ROSIE THE RIVETER NATIONAL HISTORICAL PARK, RICHMOND SHIPYARD HAER No. CA-326-M
NO. 3
(Rosie the Riveter National Historical Park, Kaiser Shipyard No. 3)
Rosie the Riveter WW II Home Front National Historical Park
Point Potrero
Richmond
Contra Costa County
California

PHOTOGRAPHS

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WRITTEN HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN ENGINEERING RECORD
National Park Service
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HISTORIC AMERICAN ENGINEERING RECORD

ROSIE THE RIVETER NATIONAL HISTORICAL PARK, RICHMOND SHIPYARD NO. 3
(Rosie the Riveter National Historical Park, Kaiser Shipyard No. 3)

HAER No. CA-326-M

Location:	Point Potrero, on the west side of Richmond's Inner Harbor, Richmond, California.
Date of Construction:	1942
Present Owner:	Port Authority/Richmond Redevelopment Agency Richmond, California
Present Use:	Port facility for importing automobiles and other maritime functions, like ship storage and repair
Significance:	Henry J. Kaiser's enterprise built and operated four shipyards at Richmond, California, for the U.S. Maritime Commission during World War II. Richmond Shipyard No. 3 is significant as the only one of the four Richmond shipyards that survives. The shipyard embodies the amazing accomplishment of American industries and American Home-Front workers in producing the ships and other materiel necessary for the military forces of the United States and its allies to defeat the Axis powers during World War II. Richmond Shipyard No. 3 has significant associations with the U.S. Maritime Commission, which oversaw the nationwide program to build emergency shipyards and then to equip and staff those shipyards so that record numbers of Liberty ships and other merchant vessels could be built in support of the war effort; with Henry J. Kaiser, one of the most remarkable of America's wartime industrialists for the extent of production by his enterprises; and with the important roles that wartime industries in the U.S. played in shaping the course of American society after the war, such as the opening of industrial work places to women and people of color.
Historian:	Fredric L. Quivik
Project Information:	In 2001, the Historic American Engineering Record (HAER) began assisting Rosie the Riveter World War II Homefront National Historical Park, a newly established National Park unit, by documenting associated significant structures within its immediate area. The project is a cooperative endeavor among: the California Coastal Conservancy, Mary Smalls, Project Manager;

the Richmond Redevelopment Agency, Gary Hembree, Project Manager; Rosie the Riveter World War II Homefront National Historical Park, Judy Hart, Superintendent; and the Historic American Engineering Record, Richard O'Connor, Project Leader.

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CHAPTER ONE: INTRODUCTION

This report surveys the history of World War II shipbuilding at Richmond Shipyard No. 3, which was part of the remarkable history of the four Kaiser shipyards that operated in Richmond during World War II. The shipyard's history is part of the even more remarkable history of the United States' nationwide accomplishments in shipbuilding during World War II, which added hundreds of ships to the U.S. Navy's fleet as well as building 5,777 merchant vessels (5,601 for the Maritime Commission and the remainder for private companies and foreign countries). The most spectacular records in merchant shipbuilding took place on the Pacific Coast, where 2,518 merchant ships were built, most of them by yards that did not exist when the war began in 1939. All told, the United States spent about $18,000,000,000 building Navy ships during the war and about $13,000,000,000 on merchant ships. Roughly half of the latter was paid to Pacific Coast yards. The Maritime Commission concentrated so much merchant shipbuilding on the Pacific Coast in part because more than half of the U.S. Navy's expenditures on new ships went to East Coast yards.[1]

Some sense of how unanticipated this record of accomplishment was, even on the eve of war, can be seen by examining a 1937 survey prepared by James Reed for the newly created United States Maritime Commission on the potential for an increased volume of shipbuilding on the Pacific Coast. The Maritime Commission was created because the U.S. shipbuilding industry was moribund, yet ominous international events portended war in both Europe and Asia, wars that might involve the United States. Reed inspected shipbuilding facilities on the Puget Sound, at Portland, on the San Francisco Bay, and around Los Angeles (including San Diego), and he sent questionnaires to shipbuilders in those areas. He reported that there had been no ocean-going ships built on the Pacific Coast, other than Naval vessels, in ten years. Nevertheless, he believed there was sufficient skilled labor (because of repair work and construction of small craft taking place in the West Coast yards, like building barges, tugs, fishing boats, and yachts) that all of the areas except Portland could support a modest shipbuilding program. Because of the existing activity, there were enough welders, machinists, carpenters, and electricians to support expanded shipbuilding, but draftsmen, loftsmen, and shipfitters would be in short supply. The San Francisco Bay, with substantial shipyards at San Francisco, Oakland, Alameda, and Mare Island, was the only area on the Pacific Coast that had facilities for building ocean-going merchant vessels; all the other areas would require construction of new facilities.[2]

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[1]Fredric C. Lane, *Ships for Victory: A History of Shipbuilding under the U.S. Maritime Commission in World War II* (Baltimore: The Johns Hopkins University Press, 2001 reprint of the 1951 edition), 3, 8-9; Gerald J. Fischer, *A Statistical Summary of Shipbuilding under the U.S. Maritime Commission during World War II*, Historical Reports of War Administration, U.S. Maritime Commission No. 2 (Washington, DC: Government Printing Office, 1949), 39.

[2]James Reed, "Pacific Coast Survey of Shipbuilding Facilities and Labor Supply for U.S. Maritime Commission," unpublished report dated September 1937, in National Archives and Records Center, Archives II, College Park, MD (hereinafter cited as NARA), RG-178, Records of the United States Maritime Commission, entry 28, box 159.

Despite that dire outlook, the Maritime Commission, prodded by the necessities of war and encouraged by the almost outrageous promises of Henry J. Kaiser and his associates (most of whom had no experience in building ships), allocated billions of dollars to the building of shipyards and ships on the Pacific Coast. By the end of the war, the Maritime Commission had spent more money on shipbuilding in the Pacific Coast region than in any of the other three regions (East Coast, Gulf Coast, Great Lakes), more people were employed in shipbuilding than in any of the other regions, the Pacific Coast yards built more merchant ships than any of the other regions, and the productivity of the Pacific Coast shipyards and their workers was generally higher than productivity in any of the other regions. Kaiser developed and operated more shipways and his companies built more ships than any other managerial group in the nation, whether old-line shipbuilders, like Bethlehem, or groups new to shipbuilding, like Bechtel. Kaiser's shipyard at Portland, Oregon (a port which the 1937 Maritime Commission said had an insufficient labor supply to support a shipbuilding program), grew to employ over 30,000 workers, who established the best record for productivity of any shipyard in the country. Richmond, California, which had no shipyards at all prior to the war, produced more merchant ships during World War II than any other city in the U.S. Oregon Ship and Richmond Shipyard No. 2 were able to build Liberty ships at a lower cost per ship than any other yard in the nation except the North Carolina Shipbuilding Corporation yard at Wilmington, North Carolina.[3]

The report that follows offers some overview comments on the nationwide merchant shipbuilding program, but a thorough nationwide history is well beyond the scope of this study. Rather, the nationwide program is surveyed, as appropriate, only to provide context for understanding the history of the Richmond yards. (Moreover, Frederic Lane's exceptional 1951 history of the Maritime Commission's shipbuilding program has recently been re-issued by the Johns Hopkins University Press.[4]) The focus of this history is on the shipyards in Richmond, where the National Park Service is developing the new Rosie the Riveter/World War II Home Front National Historical Park. Special attention is given to Yard No. 3, the sole surviving Richmond shipyard. The report concludes with a description of the present condition of Yard No. 3.

CHAPTER TWO: HISTORICAL CONTEXT FOR KAISER'S RICHMOND SHIPYARD NO. 3

> The shipbuilding program, which started out in 1937 to be an orderly production of 500 ships in ten years, has mushroomed into an enormous project with a total of 1383--nearly 1400--vessels of all types, either contracted for or proposed, the great bulk of them to be completed and delivered by the end of 1943.

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[3]Lane, *Ships for Victory*, 207-210, 469-471, 475, 644, 826-829; Fischer, *A Statistical Summary of Shipbuilding*, 152-154.

[4]See footnote 1.

> From one ship a week in the original program, we now plan on delivery into service of approximately two ships a day throughout 1942 and 1943.
>
> And those ships will be built on time! There is no question about that, for we are more than a month ahead of schedule now. Probably no other nation in the world could adapt itself to such rapid expansion of an industry that was virtually dormant four or five years ago. At that time there were about ten shipyards in the United States, in some degree of activity, which were large enough for the construction of 400-foot ocean-going ships. Those yards had a total of 46 ways and a large proportion of them was being used for naval construction. A little later this year there will be in full operation in the United States 32 shipyards, with a total of 234 ways, devoted entirely to the construction of ocean-going merchant ships of some type.
>
> J.E. Schmeltzer, August 1941[5]

Richmond Shipyard No. 3 is one of four shipyards that Henry J. Kaiser's enterprise operated at Richmond during World War II (see HAER No. CA-326-L for more information on the Richmond shipyards). The Richmond shipyards were four among several others along the West Coast that the Kaiser organization operated either by itself or with other large business enterprises during the war. That empire of Kaiser shipyards was in turn part of a spectacular array of new and expanded shipyards that a relatively new federal agency, the U.S. Maritime Commission, brought into being in World War II. America's amazing record in shipbuilding was just one of several accomplishments stemming from the nation's unsurpassed ability to mobilize its industry during the war to produce ships, weapons, ammunition, vehicles, and supplies for its fighting forces and those of its allies. A key aspect of America's ability to out-produce its enemies during World War II grew out of the government's decision, even before the U.S. formally entered the war, to devote considerable resources, especially early in the industrial mobilization drive, to expand the nation's industrial infrastructure. Between July 1940, when the government's emergency spending began, and the war's end in 1945, $25,790,000,000 was invested in new industrial plants and equipment. Of that total, the federal government financed two-thirds ($17,170,000,000), and the remaining one-third was privately financed.[6]

For more information on the grand strategy to win the war by out-producing the Axis powers, see the HAER report on the Ford Assembly Plant, HAER No. CA-326-H. Suffice it to say that America's grand strategy would play a major role in shaping the history of California, which in turn has, since World War II, played in major role in shaping the history of the United

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[5]Schmeltzer quoted in "Epic of the Liberty Shipyards," *Marine Engineering and Shipping Review* 47 (April 1942): 181. Schmeltzer was the Director of the Maritime Commission's Division of Emergency Ship Construction.

[6]Robert Higgs, "Private Profit, Public Risk: Institutional Antecedents of the Modern Military Procurement System in the Rearmament Program of 1940-1941," in *The Sinews of War: Essays on the Economic History of World War II*, ed. Geoffrey T. Mills and Hugh Rockoff (Ames: Iowa State University Press, 1993), 180.

States. California contractors received 17.3 percent of the $29.7 billion the U.S government spent on shipbuilding during the war and 15.6 percent of the $59.3 billion the government spent on aircraft during the war. For those two sectors, California received more than any other state.[7]

Throughout the 1930s, Congress and the Roosevelt administration recognized that a depressed shipbuilding industry in the U.S. was putting the nation at a competitive disadvantage with other industrial powers. As the world appeared to be moving toward war in the late 1930s the depressed state of the industry also threatened to put the nation at a military disadvantage. Congress created the U.S. Maritime Commission in 1936 with funding and authority to expand both the size of the United States' fleet of merchant vessels and the capacity of the nation's shipbuilding industry. As a consequence, there were thirty-eight shipyards in U.S. in 1939 capable of building ocean-going ships. Those yards had a total of 120 shipways of 300 feet or more, and they employed a total of 120,000 workers, virtually all of whom were men. By 1944, the U.S. had increased its shipbuilding capacity, at a cost of $2,800,000,000, to eighty-four yards operating a total of 614 ways and employing a total of 1,700,000 workers, many of whom were women.[8] The following tables show how deliveries of merchant ships by U.S. shipbuilders increased during the war years:

Merchant Ships Produced by American Shipyards, 1936-1944[9]

Year	No. of Ships	Deadweight Tons
1936	9	107,938
1937	18	194,788
1938	25	289,765
1939	28	341,219
1940	55	641,056
1941	99	1,137,163
1942	746	8,089,732
1943	1,896	19,238,626
1944	1,677	16,348,446

[7]Paul H. Anderson, *State, Regional, and Local Market Indicators, 1939-1946* (1948), table reproduced in Paul Rhode, "California in the Second World War: An Analysis of Defense Spending," in *The Way We Really Were: The Golden State in the Second World War*, ed. Roger W. Lotchin (Urbana: University of Illinois Press, 2000), 95.

[8]John G.B. Hutchins, "History and Development of the Shipbuilding Industry in the United States," in *The Shipbuilding Business in the United States of America*, vol. I, ed. F.G. Fassett, Jr. (New York: The Society of Naval Architects and Marine Engineers, 1948), 58.

[9]"Merchant Shipyards Deliver 1677 Ships of 16,348,446 Tons in 1944," *Marine Engineering and Shipping Review* 50 (January 1945): 148.

Deadweight Tons of Dry Cargo Merchant Ships and Tankers Delivered by American Shipbuilders during World War II[10]

Year	Deadweight Tons Delivered Dry Cargo Ships	Tankers
1940	402,000	239,000
1941	740,000	426,000
1942	6,949,000	990,000
1943	15,140,000	3,421,000
1944	12,009,000	4,024,000

In addition to merchant shipping, American shipyards greatly expanded their capacity for building large naval vessels. This tremendous expansion in shipbuilding was part of the United States' even larger mobilization of its industrial capacity for the production of munitions of all kinds. Between July 1940, when government emergency spending for the war began, and July 1945, the government spent $186,000,000,000, of which 21.9 percent was for ships. Peak expenditures (and peak production) occurred during the third quarter of 1943.[11] The following table shows how the government apportioned its spending among various categories for the war effort:

U.S. Munitions Production, 1 July 1940 - 31 July 1945[12]

Aircraft	23.9%
Ships	21.9
Other Equipment and Supplies	20.5
Combat and Motor Vehicles	11.6
Ammunition	10.6
Guns and Fire Control	5.8
Communications and Electronic Equipment	5.7
Total	**100.0**

This chapter provides some historical context for the construction and operation of the Kaiser shipyards in Richmond, including a summary of America's shipbuilding experience prior

[10]Hutchins, "History and Development of the Shipbuilding Industry in the United States," 58.

[11]Alan Gropman, "Industrial Mobilization," in *The Big 'L': American Logistics in World War II*, ed. Alan Gropman (Washington, DC: National Defense University Press, 1997), 59.

[12]Gropman, "Industrial Mobilization," 59.

to World War II, an overview of Henry J. Kaiser's career, and a description of the Richmond waterfront where Kaiser built the four shipyards.

A. U.S. Shipbuilding Prior to World War II

The year 1844 marked the beginning of building ships of iron in the United States. Robert L. Stevens built a steamboat of iron at his yard at Hoboken, New Jersey. That same year, the Betts, Harlan & Hollingsworth yard near Wilmington, Delaware, built three iron hulls. The use of wrought iron for hulls of steamboats on American rivers was well established by the mid-nineteenth century, but American shipyards continued to rely primarily on wood for ocean-going ships until well into the second half of the century. The U.S. had an ample supply of timber, and the nation's iron and steel industry had yet to advance to the levels of European countries. Development of iron and steel structures for ocean-going ships took place primarily in Europe and especially Great Britain, both in England and Scotland. Yards there were building iron steamships as early as 1820, and they reached a milestone in 1858 with the construction of the *Great Eastern*, an all-iron steamship with a tonnage four time greater than any other ship of the time. The ship was large so that it could carry sufficient coal to travel long distances without refueling, thus enabling it to compete with large clipper ships. Some American shipyards began to produce iron and steel ships in the 1870s, but the material did not become dominant until after 1880.[13]

During the late nineteenth century, the U.S. and the industrialized world continued the transition from building wooden ships to building ships of iron and steel. By the outbreak of World War I, the use of wood for building the hulls of large commercial ships had nearly ended, receiving a reprieve only because of the temporary wartime spike in demand for new ships. Even though the shipping industry had largely converted to steam for motive power, many in this last generation of wooden commercial ships even featured masts and sails and relied on the wind to power their movement through water. In general, however, both navies and commercial lines in the early twentieth century were fully committed to buying steel-hulled ships that were driven by propellers (screws) and powered by steam. Triple-expansion steam engines had become the norm in commercial and military ships built after 1890, and beginning in 1894 warships and passenger liners, which required higher speeds, often employed steam-turbine engines. As the shipbuilding industry made the transition from traditional wood and wind to industrial steel and steam, so too did the overall character of the industry move from shipyards owned and operated by individuals to shipyards owned and operated by corporate entities controlled by outside investors. The largest American company to grow out of the restructured shipbuilding industry was Bethlehem Shipbuilding Corporation, formed by the 1917 consolidation of five yards owned by Bethlehem Steel, which had become a major supplier of steel for shipbuilding. The yards were at Quincy, Massachusetts; Baltimore, Maryland; San Francisco (the old Union Iron Works

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[13] A.J. Dickey, "Development of Steel and Iron Shipbuilding in America," *Pacific Marine Review* 41 (January 1944): 77-79, (March 1944): 70-72, and (April 1944): 74-75; E.F. Kenney, "The Development and Use of Steel in Shipbuilding," *Historical Transactions, 1893-1943* (New York: The Society of Naval Architects and Marine Engineers, 1945), 442-446.

yard); Wilmington, Delaware; and Carteret, New Jersey.[14]

With the transition to steel ships, the shipbuilding process also changed, drawing upon skills and methods from the steel industry. Typical of plants in heavy industry at the turn of the century, shipyards, their owners, and their engineers adopted layouts of ways and buildings that facilitated efforts to rationalize operations increasingly characterized by mechanization. Older shipyards had featured steam-powered machine tools driven by belts and line shafts, but late in the nineteenth century compressed air and electricity became more prominent means of driving mechanized operations, especially because they offered more flexibility than belts and line shafts. Shipyards added a new array of machine tools, including planers, punches and drills, flangers, shears, and rolls, to fashion hulls, decks, and cabins from steel plate and sections. Giant riveting machines and associated mechanized hand tools, like hammers and chisels, extended the reach of mechanization in shipyards. Another important new task associated with the use of steel was the bending of structural members for use in the frame, a job that took place on the bending slab (see description of the bending slab in chapter V, section A). Yard layout featured spaces devoted to steel storage and fabrication, arranged in sequential order leading to assembly on the ways. Shipbuilders also expanded their reliance on sub-contractors to supply components like boilers, turbines, propellers, pumps, and winches. Perhaps the most important type of mechanization was the increased use of cranes for lifting heavy parts and equipment. Prior to the 1880s, shipyards used block-and-tackle, gin poles, and human or animal power to lift heavy objects. With wider use of steel and steam power, however, gantry cranes become prominent visible features of shipyards, and their ability to pivot and to move laterally helped shape the configuration of shipyard layouts (see section chapter V, section C, on whirley cranes).[15]

1. Shipbuilding during World War I

With the outbreak of World War II and the accompanying increase in America's production of merchant shipping, many observers drew comparisons with World War I, recognizing that the nation's output in the second war would certainly outstrip what shipyards had accomplished in the first.[16] The comparison was and is important as well because of the experience the nation gained during the first war in government sponsorship of a massive increase in shipbuilding and because many of the shipbuilding methods that came to fruition so spectacularly in World War II, like welding and pre-assembly, had their germs in the World War I era.

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[14]Hutchins, "History and Development of the Shipbuilding Industry in the United States," 40-41, 46-49; Cedric Ridgely Nevitt, "American Merchant Steamships," in *Historical Transactions, 1893-1943*, 54-73.

[15]Hutchins, "History and Development of the Shipbuilding Industry in the United States," 49-51.

[16]"American Shipbuilding in the Two World Wars," *The Marine Engineer* 65 (January 1942): 17-18.

Prior to World War I, the shipbuilding industry in the United States had adopted many of the above methods associated with the use of steel, but the domestic industry had had difficulty competing with Great Britain and Germany. The exigencies of war thrust a surge in demand upon the U.S. and its shipbuilders. Industry yards increased their output of both naval and merchant ships even before the U.S. entry into the war in 1917 and the government chartering the Emergency Fleet Corporation, of which the U.S. Shipping Board, a government agency, retained sole ownership. As a result of government and other orders, shipbuilding in the U.S. ballooned from 337,683 deadweight tons (deadweight is the total weight of water, fuel, stores, cargo, passengers and crew that a ship can carry) in 1915 to 1,951,302 deadweight tons in 1918. Correspondingly, the number of shipyards grew. In August 1917, there were thirty-seven yards in the U.S. capable of building steel ships, and a year later there was more than twice that many (and the number of yards building wooden ships quadrupled). In August 1918, yards for building steel ships had 410 ways completed and an additional sixty-three still under construction. Because of ships that were under construction due to orders issued during the war, U.S. output continued to increase after the war, despite cancellation of orders for thousands of ships that had not been built.[17] The following table shows annual deliveries of new merchant ships for the years 1915-1921:

Deadweight Tons of Ships Delivered by American Shipbuilders As a Result of World War I[18]

Fiscal Year	Deadweight Tons Delivered
1915	337,683
1916	488,119
1917	996,718
1918	1,951,302
1919	4,989,931
1920	5,694,567
1921	2,863,465

The boom in shipbuilding left American merchant fleets with an ample supply of vessels, leading to a precipitous decline in shipbuilding that lasted for more that a decade.[19] The World War I

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[17]Hutchins, "History and Development of the Shipbuilding Industry in the United States," 51-55; Ralph A. Graves, "Ships for the Seven Seas: The Story of America's Maritime Needs, Her Capabilities and Her Achievements," *National Geographic* 34 (September 1918): 180.

[18]Hutchins, "History and Development of the Shipbuilding Industry in the United States," 52-53. A comparable table appears in "American Shipbuilding in the Two World Wars," *The Marine Engineer* 65 (January 1942): 17. It is arranged by calendar year rather than fiscal year, showing the peak production in 1919, rather than fiscal year 1920. It also shows gross tons, rather than deadweight tons.

[19]Hutchins, "History and Development of the Shipbuilding Industry in the United States," 53.

experience would have a great influence on decisions made by the U.S. government as the clouds of war again appeared in the late 1930s. Oversupply of shipping capacity caused by World War I left the U.S. with a decimated shipbuilding industry in the 1930s, and the government learned several lessons about sponsoring private shipbuilding. Both of these matters are discussed subsequent chapters.

Details of the World War I program presaged aspects of the World War II program that claimed greater attention. For example, the government in World War I helped to expand existing yards and build new ones, to procure materials, to recruit and train new workers, to build housing for shipyard workers, and to finance each of these programs. Such a wartime effort entailed, for the first time in U.S. history, the pre-fabrication of components and the standardization of ship designs to facilitate prefabrication. Standardization did not occur nationwide as in World War II, however. Rather, each shipyard designed its own standardized ship, which it could build in multiple copies. Inland plants not only produced machinery for use on ships but also fabricated pieces of hulls. Inland shops cut, bent, rolled, and punched steel plates and shapes. The shipyards themselves became more specifically sites for assembly and erection. One of the areas that benefited especially from the government's programs during World War I was the West Coast, which had heretofore been the scene of relatively little steel shipbuilding. Expansion of shipbuilding capacity was especially noteworthy in Portland, Seattle, and Tacoma.[20]

The largest of the new World War I shipyards was built at Hog Island, just outside Philadelphia where the Philadelphia International Airport is now located, at a cost of $65,000,000.[21] The Hog Island yard had fifty ways and a $230,000,000 contract to build 180 ships. Construction of the shipyard began in October 1917. The keel for Hog Island's first ship, the *Quistconck*, was laid on 12 February 1918, and the ship was launched on August 5th. When the war ended in November 1918, the government cancelled some of the ships it had ordered from Hog Island, but the yard still produced 122 ships, of which 110 were the standardized Hog Island vessel, rated at 7,600 deadweight tons. The yard completed the last of its wartime orders on 29 January 1921. Peak employment at Hog Island reached more than 30,000. One of Hog Island's major problems at the outset had been a tremendous turnover rate among its workers. Morale was very low because of poor working conditions and poor responses by management to grievances. During the worst period, Hog Island was hiring each week as much as seven times the number of workers who remained on the payroll at week's end. By the end of the war, managers at Hog Island developed a much improved grievance system, resulting in a reduction of the turnover rate.[22]

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[20]Hutchins, "History and Development of the Shipbuilding Industry in the United States," 52-54, 57.

[21]Contemporary accounts stated that the government spent $35,000,000 building Hog Island; see Edward N. Hurley, "The American People Must Become Ship-Minded," *National Geographic* 34 (September 1918): 200; Graves, "Ships for the Seven Seas," 186. A history of U.S. shipbuilding published after World War II, however, put the cost at $65,000,000; see Hutchins, "History and Development of the Shipbuilding Industry in the United States," 53.

[22]Hutchins, "History and Development of the Shipbuilding Industry in the United States," 53;

Hog Island and other standardized yards featured a rationalized flow of materials from the point of delivery by rail to the point of assembly on the ways. The design featured a large storage area near the point of delivery for steel and manufactured parts and equipment, a large assembly area for prefabricating components, and ample cranes (both overhead and gantry) and rail connections for the efficient movement of materials from stage to stage and eventually to the ways for erection. These features sound similar to those found at Kaiser's Richmond yards and others of the World War II era, but they differed in scale and scope. It typically took between ten and twelve months for World War I yards to build a standardized cargo ship, although several shipyards made special efforts to set records for speed in building merchant ships in less than a month, just as Kaiser would do during World War II. One of the yards to hold a record during World War I was Bethlehem Shipbuilding Corporation's yard in Alameda, California, which built the 12,000-ton, 457' *Invincible* in twenty-four days. The shipyards constructed to build standardized ships during World War I were designed specifically for ships of a particular design. They had little flexibility for building ships of other designs.[23]

Because Hog Island was so huge and its methods were considered so advanced for the time, it was the subject a quarter-century later of many comparisons with World War II yards. The Maritime Commission's Admiral Vickery drew one set of comparisons between Hog Island and the Oregon Shipbuilding Corporation's yard at Portland, built and operated by the Henry J. Kaiser organization and considered by the Maritime Commission to have achieved the best record in World War II. Hog Island, with fifty ways, had cost $65,000,000 to build; Oregonship, with eleven ways, had cost less than $20,000,000. In the year after its first keel was laid, Hog Island delivered five ships; Oregonship delivered thirty. In its second year, Hog Island delivered sixty-six ships; during the first ten months of its second year, Oregonship delivered 150. During the peak of production at Hog Island, ships averaged 225.8 days from keel laying to delivery; during January 1943 at Oregonship, ships averaged 32.5 days from keel laying to delivery.[24]

2. U.S. Maritime Commission

Philip Lemler, "Multiple Yards--Record and Prospect," in *The Shipbuilding Business in the United States of America*, vol. I, ed. F.G. Fassett, Jr. (New York: The Society of Naval Architects and Marine Engineers, 1948), 226-227; Graves, "Ships for the Seven Seas," 185-186; Hurley, "The American People Must Become Ship-Minded," 200-211; Charles M. Schwab, "Our Industrial Victory," *National Geographic* 34 (September 1918): 212-229; Philadelphia War History Committee, *Philadelphia in the World War, 1914-1919* (New York: Wynkoop Hallenbeck Crowford Company, 1922), 379-380; Benjamin W. Labaree, William M. Fowler, Jr., John B. Hattendorf, Jeffrey J. Safford, Edward W. Sloan, and Andrew W. German, *America and the Sea: A Maritime History* (Mystic, CT: Mystic Seaport Museum, Inc., 1998), 502-506.

[23]Hutchins, "History and Development of the Shipbuilding Industry in the United States," 53-55; Graves, "Ships for the Seven Seas," 183; Schwab, "Our Industrial Victory," 213-214.

[24]Howard L. Vickery, "Shipbuilding in World War II," *Marine Engineering and Shipping Review* 48 (April 1943): 187-188.

After U.S. shipyards completed the orders for new ships following World War I, the industry went into severe depression because of an oversupply of shipping capacity. Over the next two decades there were some important technological changes in ships and shipbuilding, but there was little incentive for American shippers to avail themselves of such improvements because the U.S. government continued to sell its surplus ships at prices near scrap value. Most American shipyards were liquidated, and the few that survived did so doing limited custom work for the U.S. Navy. Market factors were different in Europe and Great Britain, and shipyards there adopted improved designs. Steam-powered ships had geared turbine propulsion systems instead of triple-expansion steam engines. Another new design featured the diesel engine, which, although heavier and more expensive than a steam engine, used less fuel and occupied less space in the ship. Diesel engines were especially popular among designers and builders of passenger liners.[25]

Alarmed at the potential consequences of diminished shipbuilding capacity, Congress began to try to stimulate the industry in 1928 with passage of the Merchant Marine Act, which re-established the merchant marine and offered shipping lines contracts featuring graduated rates, that is lower rates for cargo and mail shipped in smaller, slower boats and higher rates for cargo shipped in larger, faster vessels. The graduated rates were aimed at stimulating the purchase and construction of more modern ships. The program had limited success, leading to the building of only forty-one ships totaling 480,000 gross tons (the measure of gross tons is derived by taking the total volume of a ship in cubic feet, minus certain spaces within the ship that by law may be excluded from the calculation, and dividing by 100). From the beginning of 1922 through the end of 1936, American yards built ships, not counting Great Lakes vessels, totaling barely more than 1,000,000 gross tons, joining Germany, France, Japan, and Italy as nations whose shipbuilders built between 1 and 2 million gross tons of shipping in that span. Great Britain was far ahead of the rest, having built ships totaling nearly 10,000,000 gross tons during those years.[26]

Congress passed another Merchant Marine Act in 1936, this time creating a five-member U.S. Maritime Commission and empowering it to modernize the nation's merchant fleet, which it would do through the distribution of subsidies granted to both domestic shipping lines and shipbuilding companies. The grants to shipping companies were intended to help them pay the costs of operating more expensive new ships, and the grants to shipbuilders were intended to underwrite costs and thereby bring prices of American-built ships down to levels of other nations in the world market. The first chairman of the Maritime Commission, Joseph P. Kennedy, inaugurated a fairly limited program to build seventy-five new ships. After two years, he resigned upon his appointment as U.S. Ambassador to England, and in his place President Franklin D. Roosevelt appointed an old friend and decorated naval officer, Adm. Emory Scott Land. Their relationship dated back to the 1910s, when FDR had been Assistant Secretary of the

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[25]Hutchins, "History and Development of the Shipbuilding Industry in the United States," 55-56.

[26]Hutchins, "History and Development of the Shipbuilding Industry in the United States," 56-57.

Navy and Land was an officer in the Navy's Bureau of Construction and Repair. FDR appointed Land chief of that bureau in 1933. By the time of Land's appointment to the Maritime Commission, Europe and Asia were again moving toward war, and the U.S. government gradually began making preparations for that possibility, including increasing the shipping tonnage available for moving cargo overseas. To meet the possibility of war, the Maritime Commission embarked on a program to build 500 ships in ten years.[27]

In conjunction with its program to subsidize the building of ships, the Maritime Commission developed standardized designs for the cargo ships it would build. There were three basic types, the C-1, C-2, and C-3. About these ships, Admiral Land wrote:

> The Maritime Commission is not building spectacular ships. It is not building superliners. It is building fast, modern, safe, and to repeat the word, "efficient" ships which will give American shippers and American travelers the most in service with the least in unnecessary gadgets.[28]

The C-1 was a relatively slow cargo ship, not fast enough to qualify as a Navy auxiliary ship but fast enough, the Maritime Commission decided, for certain trade routes. The C-2 was a cargo ship of about the same capacity but faster than the C-1. The C-3 was the largest and the fastest of the three and also could be ordered as either a cargo ship or a combination cargo and passenger ship. The table below shows the basic characteristics of the three types:[29]

Type	**Length**	**Deadweight Tonnage**	**Design Speed in Knots**
C-1	417'-9"	9,075	14
C-2	459'-6"	8,794	15.5
C-3	494'	12,500	16.5

The Maritime Commission specified steam-turbine engines for most of the C-type cargo ships, but had diesel engines put in some of them. The first two C-2 ships were delivered to the Maritime Commission in summer 1939, one by Sun Shipbuilding and Dry Dock Company of

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[27]M.B. Palmer, *We Fight With Merchant Ships* (Indianapolis and New York: The Bobbs-Merrill Company, 1943), 86-89; Hutchins, "History and Development of the Shipbuilding Industry in the United States," 57; Lane, *Ships for Victory*, 10-13; Labaree, et al, *America and the Sea*, 536, 541-542.

[28]Emory S. Land, "Building Ships with the Maritime Commission," *Marine Engineering and Shipping Review* 44 (August 1939): 356.

[29]"A Description of the C-3 Type Cargo Carriers Building for the U.S. Maritime Commission at the Moore Dry Dock Company, Oakland, California," *Pacific Marine Review* 36 (February 1939): 32-36; "C-1 Vessels of the U.S. Maritime Commission," *Pacific Marine Review* 36 (September 1939): 24-28; J.E. Schmeltzer, "Machinery for Commission Vessels," *Marine Engineering and Shipping Review* 44 (August 1939): 360-361; Lane, *Ships for Victory*, 27-28.

