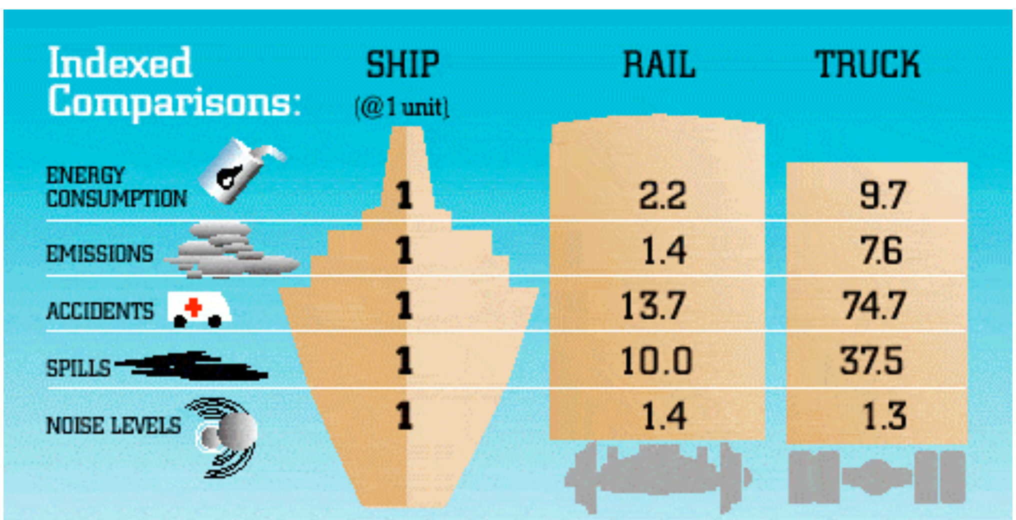


Figure 5.1.5.1: Transportation Method Comparison (10)

5.1.6 Most Economical

Carrying a ton of freight, a ship can travel 500 miles (800 km) on 1 gallon (4 liters) of fuel. In comparison, a train can bring the freight 62 miles (100 km) and a truck can go 19 miles (30 km), as shown in Figure 5.1.6.1.

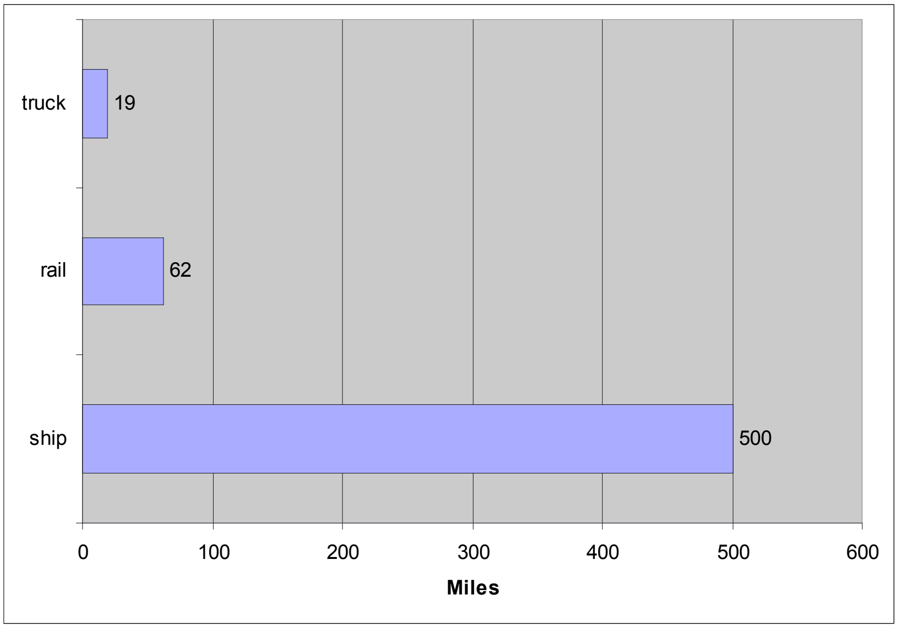


Figure 5.1.6.1: Miles Traveled on 1 Gallon of Fuel (10)