Chester, Pennsylvania, and one by Federal Shipbuilding and Dry Dock Company of Kearney, New York. Shipyards delivered more of the ships in 1940, and one of the first C-3s, the *Sea Fox*, powered by a steam-turbine engine, exceeded its design speed by three knots during its sea trials.[30]

As the Maritime Commission began its program, there were few active shipyards in the U.S., and they were concentrated on the East Coast. The largest of them had barely been able to stay solvent on a few contracts with the Navy or because of their connections with other facets of a larger corporate enterprise. Bethlehem Steel, which emerged from World War I in a strong position, retained its prominence in the industry during the depressed years of the 1920s and 1930s. Its yards at Fore River in Quincy, Massachusetts, at Sparrows Point near Baltimore, and on Staten Island still built ships, and repair facilities on both coasts added to its capacity. To gain some of the new Maritime Commission work, Bethlehem reopened its Union Iron Works yard in San Francisco. Newport News Shipbuilding and Dry Dock Company in Virginia and the New York Shipbuilding Company at Camden, New Jersey, had relatively long histories of building all sorts of big ships, including battleships for the Navy. The Federal Shipbuilding and Dry Dock Company at Kearney, New Jersey, and Sun Shipbuilding and Dry Dock Company at Chester, Pennsylvania, were subsidiaries of U.S. Steel and Sun Oil Company, respectively. Two smaller companies, Electric Boat Company at New London, Connecticut, and Bath Iron Works in Maine also survived the shipbuilding depression exclusively on Navy contracts, making submarines and destroyers, respectively.[31]

In September 1940, a year after hostilities had begun in Europe, the Senate confirmed FDR's nominee, Commander (ret.) Howard LeRoy Vickery, to fill a vacancy on the Maritime Commission. Like Admiral Land, Vickery was a graduate of the Naval Academy at Annapolis, was educated as a naval architect at MIT, and had served a distinguished career in the Navy's Bureau for Construction and Repair. Land had appointed Vickery in 1937 to be his senior assistant, in which capacity Vickery organized the Maritime Commission's Technical Division, responsible for design, construction, and testing of hulls and machinery that would be specified by the commission.[32] Both Land and Vickery served distinguished tenures on the Maritime Commission, with Vickery playing an especially prominent and hands-on role in motivating and coordinating the work of the nation's merchant shipyards.

3. Shipbuilding Methods before World War II

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[30]Land, "Building Ships with the Maritime Commission," 355-356; "Shipbuilding and Marine Engineering in 1939," *The Engineer* 169 (12 January 1940): 48; Schmeltzer, "Machinery for Commission Vessels," 361-362; W. Creighton Peet, Jr., "We Build More Ships," *Scientific American* 164 (February 1941): 86-88; Lane, *Ships for Victory*, 28-29.

[31]"Ships for This War," *Fortune* 24 (July 1941): 46; Lane, *Ships for Victory*, 32-34.

[32]"Vickery Appointed to Maritime Commission," *Pacific Marine Review* 37 (October 1940): 23; "How Many Ships How Soon?" *Fortune* 24 (July 1941): 100.

The adoption of such methods as pre-assembly and welding to the shipbuilding process was not immediate. The methods had been known since before World War I, but builders of steel ships only gradually replaced the traditional methods of piece-by-piece assembly on the ways and riveting with the methods of pre-assembly and welding. One could trace the development of standard methods in American shipyards by means of a detailed comparison of such texts as Carmichael's *Practical Ship Production*, the first edition of which appeared in 1919 and the second in 1941. For example, in a sub-section of the chapter on "Shipyards" called, "Yard Lay-Out--Shops, Buildings, Etc.," the 1919 edition makes no mention of providing suitable space for welding, even though welding gets its own sub-section in a subsequent chapter on "The Building of Ships." The sub-section on "Yard Lay-Out--Shops, Buildings, Etc." in the 1941 edition repeats many of the paragraphs from the 1919 edition verbatim, but there is a new paragraph describing the considerations that shipbuilders should give to providing adequate space for welding and its equipment. Similarly, the 1941 edition offers an enhanced description of how the yard and ways should be laid out for the effective use of cranes for moving parts, assemblies, and equipment from stage to stage in the process until finally they are hoisted into position on the ways.[33] A more detailed comparison of the developments reflected in Carmichael's book is beyond the scope of this study.

Nevertheless, developments in shipbuilding methods between the wars form an important part of the context for understanding what took place at the Kaiser shipyards in Richmond. In light of that context, one can see that Kaiser and his engineers, managers, and workers merely advanced trends, already underway, to spectacular extents. In 1931, John Woodward, general manager of the Newport News Shipbuilding and Dry Dock Company identified what he believed to be the causes underlying those trends:[34]

1. Costs of labor and materials had increased in the U.S. after World War I, putting the U.S. in a poor competitive position in the world shipbuilding market, inducing shipbuilders to compensate by finding methods that could otherwise reduce costs.

2. American yards were setting higher standards for comfort, safety, and economy in ships.

3. Ships with increased power and speed had consequent effects on equipment and practices used in shipyards.

4. Yards began to use new materials, like aluminum, and new processes, like welding.

5. The depression in the shipbuilding industry led yards to seek business in other

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[33]A.W. Carmichael, *Practical Ship Production* (New York: McGraw-Hill Book Company, Inc., 1919), 157-159; Carmichael, *Practical Ship Production* (New York: McGraw-Hill Book Company, Inc., 1941), 169-172.

[34]John B. Woodward, "Some Recent Developments in the Shipbuilding Art in America," *Transactions of the Society of Naval Architects and Marine Engineers* 39 (1931): 109-110.

sectors, like structural steel fabrication, building railroad cars and hydraulic turbines, repairing locomotives, and fabricating pressure vessels. Even if these ventures proved unprofitable, the yards gained valuable experience with new methods and equipment that they then applied to shipbuilding.

6. Shipyards continued to develop or adopt new management techniques, such as implementing incentive systems to reward employees for developing labor-saving tools or methods.

7. The depression in shipbuilding caused many skilled workers to move to other industries, inducing shipyards to replace skill needed for hand work by introducing automated equipment. Loss of skilled workers also induced shipyards to establish their own training programs for developing new skilled workers.

A few developments in welding, pre-assembly, and yard layout merit mention. Regarding welding, its application to shipbuilding was just beginning in World War I, spurred by the need to build ships as quickly as possible. During the war years, for the first time in the maritime industry, welding went beyond being a valuable tool for repair to being used, instead of riveting, to join parts of a ship under construction. One of the leading shipbuilders in this regard was the Chester, Pennsylvania, yard of W.A. Harriman's Merchant Shipbuilding Corporation. Technical people recognized that welding promised advantages over riveting, including weight-saving, eliminating need for caulking, labor-saving, and time-saving, but it remained to be seen how extensively welding could be used to replace riveting, which had proven itself a strong and safe method for joining pieces of steel.[35] The uncertainty was reflected in a 1918 statement that accompanied the Lloyd's Register Technical Committee's approval of the use of electric-arc welding for joining structural members in hull construction:

> The application should proceed cautiously in view of the unknown factors involved, the most important of which are the need of experience with the details of the welded joints and the necessity for training skilled workmen and supervisors.[36]

Thereafter, American shipyards led the world in expanding use of welding in shipbuilding. The Sun Shipbuilding Company in Chester was especially noteworthy for the large tankers it built for oil companies. By the time the Maritime Commission was ready to launch its program for building the standardized C-type cargo ships, some shipyards, like Ingalls

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[35]J. Montgomerie, "Shipbuilding Practice Abroad," *Transactions of the North-East Coast Institution of Engineers and Shipbuilders* 54 (1938): 167-169; James G. Dudley, "Reminiscences in Connection with Design of the First All-Welded Steam Power Freighter," *Welding Journal* 18 (May 1939): 307; Carmichael, *Practical Ship Production* (1919), 227-231; Kenney, "The Development and Use of Steel in Shipbuilding," 449-450; Thomas R. Heinrich, *Ships for the Seven Seas: Philadelphia Shipbuilding in the Age of Industrial Capitalism* (Baltimore: The Johns Hopkins University Press, 1997), 178.

[36]Quoted in Carmichael, *Practical Ship Production* (1919), 229.

Shipbuilding Corporation in Alabama and Western Pipe and Steel Company in San Francisco, were in a position to negotiate contracts to build all-welded ships, and the Maritime Commission was in a position to approve them.[37]

American shipyards were not alone, though, in pioneering the application of methods of mass production process to the shipbuilding process. From the 1920s onward, for example, some Swedish shipbuilders developed standardized designs for oil tankers, ships that they sold to Norwegian shipping lines. The standardized designs allowed the shipbuilders to develop yards that were predicated on extensive pre-assembly of ship components and that were suitable for extensive use of welding.[38]

Pre-assembly of hull components was accompanied by developments in the mold loft. In the traditional shipyard, the workers in the mold loft made templates from drawings only for fabricating pieces for the keel, center girder, frames and beams, and floors. Workers then hauled sheets of wood into the partially erected hull to mark-off templates to be used in fabricating other components of the hull. By expanding the amount of work done in the mold loft, workers could make templates directly from drawings, obviating the need to move template material to the shipway and back to the fabricating shop. This trend in turn made it possible to pre-assemble more and more components of the hull. The extent to which components could be pre-assembled was in part limited by the capacity of cranes to lift those components into place on the ways. While nations throughout the world were using cranes to move ever larger pre-assemblies, American shipyards were known in the 1930s for carrying the trend the farthest, pre-assembling components like sterns and deck houses weighing as much as 60 tons.[39]

Prior to the 1930s, shipyards typically built their scaffolding or staging of lumber. Increasing timber prices, however, led shipyards to convert to steel staging, which had several advantages. Individual steel poles could more easily be disassembled and re-assembled while yielding a more stable platform for work. The steel members were more durable, and because each pole had a smaller cross-section than a piece of wood with comparable strength, the overall staging structure sustained less wind loading, making it less susceptible to storm damage.[40]

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[37]Montgomerie, "Shipbuilding Practice Abroad," 167; David Arnott, "Welding in Shipbuilding," *Welding Journal* 19 (November 1940): 813-815; Alfred C. Leigh, "The First All-Welded Cargo Ship Built Under Maritime Commission Specifications," *Welding Journal* 20 (March 1941): 158-162; L.W. Delhi and M.N. Maltseff, "All Welded Ships," *Welding Journal* 20 (June 1941): 358-364.

[38]Haakon With Andersen, "Producing Producers: Shippers, Shipyards and the Cooperative Infrastructure of the Norwegian Maritime Complex since 1850," in *World of Possibilities: Flexibility and Mass Production in Western Industrialization*, ed. Charles F. Sabel and Johathan Zeitlin (New York: Cambridge University Press, 1997): 490-493.

[39]Woodward, "Some Recent Developments in the Shipbuilding Art in America," 110-111; Montgomerie, "Shipbuilding Practice Abroad," 153-154, 157-161.

[40]Woodward, "Some Recent Developments in the Shipbuilding Art in America," 111-112; "Tubular Steel Staging," *Shipbuilding and Shipping Record* 46 (12 September 1935): 293-294.

Prior to World War II, shipyards for ocean-going vessels had five principle working areas: 1) materials storage, for the receiving and storage of steel plate and structural steel sections; 2) the mold loft, for the preparation of patterns and templates used in cutting steel parts; 3) the fabrication shop, for cutting steel plates and sections to shape and then drilling, planing, bending and otherwise preparing the pieces for assembly; 4) the shipway(s), for the actual erection and launching of the hull; and 5) the fitting-out or outfitting dock, for the installation of engines, wiring, mechanical equipment, and furnishings into a launched but otherwise unfinished hull. Cranes, trucks, and flatbed carts moved material and equipment from one area to the next. Although some pre-assembly took place in the fabricating shop, old shipyards often had little room for such work, so the steel plates and structural members that eventually comprised the hull, decks, and bulkheads were usually assembled piece by piece on the ways. Prior to World War II, shipyards used both welding and riveting to assemble hulls, but the tendency was already strongly in the direction of replacing riveted joints with welded joints whenever possible.[41]

New yards built by various companies to undertake contracts for the Maritime Commission featured an important sixth area, located between fabrication and the ways, that was devoted to pre-assembly.[42]

4. World War II Begins

World War II began in Europe in September 1939, Admiral Land and the Maritime Commission greatly expanded the nation's shipbuilding industry by increasing orders for new ships and by increasing the subsidies for companies to develop the capability to build ships. The large shipyards that survived the industry's prior depression received as many private and Maritime Commission contracts as they could handle. Bethlehem Steel reactivated idle yards at San Francisco and Staten Island, and Pusey & Jones reactivated its idle yard at Wilmington, Delaware. In 1940, seven new yards opened, three on the Gulf Coast and four on the West Coast:

Tampa Shipbuilding and Engineering Co.	Tampa, Florida
Ingalls Shipbuilding Corporation	Pascagoula, Mississippi
Pennsylvania Shipyards, Inc.	Beaumont, Texas
Consolidated Steel Corp., Ltd.	Long Beach, California
Western Pipe & Steel Company	San Francisco, California
Moore Dry Dock Company	Oakland, California
Seattle-Tacoma Shipbuilding Corporation	Tacoma, Washington

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[41]Horace N. Gilbert, "The Expansion of Shipbuilding," *Harvard Business Review* 20 (Winter 1942): 165-166.

[42]Philip Lemler, "Multiple Yards--Record and Prospect," in *The Shipbuilding Business in the United States of America*, vol. I, ed. F.G. Fassett, Jr. (New York: The Society of Naval Architects and Marine Engineers, 1948), 232-233.

In addition, several smaller yards received contracts to build C-type ships for the Maritime Commission. At the end of 1940, there were nineteen American shipyards building private cargo ships or standardized vessels for the Maritime Commission. The construction of merchant ships occupied a total of fifty-three berths in the U.S. (some sideways-launch ways had more than one berth), and there were no idle ways. Any berths not occupied with merchant shipbuilding were taken up with Navy contracts. In fact, the Navy was in the midst of launching a program to build new warships with a budget of $5,000,000,000, about ten times the Maritime Commission's budget at the end of 1940. While the Maritime Commission had construction of 126 cargo vessels under contract, Navy yards or Navy contractors were building 517 ships, including twelve aircraft carriers, twelve battleships, fifty-four cruisers, 205 destroyers, and eighty submarines. Some of the companies building new shipyards for the Maritime Commission agreed to build additional capacity in order to build warships for the Navy. For example, Seattle-Tacoma Shipbuilding Corporation agreed to supplement its Tacoma yard with another one at Seattle and then entered a contract with the Navy to build twenty destroyers.[43]

The Maritime Commission's budget was about to be greatly enlarged, however, largely at the insistence of the British and American policy-makers who advocated that the U.S. fully commit to helping the British defend themselves against Germany. The war was taking a terrible toll on British shipping. During each of the third and fourth quarters of 1940, Germany destroyed British ships totaling more than 1,000,000 deadweight tons. Despite the tremendous increase in U.S. shipbuilding after war broke out in 1939, British yards were still producing merchant ships at twice the U.S. rate in 1940, yet Germany was destroying British ships even faster. Therefore, a British Merchant Shipbuilding Mission arrived in the U.S. in October 1940 to see if they could purchase new merchant vessels built in American yards, suggesting that they pay to build the yards. The Maritime Commission agreed to help, but insisted that the new cargo ships would have to be powered by steam engines--limiting their speed to 11 knots--because the United States' entire capacity to build steam turbines and reduction gears for faster ships was already committed to the Navy's huge expansion program and the Maritime Commission's more limited program for building C-type vessels.[44]

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[43]"National Defense Program Allots Huge Orders to Pacific Coast Shipbuilders," *Pacific Marine Review* 37 (October 1940): 25; "Shipbuilding at Record Level," *Steel* 108 (6 January 1941): 385-386; "Labor Requirements for Shipbuilding Industry under Defense Program," *Monthly Labor Review* 52 (March 1941): 572; Gilbert, "The Expansion of Shipbuilding," 34-39.

[44]Hutchins, "History and Development of the Shipbuilding Industry in the United States," 58; Lane, *Ships for Victory*, 40-42, 64. For a somewhat different interpretation of the decision to build slow ships for the British and eventually the United States' Liberty Fleet, blaming the decision on the original desire of the British rather than understanding the decision as a practical response to the shortage of steam turbines and diesel engines, see Rene De La Pedraja, *The Rise and Decline of U.S. Merchant Shipping in the Twentieth Century* (New York: Twayne Publishers, 1993), 139-140. De La Pedraja's position is refuted, however, by E.S. Land to The President, memoranda dated 29 November and 2 December 1940, in NARA RG-178, entry 28, box 158, 1940 Shipyard and Construction Data file. In these memoranda, Land notes the machine tool shortage facing the entire national defense program and the fact that allocating any fast cargo ships to the British would cut into machinery obligations already made for Navy ships and the C-type merchant vessels.

On November 12th, the British Merchant Shipbuilding Mission and the U.S. Maritime Commission agreed to a general plan to construct at least two and no more than four new shipyards for the purpose of building sixty new ships. Both the British and the Maritime Commission surveyed such conditions as the availability of facilities, labor, management skill, and capital in choosing among alternative sites on the East, Gulf, and Pacific coasts. For example, the Maritime Commission had already experienced at Tampa, Florida, the disruption that the Ku Klux Klan could cause in trying assemble a labor force, leading Admiral Land to recommend avoiding the South if possible. Both the British and Land were attracted to the capital that Henry Kaiser and the Six Companies (contractors that had built Hoover Dam and other big New Deal projects) could bring to any project in which they were involved. Land recognized at this early date that building emergency ships for the British would rely heavily on welding rather than riveting, that the process of building emergency ships would therefore be more of an assembly process than a traditional shipbuilding process, and as a consequence that the new yards would not have to rely on existing old-line shipbuilders. On December 11th the Maritime Commission selected the locations for the two yards: South Portland, Maine, and Richmond, California. The latter yard would become known as Richmond Shipyard No. 1. Both the new yards would be built and operated by a group headed by Todd Shipyards Corporation, and comprised as well of the Six Companies, the organization of Pacific Coast contractors, including Kaiser.[45] The Six Companies and the beginnings of the Todd-Kaiser relationship are described in detail below.

Shortly after it made the commitment to build sixty new ships for Britain, the Maritime Commission decided, at FDR's insistence, to build 200 comparable new ships for the American merchant fleet. The Maritime Commission had initially wanted to follow its deliberate plan to develop a new fleet of faster cargo ships of the C-type, but the White House decided that the nation needed ships as soon as possible, so it could not wait until a later date when more turbines would be available for faster ships. The new, slow ships, officially called the Liberty Fleet and informally the "ugly ducklings," would be almost identical to the ones the British were getting. The main difference between the two ships was that the sixty British ships were to be fired by Scotch boilers, while ships of the Liberty fleet were to be fired by water-tube boilers. In January 1941, the Maritime Commission awarded contracts to build seven more new shipyards in addition to the two for the British ships. Three of the new emergency shipyards would be built and operated by the Todd group: California Shipbuilding Corporation (Calship) at Terminal Island in the Los Angeles harbor, Oregon Shipbuilding Corporation (Oregonship) in Portland, and Houston Shipbuilding Corporation in Houston. Two of the new emergency yards would be built and operated by old-line shipbuilders: a yard near Baltimore by Bethlehem-Fairfield's existing yard, and a yard at Wilmington, North Carolina, by Newport News Shipbuilding and Dry Dock Company. Two other new emergency yards would be built on the Gulf Coast. The one at Mobile, Alabama, would be built and operated by an existing repair company, Alabama Dry Dock and Shipbuilding Company. The other Gulf Coast yard, at New Orleans, would be built and operated by the Delta Shipbuilding Company, established by a Great Lakes shipbuilder

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[45]E.S. Land to The President, memoranda dated 29 November and 2 December 1940, in NARA RG-178, entry 28, box 158, 1940 Shipyard and Construction Data file; Lane, *Ships for Victory*, 40-42.

(American Shipbuilding Company of Cleveland) that had an excellent reputation in shipbuilding but could not get ocean-going cargo ships from its yards on Lake Erie through the locks to the Atlantic.[46]

Desperate to both replace destroyed ships and expand its shipping capacity to sustain a prolonged war against Germany, the British Merchant Shipping Mission sent another delegation, headed by Sir Arthur Salter, to the U.S. in March 1941 to ask that the U.S. divert some of its existing merchant ships from less important routes to the task of supplying England and to seek additional shipbuilding capacity in this country that could add to the British fleet. (Interestingly, Salter's nation had sent him to the U.S. in 1917 for the same purpose, to plead with President Wilson to mobilize more of America's shipping and shipbuilding capacity in support of the Allies in Europe.) FDR had already asked Congress to establish the Lend-Lease Program, which would allow the U.S. to better supply Great Britain and Russia in the war against Germany. Congress passed the enabling legislation and Roosevelt signed the bill about the time of Salter's arrival, putting the Lend-Lease Program into effect. Three weeks later, FDR announced that the U.S. would build another 212 of the "ugly duckling" ships for Britain. The Maritime Commission also began organizing as much of the existing private shipping capacity in the U.S. that could be reallocated to supplying Britain. Land tried to put the brakes on orders for additional vessels after that, arguing that expansion of the shipbuilding program would dilute the nation's skilled labor force and, more importantly, its corps of experienced managers necessary to execute the existing orders effectively. Nevertheless, the White House again prevailed, and on May 26th the Maritime Commission announced that it had awarded contracts for yet another 123 ships of the C-type.[47]

Although Land had not been able to put the brakes on the expansion of America's shipbuilding program, he had been able to shape the overall approach. Prior to initiating the emergency program for the construction of new yards, the Maritime Commission had studied alternate approaches to providing the number of ways that would be necessary should a massive shipbuilding program be undertaken. At one end of the spectrum was the possibility of building one or more yards of fifty or more ways, but the experience of Hog Island during World War I suggested that such monstrous facilities would create untenable bottlenecks in supplying building materials and labor. At the other extreme was the possibility of building many small

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[46]"180,000 Tons Steel Being Placed in 900,000-Ton Shipbuilding Program," *Steel* 108 (20 January 1941): 49; Ward Gates, "Shipbuilding in New Age," *The Magazine of Wall Street* 68 (31 May 1941): 178-181; "Ships for This War," *Fortune* 24 (July 1941): 42; Gilbert, "The Expansion of Shipbuilding," 162; Lane, *Ships for Victory*, 43, 46-53.

[47]"U.S. to Start Construction on 32 More Shipways," *Engineering News-Record* 126 (24 April 1941): 43; "How Many Ships How Soon?" *Fortune* 24 (July 1941): 37-38, 105; "Ships for This War," *Fortune* 24 (July 1941): 42; Hobart S. Perry, "Ocean Shipping," *Harvard Business Review* 19 (Summer 1941): 447; Emory S. Land, "Progress of the Shipbuilding Program," *Marine Engineering and Shipping Review* 46 (October 1941): 74-75; Hutchins, "History and Development of the Shipbuilding Industry in the United States," 57-59; Lane, *Ships for Victory*, 64. The article by Perry provides a business analysis of the world markets for shipping and shipbuilding through the first eighteen months of the war.

shipyards along the nation's coastal areas, but Land and his planners determined that such an alternative would not work because there were not enough skilled managers to operate so many yards. The solution that the government selected represented the middle ground of building a series of large but not huge shipyards, trying to focus when possible on coastal areas that would not already be congested with other shipbuilding or industrial pursuits in support of the war effort.[48]

On 27 May 1941, FDR proclaimed a national emergency, committing the United States to a massive industrial mobilization to manufacture ships, weapons, ammunition, combat vehicles, and other supplies needed for war. In his speech, Roosevelt underscored the need for more merchant ships by pointing out that Germany was sinking merchant ships at a rate twice that at which the combined resources of American and British shipyards were producing them.[49]

The Maritime Commission ordered more ships by continuing to sign new contracts with existing shipbuilders, both long-standing and recently created ones, and continuing to sign contracts with new companies to build new yards. The Todd-Six Companies group had eight such new yards by mid-1941:

Seattle-Tacoma Shipbuilding Corporation	Tacoma & Seattle
Todd-Bath Shipbuilding Corporation	Bath, Maine
Todd-California Shipbuilding Corporation	Richmond, California
Richmond Shipbuilding Corporation	Richmond, California
Houston Shipbuilding Corporation	Houston, Texas
California Shipbuilding Corporation	Los Angeles
Oregon Shipbuilding Corporation	Portland, Oregon
South Portland Shipbuilding Corporation	South Portland, Oregon

The eight yards had contracts with the Maritime Commission to build a combined total of 175 merchant ships as well as some Navy ships.[50] About the contracts, Todd president John D. Reilly wrote in his May 1941 annual report of Todd Shipbuilding Corporation:

> The contracts for most of these vessels were offered and accepted upon a very moderate fixed-fee basis. It follows that, because of the restricted margin of profit and the high income and excess profits tax rates to be in effect over the period in which the vessels are to be constructed, the return from this special work will be small in comparison with the volume of work, so that this business should be regarded as a part of your company's contribution toward the National

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[48]"How Many Ships How Soon?" *Fortune* 24 (July 1941): 105-106; Lane, *Ships for Victory*, 46-48.

[49]"Prelude to Total War," *Fortune* 24 (July 1941): 34; "How Many Ships How Soon?" *Fortune* 24 (July 1941): 38; Lane, *Ships for Victory*, 61.

[50]"The Todd Shipyards Corporation," *Pacific Marine Review* (June 1941): 37, 55.

Defense Program than as a source of large profit.[51]

The Maritime Commission declared 27 September 1941 "Liberty Fleet Day" to celebrate the launching of the first ships in the new fleet. With President Roosevelt in attendance that day, Bethlehem-Fairfield at Baltimore launched the first one, the *Patrick Henry*. The publicity the celebration garnered led the "ugly ducklings" to claim a noble name: Liberty ships. Yards all over the country joined in the celebration, with yards on the Atlantic, Gulf, and Pacific coasts launching a total of fourteen ships that day, three of which were Liberty Ships. Calship launched the first Liberty Ship on the Pacific Coast, the *John C. Freemont*. Later in the day, Oregonship launched the *Star of Oregon* at Portland. Other yards launched three C-1s, one C-2, three C-3s, one Army transport ship, and one tanker. Richmond Yard No. 1 launched two of the British ships that day, the *Ocean Voice* and the *Ocean Venture*. With Fred Parr serving as master of ceremonies at the Richmond launchings, the central feature of the day was the reading of a transcription of FDR's Liberty Fleet address to the nation.[52]

America's accelerated program for building cargo ships was well underway on Liberty Fleet day, and the rate at which the new shipyards began delivering ships quickened throughout the fall. Then Japan attacked Pearl Harbor and the U.S. was at war. Shipbuilding was no longer something to undertake to help Great Britain and prepare for potential U.S. participation. Given the reality of war, FDR issued a directive that the Maritime Commission increase production by another 50 percent. To meet the target, Roosevelt challenged the Maritime Commission to get shipbuilders to agree to speed production. Improved shipbuilding methods were allowing shipbuilders to shorten the length of time hulls sat on the ways from six months to three or four months. Land and Vickery believed that with improved management methods and intensified effort by workers, time on the ways could be shortened to two months. Vickery first tried to negotiate contracts calling for such a schedule with Kaiser's engineers, who finally agreed to the schedule. With the Kaiser yards in agreement, Vickery then turned to the other companies to get them to agree to the speed-up as well. The government also signed agreements to put three new yards into operation, two to be built and operated by Kaiser and one by Bethlehem. The two new Kaiser yards were Richmond No. 3 and the yard at Vancouver, Washington, across the Columbia River from Portland. The Bethlehem yard was at Alameda, California.[53]

With the expanded program in place, the Maritime Commission met with the U.S. Bureau of Ships and the Office of Production Management in mid-January 1942 and issued a statement

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[51]"The Todd Shipyards Corporation," 55.

[52]"President Says Ships Must Sail All Seas," and "This No Time to Be Content, F.D.R. Warns in Yard Talk," *Richmond Independent* (27 September 1941), 1 and 2; "'Liberty Fleet Day' along the Pacific Coast," *Pacific Marine Review* 38 (October 1941): 91-99; "The Liberty Ships," *Marine Engineering and Shipping Review* 46 (October 1941): 72; "Epic of the Liberty Shipyards," *Marine Engineering and Shipping Review* 47 (April 1942): 182; Lane, *Ships for Victory*, 68.

[53]A.D. Rathbone, "Ships off the Line," *Scientific American* 167 (August 1942): 68; Lane, *Ships for Victory*, 138-143.

saying they had agreed that the nation's shipbuilding capacity had reached its absolute limit. Soon thereafter, the President ordered the Maritime Commission to make yet another increase in planned production. To meet the target, Admiral Vickery again turned to the Kaiser organization, contracting with it to build yet another shipyard in the Portland vicinity at Swan Island and to expand Richmond No. 2 from nine ways to twelve. The Maritime Commission contracted with Sun Shipbuilding in Chester, Pennsylvania to expand its yard by eight ways to twenty-eight, making it the one U.S. shipyard of the World War II era that approached Hog Island in size. The Maritime Commission also contracted with companies to build a new round of six-way yards. One such yard was to be built on the San Francisco Bay at Sausalito by the Bechtel organization, part of the Six Companies and the lead participant in the Calship operation. The Sausalito yard was called Marinship. Other six-way yards were built at Providence, Rhode Island; Brunswick, Georgia; and Jacksonville and Panama City, Florida.[54]

For the above-described build-up of new emergency shipyards, a key factor for the Maritime Commission was to find pools of management talent that could build huge industrial facilities on vacant sites and then effectively organize and operate them. The Maritime Commission relied upon several pools of managerial talent. When possible, it drew from existing shipbuilders, seeking at those yards not to dilute the staffs necessary for accomplishing the tremendous slates of ship orders with the Navy. The commission was also able to recruit talent from a related source, the ship-repair industry of which the Todd organization was a part. The major source of skill outside the maritime industry was the construction industry, where managers were used to handling large contracts, meeting deadlines, and hiring and organizing thousands of workers. By the end of 1942, there were fourteen shipyards on the Pacific Coast that had been built and were being operated by firms in the construction industry. The Kaiser organization, of course, had gained its management experience on large construction projects. Companies that were essentially joint ventures of firms from two or more industrial sectors managed several of the emergency shipyards. They were therefore able to combine resources as Todd and Kaiser had done. Some of the joint ventures drew as well upon the managerial talent available in large engineering firms and the steel fabrication and steel construction industries.[55]

There was one other shipyard that the Maritime Commission contracted to build during the last expansion in the shipbuilding program, but it was never completed. The contract was with Andrew J. Higgins, an experienced boatbuilder (small boats, not ships) from New Orleans. While he had never built ocean-going vessels before, he was a highly regarded businessman in his field, which was thought to be closer to shipbuilding than was the construction business from which Kaiser and other members of the Six Companies had sprung. Higgins proposed building a shipyard of a novel design based on the concept of the assembly line. He would build two large fabricating areas, each of which would be flanked by two long, moving ways that would convey ships in partial states of completion from station to station, where appropriate components of ships were being prefabricated and pre-assembled. There would thus be four ways in total, each of which could accommodate up to eleven ships under various stages of completion. Another

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[54]Lane, *Ships for Victory*, 143-148.

[55]Lemler, "Multiple Yards--Record and Prospect," 226; "Contracting to Shipbuilding," *Western Construction News* 17 (December 1942): 540.

novel feature of Higgins' plan was that the entire crew at one of the fabricating areas and its accompanying two ways would be all African-Americans, and the entire crew at the other fabricating area and its accompanying two ways would be all whites, with the workers of the groups competing against each other for speed of production. To help Higgins develop detailed designs for his scheme, the Maritime Commission sent him to visit the Kaiser yards in Richmond and also yards operated by Bethlehem.[56]

In June 1942, however, War Production Board Chairman Donald Nelson announced that with shipbuilding accelerating along with production in other wartime industries, the nation was facing a steel shortage. In early July, Land and Vickery had a series of meetings with Nelson and other top-ranking officials in the Roosevelt administration's top industrial mobilization group. Aided by decisions made by the President about levels of production that had to be met, the Maritime Commission decided on July 10th to cancel the contract with Higgins Industries, Inc. One of the reasons had to do with the nature of the Higgins process. Higgins' assembly line was dependent on having a full supply of materials. If materials shortages halted work at any point along the line, it would have to stop, halting work at all other points along the line as well. The Maritime Commission realized that the other new yards, especially the six-way yards, offered greater flexibility. If a shortage halted work on one ship, work on other ships on the other ways could continue. Furthermore, canceling the Higgins contract would reduce the amount by which other yards were likely to be short of steel.[57]

Meanwhile, targets for the number of merchant ships the nation's shipyards would build kept increasing. By spring 1942, the Maritime Commission and the nation's shipbuilders were working toward the target of building 2,300 new merchant ships by the end of 1943. That would include 850 ships in 1942 and 1,000 in 1943. The main factor that kept the U.S. from meeting that goal was a shortage of steel, which continued to slow shipbuilding into 1943. Nevertheless, by October 1942, American shipyards were delivering an average of three cargo ships daily. Most of them were Liberty ships.[58]

The shipyards operating in the U.S. in 1942 fell into two basic categories: the permanent

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[56]Lane, *Ships for Victory*, 184-190.