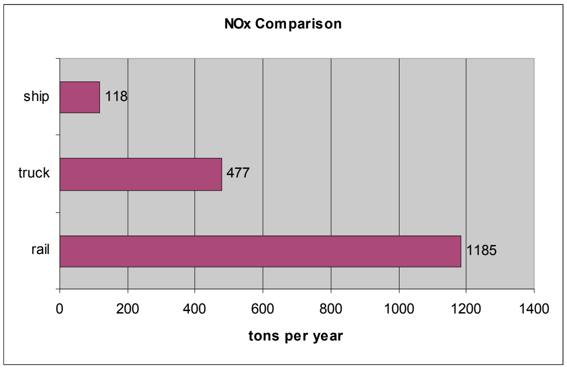
Marine transportation also is economical in the respect that it does not damage its waterways in the way that truck and trains destroy roads and rails. The Midwest states spend hundreds of millions of dollars annually to repair roads. This is due do weather wear and the large amount of truck traffic. Roads can take a finite amount of weight and use and once that is exceeded, they must be replaced. The same goes with railways, they can only take a certain amount of use and abuse before wearing. Water on the other hand, does not have a limit and can be used repeatedly and more economically than roads. One truck is equivalent to 10,000 – 20,000 cars with regards to pavement impact.

5.1.7 Environmental Impact

Of the three modes of transporting freight, ships have the superior fuel efficiency. Ships emit one-tenth the greenhouse gases of trucks and half that of trains. Therefore, ships are much better for the environment than other options of transportation.

A study done in 2004 (17) in the Cleveland Ohio region shows how marine transportation has far less emissions than trucks and rails carrying cargo from ships. The emissions evaluated in this study are: hydrocarbon (HC), oxides of nitrogen (NOx), carbon monoxide (CO), and particulate matter (PM listed as PM-10 and PM-2.5).

As seen in Figure 5.1.7.1, ships release much fewer harmful emissions than trucks and rail.



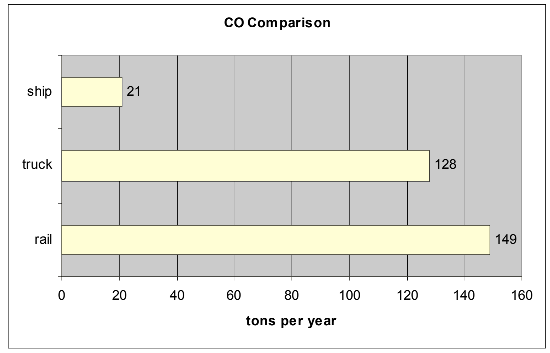


Figure 5.1.7.1: Annual Emission Comparisons Between Transportation Methods (17)

Many studies have repeatedly shown the environmental value of marine transportation. The major issue concerning US shipbuilders is how the environmental social value and saved roadway repair cost are translated to the shipbuilders and ship owners. Currently the European Union provides subsidies to shipbuilders and ship owners willing to enter the short sea shipping market. The large capital investment required to produce ships and moving cargo off the roads will require governmental incentives to make the business viable and profitable.

5.2 Current Great Lakes Markets

After a shipbuilding boom in the 1980's due to the Navy fleet buildup, American shipbuilding has declined in both domestic and international production (23). The Great Lakes region has lost a lot of its shipbuilding market to foreign countries and to U.S. Gulf Coast builders. In addition to the aging workforce and Jones Act requirements affecting the country, the Great Lakes shipbuilders have other production ailments and physical limitations when it comes to competing in the national and international shipbuilding markets.

Another issue that is unique to the Great Lakes is the fact that the Great Lakes are fresh water. This seems to be a trivial fact but ships that operate on the Great Lakes can last four to five times longer than an equivalent ocean going vessel. Currently Great Lakes ship owners are not replacing their vessels and have stated that they have no intention of replacing them in the future. To handle the increase in energy costs, ship owners are replacing the older, less efficient engines with modern efficient ones. Because of this, ship repair and conversion has a stable demand in the Great Lakes region and should increase in the coming years depending on changes in environmental regulations that may impact ship owners. The labor and technical skills within the GL region are well suited for this type of work.

5.2.1 Military

There is always need for military shipbuilding during wartime. However, after the mass amounts of ships are created, the industry demand plummets and the shipyards have much fewer contracts for new vessels. Additionally, the military tend to be conservative and will favor working with yards that they have worked with in the past. The exception is the current LCS vessel completed by Marinette Marine. The continuation of the LCS program is currently in negotiation within the Navy. Most news sources say that another LCS vessel will be unlikely.

5.2.2 Commercial

The commercial shipbuilding industry has faltered since government subsidies ended in 1981. Now, shipbuilders in the region are losing a big piece of their market with much of the foreign competition receiving subsidies averaging 30-35 percent of their construction costs. With low demand, and construction moving overseas to take advantage of cheaper labor, there is now a more stable future in ship repair. The exception has been in the luxury yacht building market. There are currently two major luxury yacht producers on the Great Lakes. The successful introduction of another in the region is low. A Jones Act tugboat is another potential opportunity for the Great Lakes. The issue is that the increased tugboat demand is being met and the GL shipbuilders would be late to entry in that market.

5.2.3 Current Ship Repair Opportunities on the Great Lakes

The need for ship repair is much greater than shipbuilding in the Great Lakes region, mostly because the Great Lakes ships have a far longer lifespan than ocean-going vessels. Corrosive salts in the ocean can make a vessel ineffective within 25 years. As a result, the demand for new ship construction has fallen, while demand for repair and refurbishing of the older vessels has risen. Additionally, repairs are done in the winter months on ships having to remain in the Great Lakes.

5.2.3.1 Military

The Great Lakes ship repair industry does not have the opportunity to work with military vessels with the exception of a few Coast Guard vessels. The repair business on the Great Lakes is only in commercial ship repair.

5.2.3.2 Commercial

Each winter, current shipyards are repairing and maintaining vessels that remain in the Great Lakes region or ones that are not able to travel out of the lakes due to freezing and seaway closings.

5.3 Gulf of Mexico Region Market

Much of the shipbuilding and repair jobs are being taken by Southern or Gulf of Mexico region shipyards, not leaving many options for the Great Lakes shipyards. Much of this has to do with the unionization law differences between the two regions, wage rates, easy of market entry due to better weather, proximity to the growing Gulf of Mexico oil industry (5,16), and congressional support.

5.4 National Market

The U.S. Market is much different than the Great Lakes market segment. In addition to the building of some commercial vessels, military contracts are important to the success of this industry.

A near problem for the country is an aging workforce. This does not provide a stable future for the American shipbuilding companies. The current nationwide average age of shipyard production workers is 42.1 years and large volumes of replacement workers are not readily available (1).

Although the present state of both military and commercial shipbuilding looks stagnant, there are plans to put new ships in the waters in military and commercial markets. This will be achieved through the MARAD Title XI program funding and the new Title IV of the Transportation Energy Security and Climate Change Mitigation Act of 2007 funding for domestic shipbuilding increase as well as an increased budget for military shipbuilding.

5.4.1 Military

In the 1980's, the U.S. shipyards thrived during the Navy fleet buildup. Since the need for Navy ships has declined lately, shipbuilders have had fewer new vessel contracts. However, new military projects are underway. All in the beginning stages of construction are the 300 Ship Navy as well we the Coast Guard Integrated Deepwater System (26).

The Navy plans to build 280 new vessels between 2007 and 2036. The Congressional Budget Office estimated the Navy would spend about $21 billion to carry out this plan. Table 5.4.1.1 shows how many of each type of ship will be built in each upcoming year. This will provide U.S. shipbuilders an increase in business.

Table 5.4.1.1: Long Range Naval Vessel Construction Plan (8)

	Near Term					Mid Term									Far Term															
Type/Class	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
Aircraft Carrier		1				1				1					1				1				1					1		
Surface Combatants	2		1	1	2	1	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Littoral Combat Ships	2	3	6	6	6	6	5	6	6	5														1	3	2	3	6	6	6
Attack Submarines	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	1	2	1	2	1	2
Cruise Missle Submarines																														
Ballistic Missle Submarines																1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Expeditionary Warfare Ships	1	1		1								1			1	1	1	2	1	1	2	2	1	2	1	1	1			1
Combat Logistics Force	1	1										1		1	2	2	2	2	3	3	2	1								
Mine Warfare Ships																														
Maritime Perpositioning Force (Future)			2	2	4	2	1																							
Support Vessels			1	1	1	1	2	2	1	1					1	2	3	2		1	1		1	2						
Total New Construction Plan	7	7	11	12	14	13	12	11	11	10	4	6	4	5	9	10	11	11	10	10	10	8	7	10	8	8	8	12	10	11

The Coast Guard's Integrated Deepwater System is a multi-year program to modernize and replace the Coast Guard's aging ships and aircraft, and improve command and control and logistics systems. It is an $11 billion contract which covers both marine and air vessel construction. The bulk of the ship construction is awarded to Northrop Grumman's Ingalls and Avondale shipyards. Subcontract work for smaller vessels will go to Bollinger Shipyards and Halter Marine. This benefits several Gulf Coast shipyards, providing no scheduled work for the Great Lakes shipyards.