[57]Palmer, *We Fight With Merchant Ships*, 90-95; Lane, *Ships for Victory*, 182-184, 190-194.

[58]Rathbone, "Ships off the Line," 68; Howard L. Vickery, "All Out...To Build Ships!" *Pacific Marine Review* 39 (February 1942): 37; "Three Ships a Day Reached in September," *Pacific Marine Review* 39 (October 1942): 94; "Liberty Ships a Key to Victory," *Marine Engineering and Shipping Review* 47 (April 1942): 133; Emory S. Land, "Build More Ships Faster to Win the War" (Land's March 24th radio address), *Marine Engineering and Shipping Review* 47 (April 1942): 136-137, 165; "Donald M. Nelson Urges Greater Effort in War Production," *Marine Engineering and Shipping Review* 47 (April 1942): 138-140; Howard L. Vickery, "Liberty Ships for Victory," *Marine Engineering and Shipping Review* 47 (April 1942): 141-142; "Demand for Steel Plate Exceeds Production by 50 Percent," *Marine Engineering and Shipping Review* 47 (April 1942): 145; "United States Only Nation Whose New Shipping Exceeds Losses," *Steel* 113 (20 September 1943): 174.

yards, which had greatly expanded their capacity by building additional ways, fabrication, and storage areas, and the emergency, multiple yards, which had been built on parcels of vacant waterfront with no intention of operating beyond the war. As a rule, the Navy relied on the permanent yards for the production of its large ships, like cruisers, battleships, and aircraft carriers. The permanent yards also handled some Maritime Commission contracts for standardized cargo ships, but they were less suited for that work because their yards were not laid out to accommodate mass production of parts and pre-assembly of components to the extent that the multiple yards were. The multiple yards primarily handled contracts for standardized ships, especially the Maritime Commission's C-type cargo vessels, Liberty ships, and warships like destroyers, destroyer escorts, and landing craft.[59]

With the tremendous growth in emergency shipbuilding throughout the nation, the Maritime Commission appointed four Regional Directors of Construction in March 1942. The four regions were the East Coast, Gulf Coast, Great Lakes, and Pacific Coast. Carl W. Flesher was placed in charge of the Pacific Coast Regional Office, located in Oakland. A graduate of the Naval Academy at Annapolis, Flesher had worked for Westinghouse for ten years before joining the Maritime Commission, where he had worked as chief of the Engineering Design and Specifications Section and then Acting Director of the Construction Division. He was the youngest of the Regional Directors.[60]

Henry J. Kaiser and the Pacific Coast shipyards made an important contribution to the United States' shipbuilding record during World War II. During the years 1941-1945, the Maritime Commission oversaw the building of 5,695 ships. Of those, yards managed by the Kaiser organization built 1,552 ships, far more than any other shipbuilding group. The next highest was the group of yards affiliated with Bethlehem Steel, which built 621 ships, followed closely by the various Bechtel yards, which built 560 ships. In 1940, American shipyards delivered to the Maritime Commission fifty-five ships, of which only one was built at a Pacific Coast yard. In 1941, shipyards delivered to the Maritime Commission 134 ships, of which twenty-seven (20 percent) were built at Pacific Coast yards. In 1942, U.S. shipyards delivered to the Maritime Commission 746 ships, of which 371 (nearly 50 percent) were built at a Pacific Coast yard. For the duration of the war, Pacific Coast yards delivered a major portion of ships built under Maritime Commission contracts.[61]

This was the context of federal procurement within which Henry J. Kaiser came to build four shipyards at Richmond. The next section describes Kaiser's background, which equipped him and his organization to tackle such an undertaking.

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[59]Lemler, "Multiple Yards--Record and Prospect," 225-226.

[60]"Maritime Commission Establishes West Coast Regional Construction Office," *Pacific Marine Review* 40 (January 1943): 78-79; Lane, *Ships for Victory*, 170-171.

[61]Monroe Jackson, "Ships and Men," *Pacific Marine Review* 42 (January 1945): 21; Lane, *Ships for Victory*, 470. Note: the Maritime Commission oversaw the building of 5,695 during the years 1941-1945, but if 1939 and 1940 are included, the count is 5,777, the number used at the beginning of this report.

B. Henry J. Kaiser & His Industrial Enterprises

> The most portentous industrial phenomenon in the U.S. today, Henry J. Kaiser has fired the mind of the common man. He is something new in our time: an American businessman with a popular following. His faults are not inconsiderable and his detractors are not few, but this determined and imaginative man stands today as one of the great forces working for a postwar world of creative opportunity and full employment.
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> *Fortune*, 1943[62]

Henry J. Kaiser was part of a group of contractors, known as the Six Companies, with whom the Maritime Commission contracted to build emergency shipyards during World War II. Kaiser and the Six Companies are considered by historians of the American West to have been a major force in the second half of the twentieth century in creating the modern West.[63] That history is beyond the scope of this report, but what is germane to this report is the story of how Kaiser and the other contractors became shipbuilders. After they built the shipyards, which in itself would not have been such an unusual undertaking for enterprises accustomed to large construction projects, the contractors operated the yards, producing hundreds of ships and helping the United States achieve its amazing record of shipbuilding during the war, even though they had no experience in shipbuilding. This summary history of Kaiser's early life and the evolution of his organization focuses on the skills he and his managers and engineers developed, which in turn allowed them to tackle an undertaking like the Richmond shipyards. The other contractors probably brought similar skills and experience to the shipbuilding business.

Henry J. Kaiser was born on 9 May 1882 to German-immigrant parents at Sprout Brook in upstate New York. His shoemaker father moved the family west to Whitesboro in 1889. Young Henry left home at the age of twelve and, through a succession of jobs in nearby Utica, worked himself into the position of owning and operating photographic studios and supply stores, first in Lake Placid, New York, and then in several Florida cities. Unsatisfied with the photography business and at the urging of his future father-in-law (Edgar C. Fosburgh of Massachusetts, father of Bess Fosburgh), Kaiser headed west in 1906, settling in Spokane, where he went to work for McGowan Brothers Hardware. After a few years of climbing the McGowan organizational ladder as a successful salesman, Kaiser shifted to the construction industry, gaining experience in the sand and gravel business and supervising paving jobs for J.F. Hill Company in Spokane. That company transferred him to its Canadian subsidiary, but then a power-struggle between factions in the Hill company led to his firing, because he refused to

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[62]"Henry J. Kaiser," *Fortune* 28 (October 1943): 145.

[63]On the importance of Kaiser and the Six Companies to the development of the West, see Gerald D. Nash, *The American West in the Twentieth Century: A Short History of an Urban Oasis* (Englewood Cliffs, NJ: Prentice-Hall, 1973), 205; Peter Wiley and Robert Gottlieb, *Empires in the Sun: The Rise of the New American West* (Tucson, The University of Arizona Press, 1982), 3-29.

participate. Undaunted, he decided in 1914 to go into business for himself. He bid on a paving job in Vancouver, B.C., and was awarded the contract. Lacking a company, equipment, or capital, he went to a Vancouver bank, seeking a loan for $25,000. Remarkably, Kaiser received the loan, and his career as a construction contractor was launched.[64]

Kaiser formed Henry J. Kaiser Company, Ltd., in Vancouver in late 1914, and he succeeded in securing new paving contracts. As the popularity of the automobile continued to grow, he turned his attention southward, gaining contracts as well in Washington and Oregon, where he did business as Kaiser Paving Company. In 1921, he moved his business to Oakland, and two years later Kaiser Paving built its first permanent sand-and-gravel plant at Livermore. By that time, he had gathered a core of key employees who helped manage his jobs, office, finances, and purchasing. They included Alonzo B. Ordway, Stewart McWhorter, Tom Price, and George G. Sherword. After moving to Oakland, the Kaiser firm continued to grow with more road-building jobs, and other key men joined the firm, including Joaquin Reis, Donald A. Rhoades, Eugene E. Trefethen, Jr., and son Edgar F. Kaiser. The senior Kaiser also began working with Robert G. LeTourneau, a Stockton manufacturer of heavy equipment, to devise mechanized ways of replacing the traditional teams of horses and mules that typically still pulled earth-moving equipment. In 1926, Kaiser and LeTourneau bid on construction of the Philbrook dam on the Feather River in Butte County, California. Together, they devised equipment and methods that allowed them to dispense completely with animal-powered machines. Men still used picks and shovels, of course, but power shovels, dump trucks, and mechanized scrapers accomplished the bulk of the earth-moving. The Philbrook dam, an earth-fill structure, was Kaiser's first dam, opening another phase of Kaiser's construction career.[65]

During Kaiser's early years in the construction business, he made some important contacts with established contractors who would help further his career. In 1911, he met Ralph Warren, who was in charge of the Warren Brothers' western operations. Based in Massachusetts, Warren Brothers had developed a paving product and method called bitulithic asphalt. When Kaiser started his paving business in Canada, he used the Warren process, and Warren Brothers in turn helped to finance some of his projects. That relationship proved fruitful in 1927, when Warren Brothers landed a contract to pave 750 miles of highway in Cuba. Warren Brothers in turn sub-contracted 200 miles of that work to Kaiser Paving. The project included bridges and culverts, and its size made it necessary for Kaiser to expand the managerial capabilities of his

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[64]Frank J. Taylor, "Builder No. 1," *The Saturday Evening Post* 213 (7 June 1941): 11, 120; "Henry J. Kaiser" (*Fortune*), 147-148; "Early History and Early Projects" section of "History of Kaiser Organization," unpublished report dated ca. 1945 in Henry J. Kaiser papers, Bancroft Library, University of California, Berkeley (hereafter cited as HJK) 83/42c, box 276, file 29; "Facts in Brief about Henry J. Kaiser," booklet published by the Kaiser organization prior to his testimony before the U.S. House of Representatives Merchant Marine and Fisheries Committee in 1946, pp. 43-45, in HJK 83/42c, box 276, file 8; *The Kaiser Story* (Oakland, CA: Kaiser Industries, 1968), 5-7; Mark S. Foster, *Henry J. Kaiser: Builder of the Modern West* (Austin: University of Texas Press, 1989), 6-29.

[65]"Facts in Brief about Henry J. Kaiser," 45-46; "Early History and Early Projects" section of "History of Kaiser Organization," n.p.; *The Kaiser Story*, 8-13; Foster, *Henry J. Kaiser*, 29-37.

organization. At $20,000,000, the Cuban contract was by far the largest Kaiser had yet undertaken. Another important contact occurred at about the same time Kaiser was establishing his headquarters in Oakland, when he met Warren A. Bechtel, a successful western contractor who was a leader in the Northern California Chapter of the Associated General Contractors (AGC), a trade advocacy organization. Working through the AGC chapter, Kaiser gained valuable experience lobbying the California legislature on highway issues important to contractors. Then beginning in 1930, in the wake of the boom in natural gas development, Kaiser and Bechtel jointly won contracts to build gas pipelines in Great Plains states.[66]

These big projects helped prepare Kaiser and his organization for the next leap in project magnitude to the giant federal dam projects. The first was Hoover Dam, which in its planning stages was known as Boulder Dam. Even as the United States was falling precipitously into the Great Depression, engineers for the U.S. Bureau of Reclamation were putting finishing touches on designs for a dam across the Colorado River at Boulder Canyon along the Arizona-Nevada border. They planned that it would be the world's tallest dam, but building it would be beyond the means of any single contractor in the nation. Not only would it be the largest construction contract in American history, but also it would be located in one of the most inhospitable environments in the country. The Bureau of Reclamation set a very demanding construction schedule and required a $5,000,000 performance bond that exceeded what any single company could afford.[67] Contractors interested in bidding on the project began contacting each other with the idea of forming joint ventures to bid on the project. Kaiser and Bechtel were interested, and they eventually fell in with a group of contractors who submitted a bid under the name, "Six Companies." Despite the name, there were actually eight entities initially involved in the Six Companies. The Kaiser-Bechtel entity consisted of Kaiser Paving, W.A. Bechtel, and Warren Brothers. The following shows the percentage of the performance bond that each of the six companies invested in the project:[68]

MacDonald and Kahn	20%
Utah Construction	20
Kaiser Paving & W.A. Bechtel	30
Morrison-Knudsen Co., Inc.	10
J.F. Shea Co.	10
Pacific Bridge Co.	10

Henry Kaiser had heard of the prospective dam project in the late 1920s while working on the Cuba contract. Upon his return to the U.S. in 1930, he enlisted first Bechtel's support and then the Warren Brothers' involvement to put together a team to pursue the Boulder Canyon

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[66]"The Earth Movers I," *Fortune* 28 (August 1943): 105-106; *The Kaiser Story*, 13-15; Foster, *Henry J. Kaiser*, 30-31, 38-43; Stephen B. Adams, *Mr. Kaiser Goes to Washington: The Rise of a Government Entrepreneur* (Chapel Hill: The University of North Carolina Press, 1997), 26-28.

[67]For background history on the Hoover Dam, see Joseph E. Stevens, *Hoover Dam: An American Adventure* (Norman: University of Oklahoma Press, 1988), 3-34.

[68]Foster, *Henry J. Kaiser*, 47.

work. Later that year, the Kaiser-Bechtel team joined forces with the other firms, which had been assembled by Harry Morrison of the Morrison-Knudsen Company, a Boise-based firm with experience on dam projects for the Bureau of Reclamation. One of the key members of the Morrison-Knudsen team was Frank T. Crowe, the engineer who would superintend construction of Hoover Dam. Utah Construction was a prominent railroad contractor, which had moved out of track-laying into dam construction in 1917 with the contract to build O'Shaugnessy Dam on the Tuolumne River as part of the Hetch Hetchy project in California. In the 1920s, Utah Construction started working on joint ventures with the Morrison-Knudsen Company. J.F. Shea Company, based in Portland, specialized in tunnels and sewer projects and was the largest contractor in that niche on the Pacific Coast. Also based in Portland, Pacific Bridge specialized in building underwater structures and had already worked with Shea on large projects like the aqueduct linking Hetch Hetchy Reservoir with San Francisco. MacDonald & Kahn was a construction company based in San Francisco that built sewers as well as industrial buildings and skyscrapers. Felix Kahn (brother of Albert Kahn) and Alan MacDonald were both engineers.[69]

The Bureau of Reclamation formally issued its call for bids on 10 January 1931. Prospective bidders could procure plans and specifications for $5.00 per set. Representatives of the firms comprising the Six Companies, accompanied by teams of engineers and lawyers, met at San Francisco's Engineers Club in February to negotiate the formalities of their business arrangement and to try to reach agreement on a bid. In preparation for the meeting, engineers for MacDonald & Kahn, Utah Construction, and Morrison-Knudsen had each developed preliminary bids ranging from $40,000,000 to $40,700,000. The slim differences among the figures (less than 2 percent) gave those at the meeting confidence that they had a firm grasp of the task at hand and its costs. They proceeded to work out the details of a bid, and they agreed to call themselves the Six Companies, emblematic of the six units that were buying into the venture. As they approached the deadline for putting up the money necessary for the bond, Warren Brothers had to back out, meaning Kaiser and Bechtel each had to put up another $250,000. Morrison-Knudsen and Pacific Bridge also had difficulty meeting their commitments, so each brought in an additional partner. The loss of Warren Brothers and the addition of two new partners brought the total number of entities comprising the Six Companies to nine. Six Companies, Inc., incorporated in Delaware on 19 February 1931, with W.H. Wattis of Utah Construction as president, W.A. Bechtel vice president, Felix Kahn treasurer, and Charles Shea secretary. Carrying a bid of $48,890,995.50, principals in the Six Companies traveled to Denver for the March 4th bid-opening.[70]

Only two other consortia submitted qualified bids, and the Six Companies' bid was $5,000,000 lower than the nearest bid. With the contract in hand, the Six Companies set to work. The constituent firms would each have responsibility for various aspects of construction. For example, Kaiser was in charge of preparing sand and gravel. The board of directors had already agreed that Frank Crowe would be general superintendent, coordinating activities at the

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[69]"The Earth Movers I," 99-100, 102-106; *The Kaiser Story*, 18-19; Foster, *Henry J. Kaiser*, 46-47; Stevens, *Hoover Dam*, 35-43.

[70]"The Earth Movers I," 106-107, 210; *The Kaiser Story*, 19-20; Foster, *Henry J. Kaiser*, 47-48; Stevens, *Hoover Dam*, 34, 43-45.

job site. The board now decided to designate an executive committee for day-to-day oversight of the project. Charles Shea would oversee actual construction, Felix Kahn would have oversight of fiscal and legal matters as well as provide thousands of workers with food and shelter, and Stephen Bechtel would watch purchasing, warehousing, and general administration. The board appointed Henry Kaiser to chair the executive committee. As it developed, one of his most important tasks was to lobby Congress to appropriate enough money to pay the Six Companies for the work as it progressed. During his frequent visits to Washington, he also became well-known among New Deal administrators, who came to recognize Kaiser as a person who kept his word when he said that he could accomplish something quickly. While Kaiser kept funds flowing from Washington, DC, to the construction project, Crowe supervised the complex physical undertaking in the desert near Las Vegas. Under Crowe's excellent management, the Six Companies completed the Hoover Dam in five years, which was two years and two months less than the Bureau of Reclamation's schedule had specified.[71]

With an organizational structure in place to bid on and manage large construction projects, Six Companies decided to pursue other contracts. The first was the Bonneville Dam, a New Deal project to be built across the Columbia River and bid in late 1933. Henry Kaiser wanted to bid on it, and he convinced Bechtel, Kahn, Morrison, and Utah Construction to join him in the venture, but Shea decided to combine with a Seattle firm (General Construction Company) to submit a competing bid, setting a precedent for how the Six Companies would henceforth approach projects. Any member of the group interested in a new project could sponsor the project and try to enlist other members to join. A team would form, without obligation to reconstitute itself on future projects. Kaiser's group was the successful bidder on construction of Bonneville Dam, but Shea's group won the contract to build the powerhouse. In 1934, the federal government announced that it would solicit bids for the site work on an even larger dam across the Columbia, the Grand Coulee Dam. It would be the largest structure ever built, and its cost would be four times that of Hoover Dam. The total cost for the Grand Coulee project, including the system of irrigation canals and related structures, would be $404,000,000. Kaiser organized a group to bid on the site work, but another consortium submitted a lower bid. Undaunted, a Six Companies group, minus only Shea, prepared for the 1938 bid on construction of Grand Coulee Dam itself. This time, they expanded the team to include the consortium that had beat them on the site-work bid as well as General Construction Company of Seattle. Kaiser's group submitted the low bid at $34,442,230. Although others in the Six Companies would work on subsequent dam projects, it was the last dam for the Kaiser organization.[72]

Despite the fact that Grand Coulee was the Kaiser organization's last dam, dam construction played a significant role in the evolution of the Kaiser enterprise overall. Formation of the Six Companies had given Kaiser and his closely associated fellow contractors a model for

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[71]"The Earth Movers I," 214; *The Kaiser Story*, 20; Foster, *Henry J. Kaiser*, 48-51, 57-60; Foster, "Giant of the West: Henry J. Kaiser and Regional Industrialization, 1930-1950," *Business History Review* 59 (Spring 1985): 4.

[72]"The Earth Movers II," *Fortune* 28 (September 1943): 120-122, 219; "Construction Projects (Joint Ventures)" section of "History of Kaiser Organization," n.p.; *The Kaiser Story*, 21-23; Foster, *Henry J. Kaiser*, 62-63.

how they could work together on big projects, and it had given them experience together that they would use to their mutual benefit in tackling other, very different projects, like building both the substructure and the superstructure for the San Francisco-Oakland Bay Bridge in the 1930s or building ships in the 1940s. The Kaiser organization began experiments at Grand Coulee in providing for worker health needs, experiments that led to the Kaiser Health Plan. Equally as important, Kaiser managers gained positive experience in working with labor unions at Grand Coulee, leading Henry Kaiser to take a turn in his relationship with workers so that he would become known among unions as a friend of labor, an anomaly among American industrialists. It was Kaiser's failure to win yet another dam contract, for the construction of Shasta Dam near Redding, California, that launched Kaiser from his position as a construction contractor into the realm of industrialist. After the group organized by Kaiser lost the Shasta bid in 1939, he decided to go after the contract to supply the project with cement. He had long been convinced that the major producers of cement in California were acting as a pool to manipulate prices, so when his engineers found a large deposit of limestone on Permanente Creek in Santa Clara County, he submitted a bid to supply cement for the Shasta project that was 16 percent lower than the pool's bid. With the backing of his Six Companies associates, Kaiser then built his Permanente Cement plant, which would soon become the world's largest.[73]

It was in the above context of an expanding industrial enterprise, an enterprise closely tied to government projects, that Kaiser and other members of the Six Companies moved into shipbuilding in 1939. According to some accounts, Stephen Bechtel and John A. McCone of the Bechtel organization were the first to take an interest in shipbuilding, sensing in about 1937 that the industry was going to expand. J.A. McEachern of the General Construction Company and Charles F. Shea had been associated with shipbuilding in the Pacific Northwest during World War I. By late 1938, when Todd Shipyards was trying to organize the Seattle-Tacoma Shipbuilding Company, Henry Kaiser was also interested. McEachern served as the intermediary, introducing Todd officials Roscoe Lamont, head of Todd's Seattle repair operations, and John D. Reilly, president of the parent Todd Shipyards Corporation, to the Six Companies group, who were looking for a project to employ the thousands of workers who would soon be completing the Grand Coulee project.[74]

A year later, when the Maritime Commission was ready to sign a contract with Seattle-Tacoma Shipbuilding to build five C-1 cargo ships, as described above, the Kaiser and Bechtel organizations were part of the Six Companies group (plus General Construction) that held a 50 percent share in the new venture. Todd owned the other 50 percent. Seattle-Tacoma Shipbuilding Corporation's Tacoma yard was built on land owned by Todd Shipbuilding Corporation, because Todd's existing subsidiary in the Puget Sound, Todd-Seattle Dry Docks, had no capacity for building new ships and no land on which to build such capacity. The Six Companies involvement was initially mainly financial, because the group had no experience

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[73]"The Earth Movers II," 219-220, 222; "Construction Projects (Joint Ventures)" section of "History of Kaiser Organization," n.p.; Foster, *Henry J. Kaiser*, 64-67.

[74]"Biggest Splash," *Fortune* 24 (July 1941): 121-122; "The Earth Movers II," 222; "Facts in Brief about Henry J. Kaiser," 47; *The Kaiser Story*, 27; Foster, *Henry J. Kaiser*, 69; Foster, "Giant of the West," 8.

building ships, as Todd did. As the first Seattle-Tacoma shipyard got underway, the Six Companies group was in charge of building the yard itself, while Todd personnel took charge of building the ships.[75]

Thereafter, the rate at which the U.S. wanted to build shipyards accelerated, first with the two shipyards located at Portland, Maine, and Richmond, California, to build cargo vessels for the British government, and then with the launching of America's Liberty ship program in January 1941. By then, Kaiser and his contractor associates were ready to gain a large share of the emergency program. With Todd, they formed Todd-Bath Iron Shipbuilding Corporation and Todd-California Shipbuilding Corporation to build the British ships. Then they formed a series of other companies to build additional shipyards in Maine, Texas, California, Oregon, and Washington, as well as in Rhode Island and Indiana, to build shipyards and ships in support of America's war effort. By 1943, members of the Six Companies jointly owned twelve shipyards.[76] The following table lists the initial distribution of shares in one of those companies, South Portland Shipbuilding Corporation, as an example of how Todd, Kaiser, and the other Six Companies members formed such joint ventures:

Distribution of Shares of Stock in South Portland Shipbuilding Corporation[77]

Name of Shareholder	No. of Shares
Bath Iron Works Corporation	996
Todd Shipyards Corporation	746
The Kaiser Company	92.5
Bechtel-McCone-Parsons Corporation	92.5
The Henry J. Kaiser Company	91.5
W.A. Bechtel Company	91.5
The Utah Construction Company	69.5
Morrison-Knudsen Company, Inc.	69.5
MacDonald & Kahn, Inc.	69.5
General Construction Company	68.5
J.F. Shea Company, Inc.	68.5
Pacific Bridge Company	32.5

[75]"Shipbuilding on Puget Sound," *Pacific Marine Review* 38 (January 1941): 61; "Richmond Shipbuilding Corporation," *Pacific Marine Review* 38 (May 1941): 48; "The Todd Shipyard Corporation," *Pacific Marine Review* 38 (June 1941): 37; "Biggest Splash," *Fortune* 24 (July 1941): 121-122; "The Earth Movers II," 222.

[76]"The Earth Movers I," 100; "The Earth Movers II," 222, 225; *The Kaiser Story*, 25-28; Foster, *Henry J. Kaiser*, 68-71.

[77]Robert L. Bridges to H.W. Morrisson, letter dated 18 June 1941, in HJK 83/42c, box 10, file 46.

Henry J. Kaiser		1
	(continued on next page)	
S.D. Bechtel		1
J.A. McEachern		1
Charles A. Shea		1
Joseph Haag, Jr.		1
Charles F. Strenz		1
John D. Reilly		1
J. Herbert Todd		1
William S. Newell		1
Mortier D. Harris		1
Thomas R. Allen		1
John R. Newell		1
	Total	**2,500**

Note that all six of the original units in the Six Companies had interests in South Portland Shipbuilding, as did General Construction Company. Detailed histories of the Richmond and other shipyards appear in subsequent chapters of this report.

As the number of shipyards jointly owned by Todd and the Six Companies grew, so did the strain in their relationship. Todd and the Six Companies decided to sever their relationship in February 1942, after Kaiser secured the contract to build and operate Richmond Shipyard No. 3 without the participation of any of the partners, including Todd. Moreover, Yard No. 3 would be designed with basins instead of shipways so that it could serve as a ship repair facility after the war. Todd viewed this as an encroachment on its principal peacetime market, the ship repair business, which it had dominated on the Pacific Coast along with Bethlehem. Todd and the Six Companies agreed to divide their shared assets along fairly simple geographical lines. The Six Companies divested themselves of all interest in the South Portland yards in Maine and the Houston yard in Texas. Todd in turn relinquished its interest in the western yards (Richmond Yards 1 and 2 and Calship in Los Angeles). Todd also withdrew its interest in the Permanente Metals magnesium plant (see below), and the operations at Richmond Yards 1 and 2 were placed under the auspices of Permanente Metals. Kaiser later regained an interest in East Coast yards when the Maritime Commission asked the Six Companies to assume operations of the Rheem yard in Providence, Rhode Island. Kaiser took over the Rheem yard along with Morrison-Knudsen and Walsh Construction of Davenport, Iowa, one of the partners in the Grand Coulee consortium.[78]

As historian Kevin Starr has written, "Kaiser's shipbuilding career was based on the same formula as his construction career: a big project, a bold approach, and lots of government money."[79] Not satisfied with merely building ships, Kaiser used that formula and the

[78]"The Earth Movers II," 225; "The Earth Movers III," *Fortune* 28 (October 1943): 140, 193; "History of the Permanente Metals Corporation."

[79]Kevin Starr, *Embattled Dreams: California in War and Peace, 1940-1950* (Oxford: Oxford University Press, 2002), 146.

opportunities of the World War II mobilization to move into other industrial sectors as well. This section concludes with a summary of those efforts.

Kaiser used his shipbuilding contracts to launch another industrial enterprise: a magnesium reduction plant. In 1940, the only company in the U.S. producing magnesium was Dow-American Magnesium, which tried to assure the government that it could supply all the nation's wartime needs. Kaiser believed the U.S. would need much more magnesium to build the airplanes necessary to fight and win a modern war. In early 1941, Kaiser, the Six Companies, and Todd reached an agreement with the government's Reconstruction Finance Corporation allowing the companies to use Todd-California Shipbuilding Corporation's profits from the construction of the thirty British cargo ships to invest in the construction of a magnesium plant next to the Permanente Cement plant. To undertake the magnesium project, they changed the name of Todd-California to The Permanente Metals Corporation in November 1941. The following month Permanente Metals purchased all the stock in Richmond Shipbuilding Corporation, which operated Richmond Shipyard No. 2. Todd then left the venture on 25 February 1942. Permanente Metals Corporation operated Richmond Shipyards 1 and 2 as well as the magnesium facility.[80] With Todd's departure, Six Companies members owned shares in Permanente Metals in the following proportions:

Six Company Shares in Permanente Metals Corporation[81]

Company	Percentage of Shares
The Henry J. Kaiser Co.	11.3
The Kaiser Company	11.3
General Construction	11.2
J.F. Shea Co.	10.3
Bechtel	9.9
Bechtel-McCone-Parson	9.9
Morrison-Knudsen	9.9
Utah Construction	9.9
MacDonald & Kahn	9.9
Pacific Bridge	5.4
Total	**100.0**

At the outset of the magnesium project, Kaiser hired a immigrant from Austria, Fritz Hansgirg, to work on development of his "carbothermic reduction" process for producing

[80]"The Todd Shipyard Corporation," *Pacific Marine Review* (June 1941): 55; "The Earth Movers I," 101; "The Earth Movers III," 139-142; Foster, *Henry J. Kaiser*, 197-198; "History of Kaiser Organizations," Vol. II, p. 238A, in HJK 83/42c, box 299; "History of the Permanente Metals Corporation," 1-2, unpublished report dated ca. 1943 in HJK 83/42c, box 281, file 27.

[81]"The Earth Movers III," 140; "History of Kaiser Organizations," Vol. II, p. 238, in HJK 83/42c, box 299.

magnesium. Despite the FBI arresting Hansgirg as a security risk because of family connections with a Nazi official in Germany, Kaiser continued to support his work. Permanente Metals did not meet the deadlines it had given the War Production Board for the beginning of magnesium production, but by 1943 the carbothermic process was working. By then, Kaiser also had three other magnesium facilities operating in the vicinity. Three of the four plants used large quantities of natural gas. The carbothermic plant did not consume natural gas but rather merely used the gas, on its way to the other plants and the Permanente Cement plant, for cooling and for carrying away carbon monoxide. The other two magnesium plants that used natural gas burned it in the furnaces and kilns. In 1943, Kaiser engineers, working with the Army's Chemical Warfare Service, developed a process for making an incendiary material from powdered magnesium and other ingredients. In 1944, the Army ordered Permanente Metals to direct all of its magnesium output into the production of the incendiary material, called "goop."[82]

By 1941, federal planners were well aware that the nation was about to face a steel shortage as new shipyards and other manufacturing plants for the war effort went into production. Moreover, most of the nation's steel-producing capacity was located east of the Rocky Mountains. Kaiser and some government analysts criticized the nation's big steel companies for being too timid in responding to the growing demand for steel. Late in the year, the government's Defense Plant Corporation received authorization to build or finance new steel-producing facilities worth $1,300,000,000. None of them, however, were scheduled to be located on the Pacific Coast, although the government did decide to build one new steel mill at Geneva, Utah, to be operated by U.S. Steel. Concerned that his new shipyards would not be able to meet production schedules for lack of steel, and wanting to dislodge the old-line steel companies' comfortable control of the steel market (in a manner similar to what he had done with the California cement producers' control of the cement market there), Henry Kaiser finally received approval from the War Production Board to build a new steel mill at Fontana, California, 50 miles east of Los Angeles. For his entry into the steel industry, Kaiser acted without his associates in the Six Companies. In cooperation born of wartime necessity, other big steel companies aided Kaiser in Fontana's construction: Republic Steel supplied engineering plans, Consolidated Steel built the blast furnace, Bethlehem Steel supplied and erected much of the steel for the buildings, and U.S. Steel supplied many of the other materials, including the coke necessary to commence operations. The first blast furnace at Fontana, named Bess No. 1 for Henry Kaiser's wife, was blown in on 30 December 1942. During the course of the war, Fontana produced steel plate primarily. Kaiser Steel bought the facility from the government after the war and operated it until 1980.[83]

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[82]J.H. Gumz, "Natural Gas Plays Dual Role in Kaiser Magnesium Plants," *American Gas Association Monthly* 25 (October 1943): 400-401, 420; "The Earth Movers III," 139-142; Foster, *Henry J. Kaiser*, 198-199.

[83]Henry J. Kaiser to Admiral Vickery, et al, telegram dated 24 September 1942, in HJK 83/42c, box 15, file 36; Henry J. Kaiser, speech delivered 30 December 1942 at the blowing-in of the blast furnace at the Fontana steelmill, in HJK 83/42c, box 12, file 12; "The Earth Movers I," 101; "The Arrival of Henry Kaiser," *Fortune* 44 (July 1951): 144, 146, 148, 151; "Who Says We Can't Make STEEL," booklet published by Kaiser Company, Inc., Iron and Steel Division, and dated 25 June 1943, attached to E.E. Trefethen, Jr., to Howard L. Vickery, letter dated 1 July 1943, in NARA RG-178, entry 28, box 159, Pacific Coast Survey file; *The Kaiser Story*, 35-37;

At the height of the war, the Kaiser enterprises were divided among several corporate entities, all of which were headquartered in the Latham Square Building in Oakland. Henry Kaiser's primary holding company was The Henry J. Kaiser Company. It in turn owned two subsidiaries, Kaiser Company, Inc., and Kaiser Cargo, Inc. They operated four shipyards: Richmond Shipyard Nos. 3 and 4, Swan Island, and Vancouver, and they also operated the Fontana steel mill and an airplane factory in Pennsylvania. The parent company continued to own and operate a substantial aggregates business consisting of sand and gravel pits, concrete and asphalt batch plants, and numerous trucks. Kaiser's aggregate business prospered during the war. Then there was a separate company called The Kaiser Company, owned by Kaiser's top executives, which he used to share profits with them. Typically, The Kaiser Company and The Henry J. Kaiser Company would each own 50 percent of the overall Kaiser share in the various joint ventures, like Permanente Cement or Permanente Metals (see, for example, the list of ownership shares in the South Portland Shipbuilding Corporation above). Kaiser also encouraged his lieutenants to use The Kaiser Company to bid on their own projects. As of 1943, they had done that successfully only once, securing a construction contract with the Navy at Mare Island worth $18,000,000.[84]

Several key individuals in the Kaiser enterprise merit brief biographical sketches. Foremost among them is Clay Bedford, who was the general manager of the four Richmond shipyards. Born in Texas in 1903, Bedford spent his childhood moving from place to place, because his father worked in construction. After graduating from high school in Oakland, California, he went to Rensselaer Polytechnic Institute, where he graduated with a degree in civil engineering in 1925. Moving back to Oakland after graduation, he began his career with the Kaiser organization, taking a job as surveyor, draftsman, and engineer with Kaiser Paving Company. After two years of paving jobs around California, Bedford went to Cuba with the Kaiser organization. By the time he returned to California in 1930, he had risen to general superintendent of the Cuba highway project. Thereafter, he was project manager on some pipeline construction projects undertaken as Bechtel-Kaiser joint ventures, and he served as superintendent of transportation for the Six Companies at Hoover Dam. The Kaiser-led consortium building Bonneville Dam named him general superintendent in 1934. After completing that job in four years, he moved to the Grand Coulee project, where he again became general superintendent. The Kaiser organization moved him to Corpus Christi, Texas, in 1940 to supervise the $54,000,000 construction of a new naval air station. When Todd and the Six Companies secured the contract to build cargo ships for the British, Kaiser recalled Bedford to California to take charge of building and then operating the shipyards. He was not yet 40 years of age when he took charge of developing the Richmond shipyards.[85]

Foster, *Henry J. Kaiser*, 90-111; Foster, "Giant of the West," 14-22.

[84]Taylor, "Builder No. 1," 11; "Henry J. Kaiser" (*Fortune*), 148-149; "Plants, Projects, and Affiliations" section of "History of Kaiser Organization," n.p.

[85]"Richmond Shipyard Executive Turns a Few 'Miracles' Himself," *Oakland Tribune* (3 February 1943): 13; "Clay Bedford....," personal statement dated 19 July 1943, and "Biography Data Clay P. Bedford," typescript dated ca. 1945, both in HJK 83/42c, box 282, file 7.

Edgar F. Kaiser was Henry J. Kaiser's oldest son. Born in Spokane in 1908, Edgar grew up around his father's construction projects, and at the age of 12 his father had him writing-up dispatch tickets for recording truckloads of aggregate. When one driver forgot his ticket, Edgar chased after the truck. Nearing the truck, he slipped, falling so that his foot was crushed beneath a rear wheel. A.B. Ordway and Tom Price rushed him to a hospital, where doctors wanted to amputate the foot. Ordway insisted they wait until Edgar's father arrived. In the end, Edgar's foot was surgically repaired. Edgar attended the University of California at Berkeley, graduating in 1930 with a degree in economics. Like Clay Bedford, Edgar assumed key supervisory roles at Bonneville and Grand Coulee. The Kaiser organization then put Edgar in charge of the three giant shipyards in the Portland area (Oregonship, which Admiral Vickery called the finest in the U.S., Swan Island, and Vancouver). An intense rivalry arose within the Kaiser organization, as Edgar Kaiser's Portland shipyards and Clay Bedford's Richmond shipyard tried to out-perform each other.[86]

Eugene E. Trefethen graduated from the University of California at Berkeley the same year as Edgar Kaiser. A native of Oakland, Trefethen worked for Kaiser's Livermore sand-and-gravel plant during his college years. After graduating in 1930, he spent a year at the Harvard Business School before returning to California to work in administrative positions at various Kaiser operations before becoming Henry J. Kaiser's executive assistant.[87]

Morris N. Wortman was the lead architect in Kaiser's engineering office. Born in New York City in 1904, he received a bachelor's degree from Columbia University and studied architecture at the Ecole d'Beaux Arts in Paris, New York University, and the University of California at Berkeley. In addition to designing buildings at the Richmond shipyards, Wortman designed buildings for Kaiser's cement, steel, and aluminum plants and Kaiser hospitals and clinics.[88]

A search of indexes to periodical literature and other data bases reveals no writings by Wortman in which he expounded upon his design approach to industrial buildings. An interesting parallel exists, though, in the writings of Alonzo J. Harriman, an architect and engineer practicing in Maine who designed shops and warehouses at shipyards and other industrial plants during World War II. Harriman grew up in Bath, Maine, went to the University

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[86]John Hildreth, "Californians with Kaiser," *California Monthly* (February 1950): 14-15; "The Earth Movers I," 102; Foster, *Henry J. Kaiser*, 25, 32-33, 63; Adams, *Mr. Kaiser Goes to Washington*, 114-115.

[87]Hildreth, "Californians with Kaiser," 14-15; "The Arrival of Henry Kaiser," 72; Foster, *Henry J. Kaiser*, 38.

[88]John F Gane, ed., *American Architects Directory*, 3d ed. (New York: R.R. Bowker Company, 1970), 1014. See also a copy of a drawing by Bill Brooke dated 3 March 1944 and titled, "This Is the House that Morrie Built," showing caricatures of people who worked under Wortman in Kaiser's Facilities Engineering Department, drawing in possession of Don Hardison, El Cerrito, CA.

of Maine, where he received a B.S. in Mechanical Engineering in 1920, and worked at the shipyards of the Bath Iron Works during his school years. Because of the depression in shipbuilding following World War I, however, he could not make shipbuilding a career, so he went into the construction industry, working five years as a structural engineer in an architect's office. He then went to Harvard University and completed an M.A. in Architecture. Returning to Maine, he established his own architectural practice in 1928, designing schools, institutional buildings, and housing. Beginning in 1939 and the United States' preparations for war, Harriman's work turned toward designing industrial buildings, including those at the new and expanded shipyards at Bath and South Portland. Articles in architectural journals offer photographs of Harriman's industrial buildings, showing a similarity between them and those designed by Wortman.[89] Too much should not be made of this similarity, since there was a general similarity among industrial buildings of the war era. On the other hand, Wortman was a member of the Kaiser team that visited the Maine shipyards before embarking on the design of Richmond Yard No. 3.

C. Industrial Development in Richmond

Richmond, California, is located in Contra Costa County, on the east side of San Francisco Bay. In the nineteenth century, San Francisco developed on the peninsula that forms the south end of the Golden Gate, the opening in the coastal headlands through which the San Francisco Bay flows into the Pacific Ocean. Cities in Alameda County like Oakland, Berkeley, and Alameda grew up on the east side of the bay, becoming especially prominent with the completion of the transcontinental railroad in 1869. Contra Costa County is located north of Alameda County and south of the San Joaquin River. Prior to 1900, most of Contra Costa County was agricultural or undeveloped land. Much of the area that would become Richmond was farmland that had been Mexican land-grants prior to 1848. There were a few small landings along the shoreline where farmers could ship their produce to San Francisco and where miners or merchants heading into the gold country could procure provisions. One of the most important of these was Ellis Landing, established by Capt. George Ellis. His wharf was located on the mudflats where Henry Kaiser's crews would establish Richmond Shipyard No. 1 in 1942. Ellis Landing was situated at the north end of what is now Richmond's Harbor Channel.[90]

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[89]Alonzo J. Harriman, "Shipbuilding Yard," *Architectural Forum* 77 (October 1942): 82-88; Harriman, "Machine Shop and Assembly Building for a War Plant in Maine," *Pencil Points* 25 (March 1944): 36-38; Harriman, "Iron Works--Expanded Facilities," *Pencil Points* 25 (March 1944): 41-45. For a biographical sketch of Harriman and some insights into his approach to industrial architectural design, see "Perspectives, Practical Idealist from the Pine Tree State: Alonzo J. Harriman," *Pencil Points* 25 (March 1944): 39-40.

[90]J. George Smith, "Official Map of City of Richmond and Vicinity" (San Francisco: Foster & Ten Bosch, Printers, 1911), Earth Sciences Library, University of California, Berkeley, CA; J.D. Chapman, "City of Richmond," map dated 7 October 1912 in Earth Sciences Library, University of California, Berkeley, CA; Richmond Chamber of Commerce, *A History of Richmond, California* (Richmond, CA: Independent Printing Company, 1944), 94; David L. Felton, "The Industrial Heritage of the Richmond Inner Harbor Area: An Initial Inventory of Cultural Resources," unpublished cultural resources report dated 6 November 1979 and prepared for the

In 1895, A.S. Macdonald acquired much of the Mexican land grant that is now Richmond. He began negotiating with the Santa Fe Railroad to establish a railroad and ferry terminal at Point Richmond to provide a railroad link to San Francisco, arguing that it was closer than the terminals at Oakland or Alameda. The Santa Fe's new facility went into service in July 1900, spurring commercial growth near Point Richmond. Macdonald, however, intended the commercial center for the town he was developing to be a few miles inland. He platted commercial lots along his city's main east-west thoroughfare, named Macdonald Avenue, and platted residential lots around the core. Macdonald and other developers offered businesses and workers incentives like housing and transportation to locate near the area he intended to be the city's center. The City of Richmond incorporated in 1905. Municipal government was first located at Point Richmond, but it moved to new quarters in downtown Richmond in 1917.[91]

In the early years of the twentieth century, developers began to more intensively develop waterfront property at Richmond. The Standard Oil Company built an oil refinery in 1901 along the waterfront northwest of Point Richmond. The Pullman Coach Company moved its manufacturing and repair shops from San Francisco to Richmond in 1910. Other companies built smaller industrial facilities, like machine shops, brick yards and potteries, and a winery. In 1905, H.C. Cutting purchased 400 acres of marshy land around the old Ellis Landing. He then formed the Point Richmond Canal and Land Company to cut a channel through the swamp toward the northwest, using material excavated from the channel to begin filling swamp. That dredge cut has been improved over the years and is now known as the Santa Fe Channel. In 1910, the City of Richmond began working to help improve the harbor, securing the assistance of the federal Rivers and Harbors Committee to study the harbor while at the same time contracting with a San Francisco engineering firm to do so. Both studies were completed in 1912, and both recommended similar improvements, which formed the basis for the Inner Harbor as it exists today. There were to be three components that required dredging: 1) an entrance channel extending from deep water in the San Francisco Bay eastward along the south side of the Richmond peninsula to the north side of Brooks Island, 2) a rectangular basin running along the Richmond waterfront from Brooks Island to Point Isabel, and 3) a 600-foot-wide channel extending from the entrance channel, adjacent to Brooks Island and Point Potrero, roughly northward to the vicinity of Ellis Landing. The latter channel is now called Ellis Channel or the Harbor Channel.[92]

Richmond Inner Harbor Port Redevelopment Project, City of Richmond, pp. 4-8; Shirley Ann Wilson Moore, *To Place Our Deeds: The African American Community in Richmond, California, 1910-1963* (Berkeley and Los Angeles: University of California Press, 2000), 8.

[91]Richmond Chamber of Commerce, *A History of Richmond, California*, 94-96; Felton, "The Industrial Heritage of the Richmond Inner Harbor Area," 11-12; Moore, *To Place Our Deeds*, 8-9.

[92]Richmond Chamber of Commerce, *A History of Richmond, California*, 100-102; Felton, "The Industrial Heritage of the Richmond Inner Harbor Area," 12-14; Moore, *To Place Our Deeds*, 14.

Congress did not authorize federal construction of the improvements until 1917. During the intervening five years, the municipal government and other local parties began paying for dredging to improve the Harbor Channel and for construction of bulkheads along the channel behind which to place the dredged fill. Federal dredging and filling lasted from 1917 to 1933, with new fill expanding the areas of improved ground on both sides of the channel during that period. By the early 1930s, there were several manufacturing and transportation facilities along the Inner Harbor, including two municipal shipping terminals (one equipped for handling sugar and one for handling general cargo), a few private docks, the Filice and Perrelli cannery, and the Ford Motor Company's Richmond assembly plant. The latter two facilities began operating in the early 1930s. They were in part the fruits of Fred Parr's efforts to promote the development of new land, created by dredge fill, for industrial development along the Inner Harbor's waterfront.[93]

Fred Parr was born in 1885 on a ranch near Visalia, California. His father died when he was still a teen, so before he had completed high school his mother sent him to business school in San Francisco. After completing a course in business administration, he went to work as a bookkeeper for E.J. Dodge Company, a San Francisco business of which former California governor J.N. Gillett was president. Noticing that most steam schooners delivering lumber to San Francisco from the Pacific Northwest returned empty, Parr started a business predicated on the improved rates he could obtain for cargo shipped on the schooners' return trips. He built his business during World War I into the Parr-McCormick Steamship Line, of which the E.J. Dodge Company was a major investor. At the same time, Parr got involved in developments on Oakland's inner harbor, working with the Corps of Engineers to accomplish some dredging for a deep-water channel, building a terminal to provide Oakland with steamship service, and participating in the political moves that led to the Port of Oakland and its governing commission being independent of the Oakland City Council.[94]

Seeing what an effective operator Parr was, and concerned that Richmond might lose federal funds appropriated for harbor improvements, the Richmond Chamber of Commerce asked him in 1925 to speak in Richmond about that city's potential for expanded harbor facilities. In response to his remarks, Richmond's mayor asked Parr to manage and operate the city's municipal docks, which were small and received little business. Parr proposed instead that he head the implementation of a comprehensive plan to expand Richmond's harbor facilities. Among the features of Parr's plan were his commitment: to acquire 100 acres on the Richmond harbor; to coordinate efforts by the city to get the Corps of Engineers, finally, to dredge the

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[93]Richmond Chamber of Commerce, *A History of Richmond, California*, 102-103; Felton, "The Industrial Heritage of the Richmond Inner Harbor Area," 14-37; Marjorie Dobkin, "Filice and Perrelli Canning Company, Inc., Richmond, California: Historic Resource Evaluation Report," unpublished cultural resources report dated August 1998 and prepared for the STG Group, Santa Rosa, CA, pp. 7-9.

[94]Richmond Chamber of Commerce, *A History of Richmond, California*, 105; "The Reminiscences of Mr. Fred D. Parr," Oral History conducted by Owen Bombard and dated 14 June 1952, in Records of the Ford Motor Company, Henry Ford Museum, Dearborn, Michigan (hereinafter cited as "HFM"), Acc. No. 65, 1-28.

channel to the Richmond harbor and make it suitable for ocean vessels; to fill waterfront areas and make them suitable for industrial development; to expand railroads, streets, and utilities into the harbor area; to lobby the legislature to allow cities to make lease agreements with fifty-year terms; and to bring industries of national scope to Richmond. In implementing the plan, he formed the Parr-Richmond Terminal Company, which built a large terminal facility in cooperation with the City of Richmond.[95]

Parr secured the first of the promised national developments in 1926, when he read a notice in a newspaper that Ford was looking for a site on which to build a new assembly plant in the Bay Area. Even though Parr had sold land on the east side of the Ellis Channel to Ford in 1926, that company had not yet built its new plant in 1929, when Parr sold another parcel of reclaimed land to the Filice and Perrelli Canning Company. Gennaro Filice and John Perrelli had emigrated to California from Italy in 1908. They and members of their families worked in canneries near San Jose and Gilroy until 1914 when they formed their own business to grow and can tomatoes. The next year, they leased a small cannery at Gilroy, and in 1918, they incorporated as the Filice and Perrelli Canning Company. They leased another cannery in San Jose in the 1920s. Toward the end of the decade, they bought land in Oakland on which to build their own facility, but then Fred Parr contacted them, offering to trade land in Richmond for the Oakland property. Filice and Perrelli made the swap early in 1929 and began building their new fruit cannery, which was ready to can that year's crop. Filice and Perrelli canned cherries, peaches, apricots, plums, and figs, as well as fruit cocktail, a product developed by the University of California in the 1930s.[96]

Because of the Great Depression, there was little other development on the Richmond waterfront during the 1930s. One exception was a small boatyard built by Ernest Coxhead in the early 1930s at the head of the Santa Fe Canal. He only worked on wooden hulls, building some motorized skiffs and repairing pleasure craft and small industrial vessels. Coxhead continued operating his small yard throughout World War II, although Richmond Shipyards 1 and 4 on either side dwarfed his. He even received at least one government contract, to build five 17-foot motorized skiffs for the Navy. Two high school students whom he hired to help build those skiffs had the idea of designating Coxhead's facility Richmond Shipyard No. 1/2, a play on the designations used for distinguishing the four giant Kaiser yards that now dominated the Richmond waterfront and perhaps also indicating that Coxhead's yard pre-dated the Kaiser yards by ten years.[97]

In 1939, Fred Parr, perhaps knowing that the Maritime Commission was looking for sites for new shipyards, contacted the Kaiser organization about the possibility of locating a shipyard on Point Potrero, where Shipyard No. 3 would eventually come to be. He met with Kaiser

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[95]Richmond Chamber of Commerce, *A History of Richmond, California*, 103-107; "The Reminiscences of Fred D. Parr," 28-32.

[96]Felton, "The Industrial Heritage of the Richmond Inner Harbor Area, 33-37; Dobkin, "Filice and Perrelli Canning Company," 3-13.

[97]*Richmond Independent* (23 July 1943): 5.

engineer George Havas in June, after which Parr had some drawings and photographs of potential Richmond sites prepared for the Kaiser organization. Little else transpired until September 1940, when Parr met Stephen Bechtel, again on Point Potrero. That conversation led to a letter from Parr to Bechtel, in which he described the parcels of land he could assemble for shipyard sites. At the end of October, Parr received a telephone call from Henry Kaiser asking for a concrete proposal to lease a site along the Santa Fe Canal between the Parr Canal on the east and the Lauritzen Canal on the west. The ground was owned by several entities, including Parr-Richmond Terminal Corporation, Proctor & Gamble, and the Enterprise Foundry Company. Kaiser informed Parr that neither the Kaiser organization nor the Maritime Commission would purchase the land. Parr would have to acquire it and lease it for use as a shipyard or convince the existing owners to lease the land. Parr convinced Proctor & Gamble to lease its land, and Parr-Richmond purchased the Enterprise Foundry land to make it available for lease.[98] That is the parcel that came to be Richmond Shipyard No. 1.

CHAPTER THREE: KAISER ENTERS THE SHIPBUILDING BUSINESS

Even though Richmond Shipyard No. 3 is the one that survives, and therefore its history is critical to the development of resources at Rosie the Riveter/World War II Home Front National Historical Park, the history of Kaiser's shipbuilding industry in Richmond began with Shipyard No. 1. Once the first yard was successfully launched, the other three almost fell into place. The history of Yard No. 1 is therefore in some ways more important than that of the other three. This chapter provides a detailed background history of Yard No. 1, and the following chapter features histories of the other three.

A. Todd, the British, & Richmond Shipyard No. 1

As mentioned above, the British government sent a Technical Merchant Shipbuilding Mission to the United States in autumn 1940 to try to arrange American shipbuilding capacity that could supply Great Britain with merchant vessels of the type the Brits called tramp steamers. The mission was also authorized to investigate commitments that Canadian shipyards could make in that regard. The mission, headed by R.C. Thompson, consisted of five men. Thompson, Harry Hunter, and R.R. Powell represented the British Admiralty, and William Bennett and John S. Heck were surveyors for Lloyd's Register of Shipping. On September 21st, Thompson and Hunter sailed on the *Scythia* to join the other three, who were already in the U.S. Arriving in New York on October 3rd, Thompson, Hunter, and the rest of the mission began meeting in both New York and Washington, DC, with prospective shipbuilders, among whom were representatives of Todd Shipyards, who impressed the mission by the colored drawings they presented of a proposed tramp steamer. The Todd representatives informed the mission that they were associated with the Six Companies in the Seattle-Tacoma Shipyard and that they could build the ships the British desired so long as the ships were powered by reciprocating engines.

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[98]"Richmond Took a Beating: From Civic Chaos Came Ships for Ware and Some Hope for the Future," *Fortune* 31 (February 1945): 264; Richmond Chamber of Commerce, *A History of Richmond, California*, 117-119; "The Reminiscences of Mr. Fred D. Parr," 48-53.

After a quick trip to visit Canadian shipyards, the mission realized that they would only be able to obtain ships with reciprocating engines in North America.[99]

On October 15th, members of the British mission left New York for a two-week tour of shipyards and prospective shipyard sites on the East Coast, the Gulf Coast and the Pacific Coast, visiting the San Francisco Bay Area twice. The mission visited Seattle-Tacoma Shipbuilding's yard at Tacoma as well as Bethlehem's Union yard, Moore Dry Dock, Western Pipe & Steel, Joshua Hendy, and other sites in the Bay Area. It is not known if members of the mission visited Richmond, but they did meet with Henry Kaiser and his assistants in Oakland. By the time the mission returned to New York on November 1st, Bath Iron Works was part of the Todd-Six Companies group. William Newell of Bath Iron Works had been negotiating with the Soviet government to build a new yard for cargo ships along the waterfront at South Portland, Maine, but the pact between Stalin and Hitler ended that prospect. He now saw the Todd-Six Companies venture with the British as a means to build a shipyard at South Portland. Believing the Todd-Six Companies-Bath Iron Works group to be the most promising, the British government began concrete negotiations for the construction of two shipyards and the delivery of sixty tramp steamers. The U.S. Maritime Commission approved the recommended sites at South Portland and Richmond on December 11th. Todd-Bath Iron Shipbuilding Corporation and Todd-California Shipbuilding Corporation signed contracts with the British Purchasing Commission to accomplish those tasks on 20 December 1940, leading to the construction of two seven-berth yards, one at South Portland and one at Richmond. Each shipyard entailed three contracts: one to build the yard, one to deliver thirty ships, and one signed by the stockholders of the new company guaranteeing that the other contracts would be fulfilled.[100]

Todd Shipbuilding Corporation and the Six Companies each took a 35 percent share in the Todd-Bath Iron Shipbuilding Corporation, and Bath Iron Works took a 30 percent share. Todd owned a 35 percent share in Todd-California Shipbuilding Corporation (incorporated in

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[99]R.C. Thompson and Harry Hunter, "The British Merchant Shipbuilding Programme in North America 1940-42," *Transactions of the North East Coast Institution of Engineers and Shipbuilders* 59 (1943): 61-62.

[100]George Havas to W.F. Gibbs, letter dated 29 October 1940, in HJK 83/42c, box 7, file 7; E.S. Land to The President, memoranda dated 29 November and 2 December 1940, in NARA RG-178, entry 28, box 158, 1940 Shipyard and Construction Data file; "Biggest Splash," *Fortune* 24 (July 1941): 122, 124, 126; Thompson and Hunter, "The British Merchant Shipbuilding Programme in North America 1940-42," 62; Lane, *Ships for Victory*, 42, 48.

The Havas letter to Gibbs concerns the Kaiser organization's efforts to obtain cost quotations for building merchant ships for the British. The letter shows that Kaiser officials began negotiating with the firm Gibbs & Cox, the Maritime Commission's naval architect for the merchant ships, concerning design changes requested by the British mission as early as 29 October 1940.

The British Purchasing Commission was arranging contracts with U.S. manufacturers for numerous wartime needs in addition to cargo ships; see, for example, "Mr. Jones Goes in for Guns," *Fortune* 24 (July 1941): 58-60, 82, 84, 87.

Delaware on 9 December 1941), with the Six Companies taking the remaining 65 percent.[101] The following table shows how the shares in Todd-California were divided:

Initial Ownership Participation in Todd-California Shipbuilding Corporation[102]

Company	Ownership Percentage
Todd Shipbuilding Corporation	35%
The Henry J. Kaiser Company	8
The Kaiser Company	8
W.A. Bechtel Company	8
Bechtel-McCone-Parsons	8
General Construction Company	6
J.F. Shea Company, Inc.	6
Utah Construction Company	6
Morrison-Knudsen Company, Inc.	6
MacDonald & Kahn, Inc.	6
Pacific Bridge Company	3

Todd-Bath had authorization to build basins for its yard, rather than shipways. The seven basins were similar to dry docks, but they were designed only to launch ships, not to receive them for repairs, and they only had enough depth (7' below mean low tide) to float hulls before they had been outfitted, which would take place at a nearby pier. Two advantages to the design were that ships could be built with keels on the level, and it would be easier to launch a ship by filling the basin with water, floating the hull, opening the gate, and towing the ship out of the basin, than it was to launch the ship by sliding it down the shipway. The basins cost more to build than shipways, but not as much as dry docks. Due to freezing weather in Maine during February and March 1941, construction of the South Portland yard fell behind construction at the Richmond yard, despite unusually rainy weather there. In the end, both shipyards delivered their thirty ships to the British ahead of schedule, but Richmond beat South Portland by four months (July 1942 and November 1942, respectively), despite the fact that there were more people with experience building ships in Maine at the outset than there were in Richmond. One reason that the Todd-Bath yard could not match the speed with which Todd-California built ships was that the Richmond yard had more space available at the head of the ways for pre-assembly. William Newell of Bath Iron Works was used to the compact layout of his old yard at Bath, and he chose not to afford the new shipyard at South Portland the space it could have had for pre-assembly.[103]

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[101]"Shipbuilding on San Francisco Bay," *Pacific Marine Review* 38 (January 1941): 68; "The Todd Shipyard Corporation," *Pacific Marine Review* (June 1941): 37; "Biggest Splash," 126; "History of the Permanente Metals Corporation," p. 1, unpublished report dated ca. 1943 in HJK 83/42c, box 281, file 27.

[102]"History of Kaiser Organizations," Vol. II, p. 238, in HJK 83/42c, box 299.

[103]"Ship Basins Built in Large Cofferdam," *Engineering News-Record* 126 (5 June 1941): 74-76; "British Shipyards in the United States," *Engineering* 151 (20 June 1941): 496-497, 152 (1

One of the organizations represented at both the South Portland and Richmond shipyards during construction of the British ships was Lloyd's Register of Shipping, a society based in London and formed in 1760 to inspect and classify ships. Customers of shipping and insurance underwriters both needed information about a ship's fitness in order to make decisions about whether to entrust cargo to the ship or how much to charge for insurance on that cargo. Lloyd's Register, which was a completely separate organization from Lloyd's, the famous insurance underwriter (they both had their beginnings in the same Lloyd's Coffee House in London), employed a small army of "surveyors" who inspected shipyards and ports throughout the world to create lists of cargo ships classified by their type and quality of construction as well as their present soundness. In general, data generated by the Lloyd's Register of Shipping was open to the public, but during wartime, the British government pressed the Register into national service, and the data become classified. Thus, even before the first keels were laid, the Todd-Bath and Todd-California shipyards each had five surveyors in the employ of Lloyd's Register present. The surveyors were the official inspectors for the British government, representing the "owner's interests" during the building of all the ships. Lloyd's Register also had surveyors at the General Machinery Company plant, where the steam engines were being built, and at the plants making boilers. After a shipyard took a ship on a satisfactory trial run, it would "deliver" the vessel to a Lloyd's Register surveyor, representing the British Purchasing Commission. Upon acceptance by Lloyd's Register, British officers and crew would take charge of the ship.[104] The comparable organization representing the U.S. was the American Bureau of Shipping.[105]

Because the British Purchasing Commission paid for the Todd-California shipyard, it owned it. When the Maritime Commission awarded the shipyard a contract to build Liberty ships in January 1942, the Maritime Commission purchased the yard from the British, thereby

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August 1941): 86-90, and 153 (3 April 1942): 267-268; R.C. Thompson and Harry Hunter, "The British Merchant Shipbuilding Programme in North America 1940-42," *Transactions of the North East Coast Institution of Engineers and Shipbuilders* 59 (1943): 62-63. The nearby shipyard of the South Portland Shipbuilding Corporation, built for Liberty ships and not the British vessels, had conventional ways, and not basins; see "Liberty Ships Built in Basins and on Ways," *Engineering News-Record* 129 (2 July 1942): 64-67; Charles O. Herb, "Liberty Ships Built in Sunken Basins and on Ways," *Machinery* 49 (November 1942): 192-199; Lane, *Ships for Victory*, 53-55.

[104]Thompson and Hunter, "The British Merchant Shipbuilding Programme in North America 1940-42," 62; George Blake, *Lloyd's Register of Shipping, 1760-1960* (Crowley, Sussex, Great Britain: Lloyd's Register of Shipping, n.d.), 1-6, 92-96, 115-118.

[105]Lane, *Ships for Victory*, 2, 556-557. Shipbuilders, shipping lines, and underwriters cooperated to form and support the American Bureau of Shipping, which set standards for workmanship, strength of materials, and ship fitness and placed surveyors at ports, shipyards, and the plants of equipment suppliers to monitor compliance with those standards. The U.S. Department of Commerce had a comparable agency, the Bureau of Marine Inspection and Navigation, charged specifically with inspecting merchant ships and passenger liners in order to protect the safety of passengers and crew. The Bureau of Marine Inspection was placed under the jurisdiction of the U.S. Coast Guard after 1 March 1942.

ensuring that it would continue to build ships for the U.S.[106]

As mentioned in the previous chapter, in February 1942 Todd and the Six Companies severed their joint ownership of shipyards on all three coasts. The Six Companies surrendered their interests in the shipyards on the East Coast and the Gulf Coast, and in exchange acquired all of Todd's interests in Richmond Yards 1 and 2 and Calship. Prior to that time, on 18 November 1941, they had changed the name of Todd-California Shipbuilding Corporation to Permanente Metals Corporation. The latter company acquired all the stock in the Richmond Shipbuilding Corporation, the Todd-Six Companies joint venture that operated Richmond Shipyard No. 2. Richmond Shipbuilding remained a distinct corporate entity, however, until it had completed all of its contracts with the Maritime Commission to build Liberty ships at Yard No. 2. At the same time, Permanente Metals decided that Richmond Shipbuilding would accept no new contracts. Thereafter, Permanente Metals took contracts for work in both yards and distributed it between them.[107]

After the war, the two Bechtel entities sold their interests in Permanente Metals to The Henry Kaiser Company and The Kaiser Company. The six other Six Companies corporations retained the respective interests in Permanente Metals that they had held during the war.[108]

B. Design & Construction of Shipyard No. 1

As noted above, there were two distinct aspects to the emergency shipbuilding program: building shipyards and then operating the shipyards to build ships. The Maritime Commission's two separate contracts reflected that distinction. Each aspect also foisted its own distinct requirements upon the Kaiser organization, as it adjusted from the kinds of large contracts it had been undertaking heretofore. Each aspect is therefore described here in turn.

1. From Building Dams to Building a Shipyard

During the fall of 1940, the Kaiser organization was busy with several big projects. Two key managers, Edgar Kaiser and Clay Bedford, were managing construction at Grand Coulee and the Corpus Christi Naval Air Station, respectively. Once Henry J. Kaiser and Stephen Bechtel joined the Todd interests in negotiating a contract with the British for merchant ships and the shipyards to build them, Kaiser brought son Edgar, Bedford, and George Havas into the negotiations. Then, while Edgar and Bedford maintained their supervisory responsibilities at Grand Coulee and Corpus Christi, Henry Kaiser dispatched them to shipyards at Bath, Seattle, and Tacoma to learn as much as they could about their layout and construction. Kaiser gave Havas the task of working with Fred Parr to find suitable ground in Richmond to build the

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[106]"History of the Permanente Metals Corporation," 1; Lane, *Ships for Victory*, 139.

[107]"History of Kaiser Organizations," Vol. II, p. 238 and 238A, in HJK 83/42c, box 299; "History of the Permanente Metals Corporation," 1-2.