When complete, the Integrated Deepwater System will include three classes of new cutters and their associated small boats, a new fixed-wing manned aircraft fleet, and combination of new and upgraded helicopters, and both cutter-based and land-based unmanned air vessels. All of these highly capable assets are linked with Command, Control, Communications and Computers, Intelligence, Surveillance and Reconnaissance (C4ISR) systems, and are supported by an integrated logistics regime.

The five types of cutter ships the shipbuilding industry will be constructing include Fast Response Cutter, National Security Cutter, Offshore Patrol Cutter, Long Range Interceptor, and Short Range Prosecutor.

5.4.2 Commercial

The national U.S. commercial market is limited by the Jones Act, which requires all vessels operating between U.S. ports are U.S. owned, built, and operated. This causes difficulties among the international commercial market, having operated exclusively in a protected domestic market; the U.S. shipbuilding industry has not implemented the best commercial processes necessary to compete in the international arena. Even though international shipbuilding is not a huge market for the U.S., there are hundreds of national commercial ship deliveries every year, as shown in Table 5.4.2.1 below.

Table 5.4.2.1: U.S. Commercial Vessel Deliveries, 2000-2006 (3)

Vessel Type	2000	2001	2002	2003	2004	2005	2006	Totals
Oceangoing Tankers	0	1	1	1	2	2	3	10
Oceangoing Cargo Ships	1	0	0	3	1	2	1	8
Large Tank Barges	0	1	11	11	9	6	10	48
Large Dry Cargo Barges	1	3	2	0	4	1	3	14
Semi-Submersible Drill Rigs	1	0	2	0	2	0	0	5
Jack-Up Drill Rigs	1	1	1	1	2	1	1	8
Offshore Service Vessels	27	22	31	34	32	15	14	175
Crewboats	19	20	22	19	11	19	15	125
Tugs	22	18	20	20	20	16	23	139
Towboats	13	21	15	16	25	21	42	153
Ferries & Other Passenger	10	11	13	21	20	12	12	99
All Other Self-Propelled	3	3	5	2	1	7	4	25
Subtotals	98	101	123	128	129	102	128	809
Commercial Fishing Vessels	95	113	71	14	5	1	0	299
Totals	193	214	194	142	134	103	128	1108

As a positive opportunity for the commercial market, legislation that would provide enough federal monies in loan guarantees to generate $2 billion worth of domestic shipbuilding over the next four years was voted out of the House Transportation and Infrastructure Committee. This provision was part of Title IV of the Transportation Energy Security and Climate Change Mitigation Act of 2007 (H.R. 2701). Introduced by Rep. James Oberstar (D-MN), the legislation would better integrate domestic short sea shipping (also known as America's Maritime Highway) into the nation's overall inter-modal transportation system. The overall aim of the bill is to reduce global warming through greater transportation efficiencies and conservation initiatives. Other maritime provisions in the final version that passed the House committee pertain to tax incentives to stimulate the use of U.S.-flag vessels in an effort to reduce congestion in the rail and highways systems. Other objectives focus on port and shipyard pollution. The actual amount devoted to loan guarantees is $100 million. Economic studies indicate that every $1 allotted for loan guarantees generates $20 worth of shipbuilding work.

5.4.2.1 OPA-90

A future opportunity for U.S. shipyards is the passing of OPA-90; enacted following the 1989 Exxon oil spill disaster (4). This legislation requires that all vessels carrying petroleum products in U.S. waters must be replaced with double-hulls by 2015. In addition to preventing and controlling oil spills, it will also control and prevent other hazardous substances. There are currently a large number of these smaller barges that will not meet the OPA-90 requirements and have to be replaced in the near future and could cause a U.S. shipyard capacity problem. Although the schedule for the new regulations has already been delayed several years and there is no precise implementation date released, it is the next logical progression and cannot be put off any longer. OPA-90 barge conversions and new building is a strong active business with the Great Lakes with Bay Shipbuilding leading the effort. They have invested in advance manufacturing capabilities that has enabled them to obtain a high level of productivity.

5.5 International Market

The U.S. shipbuilding industry is the world's largest in terms of sales volume due to Navy contracts, yet remains uncompetitive in the international shipbuilding market. The U.S. shipbuilding industry is responsible for only one percent of international shipbuilding as shown in Figure 5.5.1. Of that one percent, a huge portion is Jones Act vessels.

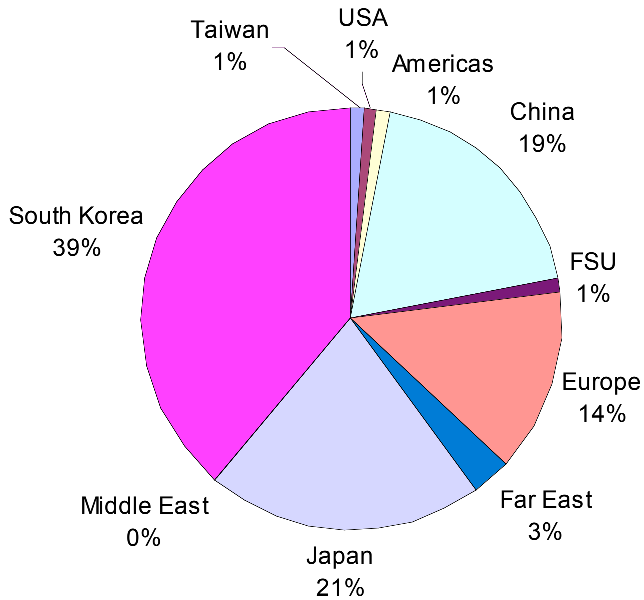


Figure 5.5.1: International Orders by Country of Build (As of 16 Aug. 2006) (3)

U.S. shipbuilding has been examined repeatedly in recent years with general agreement about the major findings. From the shipbuilders' perspective, the major problem is that too few large ships are being ordered and built; and from the perspective of buyers, the major problem is that large U.S. built ships cost too much. There is no consensus, however, about what can, or should, be done about the major problems nor about the relative importance of many related issues.

Historically, many vessels have been built at foreign yards, which have a cost advantage over U.S. shipyards because of lower wages, more innovative manufacturing techniques and government subsidies.

The commercial outlook for U.S. shipbuilders is poor. It is difficult to compete on the international commercial market due to high material and labor costs as well as lower productivity when compared to highly automated European and Asian yards. Additionally, U.S. labor issues such as union resistance to employee cross-training keeps labor costs high.

5.6 Non-Traditional Approach: Creation of Market Through High End Engineering; The Austal Model

Austal Limited, an Australian company, commenced operations in 1988 with a vision to build high quality commercial vessels for the international market. By the company's fifth anniversary, Austal had become the world's leading manufacturer of 40 meter passenger catamarans and the dominant supplier to Asia.

It was in Hong Kong as early as 1993, that Austal introduced gas turbine propulsion and the first two installations of the Austal developed motion control system. The success in Asia and the introduction of a range of sophisticated, large vehicle-carrying fast ferries were the springboard for ongoing growth in Europe, the Mediterranean and the Asia-Pacific.

Today, Austal is the world's largest builder of fast ferries and is proud to list amongst its customers many of the world's leading fast ferry and shipping operators.

Austal listed on the Australian Stock Exchange in December 1998 and has diversified its product base through acquisitions of local shipbuilders and the establishment of a new US shipyard in Mobile, Alabama.

In 1998 Austal entered the patrol boat market securing an order for eight Bay Class vessels for the Australian Customs Service. Sizeable orders from other Australian and International agencies, including the Royal Australian Navy, have cemented the company's place among the world's elite patrol vessel builders.

In 2001, Austal became the first company to supply the U.S. military with a high speed vessel, the Theatre Support Vessel (TSV).

In 2004, the US Department of Defense awarded a final design contract for the US Navy's Littoral Combat Ship (LCS) project to prime contractor Bath Iron Works, a General Dynamics company. Austal is the LCS seaframe designer and builder. The first order for a US $223 million prototype was successfully awarded to the General Dynamics/Austal Littoral Combat Ship Team in October 2005. A second order was received in late 2006.

The US Navy LCS is based on the same 127 meter trimaran hullform of a revolutionary fast ferry delivered in 2005 that not only provided full scale validation for the LCS proposal but, by showing increased passenger comfort in operation, adds a further impetus to the already strong interest being shown in trimarans by ferry and defense operators.

There is little doubt, Austal provides one of the most substantial product bases of any shipbuilder worldwide. This includes passenger and vehicle-passenger ferries, coastal combat ships, high speed military support vessels, patrol boats, cruise vessels, live-aboards, offshore crew/supply boats and private vessels.