[108]"Ships," in HJK 83/42c, box 298, file 21.

shipyard.[109]

Todd-California signed the contract with the British Purchasing Commission on December 20th. The contract specified that the yard be completed within four months and that the first keel be laid by 7 March 1941, so time was of the essence. According to some accounts, construction work for the Richmond yard began on 20 December 1940. According to a notice in the British journal, *The Engineer*, work began within ten hours of the signing of the contract. This probably refers to the work of making formal plans and giving people assignments for physical work on the ground. According to the Kaiser organization's history of the Richmond shipyards, physical work on the site of the Todd-California shipyard (Richmond Yard No. 1) did not begin until December 29th under the supervision of O.H. McCoon. He had been the carpentry superintendent at Grand Coulee. After signing the contract with the British, Edgar Kaiser sent McCoon to Washington to learn as much as he could about the construction of shipyards at the yards the Seattle-Tacoma Shipbuilding Corporation was building at Tacoma and Seattle for the Maritime Commission and the U.S. Navy, respectively. McCoon first visited the mudflats along Richmond's Santa Fe Canal on December 28th. The next day he hired two carpenters and a laborer, ordered some lumber, and began construction of a temporary office. Within a short time, the Kaiser-Bechtel team had secured additional contracts with the Maritime Commission to build emergency yards at Portland (Oregonship) and Los Angeles (Calship). Edgar Kaiser and Stephen Bechtel assumed responsibility for those respective projects, leaving Clay Bedford in charge of Todd-California.[110]

That last week in December, the Kaiser organization began assembling key men to take charge of other facets of construction. Charles H. Day moved to Oakland from Grand Coulee to become Todd-California's personnel manager, and he began selecting foremen and other supervisors from Grand Coulee and other projects for transfer to Todd-California. Working at the Kaiser headquarters in the Latham Square Building in Oakland with an assembled team of draftsmen, design engineer Fred Crocker began designing the layout of the shipyard, and architect Morris Wortman began designing the buildings. Within a short time, Day had assembled a management crew, all from the Grand Coulee project, that included Joseph F. Reis, in charge of administrative procedures; S.D. Raudenbush, office manager; Dan Peacock, purchasing agent; M.M. Spencer, paymaster; Merle Myers, chief timekeeper; and Dave Oppenheim, progress engineer. In addition, Clay Bedford brought two of his assistants with him from Corpus Christi: cost accountant Joe Friedman and secretary Howard Welch.[111]

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[109]Alyce Mano Kramer, "The Story of the Richmond Shipyards," pp. 4-5, unpublished typescript dated 1945 in HJK 83/42c, box 288, file 5.

[110]"Shipbuilding on San Francisco Bay," *Pacific Marine Review* 38 (January 1941): 68; "The Todd Shipyard Corporation," *Pacific Marine Review* (June 1941): 37; "New American Shipyards," *The Engineer* 171 (20 June 1941): 398; Kramer, "The Story of the Richmond Shipyards," 5-6, 11.

On Calship's early record, see "Calship Smashes All Records!" *Pacific Marine Review* 39 (August 1942): 50-54.

[111]Kramer, "The Story of the Richmond Shipyards," 6-7, 11.

On 3 January 1941, Frank McDonald, president of the California State Building Trades Council of the American Federation of Labor, announced that Todd and Kaiser had signed an agreement with sixteen craft unions covering working conditions and stipulating that all work at the shipyards would be by union members. Within a few days, Laborers Union Local 324 reported that 300 men had applied for membership. Laborers union business agent Robert Lee said that there would only be about forty jobs for laborers during construction and that the local would only send existing members to work. Carpenters Local 642 made a similar announcement. Nevertheless, over the ensuring weeks workers in those and other trades continued, in hopes of finding work, to travel to Richmond from throughout a country still in the grips of the Great Depression. Even union barbers were reported to be flooding into Richmond in anticipation of the workers the shipyard would bring to the community.[112]

McCoon and his crew continued erecting temporary buildings, and by mid-January plans had advanced to the point that excavation at the site could commence. The first contract went to San Bruno Feed & Fuel Company of San Francisco to haul rock fill onto the site to provide the base on the mud flats for a road. Half of the contractors' teamsters for the work were to come from a San Francisco local and half from the Teamsters' Richmond Local 315. Trucks and power shovels began moving dirt on January 14th, and Todd-California formally broke ground for its Richmond yard on the 16th. The pace of work accelerated, and by March crews were driving 500 piles each day. All told, they drove 24,000 piles. Dredges removed 337,000 cubic yards of silt from the Santa Fe Canal, 121,000 cubic yards from the launch basin, and 216,000 from the Lauritzen Canal, which would accommodate ships berthed at the outfitting dock. Trucks brought 300,000 cubic yards of additional borrow to complete the fill for the yard. The office building was the first one completed, on February 22nd, and Clay Bedford and his staff occupied the building immediately. Engineers designed the sequence of construction for the shipyard so that crews could begin building components of ships before other parts of the yard were completed. For example, the mold loft and template storehouse were complete enough that by the end of April craftsmen could begin making templates, even while other parts of the shipyard, like the plate shop and shipways were still under construction.[113]

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[112]"Pact with 18 Units Assures 100 Per Cent AFL Operations on Todd Shipyard in Richmond," Contra Costa County *Labor Journal* (3 January 1941), 1; "Laborers Big Rush to Richmond Is to No Avail, Lee Says," Contra Costa County *Labor Journal* (10 January 1941), 1; "Carpenters Have No Shipyard Jobs Open At Present," Contra Costa County *Labor Journal* (10 January 1941), 1; "Too Many Laborers Hitting Richmond for Shipyard Work," Contra Costa County *Labor Journal* (17 January 1941), 1; "Barbers Flood into Richmond with Few Jobs," Contra Costa County *Labor Journal* (10 January 1941), 1.

[113]"Teamsters Start Shipyards Work Rockfilling Road," Contra Costa County *Labor Journal* (10 January 1941), 4; "Richmond Shipbuilding Corporation," *Pacific Marine Review* 38 (May 1941), 48; "New American Shipyards," 398; "Todd-California Shipbuilding Corporation Shipyard at Richmond, California," *The Engineer* 172 (25 July 1941): 58-59; Thompson and Hunter, "The British Merchant Shipbuilding Programme in North America 1940-42," 63; Kramer, "The Story of the Richmond Shipyards," 5-8; "History of Kaiser Organizations," Vol. II, p. 238A, in HJK 83/42c, box 299.

On April 14, seventy-eight days after beginning construction of the shipyard, and despite very rainy weather that hampered progress, Todd-California laid the keel for Hull No. 1. Union members boasted of the fact that, because of the national-defense emergency, they had worked through weather conditions that, under normal work rules, would have allowed them to call a halt to their labors. Workers at the yard launched the ship on August 16th, with Mrs. Emory Land on hand for the traditional champaign ceremony, at which she christened it the *Ocean Vanguard*. Todd-California delivered its first ship to the British Purchasing Commission on October 27th. Before the *Ocean Vanguard* left the Todd-California yard, however, painters covered over the name that had been painted on the bow for the launching. Merchant ships always had their names removed during wartime to maintain anonymity, thus making it difficult for enemy spotters to observe shipping patterns.[114] More detailed descriptions of the building of the *Ocean Vanguard* and other British ships are provided below.

The launching of Todd-California's second British ship was not so propitious. The launching took place on August 31st, with Mrs. Henry J. Kaiser as the sponsor. After she threw the obligatory bottle of champagne against the bow of the *Ocean Vigil*, the ship slid down shipway no. 4. One of two drag weight cables snapped. With only one cable attached, the ship turned sideways in the water, got caught by a gust of wind, and was blown out into the Richmond Inner Harbor, where it collided stern-first with a Soviet freighter, the *Minsk*, which was docked at the Parr Terminal Warehouse. The collision tore a six-foot gash in the side of the *Minsk* but did little damage to the *Ocean Vigil*. The *Minsk* was taking on a load of aviation gasoline, oil, and machinery for delivery to the Soviet Union. The *Minsk* had been built at Odessa in 1918 and reconditioned earlier in 1941 at Moore Dry Dock in Oakland.[115]

When completed, the Todd-California shipyard had seven shipways, each 87'-6" x 425', located between the Parr Canal and the Lauritzen Canal. They were arranged so that ships could slide down the ways into a launching basin along the north side of the Santa Fe Canal. Each shipway had a set of crane tracks on either side, making a total of eight sets of crane tracks. Each set of crane tracks, except those at the extreme ends, served the shipway on either side. North of the shipways was a large building that housed the plate shop and assembly bay. Between the shipways and the plate shop was a sizeable area where steel plates and structural members could be pre-assembled before being moved to the ways by the cranes. The crane tracks extended through this pre-assembly area to the south side of the plate shop. There was a large materials storage yard north of the plate shop. The mold loft and template storehouse was

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[114]"Rainy Weather Did Not Hold up Ship Yard Construction," Contra Costa County *Labor Journal* (10 January 1941), 1; "Richmond Shipbuilding Corporation," *Pacific Marine Review* 38 (May 1941): 48; *Richmond Independent* (18 August 1941), 1, 3, and 9, (30 October 1941), 4; "Mud Flats to Deliveries in Ten Months," *Pacific Marine Review* 38 (November 1941): 28; Kramer, "The Story of the Richmond Shipyards," 10, 12; "History of Kaiser Organizations," Vol. II, p. 238A, in HJK 83/42c, box 299.

[115]"New S.F. Bay Vessel Rams Soviet Ship," *San Francisco Chronicle* (1 September 1941), 1; "Shipyard Inquiry Called in Crash," *Oakland Tribune* (1 September 1941), 3 "Vigil Crashes At Launch," *Richmond Independent* (1 September 1941), 1 and 2.

located north east of the plate shop, and the main office was at the north end of the shipyard property, near the intersection of Cutting Boulevard and Fourth Street. Buildings housing a fittings loft, a general stores warehouse, and a machine shop were located along the Lauritzen Canal, along the east edge of which was the outfitting dock with four berths. A fifth berth was located along the Santa Fe Canal between the Lauritzen Canal and shipway no. 1. A set of crane tracks ran along the full length of the outfitting dock. There was a 50-ton whirley crane on each set of tracks between the ways, four whirley cranes along the outfitting dock, and four whirley cranes serving various parts of the storage yard. Ships that had completed their sea trials could berth in the Parr Canal.[116]

The pre-assembly area occupied an area about 300' wide between the shipways and the plate shop. Such ample space for pre-assembly was still unheard-of in early 1941. Hog Island and other earlier shipyards had dedicated some space adjacent to the shipways for pre-assembly, but because pre-assembly had yet to be as fully exploited as it would be at the height of World War II shipbuilding, old-line shipbuilders did not appreciate how much space pre-assembly should be allocated in laying out the new emergency yards. The first few East Coast yards built for British merchant vessels (Todd-Bath) or Liberty ships (e.g., Bethlehem-Fairfield and North Carolina Ship) relied upon fabricating shops located some miles from the shipyard, so their shipbuilders had not envisioned how important ample pre-assembly areas could be. The first few yards built on the Pacific Coast by Kaiser and his associates (Todd-California in Richmond, Oregonship. CalShip in Los Angeles), on the other hand, were built on entirely undeveloped land by firms who were uninhibited by previous shipbuilding experience. The 300' of pre-assembly space at Todd-California and Oregonship was twice that at Hog Island. Once the West Coast yards demonstrated the effectiveness of pre-assembly, subsequent emergency shipyards, whether built along the East Coast, the Gulf Coast, or the Pacific Coast, devoted at least that much space for pre-assembly, if site conditions allowed, of course. Shipyards that initially provided that much space quickly took steps to provide more, as Todd-California did, when it developed additional pre-assembly areas next to one of the shipways.[117]

Because Shipyard No. 1 was intended to be temporary, most of the buildings were either of wood-frame or heavy timber construction. The exceptions were the plate shop and three

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[116]"Todd-California Shipbuilding Corporation Shipyard at Richmond, California," 58; "General Plant Layout," drawing dated 4-2-42, and "Shipways, drawing dated 6-4-41, both in Permanente Metals Corporation, "General Description of Richmond Shipyard No. 1," unpublished report dated 8 June 1942 in possession of James McCloud, Oakland, CA; "General Plant Layout," drawing dated 2 March 1944, in D.D. Dick, "Shipyard Facilities Index: West Coast Yards," unpublished report dated 1 July 1945, in NARA RG-178, entry 23, box 1; "Richmond Shipyard No. 1, Schedule of Shipyard Facilities As Of July 1, 1944," unpublished report in "West Coast Yards, Shipyards Facilities Index," NARA RG-178, entry 100, box 26; Kramer, "The Story of the Richmond Shipyards," 12. Another article, Charles F.A. Mann, "Building British Ships in California," *Marine Engineering and Shipping Review* 47 (July 1942): 102-111, contains considerable detail on the sizes and makers of the various machine tools and other equipment housed in the shops at the Todd-California shipyard.

[117]Lane, *Ships for Victory*, 216-220, 224.

smaller buildings (acetylene, paint shop, and electrical sub-station), which were of steel-frame construction. The plate shop was equipped with fourteen traveling bridge cranes and twenty-four jib cranes. In addition to the whirley cranes already mentioned, the yard had two locomotive cranes, fourteen truck-mounted cranes, and a crawler crane. Inventories of all the other machinery and equipment at Richmond Shipyard No. 1, down to the 128 spray-paint guns and 129 chipping hammers, are available in Maritime Commission records at the National Archives.[118]

2. A Contractor Becomes a Shipbuilder

To develop a detailed design and the necessary drawings for the sixty British cargo ships, the Todd-Six Companies group retained Gibbs & Cox, Inc., a New York firm of naval architects that was among the foremost in the field. The British Admiralty provided an initial set of drawings for a tramp steamer, and Gibbs & Cox made the necessary changes in the design so that the hulls could be welded, rather than riveted. The work facing Gibbs & Cox proved to be quite monumental. The British set of plans grew out of a different approach to standardization in Great Britain. There, each yard developed their own set of plans for a standardized ship that met broad overall specifications. The Admiralty's Director of Merchant Shipping had taken plans for one of those standard ships, the *Empire Liberty*, that was being built by Joseph L. Thompson & Sons, Ltd., at the firm's North Sands shipyard at Sunderland, and modified the plans slightly to further aid rapid ship construction. One of the director's main alterations was to eliminate nearly all double curves required in the steel plate for bow and stern sections of the hull. Thus, the British presented Gibbs & Cox with plans for a ship that had never actually been built. Moreover, British yards employed a different approach to preparing ships' drawings, producing only about 30 percent as many drawings as American yards did. In British yards, many details were missing from drawings, leaving skilled workers in the yards to interpret the details needed or to provide necessary connections or clearances with hand fitting and filing. Gibbs & Cox used scale models of portions of the ship they were designing in order to provide the detailed drawings necessary for the methods that would be used at South Portland and Richmond.[119]

The large, old-line shipbuilders in the U.S. typically had their own naval architects and marine engineers on staff. Smaller yards relied on firms like Gibbs & Cox. A role that Gibbs & Cox would play, typically, was to solicit bids from suppliers for materials and equipment. They would provide prospective suppliers with plans and specifications, and then the client shipyard would select the suppliers from among the bidders. The Todd-Six Companies consortium actually made Gibbs & Cox the purchasing agent for materials and equipment required for building the sixty British ships, adding tasks to the Gibbs & Cox assignment. Not only would the firm solicit bids for supplying nearly all materials and equipment, including steel plate,

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[118]"Richmond Shipyard No. 1, Schedule of Shipyard Facilities As Of July 1, 1944."

[119]"British Prototype of the Liberty Ship," *Marine Engineering and Shipping Review* 47 (April 1942): 168-170; Kramer, "The Story of the Richmond Shipyards," 9; "The British Merchant Shipbuilding Programme in North America 1940-42," 65-66; Lane, *Ships for Victory*, 73, 80-82.

structural steel, boilers, engines, rudders, rivets, welding rods, and electrical gear, but also Gibbs & Cox would receive bids, select the suppliers, and then specify schedules for when the various suppliers were to deliver materials and equipment so that deliveries matched as closely as possible the sequences of assembly at the yards. The two shipyards only purchased small items locally. This expanded procurement assignment quickly assumed larger proportions. At the same time that the British ordered sixty ships from the Todd-Six Companies consortium, they also ordered twenty-six ships from two Canadian shipyards. The Canadian-built ships would be riveted, not welded. Less than a month later, the Maritime Commission announced that it would order 200 emergency cargo ships based closely on the British tramp steamers. The Maritime Commission put Gibbs & Cox in charge of procurement for all emergency shipbuilding, including that at the Canadian yards.[120]

One of the important supply contracts was for the triple-expansion reciprocating steam engines. Gibbs & Cox awarded the contract for all sixty engines to General Machinery Corporation of Hamilton, Ohio. The engines were based on a British design from the North Eastern Marine Engineering Company, Ltd., Wallsend-on-Tyne, but again the British method of leaving many details to interpretation by skilled workers in the fabricating shop meant that Gibbs & Cox had to produce a greatly expanded set of drawings for American and Canadian manufacturers. Gibbs & Cox sub-contracted this work to the General Machinery Corporation. General Machinery also had to change a variety of details because customary finishes, tolerances, threads, and various fittings were different in American and British practices. As a consequence, General Machinery expanded the eighty-drawing set of plans that the British Mission provided to a set of 550 drawings. (This being the engine that the Maritime Commission adopted for use in Liberty ships, General Machinery soon had to distribute sets of the drawings to numerous other companies with which the Maritime Commission contracted to supply engines for America's Liberty fleet.) Contracts for the Scotch boilers went to three firms. American Locomotive Company of Schenectady, New York, received a contract to supply all the boilers for the ships to be built at the Todd-Bath yard in Maine, and Western Pipe & Steel and Puget Sound Machinery Depot each received contracts to supply boilers for the thirty ships to be built at Richmond. Because neither of those two firms could start producing boilers in time, however, the first ship launched from the Richmond yard was fitted with boilers from American Locomotive that had been transported by rail from New York to Richmond.[121]

Gibbs & Cox and the Maritime Commission severed their relationship in mid-1941 because of a disagreement over fees. Gibbs & Cox was used to working for cost plus fee. Maritime Commission officials believed that as the volume of work increased, the multiplier

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[120]Kramer, "The Story of the Richmond Shipyards," Thompson and Hunter, 9; Thompson and Hunter, "The British Merchant Shipbuilding Programme in North America 1940-42," 66; Lane, *Ships for Victory*, 89-92.

[121]Clay Bedford to Edgar F. Kaiser, letter dated 17 July 1941, in HJK 83/42c, box 8 file 17; "Mud Flats to Deliveries in Ten Months," 29; "Standardization of the Marine Triple-Expansion Steam Engine," *Pacific Marine Review* 39 (January 1942): 76-79; Thompson and Hunter, "The British Merchant Shipbuilding Programme in North America 1940-42," 74-75; Lane, *Ships for Victory*, 93-94.

used to calculate the firm's fee should decrease, but Gibbs & Cox disagreed. After the two entities parted company, Gibbs & Cox remained very busy throughout the war working for the Navy and receiving its customary fee. Meanwhile, the Maritime Commission established a Procurement Section to take over the function that Gibbs & Cox had been performing on the government's behalf.[122]

Crews at the Todd-California yard laid the keel for Hull No. 1 on April 14th. Three more keels were laid in the latter half of April and the remaining three by mid-May. The Kaiser organization had been able to rely on some of its experienced foremen to supervise construction of the shipyard, but supervising the actual building of ships took a somewhat different set of skills and experience. Therefore, Todd-California hired a few key men from outside the construction industry. Two of them, Ed Hannay, Sr., general superintendent of the yard, and Harry Friel, marine superintendent, came from Union Iron Works, Bethlehem Steel's San Francisco shipyard. Two others, Mike Soule, chief loftsman, and Elmer Hann, ship erection superintendent, came from Consolidated Steel, which was building C-1 cargo ships at its Long Beach yard near Los Angeles for the Maritime Commission. Kaiser also hired experienced shipwrights such as master shipwright Ivan Duncan and men like George Norman, Jack Holland, Tom Gray, and Andy Meyer, who had worked as shipwrights during World War I. By June 1941, there were 4,698 employees working at the Todd-California yard.[123]

A sizable contingent represented the British interests at the Todd-California yard. As already mentioned, employees of Lloyd's Register of Shipping, as representatives of the British Purchasing Commission, inspected the work being done at the yard. Fred C. Cocks was the Lloyd's Register's chief surveyor, and his staff included Rex B. Shepheard, John Sim, J.F. Robertson, and John Rannie. The British Purchasing Commission's auditor was Price Waterhouse, whose on-site staff accountant was D.B. Maturin. W.S. Holliday and Capt. R.F. Sturrock represented the British Ministry of War Transport. The British personnel had their offices in Todd-California's main office building.[124]

On the maiden voyage of the *Ocean Vanguard*, the ship carried a full cargo across the Atlantic in winter weather. During the voyage, the ship suffered a collision that caused some of the steel plates in the hull to buckle, but none of the welded joints fractured, giving the British

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[122]Vickery, "All Out...To Build Ships!" 37; Lane, *Ships for Victory*, 97-100.

[123]"Men Down Under," *Fore'n'Aft* 3 (11 June 1943): 2-3; Kramer, "The Story of the Richmond Shipyards," 10-12.

[124]Charles F.A. Mann, "Building British Ships in California," *Marine Engineering and Shipping Review* 47 (July 1942): 105; Kramer, "The Story of the Richmond Shipyards," Thompson and Hunter, 10-11.

Later in the war, Rex Shepheard returned to England, where he became Superintendent of Welding Development for Merchant Shipping at the Admiralty. In that capacity, he lectured on experiences he had gained at the Todd-California shipyard in welding and in particular in the lay-out of pre-assembly areas for welding large components of merchant vessels; see "Shipyard Lay-out for Welded Construction," *The Engineer* 175 (25 June 1943): 504-505.

Admiralty confidence in the ship's design, in the decision to use welding instead of riveting in construction of hulls, and in the quality of construction being employed at the Todd-California shipyard. Richmond Yard No. 1 completed its contract with the British on 22 July 1942, five months ahead of schedule, with the delivery of the thirtieth ship, the *Ocean Victory*. Meanwhile, Yard No. 1 had received a contract from the Maritime Commission in January 1942 to build sixty Liberty ships as soon as the contract with the British was completed. An addendum to the contract in May added fourteen more Liberty ships. Because the Liberty ships were so similar to the British cargo ships, very little would have to be changed at Yard No. 1.[125]

As already mentioned above, the group led by Kaiser satisfied Admirals Land and Vickery sufficiently that, as the Maritime Commission continued to expand its emergency shipbuilding program and place ever more orders for new ships, it placed the Kaiser group at the top of the list of industrial managers it was willing to put in charge of constructing and operating new yards that would be built to supply those new ships. One of the new Kaiser yards was that of the Oregon Shipbuilding Corporation, built on the Willamette River outside Portland, Oregon. The Oregon Shipbuilding Corporation was established in late 1940 with a board of the directors comprised of representatives of the Todd and the Six Companies organizations. Charles Shea was president, and Edgar Kaiser was vice president and general manager in charge of operations. The company made Albert Bauer chief engineer in charge of construction and assistant vice president. John Hallet was the shipyard superintendent and J.F. Reis the secretary and manager of administration.[126] Another of Kaiser's new yards was Richmond Shipyard No. 2, described in the next chapter.

CHAPTER FOUR: KAISER EXPANDS HIS RICHMOND OPERATIONS

Henry J. Kaiser quickly moved beyond the Todd-California shipyard to develop three more shipyards at Richmond. The four Richmond yards had a total of twenty-seven shipways (including the five basins at Yard No. 3), and they built 747 ships during the war. Employment peaked at more than 90,000 in July 1943. At that time, the Richmond shipyards employed 25 percent of the total number of workers in private California shipyards and 10 percent of the wage earners in California's durable-goods industries. Employees at the Richmond shipyards comprised 32 percent of the Bay Area's workers in durable-goods industries.[127] This chapter

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[125]H. Gerrish Smith, "Shipbuilders Speed Up," *Marine Engineering and Shipping Review* 47 (April 1942): 144; Kramer, "The Story of the Richmond Shipyards," 15.

[126]Charles F.A. Mann, "Emergency Shipyard of the Pacific Northwest," *Marine Engineering and Shipping Review* 46 (October 1941): 82-90; "Building Liberty Ships in 46 Days," *Engineering News-Record* 129 (16 July 1942): 62-67; Charles O. Herb, "Why Kaiser is the World's Number One Shipbuilder," *Machinery* 49 (November 1942): 131-143.

[127]Permanente Metals Corporation, et al, *A Booklet of Illustrated Facts about the Shipyards at Richmond, California* (Richmond, CA: Permanente Metals Corporation, et al, 1944), pp. 30-31, in HJK 83/42c, box 298, file 21.

provides overview histories of Richmond yards 2, 3, and 4, as well as of the Pre-Fab yard and brief summaries of histories of other yards in the Bay Area.

A. Shipyard No. 2

On 10 April 1941, four days before laying the keel for Hull No. 1 at the Todd-California yard in Richmond, Kaiser signed a contract with the Maritime Commission to build another yard in Richmond, this one with six shipways to be located east of the Felice & Perelli Cannery and northeast of the Ford Motor Company assembly plant on land leased from the Santa Fe Railway and the Parr-Richmond Terminal Corporation. The purpose of this second shipyard was to build emergency merchant ships for the Maritime Commission rather than for Great Britain. A new company, Richmond Shipbuilding Corporation (incorporated on 1 April 1941), would build and operate the second yard. Kaiser made Clay Bedford general manager of the second yard. Like Todd-California, Todd and Six Companies interests jointly owned Richmond Shipbuilding. Whereas the Todd interests held a 35 percent share in Todd-California, however, it initially held a 50 percent share in Richmond Shipbuilding.[128] The following table shows the distribution of stock among Todd and the Six Companies:

Initial Ownership Participation in Richmond Shipbuilding Corporation[129]

Company	Ownership Percentage
Todd Shipbuilding Corporation	50
The Henry J. Kaiser Company	6.16
The Kaiser Company	6.16
W.A. Bechtel Company	6.16
Bechtel-McCone-Parsons	6.16
General Construction Company	4.61
J.F. Shea Company, Inc.	4.61
Utah Construction Company	4.61
Morrison-Knudsen Company, Inc.	4.61
MacDonald & Kahn, Inc.	4.61
Pacific Bridge Company	2.31

As mentioned in previous chapters, Permanente Metals (formerly Todd-California) bought all of the Richmond Shipbuilding stock in December 1941. Just prior to that transaction, Richmond Shipbuilding issued 1100 additional shares of stock to Six Companies, but none to Todd, so that the distribution of Richmond Shipbuilding stock among Todd and the Six Companies members was identical to that in Permanente Metals (see table in Chapter Two). Thereby, Todd held the

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[128]"Richmond Shipbuilding Corporation," *Pacific Marine Review* (May 1941): 48; "In an Emergency There's No Schedule," *Pacific Marine Review* 38 (October 1941): 100; "History of Kaiser Organizations," Vol. II, p. 267, in HJK 83/42c, box 299.

[129]"History of Kaiser Organizations," Vol. II, p. 265, in HJK 83/42c, box 299.

same interest in the Shipyard No. 2 operation after Permanente Metals purchased the Richmond Shipbuilding stock as it had had just prior to the transaction. Richmond Shipbuilding remained a distinct corporate entity, however, until it had completed all of its contracts with the Maritime Commission to build Liberty ships at Yard No. 2. At the same time, Permanente Metals decided that Richmond Shipbuilding would accept no new contracts. Thereafter, Permanente Metals signed new contracts for work in both yards and distributed that work between them. Then on 25 February 1942, the Six Companies acquired all of Todd's interest in the Pacific Coast yards (including Yard No. 2), and at the same time Todd acquired all of the Six Companies interests in the East Coast and Gulf Coast yards.[130]

1. Construction of Yard No. 2

On a rainy April 7th, 1942, three days before Kaiser signed a contract with the Maritime Commission for Richmond Yard No. 2, a crew of the Thomas Engineering Company commenced a topographical survey for the Kaiser organization of the site located just east of the Ford Motor Company plant that would become Richmond Shipyard No. 2. As soon as Kaiser signed the contract, a sub-contractor began building a small wood building that would house offices for the field engineer's staff during construction. On April 22nd, a Kaiser crew began digging a drainage ditch at the site. Because of the rainy spring, there was a large pond in the middle of the mudflat destined to become a shipyard. Once again, O.C. McCoon was in charge of construction at the shipyard, and within two months his crews had driven more than 40,000 piles, including 12,000 for the shipways and 3,000 for the outfitting dock. Construction of Yard No. 2 involved hydraulic dredging of more than 2,5000,000 cubic yards of material from the mudflats to make way for the launching basin. The dredges pumped the silt onto the flat east of the basin, creating an area of dry land that would be used for materials storage. All told, McCoon's crews moved 4,000,000 cubic yards of fill to the site, including 215,000 cubic yards of rock fill from a nearby hill to provide a suitable ground surface over about 100 acres. Most of the buildings were built of plywood and heavy timber construction, the major exception being the plate ship, which had a steel frame and a steel truss roof system. In September 1941, the Maritime Commission contracted with Richmond Shipbuilding to add three more shipways. A contract for another three ways signed in March 1942 brought the total number of shipways built at Richmond Yard No. 2 to twelve. When completed, the yard occupied 185 acres.[131]

To build Yard No. 2, Richmond Shipbuilding Corporation entered about 400 agreements with sub-contractors to perform various facets of the construction. For example, Blake Brothers had a contract to remove 500 feet from a rock wall along the edge of the deep-water channel to provide access to the planned launching basin. Empire Construction had contracts to build the

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[130]"History of Kaiser Organizations," Vol. II, p. 238, 238A, and 265 in HJK 83/42c, box 299; "History of the Permanente Metals Corporation," 1-2.

[131]"In an Emergency There's No Schedule," 100, 103; Charles F.A. Mann, "Richmond Yard No. 2 of the Permanente Metals Corporation," *Marine Engineering and Shipping Review* 47 (August 1942): 126, 132; Kramer, "The Story of the Richmond Shipyards," 13-14; "History of Kaiser Organizations," Vol. II, p. 265; "History of the Richmond Shipyard Number Two," p. 1, unpublished, undated (ca. July 1942) report in HJK 83/42c, box 289, file 11.

administration building, the general stores building, and the concrete foundation and slab for the plate shop. Bethlehem Steel had the contract to erect the structural steel for the plate shop. D.W. Nicholson had the contract to build the machine shop. Sub-contractors as well as Kaiser engineers, managers, and employees were key to the construction of Yard No. 2, but they worked under the close supervision of Russell J. Carroll, plant engineer from the Maritime Commission. His experience in supervising shipyard construction dated back to Hog Island.[132]

When completed, Richmond Shipyard No. 2 had twelve shipways, each 87'-6" x 450' (same width as those at Yard No. 1 but 25' longer), that discharged hulls southward into the launching basin along Richmond's deep water channel. Each shipway had a set of crane tracks on either side, making a total of thirteen sets of crane tracks. Each set of crane tracks, except those at the extreme ends, served the shipway on either side. North of shipways no. 2-7 was a large building that housed the plate shop. It was the only one at Yard 2 (other than the one occupied by Hopeman Brothers, a sub-contractor) that was a steel frame structure with corrugated steel siding and a concrete floor. Other buildings were of timber or wood-frame construction with corrugated siding. North of shipways no. 9-12 was the shell assembly platform, on which forepeak and stern sections could be pre-assembled. Another assembly platform was located east of shipway no. 12. Between the shipways and the plate shop was a sizeable area where steel plates and structural members were pre-assembled before being moved to the ways by the cranes. The pre-assembly areas adjacent to the shipways were decked with heavy wood planks covered with steel plate to create a durable work surface. Each area had its own moveable shelter to protect welders and other workers from rainy weather. There was a large materials storage yard north of the plate shop. A giant traveling hammerhead crane served the plate storage yard and delivered materials to all of the bays in the plate shop. The outfitting dock extended southward into the launching basin from just west of shipway no. 1 and could accommodate ships along either side. A set of crane tracks ran along the full length of the outfitting dock. Buildings housing a fittings loft, a general stores warehouse, and a machine shop were located north of the outfitting dock and west of the plate shop.[133]

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[132]"Machine Shop to Be Constructed by S.F. Company," *Richmond Independent* (14 May 1941): 1; "In an Emergency There's No Schedule," *Pacific Marine Review* 38 (October 1941): 105; "History of the Richmond Shipyard Number Two," 1-2.

[133]"General Plant Layout," drawing dated May 1942 in Richmond Shipbuilding Corporation, "General Description of Richmond Shipyard No. 2," unpublished report dated 8 June 1942 in possession of James McCloud, Oakland, CA; "The Mighty Hammerhead," *Fore'n'Aft* 3 (8 January 1943): 5; "General Plant Layout," drawing dated 4 March 1944, in D.D. Dick, "Shipyard Facilities Index: West Coast Yards," unpublished report dated 1 July 1945, in NARA RG-178, entry 23, box 1; "Richmond Shipyard No. 2, Schedule of Shipyard Facilities As Of July 1, 1944," unpublished report in "West Coast Yards, Shipyards Facilities Index," NARA RG-178, entry 100, box 26; Charles F.A. Mann, "Richmond Yard No. 2 of the Permanente Metals Corporation," *Marine Engineering and Shipping Review* 47 (August 1942): 132; National Board of Fire Underwriters, "Permanente Metals Corporation, Shipyard No. 2, Richmond, California," unpublished Report on Fire Protection to the Navy Department dated July 1943, pp. 3-7, in NARA RG-178, entry 95B, box 532, "Fire Protection Reports" file. The article by Mann contains considerable detail on the various machine tools and other equipment housed in the shops and on the docks Richmond yard no. 2.