Austal's success in aluminum ship building is based on the fact that Austal is a high skilled engineering company that builds high technology vessels, **not** a shipbuilder who supports itself through in-house engineering.

5.6.1 Austal Model for the Great Lakes

Advanced materials such as composites, thin steel and aluminum are the future of advanced shipbuilding for maritime markets. To work with these materials highly skilled and highly technical engineers, as well as highly skilled blue-collar workers, are required. Advanced materials also require advance manufacturing facilities, technology, and equipment.

If year round short sea shipping between eastern coastal ports and ports within the Great Lakes become a reality then a possible market could be created for a high performance, Great Lakes specific, multi-cargo vessel. Historically, the uniqueness of the Great Lakes has forced innovations, such as self-unloading bulk cargo vessels. These "Lakers" are unique to the Great Lakes. Similar innovation is needed today if shipbuilding is going to increase on the Great Lakes.

The Great Lakes region needs to design and build an advanced vessel that would be part of the total GL inter-modal supply chain. This vessel should be made of thin steel or aluminum. The Great Lakes region needs to create an engineering and manufacturing base to support the development, production, and servicing of such a product. Once the GL market is realized and the expertise are developed within the region then Great Lakes shipbuilding could compete in the global shipbuilding and military market. Pieces of this structure currently reside within the region but a unified plan and support is needed to put the pieces together.

5.7 Market Opportunity Summary and Potential Economic Impacts

In summary, the current and potential markets available to the Great Lakes are varied. Except for in a few cases where expansion of current businesses are justified, there is little reason to expand the shipbuilding base on the Great Lakes. Things could change if new markets are created. If short sea shipping, as part of an inter-modal component of the Great Lakes supply chain, becomes a reality then investing in new shipbuilding base with the region becomes viable. Even with a potential new market, competition between the Great Lakes region and Gulf Coast is a real problem and must be taken into consideration. A summary of the markets and the relative value to the Great Lakes shipbuilding are listed below:

1) Repair
   a) The Great Lakes should see an increased demand for repair and conversion for ships that operate within the Great Lakes. Due to winter closure of the Seaway non-Great Lakes ships will not seek repair in the Great Lakes unless an emergency occurs.
   b) The Great Lakes labor force is suited for this type of work.
   c) Current facilities and labor are sufficient for the increase.

2) General Commercial
   a) Except for the luxury and possibly tugboat markets, general commercial vessels are not sufficient for sustained industry unless a new market is created.
   b) Current competition within the US as well as international competition may be too large for the Great Lakes to overcome.

3) Jones Act Traditional (Standard Ship Types)
   a) Short term possibility due to increased demand
   b) Late market entry compared to other shipyards such as Aker American Shipping who builds traditional Jones Act ships in its Philadelphia Pennsylvania shipyard. It will be difficult for Great Lakes shipyards to catch up and gain market share.

4) Military
   a) Low probability for large Navy contracts given the history of the LCS program and the Navy acquisition practice.
   b) Coast Guard is currently doing work on Great Lakes and will most likely want to diversify risk by providing business to other US shipyards. Additionally the issues with the Deepwater Project will most likely cause the Coast Guard to focus on the traditional Navy shipbuilding shipyards.
   c) Not viable for industry growth due to inconsistent demand.

5) OPA-90
   a) High volume of work.
   b) Good short-term opportunity for existing Great Lakes facilities.
   c) Does not increase GL competitiveness since a large majority of OPA90 volume are double-hulled barges. The ability to build barges does not mean a company can build ships. A company that can build ships can also build barges and in most cases will build them efficiently.

6) Austal Model
   a) High risk due to the large number of unknowns.
   b) High potential if successful.
   c) The Great Lakes region has a large heavy industrial base which will provide the needed technical resources to make this venture a reality.
   d) Long term viability if successful since it is based on a new market, short sea shipping, and high technology requirement. The Austal model could not only create a new shipbuilding and naval architecture industry within the Great Lakes but a new shipping market as well.
   e) Large government funding, policy changes, and seaway operations changes are needed.
   f) A new shipyard with new facilities could also provide an opportunity to create new level-land facilities which are more efficient than traditional graving dock facilities.

6.0 Conclusions

This study has presented an overview of the history of shipbuilding on the Great Lakes, information concerning past shipyards and currently active shipyards, a study of the factors that impact shipbuilding on the Great Lakes and an analysis of potential shipbuilding and ship repair markets available to the Great Lakes.

The Great Lakes has had a rich history of shipbuilding but has never reached the critical mass that other areas of the country has with regards to shipbuilding volume and number of employees. There are many contributing factors that include seaway limits, labor issues, and facility challenges.

Twenty-three shipbuilding locations, which include past and present, have been identified. A major issue that the researchers faced when completing this task concerns the accuracy of public documents. Many inconsistencies were found in local and federal documents that are used to describe current shipbuilding facilities. Other inconsistencies were found within the companies themselves. Some shipyards provide information to this study that was inconsistent when compared to the company's own websites. These discrepancies have been addressed to the appropriate agencies and companies.

A market study was completed as part of this research study. The study concluded that there is sufficient capacity within the Great Lakes region for the existing demand. Local governments such as the ports of Toledo Ohio and Door County Wisconsin have invested large sums to improve the shipbuilding and ship repair businesses in those regions. It was not the goal of this study to evaluate those decisions but the assumption is that those investments are justified. Even though local areas have invested in additional shipbuilding and ship repair businesses it is the conclusion of the researchers that there is little proof that a large scale increase in Great Lakes shipbuilding would be justified. Competition within the U.S. presents an impressive barrier to the Great Lakes. Unless new markets are created or large productivity investments are made, an increase in Great Lakes shipbuilding is unrealistic. On the other hand the Great Lakes ship repair business should see an increase in the future.

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Appendix A: The Great Lakes / Seaway System - serving the world

The Great Lakes / Seaway System – serving the world

Sailing distances from Seaway ports to overseas destinations (statute miles)

	Antwerp	Bremen	Copenhagen	Helsinki	Le Havre	Lisbon	London	Marseilles	Naples	Rotterdam	Tangier	Tunis
Chicago	4858	4918	5178	5666	4644	4567	4817	5716	6047	4864	4305	5840
Cleveland	4141	4201	4461	4949	3927	3850	4100	4999	5330	4147	3588	5123
Detroit	4225	4285	4545	5033	4011	3934	4184	5083	5414	4231	3672	5207
Duluth	4951	5011	5271	5759	4737	4660	4910	5809	6140	4957	4398	5933
Green Bay	4732	4792	5052	5540	4518	4441	4691	4590	5921	4738	4179	5714
Hamilton	3959	4019	4279	4767	3745	3668	3918	4817	5148	3965	3406	4941
Indiana	4873	4933	5193	5681	4659	4582	4832	5731	6062	4879	4320	5855
Lorain	4154	4214	4474	4962	3940	3863	4113	5012	5343	4160	3601	5136
Milwaukee	4793	4853	5113	5601	4579	4502	4752	5651	5982	4799	4248	5775
Monroe	4241	4301	4561	549	4027	3950	4200	5099	5430	4247	3688	5223
Ogdensburg	3733	3793	4053	4541	3519	3442	3692	4591	5922	3739	3180	4715
Oshawa	3897	3957	4217	4705	3683	3606	3856	4755	5086	3903	3344	4879
Oswego	3841	3901	4161	4649	3627	3550	3800	4699	5030	3847	3288	4823
Thunder Bay	4829	4889	5149	5637	4615	4538	4788	5687	6018	4835	4276	5811
Toledo	4218	4278	4538	5026	4004	3927	4177	5076	5407	4224	3665	5200
Toronto	3929	3989	4249	4737	3715	3638	3888	4787	5118	3935	3376	4911
Valleyfield	3617	3677	3937	4425	3403	3326	3576	4475	4806	3623	3064	4599
Windsor	4225	4285	4545	5033	4011	3934	4184	5083	5414	4231	3672	5207

Approximate sailing distances between Great Lakes ports (statute miles)