As construction of Yard No. 2 progressed to the point that shipbuilding could commence, McCoon became the yard superintendent, and Bedford made Hugh Williams the superintendent in charge of facilities construction. On September 17th, crews at Yard No. 2 laid the first three keels on shipways 3, 4, and 5. Richmond Shipbuilding staged a small ceremony to observe the event. In addition to 2,000 shipyard workers and managers, there were several dignitaries on hand, including Francis J. Gilbride from New York representing Todd Shipyards Corporation, Richmond Mayor W.W. Scott, Richmond City Manager J.A. McVittie, and P.N. Sanford, president of the local Chamber of Commerce. Keels were laid on the remaining three original shipways in October. Crews at Yard No. 2 launched their first Liberty ship on December 31st, by which time the U.S. was officially at war. Three weeks later, Yard No. 2 delivered the fully outfitted and tested *James Otis* to the Maritime Commission.[134]

When all twelve shipways were completed, Yard No. 2 had thirteen whirley cranes serving the ways and nine other whirley cranes serving the outfitting dock and the plate storage and shell assembly areas. There were also twenty-six truck-mounted cranes for moving materials and prefabricated units about the yard. The plate shop was equipped with twenty-five bridge cranes and twenty-two jib cranes. By the time Yard 2 began building Victory ships in 1944, it had been expanded with the construction of additional outfitting facilities along the east side of the launching basin. Called the Victory Yard, the facilities included additional warehouses and three finger piers creating six berths.[135]

2. Hull No. 440

One of the most famous ships built at Richmond Shipyard No. 2 was Hull No. 440, which was the ship the Richmond yards used to set the wartime record for speed in building a Liberty ship. It began its existence with the laying of the keel at one minute past midnight on 9 November 1942. Three days, fifteen hours, and twenty-nine minutes later, the ship was christened the *Robert E. Peary* as crews let it slide down shipway no. 1 and into the launching basin. Three days later, the yard delivered the *Robert E. Peary* to the Maritime Commission after having fully outfitted and tested the ship. Total elapsed time from laying of keel to delivery was seven days, fourteen hours, and twenty-nine minutes. Yard No. 2 had set an earlier record for Liberty ships in August 1942, launching a ship twenty-four days after laying the keel. Then Oregonship set a new record in October, launching a ship in ten days. Clay Bedford challenged his crews to think of ways that they could reclaim the record, and Hull No. 440 was the result. A much larger percentage of Hull No. 440 was prefabricated than was typical for Liberty ships at

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[134]"In an Emergency There's No Schedule," 100, 105; Kramer, "The Story of the Richmond Shipyards," 14-15; "History of Kaiser Organizations," Vol. II, p. 267; "History of the Richmond Shipyard Number Two," 3.

[135]"Richmond Shipyard No. 2, Schedule of Shipyard Facilities As Of July 1, 1944;" untitled, undated orthographic aerial view of the Richmond shipyards, photo no. P-2047-2, and undated vertical aerial view of Shipyard No. 2, photo no. P-2228-1, both in the Photographic Collection (hereinafter cited as Richmond Museum Photos), Richmond Museum, Richmond, CA.

Yard No. 2. For example, prior to Hull No. 440, decks of Liberty ships consisted of twenty-thee pieces, each lifted into place. For the record-breaking ship, the deck consisted of seven pre-assembled units, each complete with piping, hatches, and winch foundations. According to a brief report produced by the Kaiser organization a month after it delivered the *Robert E. Peary*, ships built subsequent to Hull No. 440 did not have as many prefabricated components as the *Robert E. Peary* did, but on the other hand the experience of using so many prefabricated components led to the yard adopting some of the methods tried.[136]

The crews at Yard No. 2 were very enthused about the Hull No. 440 project. Their competitive spirit was initially enflamed by a flier asking "What has Oregon got that we haven't got," which they received with their copy of *Fore'n'Aft*, the weekly Richmond shipyard newspaper. It prompted more than 250 letters from workers suggesting new methods that could speed construction. Enthusiasm for the project continued into the night of November 8th, when so many workers from the previous shift lingered around the shipway to watch the keel being laid that supervisors had trouble clearing workers out of the way. Over the next few days, workers also arrived at work an hour or two early so that they could watch the progress of Hull No. 440. Congestion got so bad that supervisors used loudspeakers to instruct employees that only those assigned to the Hull No. 440 job should be at the way where it was being erected.[137]

Maude B. Byrnes, wife of James F. Byrnes, the Board of Economic Stabilization's chairman, served as sponsor for the November 12th launching of the *Robert E. Peary*. Six minutes after the launching of the *Robert E. Peary*, crews at Yard 2's shipway no. 1 already had the keel blocks in place and had laid the keel for the next ship, Hull No. 443.[138]

3. Building Liberty Ships at Yards 1 and 2

As Yard No. 1 completed its contract to build thirty cargo ships for the British government, it began almost seamlessly to build Liberty ships for the Maritime Commission. Yard 1 launched the last British ship, the *Ocean Victory*, on 27 June 1942. Just over two weeks later, it launched its first Liberty ship, the *Edward Rowland Sill* on July 14th. Yard 1 launched two more Liberty ships that month and five more in August. By late 1942, Richmond Shipyards

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[136]"Hull 440 ...and Why," *Fore'n'Aft* 2 (12 November 1942): entire special issue devoted to the building of Hull No. 440; "7-Day Ship," *Pacific Marine Review* 39 (December 1942): 52-57; "Prefabrication at Richmond Shipyard Number Two," unpublished report dated 17 December 1942 in HJK 83/42c, box 289, file 11. On the day it delivered the *Robert E. Peary*, Permanente Metals Corporation produced a nice commemorative booklet describing the ship's construction. The book features charts and graphs depicting methods used in construction and an ample assortment of photographs showing various stages of construction. A copy of the book is in the possession of James McCloud.

[137]Clay Bedford to Henry J. Kaiser, telegram dated 9 November 1942 in HJK 83/42c, box 14, file 30.

[138]"Hull 440 ...and Why."

1 and 2 were able to deliver a combined total of eighteen Liberty ships in the month of November. Nevertheless, Bedford warned Vickery that Richmond might not be able to maintain that rate of delivery because of materials and equipment shortages, including anchor chain, generators and generator engines, gauges and valves, electrical cable, manila rope, and 50-ton booms. Carl Flesher in the Regional Office had authorized Permanente Metals to try to fill those needs through local suppliers, but Bedford predicted that local suppliers would not be able to meet the shipyards' needs in time to forestall some curtailment of operations.[139]

Yard No. 1 was noteworthy for being the first of the Richmond yards, but Yard No. 2 was larger and, because it benefited from the experience of Yard No. 1, more efficient in its layout. When Richmond Yard No. 2 completed its last Liberty ship in July 1944, it had built 351 of them. Only one other shipyard, Bethlehem-Fairfield, built more Liberty ships. Only four shipyards in the U.S. built more than 300 Liberty ships, the other two being Calship and Oregonship. The record of producing Liberty ships at Yard 2 was one of the most remarkable in the U.S. It had taken 160 days to complete its first ship, delivered in February 1942. By August 1942, it was finishing ships in less than eighty days, and a year later in less than thirty-five days. By October 1943, Yard 2 was turning out ships in thirty days or less. Of its total output of Liberty ships, 157 of them were completed in thirty days or less. The cumulative average time of completion for the 351 Liberty ships built by Yard 2 was 41.1 days. Each of the twelve ways at Yard 2 built an average of twenty-nine ships. The output at Yard 2 represented more than 15 percent of the 2,268 Liberty ships built in the U.S.[140]

One of Yard 2's remarkable achievements was the building of the *Walter Camp*. During the thirty-eight days it took to build the *Walter Camp*, Yard 2 did not report a single lost-time accident.[141] See the section below for more details on worker safety in the Richmond shipyards.

B. Pre-Fab

The Pre-Fab yard was originally built by the Richmond Shipbuilding Corporation, although it served both Yards 1 and 2. Construction of the Pre-Fab yard began in November 1941, at the same time as Richmond Shipbuilding signed a contract for three more shipways (ways 7-9) at Yard No. 2. Said to have been Clay Bedford's idea, the Pre-Fab yard was considered a new approach to pre-assembly, being capable of fabricating and lifting components weighing as much as 75 tons. Bedford assigned the design of the yard and buildings to Norman Gindrat, a facilities design engineer in Morris Wortman's department, and construction began in January 1942. The yard consisted of two large buildings (the pre-fab plant and the plate shop)

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[139]Clay Bedford to Admiral Vickery, telegram dated 2 December 1942 in HJK 83/42c, box 25, file 26; "747 Ships,' *Fore'n'Aft* 6 (February 1946): 3-8.

[140]"Permanente Richmond No. 2 Shipyard Completes Liberty Ship Contract," *Marine Engineering and Shipping Review* 49 (August 1944): 194, 196, 198.

[141]John M. Roche to James MacDonald, letter dated 3 July 1943, in NARA RG-178, entry 95A, box 529, Richmond Shipyard #2 file.

plus ample space for material storage and additional pre-assembly. There were also convenient links by both rail and roadway to Shipyards 1 and 2. Kaiser employed about 2,500 workers, both men and women, at the prefab plant. Elmer Hann, the former Consolidated Steel shipbuilder from Los Angeles whom Kaiser had recruited to be superintendent of ship erection at Yard No. 1, became the superintendent of the Pre-Fab yard. Some time later, Kaiser transferred him to become general superintendent of the Swan Island yard. Although initially steeped in the traditional methods of building ships, Hann had adapted well to the new mass-production methods and was valuable to the Kaiser organization in implementing those methods at Swan Island.[142]

The larger of the two buildings was the prefabrication plant, where crews pre-assembled deckhouses for Liberty ships. The midships deck houses were three-story structures measuring 60' in width, 75' in length, and 24' in height. They were built in four sections, each about 20' long. The after deckhouses were one-story structures, measuring 45' in width, 30' in length, and 7.5' in height. They were built in one section. The sequence of assembling sections of deckhouses was always the same: first the four sections of a midships deckhouse would be assembled, progressing from fore to aft, then an after deck house would be assembled, then the sections of the next midships deck house, etc. A steel-frame building with two 90' bays, each 480' long, the prefab plant housed an assembly-line process. Each bay had an elevated roller runway along most of the length of the floor. The runways each carried jigs having the shape of a finished Liberty ship upper deck. The jigs supported the sections of deckhouses as they moved along the assembly process. Each bay also had three overhead bridge cranes ranging in capacity from 10 to 20 tons. The elevated tracks for the craneways extended 150' beyond the east end of the building, where the assembly process began, and 75' beyond the west end. Side-aisles, 36' wide, ran along each side of the building and housed offices and shops for pipefitters, electricians, and sheet metal workers to work and store tools and equipment. The building was large enough to accommodate the simultaneous construction of ten deckhouse units, each in various stages of prefabrication.[143]

Assembly began in the layout areas at the east end of the building. After crews assembled and welded sections of a deckhouse, the bridge cranes would move those sections into

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[142]"How Kaiser Builds Liberty Ships," *American Machinist* 86 (12 November 1942): 1306; "Pre-Fabrication Plant," drawing dated 22 January 1945, in D.D. Dick, "Shipyard Facilities Index: West Coast Yards," unpublished report dated 1 July 1945, in NARA RG-178, entry 23, box 1; "Pacific Coast Shipbuilding Program of the U.S. Maritime Commission," *Pacific Marine Review* 39 (January 1942): 72; Kramer, "The Story of the Richmond Shipyards," 26, 28-29; "History of the Permanente Metals Corporation," 1; "History of the Richmond Shipyard Number Two," 3.

[143]"Prefabrication Builds Ships Faster," *Fore'n'Aft* 2 (16 July 1942): n.p.; "How Kaiser Builds Liberty Ships," *American Machinist* 86 (12 November 1942): 1299-1306; "Prefabrication Plant: General Layout of Erection and Handling Facility," drawing dated 9 February 1942 in Richmond Shipbuilding Corporation, "General Description of Richmond Shipyard No. 2," unpublished report dated 8 June 1942 in possession of James McCloud, Oakland, CA; Kramer, "The Story of the Richmond Shipyards," 26, 28.

position on the jigs. As assembly of the deckhouse sections progressed, cables and small drum hoists pulled the jigs along the roller runway. While crews welded bulkheads and decks into position within the sections, other crews installed piping, wiring, electrical equipment, and other machinery. As sections approached the end of the runway, temporary stiffening and cable attachments would be installed to assist in hoisting the sections into place on the ship. By the time the sections reached the end of the runway, they were completely built, needing only to be welded to the deck of the ship and, in the case of the midships deck house sections, to each other. The Kaiser shipyards used a special tractor and trailer to haul deckhouses to the ways. To load a section weighing as much as 72 tons on the trailer, the jig supporting the section would be rolled into position at the west end of the runway, where eight jacks were located. Operating simultaneously, the jacks would lift the jig high enough to allow a retractable section of the runway to be removed and the trailer to be backed into position. The jacks would then lower the jig onto the trailer, which was about 21' long and 60' wide. The tractor would then pull the trailer to a shipway, where two whirley cranes could hoist the section into position on the ship. Prior to construction of the prefab plant, deckhouses were about 60 percent prefabricated at the yard and then finished after pieces were hoisted into position. With the prefab plant, 95 percent of the work on deckhouses could be completed in pre-assembly. By the end of 1943, the prefab plant was producing about thirty deckhouses each month.[144]

The smaller building at Pre-Fab was called the plate shop. It housed areas for the assembly of boilers, stacks, bulkheads, and other components of a ship. It was similar to the prefabrication plant, but it was a timber structure and featured three bays side-by-side rather than two. The Pre-Fab yard also accommodated several smaller shops for the various crafts and some open-air assembly areas where crews prefabricated forepeaks, afterpeaks, double bottoms, and shaft alleys for ships being erected at Yards 1 and 2. Pre-Fab had six whirley cranes with capacities of up to 50 tons and nine truck-mounted cranes for moving the pre-assembled units about the yard and onto transports bound for Yards 1 and 2.[145]

Alyce Kramer's history of the Richmond shipyards, prepared for the Kaiser organization, provides an assessment of the role the Pre-Fab yard played in the Richmond yards' overall development of pre-assembly methods. She offers the seventh hull built for the British (the *Ocean Valley*, launched 9 December 1914) as a benchmark, noting that the steel comprising its hull weighed about 2,777 tons, of which 1,277 tons had been pre-assembled into components on the platens. Those components included double bottoms, bulkheads, portions of deckhouses, portions of fore and after peaks, and structural frames, but did not include fully assembled fore

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[144]"Prefabrication Plant," undated orthographic cut-away drawing of the Pre-Fab Plant in NARA RG-178, Photo Album series, vol. III, p. 20; "How Kaiser Builds Liberty Ships," 1302-1306; "Pre-Fab Production," *Fore'n'Aft* 4 (3 March 1944): n.p.; Kramer, "The Story of the Richmond Shipyards," 23-24, 26-27.

[145]"Prefabrication Plant, Schedule of Shipyard Facilities As Of July 1, 1944," unpublished report in "West Coast Yards, Shipyards Facilities Index," NARA RG-178, entry 100, box 26; "Pre-Fabrication Plant," 22 January 1945, in D.D. Dick, "Shipyard Facilities Index: West Coast Yards," unpublished report dated 1 July 1945, in NARA RG-178, entry 23, box 1; Kramer, "The Story of the Richmond Shipyards," 28.

and after peaks, fantail, or fo'c'sle. The peaks were assembled on the shipway from partially pre-assembled components, with about 50 percent of the peaks having been pre-assembled. With the completion of the Pre-Fab yard, peaks for the fifty-sixth hull a year later (the *Frederick Remington*, launched 6 December 1942) were almost entirely (95 percent) pre-assembled. Deckhouses went from being about 60 percent pre-assembled for the *Ocean Valley* to about 95 percent pre-assembled for the *Frederick Remington*. Overall, the *Ocean Valley* had been about 46 percent pre-assembled, while the *Frederick Remington* was about 76 percent pre-assembled. Kramer wrote that pre-assembly progressed along three lines: 1) crews added weight to items already being pre-assembled; 2) fore and after peaks, fantails, and fo'c'sles were almost entirely pre-assembled; and 3) engineers devised ways to pre-assemble bottom shells and side shells. One net result of those developments was the elimination of about 600 crane lifts in the erection of a hull.[146]

The Richmond yards fabricated components for the hulls, decks, and deckhouses at either Pre-Fab or at their own plate shops, but they continued to rely on outside suppliers for most of the equipment and specialty parts installed on Liberty ships, Victory ships, and other vessels. For example, casting propellers of bronze was a specialty not undertaken by the Kaiser organization. At one point in 1944, the Richmond yards were receiving components from manufacturers in 128 different cities and thirty-three states (and one Canadian province). One of the specialty plants for that important piece of a ship was the Cramp Brass and Iron Foundries division of the Baldwin Locomotive Works at Eddystone, near Chester, Pennsylvania. From the attack on Pearl Harbor through the end of the war, the Eddystone works devoted its entire productive capacity to producing propellers for ships ordered by the Navy and the Maritime Commission. By 1945, the plant was turning out as many as 125 propellers each month, about 75 percent of them for merchant ships. Cast of a manganese-bronze alloy, a propeller (also called a screw) required great precision in casting and precision for such a large object. A finished Liberty propeller was 18.5' in diameter and weighed 22,000 pounds. Precision was necessary because of the speed with which the blades of a propeller cut through the water. At top speed, a Liberty screw turned 76 times per minute, and the tip of each blade moved through water at 50 miles per hour.[147]

C. Shipyard No. 3

Most of the contracts to build emergency shipyards were predicated on the idea that the operation would be temporary, ending when the war ended. At some time in 1941, the Maritime Commission decided that it should invest somewhat more money in a small number of shipyards to help create a permanent infrastructure that could be used for ship repair during peacetime and would be available for shipbuilding in the event of another war. The Maritime Commission signed a contract with Kaiser to build one such yard, which became Richmond Shipyard No. 3. A permanent yard entailed basins instead of shipways, so that the basins could later be used as

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[146]Kramer, "The Story of the Richmond Shipyards," 23-25.

[147]"All-American Ships" (map), *Fore'n'Aft* 4 (4 February 1944): n.p.; "1500 Large Propellers A Year," *Pacific Marine Review* 42 (May 1945): 272-273.

dry docks for repair purposes. Building permanent basins of concrete meant that that portion of the shipyard should be built on bedrock rather than mudflats. For this project, Kaiser created a new corporation called Kaiser Company, Inc., a wholly-owned subsidiary of The Henry J. Kaiser Company. Kaiser Company, Inc., and the Maritime Commission signed two contracts on 9 January 1942, one for the new yard and one to build fifteen C-4 troop ships. By that time the Maritime Commission had made it a policy to acquire and hold the land on which it built shipyards. Acquiring the 221.17 acres on Brooks Point for Yard No. 3 required condemnation proceedings, made somewhat acrimonious because the Richfield Oil Company tried to receive more than market value for the land. In late February, Clay Bedford, general manager for the Kaiser Company, sent Admiral Vickery a proposal to modify the contracts to allow for a 50 percent increase in funds expended on construction of the facilities, which, he claimed, would allow Kaiser to build an additional ten ships in 1943.[148]

The idea of constructing a dry dock for the purpose of building new ships goes back, in the U.S. at least, to the World War I expansion of shipbuilding facilities. One of the Navy yards built such a dry dock for use in building new ships. S.M. Henry, a naval constructor for the U.S. Navy identified several advantages he believed the dry dock would have over a conventional shipway: there would be less risk and expense at launching; erection of the hull would be easier on an even keel; it would be easier moving men and materials into position during erection of the hull because the entire hull would not rise above ground level; and the dry dock could serve as a repair facility if not being used for new construction. The only drawback Henry cited was that the dry dock cost more to build than did a conventional shipway.[149] As mentioned above, the Todd-Bath Iron Shipbuilding Corporation's new yard for building British tramp steamers at South Portland also had basins. They were built for the reasons Henry had cited in World War I, and they cost more to build than the shipways at Richmond Yard No. 1. Nevertheless, they provided the Maritime Commission and the shipbuilding industry with a model of how basins could be incorporated into the design of shipyard.

Despite the fact that Todd Shipbuilding and the Six Companies were about to dissolve their joint venture in several shipyards and a magnesium plant, and despite the fact that Richmond Yard No. 3 was planned to have basins instead of shipways, thereby potentially

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[148]"Clay Bedford to Admiral Vickery, letter and attachments dated 23 February 1942, in "Kaiser Company, Inc., Estimate of Cost - Shipyard Facilities," report dated 22 February 1942, in NARA RG-178, entry 83, box 844, following "QM56-1000 divider; "Richmond Shipyard Number Three, General Information," p. 1, unpublished report dated 19 November 1942 in HJK 83/42c, box 289, file 11; "Chronological History of Kaiser Company, Inc., Shipyard Number Three," p. 1, unpublished undated (ca. 1943) report in HJK 83/42c, box 289, file 11; Kaiser Company, Inc., "Richmond Shipyard No. 3," unpublished book dated 1 June 1946 in HJK 83/42c, box 289, file 1; Commissioner Vickery to U.S. Maritime Commission, memorandum dated 16 January 1942, and associated exhibits in NARA RG-178, entry 2, box 88, exhibits for minutes Jan. & Feb. 1942; Kramer, "The Story of the Richmond Shipyards," 15; Lane, *Ships for Victory*, 112-113, 117, 141-142.

[149]S.M. Henry, "Recent Developments in Shipyard Plants," *Transactions of the Society of Naval Architects and Marine Engineers* 26 (1918): 177.

cutting into Todd's market for ship repairs during peacetime, Kaiser officials were able to visit the Todd-Bath shipyard to learn what they could about the design and construction of a yard with basins. To prepare for construction of the new yard and the building of ships that would be much more complex than Liberty ships, Clay Bedford opened a Kaiser office in New York City in January 1942, and Dan Peacock moved there temporarily to start purchasing materials. The troop ships would require a much more complex purchasing program, because each C-4 consisted of about 130,000 items, whereas a Liberty ship consisted of 9,600 items. Morris Wortman, Kaiser's chief facilities engineer, and Harry Bernat, the marine design engineer, then traveled from the Bay Area through New York to South Portland to study the Todd-Bath basins. Returning to New York, Wortman and Bernat started designing the layout of Yard No. 3 there. According to the Kaiser organization's history of the Richmond shipyards, Wortman began sketching the design of the general warehouse at Yard No. 3, on the back of an envelope as the story goes, during his flight back to California. Because of the specialty nature of the basins, however, the Kaiser organization retained L.H. Nishkian of San Francisco as consulting engineer to design them.[150]

Construction of Yard No. 3 began almost immediately, on January 13th. Clay Bedford, general manager of Yards 1 and 2, added Yard No. 3 to his list of charges. Bedford put Hugh Williams in charge of construction at Yard No. 3. Williams had become superintendent of facilities construction at Yard No. 2 when O.C. McCoon moved into the position of yard superintendent. One of the first tasks was to excavate portions of the hill at Brooks Point. Using dynamite, bulldozers, and heavy trucks, crews moved 2,200,000 cubic yards of rock and earth to level part of the hill and to fill part of the waterfront, creating additional dry land, mostly in the lagoon on the west side of Brooks Point, where materials storage would be located. Engineers used 150,000 cubic yards of the fill to build a coffer dam, which in turn allowed them to drain the area where the basins were to be built. Excavation of the basins began on March 3rd, taking the basalt rock down to 25 feet below sea level. Because of the need to hasten the construction, engineers decided to build the reinforced concrete side walls of the basins in 125' lengths, each to be poured continuously. As the concrete for one section cured, the forms would be partially disassembled and moved into position for the next section. After the walls for a basin were complete, the concrete floor for the bottom could be poured. As the floor was poured, concrete blocks were set along the center line at the appropriate elevation to support keel and ship bottom. Crews laid Yard No. 3's first keel in basin 2 on 14 May 1942, 118 days after construction began, even though excavation was still underway in the adjoining basin and concrete was still being poured in each of the four other basins. The keel for Hull No. 5 was laid on July 22nd, putting all five basins in service.[151]

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[150]"Shipyard Uses Basins Instead of Ways," *Engineering News-Record* 129 (27 August 1942): 59; "Chronological History of Kaiser Company, Inc., Shipyard Number Three," 2, 6, 19; Kramer, "The Story of the Richmond Shipyards," 16. The story of Wortman sketching the design for the warehouse on the back of an envelope while flying back to Richmond from the East is also recounted in "We Build 500 Ships," *Fore'n'Aft* 4 (14 April 1944): n.p.

[151]"Shipyard Uses Basins Instead of Ways," 58-59; "Richmond Number Three," *Pacific Marine Review* 39 (November 1942): 52; Kaiser Company, Inc., *Richmond Shipyard Number Three-A* (Richmond, CA: Kaiser Company, Inc., 1943), pp. 12-13, Employee Handbook in the collection of the San Francisco Labor Archives and Research Center, San Francisco, CA;

Each basin would be equipped with gates that could be closed to keep out the water of the Bay. The gate openings were 85' wide, and the gates consisted of two halves, each 42.5' wide. Pumps could empty a basin at a rate of 11,000 gallons per minute. Two emergency pumps could increase the rate of discharge to 50,000 gallons per minute. To float a ship, valves would allow water into a basin until it reached sea level, at which point whirley cranes on either side would lift the gates out of place and the ship could be towed out. After the cranes placed the gates back in place, the joint between them was sealed with a strip of rubber belting. The gates had horizontal trusses to resist the thrust of the water. In addition, the cranes would set a pair of trusses atop the gate halves to carry a narrow roadway that could accommodate workers and light trucks.[152]

As with the conventional yards using shipways, which had a craneway running between each pair of berths, Yard No. 3 had a craneway running between each pair of basins. The basins measured 100' wide and 590' long. The craneways between them were 35' wide. Each craneway was equipped with one 45-ton whirley crane and one 60-ton whirley crane. In addition to the tracks for the whirley cranes, the deck of the craneways had an asphalt surface so that trucks and trailers could deliver materials to ships under construction in the basins. An additional feature of the craneways was the set of galleries located a level below. The galleries provided space immediately adjacent to the basins for tool storage and for tasks like pipe threading. Freight could be lowered into the galleries by means of a hatch in the deck of each craneway. Pedestrian access to the galleries was by means of concrete stairs cast along the sides of the basins. The stairs, of which there were four sets per basin, continued to the basin bottoms. The concrete bottoms of the basins featured sockets on five-foot centers into which vertical members for steel scaffolding could be set. The basins were connected at floor level by 5' by 7' tunnels, equipped with steel bulkheads. Normally open to allow easy walking from basin to basin while they were dry and ships were under construction, any of the tunnels could be closed whenever an adjacent basin was being flooded for a launching.[153]

Aside from the basins, Shipyard No. 3 was much like Yards 1 and 2. One significant difference was that the assembly platforms at the head of the basins were much longer than at the other two yards, with nearly twice the distance between the plate shop and the basins (about 500'). This would allow more pre-assembly activities to take place on the assembly platforms, which would be especially important in the construction C-4 troop ships. Because they had to accommodate people, and not bulk cargo, the C-4s had many more bulkheads below decks,

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"Chronological History of Kaiser Company, Inc., Shipyard Number Three," 3-4, 6; Kaiser Company, Inc., *Hull 50* (Richmond, CA: Kaiser Company, Inc., September 1945), n.p., commemorative book in collection of Donald Hardison, El Cerito, CA; Kramer, "The Story of the Richmond Shipyards," 16-17.

[152]Kramer, "The Story of the Richmond Shipyards," 16-17; "Shipyard Uses Basins Instead of Ways," 58.

[153]"Shipyard Uses Basins Instead of Ways," 57-58; "Richmond Shipyard Number Three, General Information," 2.

which meant they had many more pieces of steel that could be pre-assembled. The plate shop sat at the north end of the pre-assembly area and housed equipment for cutting and shaping steel plates. Above the plate shop was the mold loft. Two sets of railroad tracks ran between the plate shop and the assembly platforms. The tracks were to accommodate flatcars for moving steel or assemble components laterally across the assembly area. The functions that were to take place in the plate shop were critical to the commencement of hull construction. Therefore, construction of the plate shop began March 4th. Not wanting to wait until the mold loft in the plate shop was complete, crews began on March 20th to loft templates for pieces of a steel hull in the mold loft at Yard No. 1. North and west of the plate shop were large areas for steel storage. Also west of the pre-assembly areas and the plate shop were several small buildings that supported shipbuilding activities, including (from south to north) a compressor building, a women's locker building, the acetylene building, and the brick and insulation storage building. Crews were ready to start moving steel from the storage area and fabricating it in preparation for hull construction on April 21st.[154]

Several important work areas were located in the space above the plate shop, including the mold loft, the engineering office, and the model shop. Head of the model shop was a woman named Julian Mesic, an artist who also had skills in architecture and drafting.[155]

Because the troop ships had to accommodate so many more people than Liberty ships (eighty crew members for a Liberty, 4,209 crew and troops for a C-4), the C-4s also had considerably more equipment that had to be installed at the Yard 3 fitting dock, which wrapped around the south and east sides of Brooks Point. There was one berth along the south end of the shipyard, just east of the basins and facing the Bay, and three berths along the east side, facing Richmond's Inner Harbor. A craneway ran along the outfitting dock equipped with two 45-ton whirley cranes and two 60-ton whirley cranes. There were several buildings in the area between the basins and the outfitting dock. Adjacent to the basins (from south to north) were the sheet metal shop (which also served as the riggers loft and the paint shop), general warehouse, machine shop, forge shop, yard office building, and yard office annex. Adjacent to the outfitting dock (from south to north) were the pipe shop, electric shop, fittings office building, matron's building, and fittings warehouse. North of the fittings warehouse was a rail station, and ferry slip, and a large surface parking lot. The buildings close to the basins and outfitting dock were directly associated with shipbuilding activities. North of the active shipbuilding areas and adjacent to the parking lot were a number of other buildings that served administrative and support functions. They included (from south to north) a first aid station, a guard house, the fire house and maintenance building, the yard garage, the administration building, the payroll and

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[154]"Richmond Yard No. 3, General Yard Plan," no date, in D.D. Dick, "Shipyard Facilities Index: West Coast Yards," unpublished report dated 1 July 1945, in NARA RG-178, entry 23, box 1; Kaiser Company, Inc., "Proposed Extensions to Craneways," drawing no. C4-M-98 dated 5-28-43 in the collection of Donald L. Hardison, El Cerrito, CA (hereinafter cited as DLH); Kaiser Company, Inc., "Shell To Shell Assembly Units," drawings no. C4-M-133 and C4-M-134, dated 15 June 1943, in DLH; "Chronological History of Kaiser Company, Inc., Shipyard Number Three," 3-4; Lane, *Ships for Victory*, 220-222.

[155]Kramer, "The Story of the Richmond Shipyards," 48.

personnel building, a training center, and the cafeteria. The latter was not built until September 1943. Prior to that time, the only shipyard cafeteria was located at Yard 2.[156]

Because Yard 3 was intended to be a permanent facility, many of the buildings at Yard 3 were of much more substantial construction than those built at the other yards. Notable among them was the general warehouse, a four-story building of cast-in-place concrete. Easily the most impressive building at Yard 3, the general warehouse was built in 120 days.[157]

As work on Yard No. 3 progressed, construction crews encountered a problem that had not been anticipated. Some of the new land that had been created with fill began in April 1942 to slip toward the Inner Harbor, which in turn damaged the footings beneath the machine shop and the yard office. Both buildings had to be relocated. Kaiser brought consultants from the California Institute of Technology to engineer a solution. They first recommended blasting the underlying mud to try to get it to disperse. When that failed, they resorted to driving sheet piling along the inside edge of the outfitting dock to prevent the ground from moving and then to tie the dock with cables to anchors set in bedrock 600 feet inland. The cost of adequately responding to the unstable ground was $3,972,467, which the Maritime Commission covered through a May 12th addendum to the Kaiser Company, Inc. contract to build Yard No. 3. In February 1943, some of the sheet piling along the outfitting dock began to fail, necessitating an additional $396,382 worth of remedial work. The original January 9th contract to build the shipyard with basins had been for $8,261,150, and the Maritime Commission had already added an addendum for $3,584,279 worth of additional facilities on March 3rd. The ground slippage was an expensive problem, adding about 33 percent to the cost of the shipyard.[158]

When the new administration building was completed at Yard No. 3, Clay Bedford moved into it and managed all the Richmond yards from there. He left Charles Day as administrative assistant at Yard No. 1 and younger brother Tim Bedford as administrative assistant at Yard No. 2. As Yard No. 3 was approaching a state of completion in which shipbuilding could begin, Hugh Williams moved into the position of yard superintendent in charge of ship construction. Andy Mori moved over from Yard No. 1 to become the general superintendent of Yard No. 3, and Dan Peacock moved back from New York to become assistant

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[156]"Richmond Shipyard Number Three, General Information," 2; "Chronological History of Kaiser Company, Inc., Shipyard Number Three," 19; Philip Drinker, et al, "Industrial Health Survey of the Richmond Yard #3," unpublished report dated 28-29 August 1942, p. 5, in NARA RG-178, entry 95A, box 529, Kaiser Company, Inc., #3 file; data sheet accompanying Kaiser Company, Inc., "Cafeteria," drawing dated 30 June 1944.