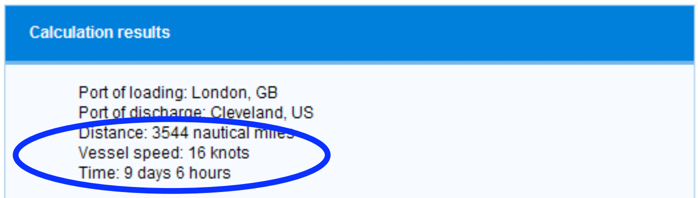
	Chicago	Cleveland	Detroit	Duluth	Green Bay	Hamilton	Indiana	Lorain	Milwaukee	Monroe	Ogdensburg	Oshawa	Oswego	Thunder Bay	Toledo	Toronto	Valleyfield	Windsor
Chicago																		
Cleveland	7 17																	
Detroit	633	84																
Duluth	808	810	726															
Green Bay	126	591	587	682														
Hamilton	899	182	266	992	773													
Indiana	15	732	648	820	279	94												
Lorain	704	13	71	816	578	195	719											
Milwaukee	65	652	568	743	180	834	80	639										
Monroe	617	100	39	765	491	282	632	87	552									
Ogdensburg	1125	408	492	1218	999	224	1140	421	1060	508								
Oshawa	961	244	331	1054	835	62	976	257	896	34	164							
Oswego	1045	380	412	1110	891	166	1032	313	952	400	108	56						
Thunder Bay	686	688	684	195	560	870	701	694	621	635	1096	932	988					
Toledo	640	77	62	733	514	259	655	64	575	23	485	321	377	611				
Toronto	929	212	256	1022	803	30	944	225	864	312	196	32	88	900	289			
Valleyfield	1241	524	608	1334	115	342	1256	537	1176	624	116	280	224	121	601	312		
Windsor	633	84	0	726	507	264	648	71	568	16	492	328	384	604	39	296	608	

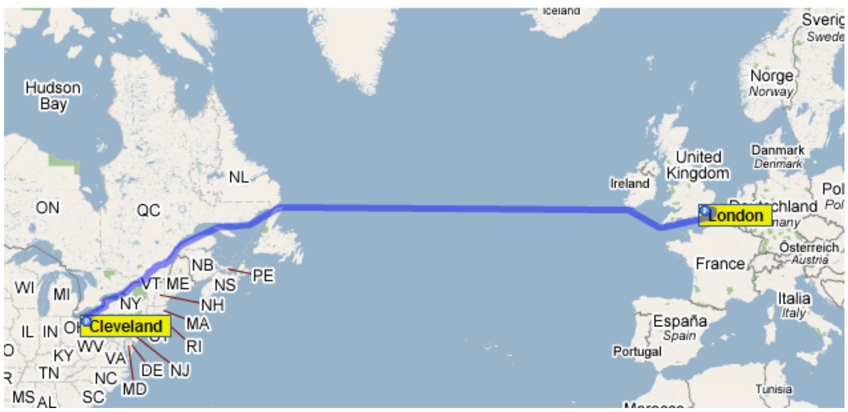
Percent of world ocean fleet able to use the St. Lawrence Seaway

Based on Length (L) Beam (B) and Draft (D)

	L-B-D	L-B
All ships	44.4%	69.0%
Freighters	61.2%	88.8%
Bulkers	9.2%	39.0%
Tankers	38.9%	49.7%

Appendix B: Water transit London – Cleveland

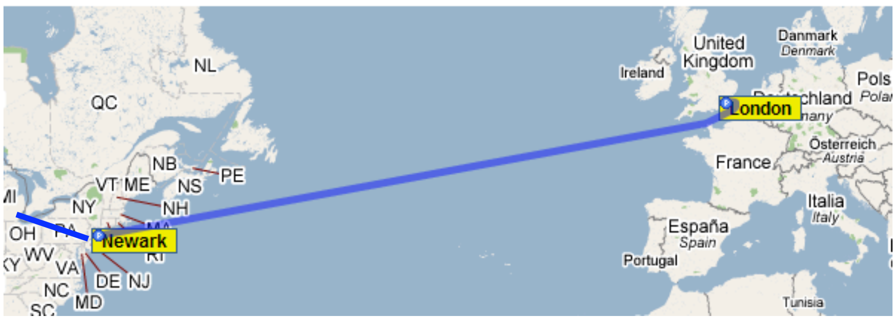




Appendix C: Water transit London - Newark & Train Newark – Cleveland

Calculation results

Port of loading: London, GB
Port of discharge: Newark, US
Distance: 3224 nautical miles
Vessel speed: 20 knots
Time: 6 days 17 hours



Service Schedules
Shipment Transit Times

Origin City, State:	NEWARK, NJ
Interchange Carrier:	
Destination City, State:	CLEVELAND, OH
Interchange Carrier:	CSXT
Service Date:	7/24/2007
Service Time:	00:01

Show Reverse Trip

Shipping Instructions Release Date	Shipping Instructions Release Cut-off Time	Delivery Date	Delivery Time	Total Time from Release to Delivery
Mon 7/23/2007	20:45	Tue 7/31/2007	18:30	7 days, 22 hours