[157]"Richmond Number Three," 53, 58; Kaiser Company, Inc., *Richmond Shipyard Number Three-A*, 13.

[158]Clay P. Bedford to Carl W. Flesher, letter and attachments dated 21 April 1942, in "Richmond Shipyard Number Three, Estimate of Cost - Shipyard Facilities," report dated 15 April 1942, in NARA RG-178, entry 83, box 843, following the "QM56 S" divider; "Chronological History of Kaiser Company, Inc., Shipyard Number Three," 3-4, 14-15; "History of Kaiser Organizations," Vol. II, 316.

manager. All of the buildings except the electric shop were completed by August. By November 1942, there were 15,308 people on the payroll at Yard No. 3.[159]

Yard No. 3 did not get off to an auspicious start. The contract initially specified that Kaiser would lay the first keel in May 1942, launch the first C-4 in September, and deliver it in December. Thereafter, the yard would deliver two ships per month. Almost immediately, however, vendors balked at meeting the delivery dates Kaiser needed in order to meet the deadlines in the contract. To complicate matters, the Maritime Commission did not yet have completed plans and specifications for the C-4, so Dan Peacock and others in the New York office made their best guesses concerning what materials they should be ordering to begin building the ships. When plans for the C-4 were complete enough to develop accurate materials lists, it became apparent that many of the purchase orders were faulty. George Sharp continued to modify plans for the C-4 into the summer of 1942 because of arguments between the Navy and the Army. For example, should the Navy's standards be used in the design of on-board hospital facilities because the Navy would be operating the C-4s, or should the Army's because the C-4s would be transporting Army soldiers? In August, Admiral Vickery requested that the specification for the propeller be changed from a built-up item to one cast of solid bronze, which in turn necessitated a change in the stern frame. The stern frame for Hull No. 1 had already been cast. By the end of 1942, draftsmen working for Sharp had sent Yard No. 3 only 647 approved drawings out of the full set of 999 drawings for the C-4, and of those sent, 441 required subsequent modifications.[160]

The dispute between the Army and Navy simmered well into 1943. Initially, Admiral Vickery told his ship designers to ignore suggestions from the Navy for design changes. Then in February 1943, the Army agreed to let the Navy operate the ships, which meant that the Navy could make certain design decisions. In May, Yard No. 3 received notice from the Navy that certain design changes would have to be made. They were all relatively small, but important and therefore slowed the progress of construction. For example, a pump room and a fire pump had to be added to the platform near the bow of the ship, arrangements for the mess facilities on the second deck had to be altered, and a radar room had to be installed on the superstructure deck. Painting would have to meet Navy specifications rather than Maritime Commission specifications. The Navy did not require that such changes be made where physical work had already been completed in the hulls, only that the modifications be introduced to new work being fabricated. Nevertheless, on-going modifications continued to delay Sharp's completion of drawings into late 1943, which in turn delayed Kaiser's managers in their attempts to standardize fabricating, erection, and outfitting procedures. Moreover, Sharp's drawings had to be interpreted at the Yard 3 engineering office so that Kaiser's New York office would know what supplies to order. And even with the resolution of the differences between the Army and Navy, the design could not be finalized. In summer 1944, the Navy informed the Maritime

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[159]"Chronological History of Kaiser Company, Inc., Shipyard Number Three," 7; "Richmond Shipyard Number Three, General Information," 2; Kramer, "The Story of the Richmond Shipyards," 17.

[160]"The Earth Movers II," 226; "Chronological History of Kaiser Company, Inc., Shipyard Number Three," 2-3, 7, 13.

Commission that it would not be able to man the C-4s and therefore would not accept delivery. Instead, the ships would have to be manned by merchant crews, meaning that the ships would have to be modified again, this time to meet Coast Guard specifications for merchant vessels.[161]

More problems appeared in September 1942. By that time, crews at the Yard 3 plate shop had fabricated considerable quantities of steel for hulls, but as crews on the assembly platform and in the basins began the work of assembling components of the hulls they found numerous errors had been made, both by draftsmen preparing plans for George Sharp and by workers executing the plans in the Yard No. 3 mold loft and plate shop. As a consequence, workers had to fit, mark, and re-work many pieces of steel before they could be completely installed in a hull. Then in October, because designers were worried about the stability of the ship's design, the Maritime Commission issued a change order, calling for bulkheads in the upper decks to be made of light sheet metal rather than steel plate. By this time, Hull No. 1 at Yard 3 was only a month away from its scheduled launch, and 80 percent of the steel bulkheads had already been installed. In December, the launching of Landing Ship Tanks (LSTs) at Yard No. 4 began to further delay work on the C-4s. Yard No. 4 was built only to erect and launch hulls; it initially did not have its own outfitting dock, instead depending on Yard No. 3's outfitting dock. The Maritime Commission decided that completion of the LSTs should have priority over completion of C-4s in allocating the assignments of electricians and pipefitters on the Yard No. 3 outfitting dock. Delays in the outfitting of C-4s also caused managers of Yard No. 3 to have to delay erection of hulls in the basins, so that there would not be too many C-4 hulls tied to the dock awaiting outfitting.[162]

Even when the skilled electricians and pipefitters were finished outfitting the LSTs, lack of skilled workers slowed progress on the C-4 contract. A C-4 had more than twice as much machinery than a Liberty ship and more than three times as much welding, as measured in linear feet of weld (see table comparing C-4s and Liberty ships in chapter VI), but a C-4 also had more than five times as much sheet metal, almost six times the piping and tubing, more than eight times the length of wire and cable, and nine times the number of electrical fittings, fixtures, and

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[161]Memorandum of Conference Held at the Offices of the U.S. Maritime Commission dated 16 April 1943 in San Bruno RG-178, box 2, file Conferences 1943; Report of Conference Held in the Offices of the Vice Chief of Naval Operations dated 7 May 1943 in San Bruno RG-178, box 2, file Conferences 1943; Conference in Office of C.W. Flesher dated 17 May 1943 in San Bruno RG-178, box 2, file Conferences 1943; Meeting Held in the Office of G.G. Sharp dated 17 May 1943 in San Bruno RG-178, box 2, file Conferences 1943; Minutes of Conference Held Kaiser Company, Inc., dated 18 May 1943 in San Bruno RG-178, box 2, file Conferences 1943; Meeting Held Monday May 17, 1943 in Office of G.G. Sharp in San Bruno RG-178, box 2, file Conferences 1943; D.L. Hardison to Hull Engineering Personnel, memorandum dated 27 June 1944 and in the collection of Donald Hardison, El Cerito, CA; "Chronological History of Kaiser Company, Inc., Shipyard Number Three," 16-17; Lane *Ships for Victory*, 619-622.

[162]"Chronological History of Kaiser Company, Inc., Shipyard Number Three," 9-11. Yard No. 4 did eventually develop an outfitting dock; see untitled drawing of Yard No. 4, no date, in D.D. Dick, "Shipyard Facilities Index: West Coast Yards," unpublished report dated 1 July 1945, in NARA RG-178, entry 23, box 1.

instruments. Each C-4 had about 100,000 feet (19 miles) of steel and copper pipe and more than one million feet (230 miles) of wiring. The complex nature of the troop transports created a great demand for skilled machinists, electricians, and pipefitters on the outfitting dock, but there was a severe shortage of those trades in the Richmond area. For example, the marine pipe shop at Yard 3 needed at least 700 pipefitters and 250 pipewelders. Bedford could not simply transfer skilled workers in those trades from Yards 1 and 2 to Yard 3 because there was so little work in outfitting the Liberty ships requiring those skills that Bedford's managers had devised methods to accomplish most of it with relatively unskilled labor trained especially for those few tasks. Workers at Yards 1 and 2 did not have the breadth of skill to be able to tackle the complexity of outfitting C-4s. Therefore, Bedford sought approval from the Maritime Commission to establish the necessary programs to train electricians, pipefitters, and machinists.[163]

Another consequence of the delays in building the C-4s was that Yard No. 3's storage facilities become overwhelmed with inventory. Kaiser had negotiated delivery schedules with suppliers intended to match the anticipated production schedule for the troop ships. When erection and outfitting of the ships did not proceed as planned, materials and equipment accumulated beyond the capacities of the various warehouses. Some equipment, like pumps, valves, and bearings, was therefore stored outdoors, and by spring 1943 it was beginning to deteriorate. The Yard No. 3 machinery inspector provided Maritime Commission Regional Director Carl Flesher with an itemized list of about 2,000 pieces of equipment that were being stored outdoors, and in June 1943 the Maritime Commission issued Kaiser Company, Inc., an addendum to the contract authorizing $1,033,300 for the construction of an off-site warehouse.[164]

Despite the difficulties in getting Yard No. 3 up to speed, the Maritime Commission added an addendum to the contract with Kaiser Company, Inc., on 3 March 1942, calling for thirty troop ships instead of fifteen. As mentioned above, the increase in the number of ships on that date was accompanied by an addendum in the contract to build additional facilities at Yard No. 3 to facilitate building more ships. Kaiser Company, Inc., also received contracts from the Maritime Commission to build housing, schools, and transportation facilities in Richmond in an effort to alleviate the labor shortage hampering the Richmond shipyards' ability to meet production schedules. By mid-1943, the amount added to the Yard No. 3 contract for such community improvements totaled more than $29,000,000. (Kaiser's construction work in the Richmond community outside the shipyards, sponsored by the Maritime Commission, is described in Chapter VII.) Yard No. 3 was scheduled to have delivered its first C-4 in May 1943, but by September it had launched five of the ships and delivered none.[165]

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[163]Clay P. Bedford to Henry J. Kaiser, telegram dated 14 January 1943 in HJK 83/42c, box 16, file 18; "Macaroni and Spaghetti," *Fore'n'Aft* 3 (15 January 1943): 6-7; "Marine Electricians Are the Men Who Make It Safe for Electricity to Go to Sea," *Fore'n'Aft* 3 (26 February 1943): n.p.; "Chronological History of Kaiser Company, Inc., Shipyard Number Three," 19.

[164]"History of Kaiser Organizations," Vol. II, 316; "Chronological History of Kaiser Company, Inc., Shipyard Number Three," 15-16.

[165]"The Earth Movers II," 226; "History of Kaiser Organizations," Vol. II, 316; "History of Kaiser Organizations," Vol. III, 380-381.

The last significant change in the contract for C-4s occurred in 1944, again partially a result in the delays that had been transpiring not only at Richmond Yard No. 3 but also at Sunship in Chester, Pennsylvania, which was the other yard that had initially received a contract to build C-4 transports. Sun's original contract had it building a version of the C-4 that allowed it to carry tanks. Sun's early record in building the C-4 tank carriers was more impressive than the record at Richmond Yard 3 in building C-4 troop transports, so Admiral Vickery engaged in his typical technique of trying to prod the Kaiser organization by comparing it unfavorably with another, in this case Sun. Vickery even predicted that Yard 3's poor record might lead to adverse publicity for Kaiser. Vickery's prediction came true, and that publicity led to Congressional hearings on the problem in June 1943. Before Congress, however, Vickery defended Kaiser's accomplishments in characteristic fashion and explained all the problems facing builders of the C-4 caused by design changes. In September 1943, the Joint Chiefs of Staff decided that the remaining forty-nine C-4s in Sun's contract should be troop transports. By April 1944, however, Sunship was falling woefully behind in its C-4 schedule, due to shortages in labor and management. Vickery decided that Sun's resources would be better utilized building tankers, so he transferred some of the contract to Richmond and to the Kaiser yard at Vancouver. The decision required shipping materials Sun had acquired for its C-4s to Kaiser. It also required some design changes for the hulls to be built at Vancouver because that yard was better equipped to build an all-welded hull, whereas Richmond Yard 3 used considerable riveting.[166]

When Yard No. 3 was fully operational, the basins had twelve whirley cranes, eight of which had 60-ton capacities, the outfitting dock had four whirley cranes, and the plate storage area had three. In addition, the yard had fifteen truck-mounted cranes for moving materials and machinery about the yard. The plate shop had thirteen traveling bridge cranes and nineteen jib cranes.[167]

Erection of a C-4 at Yard No. 3 followed the following sequence. Workers first laid the keel plates on supports along the bottom of a basin. At the same time, riggers erected the scaffolding around the perimeter of the basin. Then crews attached bottom shell panels and the stern frame to the keel plates. After that, cranes could start hoisting pre-assembled double

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[166]Report of Conference at the Office of George G. Sharp, Oakland, dated 8 March 1944, in San Bruno RG-178, box 2, file Conferences 1944; Report of Conference between Representatives of Kaiser Company, Inc., Sun Shipbuilding and Dry Dock Company, and U.S. Maritime Commission dated 27 April 1944, in San Bruno RG-178, box 2, file Conferences 1944; Report of Conference at U.S. Maritime Commission, Washington, DC, dated 1 May 1944, in San Bruno RG-178, box 2, file Conferences 1944; Lane, *Ships for Victory*, 618-623. For the Congressional hearings, see *Production in Shipbuilding Plants*, Executive Hearings before the Subcommittee on Production in Shipbuilding Plants of the Committee on the Merchant Marine and Fisheries, House of Representatives, Part 3 (June 1943) and Part 4 (June and July 1943), Seventy-Eighth Congress (Washington, DC: Government Printing Office, 1944).

[167]"Richmond Shipyard No. 3, Schedule of Shipyard Facilities As Of July 1, 1944," unpublished report in "West Coast Yards, Shipyards Facilities Index," NARA RG-178, entry 100, box 26.

bottom units and lower portions of the fore and after peak units into position, and the components would be welded into place. From that point onward, the hull would begin to take shape with the placement of pre-assembled shell panels. At the same time cranes would lower internal components into position, including pre-assembled decks, foundations for the machinery of the propulsion system, the engine room and the propulsion system itself, tanks and distiller for the potable water system. After the upper deck was placed and welded into position, on-deck equipment and then pre-assembled components of the deckhouses and the superstructure decks were hoisted into place. Finally, items like masts, the stack, and gun tubs were lifted into position. At the same time, crews would disassemble the scaffolding and prepare the basin to be flooded. With the basin filled with water, the ship would float, the gates to the basin could be removed, and the yard would be ready for its launching ceremony, after which a tug would tow the ship out of the basin to one of the outfitting docks.[168]

The first launching at Yard 3, that of the *General George O. Squier*, took place on 25 November 1942. Kaiser's Richmond shipyard weekly, *Fore'n'Aft*, heralded it as one of the most elaborate launchings yet organized at a Richmond yard. Mary Anne Somervell, daughter of the U.S. Army's supply chief, served as sponsor, and Major General F. Gilbraith was the featured speaker. Kay Kyser and his band played as tugs towed the *George O. Squier* to its berth at the outfitting dock.[169]

As already mentioned, the complex nature of the C-4, compared with relative simplicity of the Liberty ship and its successor, the Victory ship, meant that Yard 3 had a distribution of workers among the various crafts different from that at the Liberty/Victory yards (Yards 1 and 2, and Pre-Fab). The following table shows the relative distribution among the crafts as of 15 March 1944 and 30 April 1944:

Distribution of Production Workers among Various Crafts at Richmond Yard No. 3 and the Permanente Yards (1, 2, & Pre-Fab)[170]

	March 15, 1944		April 30, 1944	
Craft	Yard No. 3	Permanente Yards	Yard No. 3	Permanente Yards
Boilermakers	19.3%	20.2%	17.0%	20.7%
Welders	11.2	29.6	11.5	23.5
Burners	4.3	7.3	3.9	5.7
Shipfitters	9.0	11.0	9.0	9.1

[168]The erection sequence for a C-4 hull is depicted in a series of 31 Kaiser Company, Inc., drawings, no. ES-C4-0-1 through ES-C4-0-31 and with dates ranging from 8-26-42 through 5-7-43, in DLH. Sequential photographs of a C-4 taking shape at Yard No. 3 are presented in *Hull 50*.

[169]"Proud Day," *Fore'n'Aft* 2 (27 November 1942): n.p.

[170]Percentages derived from Tables V & VI in U.S. Maritime Commission Manpower Survey Board, "Richmond Shipyards," unpublished report dated May 1944, in NARA RG-178, entry 88, box 437 Richmond Shipyards file.

Pipefitters	10.6	7.9	10.3	6.2
Shipwrights	7.3	6.6	9.0	5.9
Painters	2.6	2.7	2.6	2.3
Laborers	8.3	5.0	9.0	6.4
Machinists	5.4	5.6	5.9	4.6
Electricians	9.9	2.9	9.6	4.9
Sheetmetal Workers	3.4	1.8	3.4	1.5
Other Crafts	8.7		8.8	9.0

This table shows that in order to match workers to the tasks that needed to be accomplished, Yard 3 had relatively fewer welders and burners than the other yards and relatively more pipefitters, electricians, and sheetmetal workers.

Yard 3 benefited from the experience in pre-assembly garnered at other emergency shipyards, including Richmond Yards 1 and 2. For example, on the assembly platforms adjacent to the basins, crews used jigs to facilitate laying out steel for hull units. Then welders could automatically weld pieces together using a rig consisting of a traveling bridge equipped with Union-melt welding heads. Welders controlled the rig as it passed over a set of steel plates and shapes laid out on a jig, laying down the proper weld along the appropriate seams. A variety of jigs were kept in storage, each configured for the pieces of steel of a particular component of the hull. Cranes could move one jig back to storage and another jig into position on the assembly platform as needed. The pipe shop was also equipped for efficient sizing and shaping of piping for the C-4 engine room. The shop had a full-scale model of an engine room, so multiple iterations of each piece of pipe could be made and fitted into place in the model well in advance of being installed on any given ship.[171]

As supervisors and crews grew more familiar with the tasks involved in building a C-4, they become more efficient, as is evident by comparing the number of manhours it took to build the hull of the first C-4 at Yard 3 and the thirtieth. Hull No. 1 took a total of 2,175,157 manhours to build. That included 82,618 manhours for fabrication of the steel, 101,417 manhours for assembly of components in the shop, another 213,143 manhours for assembly of pre-assembled units on the platform between the plate shop and the basin, and 1,777,978 manhours for erecting the hull in the basin. The hull was comprised of 7,593 tons of steel, meaning it took 286.5 manhours per ton of steel to build Hull No. 1. In comparison, Hull No. 30 took a total of 713,499 manhours to build. That included 45,633 manhours for fabrication of the steel, 75,145 manhours for assembly of components in the shop, 178,394 manhours for pre-assembly units on the platform, and 414,328 manhours for erecting the hull in the basin. The hull was comprised of 8,130.9 tons of steel (changing design and specifications accounted for some of the added weight, and the yard assembled some components in the basin for Hull No. 30 that had been installed at the outfitting dock for Hull No. 1), meaning it took only 87.8 manhours per ton of steel to build the Hull No. 30.[172]

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[171]"Richmond Number Three," 54-60.

[172]Kaiser Company, Inc., "Direct Manhours Per Ton (Gross Mill Wt.)," table in a notebook of Kaiser shipyard statistics in the collection of James McCloud, Oakland, CA.

There was a fairly steady decline in the total number of manhours required per hull. As the yard gained experience, there was also a fairly steady decline in the manhours required for erecting a hull in the basin, but those declines were achieved by means of occasional increases in the manhours employed in fabrication, shop assembly, or platform assembly. More work at the pre-assembly stages saved work required in erection, and eventually managers and crews discovered how to reduce those hours in pre-assembly as well. For example, Hull No. 6 required a total of 2,126,208 manhours of work, and Hull No. 7 required only 1,972,101 manhours. Yet to achieve that reduction, manhours expended in fabrication, shop assembly, and platform assembly each increased from Hull No. 6 to Hull No. 7. The increases and decreases for the three pre-erection functions did not parallel each other. Hull Nos. 1-5 each required 80,000-90,000 manhours in fabrication, but then there was a jump to more than 110,000 manhours in fabrication for Hull Nos. 7-10. There followed a sudden drop in fabrication from about 95,000 manhours for Hull No. 12 to about 58,000 manhours for Hull No. 13.[173]

One of the Bay Area small businesses that produced parts for the C-4s was the Columbia Machine Works in West Berkeley. Formerly located in San Francisco, the business was owned and operated by L.K. Siversen, who had been a sales manager for Bethlehem's Union Plant in earlier years. He left Bethlehem in 1931 to open his marine repair shop in San Francisco. Deciding to pursue some of the Maritime Commission work, he decided in early 1942 to expand his machine shop by moving across the bay. With a number of large lathes and other machine tools, Siversen's Columbia shop received contracts to machine line shafts, stern tubes, and rudder pintles for the C-4s that Richmond Yard No. 3 was building. He also had contracts to machine valves, line shafts and stern tubes for Liberty ships being built at Richmond Yards 1 and 2.[174]

D. Shipyard No. 4

In the spring of 1942, the Allies decided they would launch their offensive campaign against the Axis powers in Europe in spring 1943. To do so, they would need 300 LSTs, preliminary design for which had been developed jointly by the British Admiralty and U.S. Navy. Because the LST was of central importance to the military's plans, and because shipyards working under contract to the Navy were already working at capacity, the U.S. government decided that some of the ships should be built at yards the Maritime Commission had developed. The Navy initially gave the Maritime Commission responsibility for completing the design of the ship and contracting for its production. Because the LSTs would be powered by diesel engines and the Navy controlled the allocation of marine diesels being produced in the U.S., however, Admirals Land and Vickery told the Navy they could not be responsible for meeting production schedules unless they controlled procurement of diesels. Rather than relinquish control of that allocation, the Navy took back the project. The Navy's Bureau of Ships secured the plans and specifications prepared by the Maritime Commission's Preliminary Design Section and began assigning contracts to shipyards with which the commission had been negotiating.[175]

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[173]Kaiser Company, Inc., "Direct Manhours Per Ton (Gross Mill Wt.)."

[174]"Columbia Machine Works," *Pacific Marine Review* 39 (December 1942): 84-87.

[175]Lane, *Ships for Victory*, 608-611.

After the Navy awarded those yards contracts, it decided that the Maritime Commission should also divert some of the yards building Liberty ships to the production of LSTs to meet the target of 300 vessels. The Maritime Commission objected, because interrupting work at shipyards designed for Liberty ships would interfere with the ability of the commission to meet its mandate to supply cargo vessels for the war effort. Nevertheless, the Navy prevailed. The Maritime Commission therefore decided to give contracts for the ninety LSTs to two of its best shipbuilders, forty-five each to the Bethlehem-Fairfield yard at Baltimore and Kaiser. Bethlehem temporarily devoted twelve of its sixteen Fairfield shipways to production of LSTs between August and December 1942, seriously interfering with that yard's heretofore stellar record of producing Liberty ships. Kaiser Company, Inc., protested against receiving the contract, but the Maritime Commission, under pressure from the Navy, insisted.[176] Following is the telegram Admiral Vickery sent Henry J. Kaiser to cajole him into accepting the new contract:

> Have received your telegram re. urgent job this government is obliged to undertake. Cannot understand your purported inability to meet a problem in shipbuilding which is considered by the government to be most vital necessity in present war production. This is the first shipbuilding problem that has faced you since our organized building program got into full swing. You overcame in a most effective manner the difficulties of constructing your first type of ships. I had counted on you based on your excellent performance in past to meet such a situation. However you question your ability to do it. Am developing matter with shipbuilders who although it also may be disrupting to their planned production and morale are willingly jeopardizing these things to accomplish this vital construction as required by the highest branch of our government.[177]

Vickery was reminding Kaiser of the contractor's willingness a year earlier to accept an acceleration of the rate at which work could be completed on the ways, a willingness Vickery then leveraged to get other shipbuilders to accept the accelerated rate.

Because of Kaiser's resistance to interrupting production of Liberty ships at the yards dedicated to Liberty ships (Richmond Yards 1 and 2 and Oregonship), the Maritime Commission agreed to fund construction of another yard at Richmond. The new yard was initially called Yard No. 3A, because it would rely on some of the facilities of Yard No. 3, but was eventually designated as Yard No. 4. Kaiser's Vancouver yard also received a contract for some of the LSTs. Richmond Yard No. 4 was predicated on a different approach to building ships than the other three yards. There would be no steel fabrication at Yard No. 4, nor would the steel be fabricated at the other three Richmond yards. The labor shortage in the Richmond shipyards was growing too dire. Rather, Yard No. 4 would sub-contract fabrication and pre-assembly of approximately 100 separate sub-assembly units to outside vendors. The site Bedford selected for

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[176]"Chronological History of Kaiser Company, Inc., Shipyard Number Three," 4; Lane, *Ships for Victory*, 468-469, 608-611.

[177]H.L. Vickery to Henry J. Kaiser, telegram dated 16 May 1942 and quoted in "Chronological History of Kaiser Company, Inc., Shipyard Number Three," 4-5.

Yard 4 would not require dredging for construction of the three shipways, and he also made plans to use second-hand bridge cranes in lieu of whirley cranes for hoisting sub-assemblies into position on the ways.[178]

The concept of prefabricating components off-site was not new. Many of the nation's other emergency yards used a similar approach. For example, the Ingalls Shipbuilding Corporation had a yard at Pascagoula, Mississippi, but most of the steel fabrication and much of the pre-assembly work were done at the shops of the parent corporation, Ingalls Iron Works Company, in Birmingham, Alabama. The company transported materials 300 miles by rail from Birmingham to Pascagoula, giving rise to the moniker, the "300-mile assembly line." The Pascagoula shipyard also relied heavily on sub-contractors to fabricate components and then ship them to the yard for assembly.[179]

Kaiser Company, Inc., and the Maritime Commission signed the contract to build Richmond Yard 3A on 2 June 1942, and construction began immediately. Several features besides the lack of fabricating facilities distinguished Yard 3A from the three previous Richmond yards. First, there was the secrecy surrounding the LST. When Kaiser had signed contracts for the other three yards in Richmond, the types of ships they were to build was public information, but the military specifications of the LST had not yet been revealed. Yard 3A also lacked whirley cranes for moving pre-assembled units into position on the ways, because Kaiser's purchasing agents found that there were no whirleys to be had on short notice. Instead, Kaiser crews used scrap material to build gantry bridge cranes spanning each of the three ways of Yard 3A. The bridge cranes at Yard 3A had the greatest capacity of any cranes in the Richmond shipyards at 100 tons each. That was necessary in part because they could not work in pairs as they did at the other three yards for large loads. Another difference was that the crane operator on a bridge crane at Yard 3A could not see the riggers working below, so he communicated with them by telephone via a "bellboy," a rigger stationed on a platform on one leg of the gantry who communicated with the riggers on the ground using the usual hand signals (see section below on whirley cranes). By 1944, Kaiser had acquired four whirleys for Yard 4, two for the shipway area and two for the outfitting dock, but the bridge cranes remained in service as well. There was also no cafeteria within the gates of Yard 4. Rather, the yard provided a small wood-frame canteen, operated by a caterer named Brannan Commissaries, outside the main gate. Brannan's canteen was open during all three shifts selling box lunches, sandwiches, pastries, fruit, and cold drinks.[180]

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[178]C.W. Flesher to H.L. Vickery, letter dated 26 May 1942, in San Bruno, RG-178, box 2, Records of the Director, West Coast Regional Construction Division; "Richmond Shipyard Number Four," date sheet dated July 1943, in HJK 83/42c, vol. 73; Kramer, "The Story of the Richmond Shipyards," 20; "Chronological History of Kaiser Company, Inc., Shipyard Number Three," 5; Lane, *Ships for Victory*, 611.

[179]R.H. Macy, "Production Notes on C-3 Ships," *Marine Engineering and Shipping Review* 48 (June 1943): 192-196; J.G. Magrath, "Welded Ships from the Singing River," *Marine Engineering and Shipping Review* 48 (November 1943): 166-175, (December 1943): 180-190, and 49 (January 1944): 185-198.

[180]"Richmond Weight Lifters," *Fore'n'Aft* 3 (8 January 1943): 3-4; "Section of Hull No. 58,

An interesting feature of the LST was the fact that the keel would not be level but rather would rise 12" in 50' toward the bow. The Kaiser engineers had to begin designing Yard 3A before the government had finalized the design for the LST, but one feature they knew they had to accommodate in the design of the shipways was the raked or sloping keel. Einar Larsen was design engineer and Dave Williams was superintendent of construction. They decided that they would build shipways to have the same one-foot-in-fifty slope as the keel, thereby eliminating the usual declivity of the bulkheads and decks during erection. With the slope of the ways equaling the rake of the keel, bulkheads and decks could be built plumb and level, respectively. The launching basin at the head of the Santa Fe Canal was not large enough, however, to accommodate a way as such a gradual slope would require. Instead, the engineers designed a vertical curve in the shipways so that the slope would increase just downhill of the area where erection took place. That feature, in turn, required that the weight of a ship would have to be carried on articulating poppets rather than distributed along the cradle. (For explanations of these terms, see descriptions in the section on launching in chapter V on Kaiser Methods.) Winches and cables were also necessary to initiate movement during launch of a ship on such a gradually sloping way.[181]

Crews laid the keel for the first LST at Yard No. 4 on 5 August 1942. Work at the yard suffered from some of the same problems that were plaguing the C-4s at Yard No. 3: changing plans on the part of the government. After yards on the East Coast had completed sea trials of the first few LSTs, the Navy made numerous changes in plans and specifications for the vessel, delaying work at Yard No. 4. Crews launched Yard No. 4's first LST on October 4th. Further delays occurred because of a shortage of materials needed to outfit the ships. Outfitting was taking place at Yard No. 3's dock. To substitute for some of the missing items, crews at Yard No. 3 were able to draw upon stocks intended for C-4s, but that in turn led to delays in completion and delivery of troop ships by Yard No. 3. By the beginning of December 1942, there were six LSTs docked at Yard No. 3. The government decided that completion of LSTs was more critical than completion of C-4s, so electricians and pipefitters necessary for outfitting troop ships were diverted to outfitting LSTs, again delaying completion of C-4s.[182]

USMC Hull No. 2101, in Sub-Assembly Area of Way One," photo no. P-361 dated 1 February 1944 in the Photographic Collection (hereinafter cited as Richmond Museum Photos), Richmond Museum, Richmond, CA; Harry G. Beck, Kaiser Cargo, Inc. (Richmond No. 4), unpublished Industrial Health and Safety Survey dated February and March 1944, p. 4, in NARA RG-178, entry 95A, box 529, Kaiser Cargo Co. #4 file; "Richmond Shipyard No. 4, Schedule of Shipyard Facilities As Of July 1, 1944," unpublished report in "West Coast Yards, Shipyards Facilities Index," NARA RG-178, entry 100, box 26; Untitled drawing of Yard No. 4, no date, in D.D. Dick, "Shipyard Facilities Index: West Coast Yards," unpublished report dated 1 July 1945, in NARA RG-178, entry 23, box 1; "Richmond Number Three," 52; "History of Kaiser Organizations," Vol. III, 364; Kramer, "The Story of the Richmond Shipyards," 18, 20.

[181]Kramer, "The Story of the Richmond Shipyards," 18-21.

[182]"Chronological History of Kaiser Company, Inc., Shipyard Number Three," 7, 9-10.

Most of the nineteen companies that sub-contracted to fabricate units for the LSTs built by Yard 4 were within 100 miles of Richmond, but one was located at Bakersfield, 300 miles distant, while another was at Los Angeles, 475 miles away. California Steel Products was a local company, with its shop in Richmond only 2 miles from the shipyard. It had sub-contracts to build deckhouse and wheel house sections. Some companies were located in other East Bay communities, including two each in Alameda, Berkeley, and Oakland. There were two companies in San Francisco and one in Sausalito. There was one company each in San Jose, Gilroy, and Salinas, one company in Sacramento, and two companies in Stockton. Bigge Drayage Company hauled some of the prefabricated sections to Richmond on giant flatbed trucks, trips that often required temporary removal of overhead utility wires along the route. Other sections were shipped to Richmond on railroad flatcars, and yet others were shipped on barges. For the latter, Yard 4 was equipped with a fourth bridge crane erected over the water so that the crane could off-load prefabricated sections from the barges.[183]

Despite the fact that all fabrication and pre-assembly of LSTs was done off-site by sub-contractors, Yard No. 4 nevertheless needed an ample supply of welding rods to maintain its hull erection schedule. By the time the first keel was laid, however, the nation was facing a shortage of welding rod. Matters were made worse for Kaiser because one of the new suppliers with which the Richmond yards had placed orders, Weldco Company of South San Francisco, was a new operation that was itself delayed in beginning its shipments of product. When Weldco finally began shipping welding rod to customers in spring 1943, the product was found to be unsatisfactory for shipbuilding. The welding schools at the four Richmond shipyards used

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[183]"Allocation of Prefabrication Contracts for LST Sections," graphic dated 31 August 1942, in HJK 83/42c, vol. 71; "Richmond Weight Lifters," *Fore'n'Aft* 3 (8 January 1943): 4; "Yard Four's Toy Blocks," *Fore'n'Aft* 3 (8 October 1943): n.p. Photographic views of many of the sub-contractors yards, and the trucks used to transport pre-assembled units to Yard No. 4, are in the Photo Collection at the Richmond Museum; see "Fabrication of Section 1K, Yard Hull No. 58 - Fabricator's Hull No. 1," photo no. P-358 dated 28 January 1942; "Upper Wing Tank Section - LST Craft," photo no. P-363 dated 19 August 1942; "Fabrication of Section 1G, Yard Hull No. 58 - Fabricator's Hull No. 1," photo no. P-366 dated 19 January 1942; "Shell of Section 2C, Starboard Side - Yard Hull No. 58, Fabricator's Hull No. 1," photo no. P-367 dated 5 January 1942; "Fabrication of Section 1F, Yard Hull No. 58 - Fabricator's Hull No. 1," photo no. P-372 dated 29 December 1943; "Prefabrication of Section 1-C, Yard Hull No. 58, MC Hull No. 2101, Fabricator's Hull No. 1," photo no. P-378 dated 1 December 1943; "Prefabrication of Section 1-C, Yard Hull No. 58, MC Hull No. 2101, Fabricator's Hull No. 1," photo no. P-380 dated 22 December 1943; "Prefabrication of Section 1-C, Yard Hull No. 58, MC Hull No. 2101, Fabricator's Hull No. 1," photo no. P-382 dated 22 December 1943; "Fabrication of Section 2B, Port - Yard Hull No. 58, Fabricator's Hull No. 1," photo no. P-384 dated 12 January 1944; "Assembly of Section 3F, Port, for Yard Hull No. 59," photo no. P-391 dated 21 March 1944; "Fabrication of Section 1D - Yard Hull No. 58, Fabricator's Hull No. 1," photo no. P-396 dated 19 January 1944; "Fabrication of Section 4A, Yard Hull No. 58 - Fabricator's Hull No. 1," photo no. P-407 dated 28 January 1944; "Upper Wing Tank Section - LST Craft," photo no. P-421 dated 20 August 1942; "Arrival of Section 1-C, Yard Hull No. 58, MC Hull No. 2101 At Yard Four on December 22, 1943," photo no. P-823 dated 1 February 1944; all in Richmond Museum Photos.

Weldco's inferior rod for training purposes. Meanwhile, Yard No. 3 was experiencing such severe delays in building the C-4s that it had surplus welding rod on hand. The Kaiser organization distributed this material to the other three yards, including Yard No. 4, so that they could maintain their production schedules despite their own shortages of welding rod.[184]

Yard 4 delivered the fifteenth and last LST on 24 June 1943. The LST program at Yard 4 was one of the few at the Kaiser shipyards that did not measure up favorably against the performance of other yards. According to Maritime Commission evaluations, both Bethlehem-Fairfield and Kaiser-Vancouver performed better than Richmond Shipyard No. 4.[185]

Despite the problems at Yard 4 with the LSTs, the Maritime Commission awarded Kaiser a subsequent contract to build a very different kind of ship. In late 1942, the government decided to build a number of light anti-submarine escort vessels and assigned the task to the Maritime Commission. The scheme for assigning contracts was predicated partially on utilizing the resources of a number of Great Lakes shipyards that were nearing completion of their contracts to build smaller coastal cargo vessels but were unable to tackle contracts to build ocean-going vessels, like the Liberty ship, because there was no way to get such large ships to sea from the Great Lakes. Despite the fact that many of the anti-sub escorts would be built at Great Lakes yards, the Maritime Commission gave the task of developing plans and specifications for the ships to the Kaiser organization, which received the designation "leading yard" and a contract to build twelve of the escorts. Based on a design being built by Canadian Vickers in Montreal called a corvette, the American ships would be a foot wider, for stability, and a few feet longer to accommodate reciprocating engines. Initially called corvettes, like their Canadian predecessors, the new American ships designated S2-S2-AQ1 soon came to be called frigates because they did represent a new design. Kaiser's initial design was based on capabilities of shipyard cranes on the West Coast to lift large pre-assembled units, but the Great Lakes yards did not have cranes that large. Because the frigates would not fit through the Lachine Canal and therefore could not travel to sea by means of the St. Lawrence River, they had to be designed to pass through the Chicago Drainage Canal and out the Illinois and Mississippi rivers. Therefore, the masts had to be removed so the ships could pass beneath Chicago's bridges.[186]

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[184]"Chronological History of Kaiser Company, Inc., Shipyard Number Three," 13-14.

[185]"Chronological History of Kaiser Company, Inc., Shipyard Number Three," 17; "The Earth Movers II," 226.

[186]Office Order No. 57 dated 16 December 1942, in San Bruno RG-178, box 1, file Office Orders; Minutes of Conference Held in the Offices of Kaiser Cargo, Inc., Oakland, California, 23 December 1942, in San Bruno RG-178, box 2, file Conferences 1943; Resume of Conference Held in the Offices of Kaiser Cargo, Inc., 31 December 1942, in San Bruno RG-178, box 1, file C.W. Flesher's File 1942; Lane, *Ships for Victory*, 614-615.

There was an interesting meeting among representatives of the Maritime Commission's Great Lakes and Pacific Coast offices, George G. Sharp, Kaiser Company, Inc., Consolidated Steel in Wilmington, CA, and several of the Great Lakes shipbuilders at which they discussed ways the American design would simplify some Canadian/British features of the corvettes and at which they also argued over whether plans would be prepared by a central pool of draftsmen

Alteration of the Canadian plans by Kaiser designers was a complex task because the frigates had to meet Navy requirements, yet the Kaiser contract to build the ships was with the Maritime Commission. Navy approvals of the Kaiser alterations had to be negotiated through the Maritime Commission, with involvement as well by the Navy's Bureau of Ships. This necessitated several meetings held in both Washington, DC, and Richmond of Navy officials, top Maritime Commission officials, including Admiral Vickery and Carl Flesher, and top Kaiser officials, including Henry J. Kaiser himself and Clay Bedford. Changes ranged from the location of radio and radar rooms to the redesignation of space, from a workshop for depth charges to a general workshop, and from the elimination of a bath in the Executive Officer's stateroom to elimination of a linen locker. Other changes ensued because some piping and fittings in the Canadian plans corresponded to Canadian and British standards, whereas the escorts built in the U.S. would have to meet American standards.[187] Following is a list of Kaiser personnel who worked on the design:

Kaiser Cargo, Inc., Design Team for Escort Vessels (Frigates)[188]

Name	Title
J.E. Orchard	Engineering and Design Division
Andy Mori	Consultant on Hull and Prefabrication
C. Yeomans	Naval Architect
R.W. Rambo	Technical Coordinator
B. Seaborn	Administrative Coordinator, Design Eng. Dept.
L.G. Rummel	Chief, Machinery Plan Department

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from the several yards congregating in the Bay Area or whether Kaiser would prepare master plans and draftsmen at each of the Great Lakes yards would adapt them. The Great Lakes office of the Maritime Commission and the Great Lakes yards wanted to maintained their capabilities and were concerned that, if they dispatched draftsmen to the Pacific, the Kaiser organization would hire them away. The minutes are in the form of a summarized transcript of conversations at the meeting. See Conference Held in West Coast Regional Construction Office, U.S. Maritime Commission, Oakland, dated 7 November 1942, in San Bruno RG-178, box 1, file C.W. Flesher's File 1942.

[187]Resume of Conference Held in Rear Admiral Vickery's Office, Washington, DC, 15 December 1942, in San Bruno RG-178, box 1, file C.W. Flesher's File 1942; Resume of Conference Held in the Offices of Kaiser Cargo, Inc., 30 December 1942, in San Bruno RG-178, box 1, file C.W. Flesher's File 1942; Resume of Conference Held in the Offices of Kaiser Cargo, Inc., 8 & 9 January 1943, in San Bruno RG-178, box 2, file Conferences 1943; Resume of Conference Held in the Offices of Mr. C.P. Bedford on 29 January 1943, in HJK 83/42c, box 16, file 18 and in San Bruno RG-178, box 2, file Conferences 1943.

[188]Minutes of Conference Held in the Offices of Kaiser Cargo, Inc., Oakland, California, 23 December 1943, in San Bruno RG-178, box 1, C.W. Flesher's File 1942 and box 2, file Conferences 1943.

R.A. Strean	Chief, Hull and Machinery Scientific Section
E. Muzynski	Chief, Electrical Plan Department

Kaiser Company, Inc. initially operated Yard 4 as Yard 3A under contract. In March 1943, the Six Companies formed Kaiser Cargo, Inc. a joint venture initially comprised of only The Henry J. Kaiser Company (85 percent) and Morrison-Knudsen Company (15 percent). The following month, Kaiser Cargo took over the contracts with the Maritime Commission and assumed management of Yard 3A, at which point its designation changed to Yard no. 4.[189] In July 1943, The Henry J. Kaiser Company sold some of its shares so that the venture had the following participants:

Ownership Participation in Kaiser Cargo, Inc.[190]

Company	Ownership Percentage
The Henry J. Kaiser Company	45%
The Kaiser Company	15
California Kaiser (later Kaiser Engineers)	15
Morrison-Knutsen Company, Inc.	15
J.F. Shea Company, Inc.	10

Yard No. 4 was not the only one in the Kaiser group that relied on remote assembly facilities. Kaiser's Vancouver yard established a sub-assembly yard at The Dalles, Oregon, along the Columbia River and 90 miles upstream of the main Vancouver yard. A barge made weekly trips between Vancouver and The Dalles delivering steel plate to the satellite yard and returning assembled units of hulls. Kaiser developed the satellite yard to utilize labor available in the vicinity of The Dalles in the form of agricultural workers who were not willing to move to Vancouver.[191]

The small shops around the Bay Area that were pre-assembling units for the LSTs were part of a much larger array of small industrial facilities throughout the United States that found ways to contribute to the war effort, no matter how small or how remote they were. An excellent

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[189]"History of Kaiser Organizations," Vol. III, 363-364; Kramer, "The Story of the Richmond Shipyards," 50. Although the Kaiser sources state that Kaiser Cargo was created in March 1943, there is evidence that the name and perhaps the intention to create the new company existed previously. Minutes of Kaiser meeting with Admiral Vickery and Carl Flesher in January 1943 to discuss plans for the frigates refer to Kaiser Cargo; see Resume of Conference Held in the Offices of Mr. C.P. Bedford, 29 January 1943, in HJK 83/42c, box 16, file 18.

[190]"Ships," in HJK 83/42c, box 298, file 21; "History of Kaiser Organizations," Vol. III, p. 363, in HJK 83/42c, box 299.

[191]"Shipbuilding 90 Miles from The Yard," *Western Construction News* 20 (February 1945): 81-82.

example of people in a small remote community finding a way to contribute took place in the town of Taft, California, located in an oil field about 30 miles southwest of Bakersfield. Taft businessmen formed a new community-owned corporation in 1942 called Taft Alloy Steel Company, or Tasco, with the intention of putting to use an old foundry that stood on the edge of town. With help from the War Production board, they upgraded the foundry with an electric furnace, and then they secured approval by the Maritime Commission to begin producing cast steel anchor chain. Because of the nationwide shortage of steel, anchor chain was also in short supply. One way the Maritime Commission responded to the steel shortage was to reduce the length of anchor chain specified for Liberty ships from 300 fathoms to 240 and then 210 fathoms. Moreover, the commission put some Liberty ships in service with only one anchor instead of the specified two. Most of the raw material for Tasco's chain links came from piles of scrap steel that had accumulated in the vicinity because of the oil industry. Using the electric furnace allowed the foundry to add alloys so that steel in the links met specifications for tensile strength. The operation initially encountered technical difficulties in casting chain that met maritime standards, but by 1944 the problems were solved and Tasco was contributing to the nation's overall shipbuilding program. The Tasco operation employed 200 people, of whom about 25 percent were women.[192]

E. Overall Kaiser Operations in Richmond

Clay Bedford was the general manager of all four Richmond shipyards. He managed each yard through its respective yard superintendent, but he also used their proximity in Richmond to maintain an efficient overall operation and to foster a spirit of competition, intended to spur each yard to even more efficient operation. An example can be seen in the "Good Housekeeping" program Bedford initiated in July 1943. He said that it was the idea of Henry J. Kaiser, after the latter toured the four yards. In a memo to Norris Nash, Bedford ordered that several new initiatives be started. Some were rather simple, like locating ample trash barrels and other facilities throughout the yards. Others were more involved. He wanted riggers to be educated in how to set their loads down neatly rather than in a haphazard manner.

He wanted traffic officers located at busy intersections, where trucks, cranes, and other vehicles often competed for right-of-way. He wanted the maintenance superintendents to use color-coded bins to signal workers that their contents, like welding cable, were either bound for the repair shop or were repaired and ready for use again. Bedford applauded Yard 3 for installing guard rails and landscaping around the First Aid Station, which prevented workers from leaning against the building and smudging it with their dirty clothes. He recommended that the other yards implement a similar program. In order to stimulate the yards and their workers to greater cleanliness, Bedford suggested that the Program Department establish a flag of merit for good housekeeping that would be awarded monthly.[193]

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[192]N. Duke Lanfre, "Casting Steel Anchor Chain on the Desert," *Pacific Marine Review* 42 (April 1945): 214-216; Lane, *Ships for Victory*, 85, 87.

[193]C.P. Bedford to Norris Nash, memorandum dated 30 July 1943 in HJK 83/42c, box 16, file 18.

Not long after Richmond Yard No. 2 began producing Liberty ships, Kaiser signed a contract with the Maritime Commission to build Yard 3, and then Yard 4. Shipyard management jobs in the Kaiser organization were quite fluid during this early period, as numerous men moved up the Yard 1 hierarchy, or moved to Yard 2, or quickly moved on to Pre-Fab or Yard 3, etc. Following are some brief sketches of some to the key management figures.

Edwin W. Hannay, Sr. A long-time shipbuilder on the Pacific Coast, Hannay was brought to Richmond by Kaiser to serve as general superintendent for Todd-California, reporting directly to Clay Bedford, the young general manager. An early issue of *Fore'n'Aft* called Hannay Bedford's "right-hand man."[194]

Harry J. Friel Another experienced shipbuilder, Friel was brought to Richmond by Kaiser to serve as marine superintendent at Todd-California. Friel directed the first sea trial conducted by Kaiser's Richmond shipbuilders when he and a crew put the *Ocean Vanguard* through her paces. He later became yard superintendent at Yard 2. Friel stayed with the Kaiser organization after the war, working as a consulting engineer and helping with the ship-repair program.[195]

Dan C. Peacock, Jr. Peacock had ten years experience in construction on the Pacific Coast prior to the war. A graduate of University of Washington, he had worked with the Kaiser organization as a purchasing agent on the Grand Coulee project. Bedford brought him to Richmond to become general superintendent of Yard 2 during the construction phase. Then Peacock went to New York to set up the Kaiser organization's purchasing office there for Yard 3 and the C-4 effort.[196]

Tim Bedford Clay Bedford's younger brother, Tim had been superintendent of construction for Kaiser during the construction of the submarine bays at Mare Island when he was transferred to Richmond to be administrative assistant at Yard 2.[197]

Edwin W. Hannay, Jr. The younger Hannay apprenticed as a shipyard machinist and worked for a time as a chief engineer aboard merchant ships before coming to Richmond to work at Todd-California as assistant marine superintendent to Harry Friel. As the Kaiser organization began making plans to build Yard No. 3, Hannay traveled the eastern U.S. inspecting machinery that had been ordered for the new yard.[198]

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[194]*Fore'n'Aft* 1 (30 October 1941): 4; Kramer, "The Story of the Richmond Shipyards," 10; "In an Emergency There's No Schedule," 105.

[195]*Fore'n'Aft* 1 (30 October 1941): 4; Kramer, "The Story of the Richmond Shipyards," 10, 29.

[196]"In an Emergency There's No Schedule," 105; Kramer, "The Story of the Richmond Shipyards," 11, 14, 16.

[197]Kramer, "The Story of the Richmond Shipyards," 14.

[198]"Definitely Masculine...," *Fore'n'Aft* 2 (27 November 1942): n.p.

Maurice Nicholls. Consulting engineer for Richmond Shipbuilding Corporation, naval architect and marine engineer, and graduate of the University of Michigan, Nicholls apprenticed at Cramps shipyard in Philadelphia and had experience in several other shipyards on East Coast.[199]

David A. Oppenheim. Born in Harbin, China, Oppenheim graduated from the University of Hong Kong before receiving a scholarship to the University of California, where he graduated with an engineering degree in 1934. He went to work for Kaiser on the Bonneville project and then moved to Grand Coulee, where he worked as progress engineer. He moved to Richmond in January 1941 to establish the Progress and Program Department at Yard 1. As the Kaiser organization built additional yards, Oppenheim's office moved to Yard 3, from where he managed Progress and Program staffs at each of the four yards, which totaled about 500 employees by 1943.[200]

The following table offers comparisons of the facilities of the four Richmond shipyards:

Comparison of Facilities - Richmond Shipyards[201]

Feature		Yard No. 1	Pre-Fab	Yard No. 2	Yard No. 3	Yard No. 4
Cost of construction*		14,468.78*	$5,954,918.02*	$21,377,529.71*	27,530,967.22	2,842,631.00*
Yard constr. began		01-14-41		04-22-41	01-14-42	03-01-42
First keel laid		04-14-41		09-17-41	05-14-42	07-02-42
First ship launched		08-16-41		12-21-41	11-25-42	10-04-42
First ship delivered		10-27-41		02-23-42	08-30-43	02-19-43
Shipyard area (dry land, acres)		122.32	49.31	332.78	147.58	62.34
Number of shipways		7		12	5 (basins)	3
Floor area of buildings (sq.ft.)		504,822	201,023	1,289,404	1,190,366	199,609
Number of cranes:	Mobile	17	7	27	16	7
	Locomotive	2		3	2	
	Electric	55	24	97	59	8

*The costs for Yards 1 & 2 and for Pre-Fab are not exact. The amount shown for Yard No. 1 is actually the amount the British spent on construction of the yard. The amount shown for Yard No. 2 is actually the amount the Richmond Shipbuilding Corporation spent on construction, most of which was for construction of Yard No. 2. The amount shown for Pre-Fab was actually the amount spent on construction by Permanente Metals, an amount that was spread across the yards and Pre-Fab. Total cost of construction for the three facilities was $36,942,190.16.

In order to move ships around the four Richmond shipyards, the Kaiser organization contracted with a San Francisco tug builder named Nunes to build two tug boats that would be named for the two top Maritime Commission officials. Carolanne Nunes, niece of the builder,

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[199]"In an Emergency There's No Schedule," 105.

[200]"Figureheads," *Fore'n'Aft* 3 (12 March 1943): 6-7; Kramer, "The Story of the Richmond Shipyards," 11.

[201]"Comparison of Facilities, Kaiser Shipyards," and "Summary of Facilities Costs," data sheets in HJK 83/42c, box 298, file 21.

sponsored the launching of the *Admiral Land* in late August 1942, and the *Admiral Vickery* was launched about a month later. Both tugs had 600 h.p. diesel engines.[202]

By 1943, Kaiser had a diverse industrial empire working on various aspects of war production. To be sure that none of his enterprises benefited by gaining sweetheart contracts to supply his shipbuilding operations, he established the policy that none of his shipyards could purchase supplies from other Kaiser enterprises unless the purchase resulted from a legitimate low bid based on a proper set of specifications. Kaiser enterprises that were potential suppliers of the shipyards included Production Engineering Company, Permanente Metals' magnesium plant, Permanente Cement, Kaiser's steel operation, Kaiser's sand and gravel operations, Joshua Hendy Iron Works (see below), Pomono Pump, and some insurance businesses. In the same vein, Kaiser vetoed a proposal by Clay Bedford and Steve Bechtel that Industrial Equipment Company serve as purchasing agent for the Richmond shipyards. Industrial Equipment was a company initially created by Kaiser to sell used equipment from his projects, and it became a prominent dealer in new and used construction equipment. During the 1940s, Kaiser owned 50 percent of Industrial Equipment. Even though it was a business ideally organized to undertake purchasing on behalf of the shipyards, Kaiser was concerned that a public impression might arise that both Kaiser entities, the shipyards and Industrial Equipment, were trying to collect fees for the purchase of equipment, even if only one fee was actually being collected from the Maritime Commission for the service.[203]

As noted in the descriptions of each of the four Richmond shipyards above, various factors, including materials and labor shortages, caused the Kaiser organization to be late in delivering many of the ships it was contracted to build. When the Richmond yards missed a delivery date, Admiral Vickery was quick to telegraph Bedford, point out the tardiness, and ask for an explanation. While Bedford could always supply an apparently legitimate reason, Vickery rarely feigned satisfaction, always prodding Bedford to perform better.[204] This was in keeping with Vickery's nationwide reputation for using an array of methods to goad shipyard managers to greater output. He would belittle them when they were late. He tried to instill a spirit of competition by pitting yards' production records against each other. He pitted old-line yards against the emergency yards managed by construction firms, he pitted six-way yards against each other, he pitted Kaiser yards against Bechtel yards, and he pitted Kaiser yards against each other (e.g., Edgar Kaiser's Oregon yards against Clay Bedford's Richmond yards). Although Vickery was unrelenting in his needling of shipbuilders in his private correspondence, he and

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[202]Clay Bedford to Admiral Land, letter dated 28 August 1942 in HJK 83/42c, box 25, file 26.

[203]C.P. Bedford to J.E. Orchard and Bedford to All Purchasing Departments, memoranda dated 9 March 1943 in HJK 83/42c, box 16, file 18; Bedford to Henry J. Kaiser and Kaiser to Bedford, telegrams dated 12 January 1943 in HJK 83/42c, box 16, file 18; "History of Kaiser Organization," 5.

[204]See, for example, Admiral Vickery to Clay Bedford, three telegrams dated 20 April 1943 (one each for yards 1, 2, and 3A), and Bedford to Vickery, telegram dated 21 April 1943, all in HJK 83/42c, box 25, file 26.

Admiral Land always praised the shipbuilders efforts and records in public.[205]

A representative set of exchanges between Vickery and Bedford took place in early autumn of 1943. As Vickery was about to embark on a September trip to inspect shipyards, Bedford wired to wish him luck, adding:

> And if you happen to see any steel, would you mind sending it to the Permanente Metals Corporation at Richmond, California, where we are patiently marking time waiting for an opportunity to show how many Liberties we really can produce and how cheaply.[206]

Upon his return to Washington, DC, in early October, Vickery wired Bedford, "With all facilities and materials you have, it does seem you might be able to emulate Oregon instead of being a poor third. Regards."[207] Bedford responded:

> Welcome home and if we knew how Oregon got all those materials away from you we would most certainly emulate them. As I advised you when you suggested that we slow down instead of shutting down for lack of material, we can run out of steel any time you wish and on short notice. There is so much interest around the Richmond shipyards in taking Oregon on anyway despite the shortage of materials and the lack of an assembly plant that we may not be able to keep the brakes on--so don't be too surprised if we have to shutdown anyway before long. Regards.[208]

Vickery also could congratulate managers and workers. For example, in January 1944, after American shipyards delivered 1,896 ships during 1943 totaling more than 19,000,000 tons deadweight (more than double their performance in 1942), he telegraphed Bedford and the Richmond shipyards with a message he sent to all the nation's shipyards, congratulating them on their year's performance. But then he went back to prodding. In early June, as the Richmond yards were converting from building Liberty ships to Victory ships, he telegraphed Bedford, "What is wrong with Richmond Number One? No deliveries in May or so far in June. I am greatly concerned."[209] The next day, Vickery telegraphed again, "Richmond Number One is

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[205]Lane, *Ships for Victory*, 465-471.

[206]Clay Bedford to Admiral Vickery, telegram dated 9 September 1943 in HJK 83/42c, box 25, file 26.

[207]Admiral Vickery to Clay Bedford, telegram dated 2 October 1943 in HJK 83/42c, box 25, file 26.

[208]Clay Bedford to Admiral Vickery, telegram dated 5 October 1943 in HJK 83/42c, box 25, file 26.

[209]Admiral Vickery to Clay Bedford, telegram dated 8 June 1944 in HJK 83/42c, box 25, file 26.

making the worst record of any yard shifting from one design to another. What are you going to do about it?"[210] Evidently, Henry J. Kaiser sent Vickery a reply, trying to explain that weather had been bad in Richmond, to which Vickery responded, "Can well realize that you have to take refuge behind the weather, as I understand there is no other alibi for your present poor record at Richmond Number One."[211] In mid-June, Vickery sent Kaiser another telegram providing a caustic status report: "June deliveries for Richmond Number One none, Richmond Number Three None, Richmond Number Four none."[212]

In August, with Oregonship delivering ships, Vickery wired Bedford, "With Oregon's delivery, you now understand what it means to be in first class competition. Don't you ever get out of the second division?"[213] A few days later, Bedford sent Vickery a letter asking, among other things, "How about a 'Second Fiddle' Flag for us "Second Fiddle Champs?"[214] He then proceeded to explain to Vickery some of the reasons, primarily related to labor shortages, for delays at Yard No. 1. Bedford added a hand-written postscript: "We may be a little short on supervision - manpower and materials - but we do keep the perspiration level up on the rest of the Pacific Coast."[215] In September, Vickery wrote Kaiser a letter, with copies to Bedford, Edgar Kaiser, and Carl Flesher:

> For some time I have been quite critical of the performance being made at Richmond No. 1 in the building of Victory Ships. I am forwarding to you herewith the comparative record as of this date of Oregon, Calship, and Richmond No. 1, which shows Richmond running a very poor third.
>
> I know you are interested in this matter, and trust that you will look into it to see what corrective measures can be taken to make a reasonable performance at Richmond No. 1.[216]

Later that month, Vickery had a heart attack, caused in part by the unceasing energy he expended

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[210]Admiral Vickery to Clay Bedford, telegram dated 9 June 1944 in HJK 83/42c, box 25, file 26.

[211]Admiral Vickery to Henry J. Kaiser, telegram dated 10 June 1944 in HJK 83/42c, box 25, file 26.

[212]Admiral Vickery to Henry J. Kaiser, telegram dated 14 June 1944 in HJK 83/42c, box 25, file 26.

[213]Admiral Vickery to Clay Bedford, telegram dated 15 August 1944 in HJK 83/42c, box 25, file 26.

[214]Clay Bedford to Admiral Vickery, letter dated 19 August 1944 in HJK 83/42c, box 25, file 26.

[215]Ibid.

[216]Admiral Vickery to Henry J. Kaiser, telegram dated 7 September 1944 in HJK 83/42c, box 25, file 26.

inspecting shipyards throughout the country and pushing their performance. Vickery left his job until mid-February 1945. Immediately upon his return, he embarked on a long inspection trip. During his absence, some of his technical assistants and Admiral Land took over his tasks.[217]

Despite the epistolary rebukes he had received from Vickery over the previous months, Bedford sent Vickery best wishes during his recuperation. In a December telegram, Bedford wrote:

> Dear Chief: It is extremely unfortunate that nature had to take a hand before you would stop building ships for your shipbuilders. And make them go out and do a little work on their own. Please believe me, however, when I say that there isn't a man or woman in the Richmond yards who hasn't tried harder than ever to meet your schedules while you were away, so that your program would be completed just as you laid it out, or bettered. And from every one of us here at Richmond, please accept our heartfelt wishes for you to be back on the job full time again as soon as possible--needle and all--and for both you and your family, Merry Christmas and good luck![218]

Late in 1944, it became clear to the Joint Chiefs of Staff that the war in Europe would continue into the next year, so the Office of War Mobilization and Reconversion authorized the Maritime Commission to contract for more Victory ships through 1945. In January 1945, Admiral Land and the other members of the commission tried to negotiate contracts with shipbuilders, but they lacked Vickery's ability to get what he wanted from the shipbuilders.[219] Bedford, too, was unsatisfied with the new people at the commission involved in negotiations. He sent the following telegram to Admiral Vickery, who was recuperating in Florida:

> Delighted to have opportunity to bask under Washington cherry trees while waiting for additional ships. The old wagon just doesn't run the same however without you in the driver's seat.....Certainly hope you get a real rest while you are away and we are looking forward to you coming back. Even the needle could not be worse than this. Kindest personal regards.[220]

Despite Bedford's courtesies during Vickery's absence, Vickery was back to his old method of needling shipbuilders when he returned to the job in February. In June, for example, he wired Bedford, "Request information whether Richmond One has stopped shipbuilding as no

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[217]Lane, *Ships for Victory*, 672, 680-681, 788-789.

[218]Clay Bedford to Admiral Vickery, telegram dated 23 December 1944 in HJK 83/42c, box 25, file 26.

[219]Lane, *Ships for Victory*, 680-682.

[220]Clay Bedford to Admiral Vickery, telegram dated 18 January 1945 in HJK 83/42c, box 25, file 26.

deliveries report this month so far."[221] Bedford telegraphed back that he was delaying the delivery schedule because suppliers were late in shipping turbines and gears to Yard No. 1 for the last two ships the yard would build. Those keels had just been laid. The Richmond shipyards were gradually laying off workers, and he wanted to prolong the outfitting of recently launched ships so that he would still have crews to install the turbines and gears in the hulls. He closed his telegram, "Hope you are feeling okay. Kindest regards."[222] Back to his old form, Vickery wired back the same day:

> It is inconceivable to me to understand why deliveries of turbines and gears for ships for which keels have just been laid has anything to do with the delivery of ships that have been launched and lying in your basin for the past thirty days. I am not interested in that kind of alibi: I am interested in your meeting your contract and production schedule.[223]

In total, Kaiser's Richmond shipyards built 747 ships, including British tramp steamers, Liberty ships, Victory ships, troop transports, LSTs, frigates, and C-1s.[224] To build those ships, the Maritime Commission paid the Kaiser organization $1,713,800,000 for the construction of shipyards, for the construction of housing, transportation, and related infrastructure, and for labor and materials comprising the actual cost of building ships. This represented well over half of the $2,625,700,000 the Maritime Commission paid to shipyards in the Bay Area. In addition, the Navy paid $885,800,000 to Bay Area shipyards. The following table shows totals for the major shipyards on the San Francisco Bay:

Maritime Commission and Navy Expenditures for Ships Delivered by Shipyards on San Francisco Bay[225]

Yard	Maritime Commission	Navy	Total
Bethlehem	10,300,000	366,300,000	376,600,000
Mare Island		372,300,000	372,300,000
Marinship	345,800,000		345,800,000
Moore Dry Dock	346,800,000	147,200,000	494,000,000
Richmond No. 1	408,900,000		408,900,000

[221]Admiral Vickery to Clay Bedford, telegram dated 20 June 1945 in HJK 83/42c, box 25, file 26.

[222]Clay Bedford to Admiral Vickery, telegram dated 21 June 1945 in HJK 83/42c, box 25, file 26.

[223]Admiral Vickery to Clay Bedford, telegram dated 21 June 1945 in HJK 83/42c, box 25, file 26.

[224]The names of all 747 ships and their launch dates are listed in "747 Ships," *Fore'N'Aft* 6 (1 February 1946): 2-11.

[225]Fischer, *Statistical Summary of Shipbuilding*, 164.

Richmond No. 2	852,100,000		852,100,000
Richmond No. 3	333,500,000		333,500,000
Richmond No. 4	119,300,000		119,300,000
Western Pipe & Steel	209,000,000		209,000,000
Total	**2,625,700,000**	**885,800,000**	**3,511,500,000**

F. Other Bay Area Shipyards

Detailed histories of the other shipyards in the Bay Area are beyond the scope of this report, but some mention of them is important because they combined with the Richmond yards to create the context for labor shortages during the war, to help shape the Bay Area's post-war economy, etc.[226]

Bethlehem Steel Company, Shipbuilding Division

Bethlehem Steel's Union Plant in San Francisco was a descendent of the old Union Iron Works, one of California's pioneer manufacturers of mining and milling equipment for the gold fields. Founded in 1849 by Peter Donahue, the Union Iron and Brass Foundry was first located at Mission and First in San Francisco. The following year, Donahue's works cast its first iron part, a bearing, for a steamship. During the 1850s and 1860s, the works made boilers, locomotives, and marine and stationary steam engines in addition to its stock-in-trade equipment for the mining industry. With business growing and in anticipation of an expanding marine market, the Union Iron Works moved to a waterfront location on the bay in San Francisco's Potrero District in 1881, building a much larger plant and developing shipbuilding facilities as well. The *Arago* was the first steel ship built at the Potrero Works, completed in 1884. Between then and 1940, it built more than 300 steel vessels, including passenger and cargo ships, tankers, navy ships ranging from gunboats and destroyers through cruisers and battleships, and submarines. Bethlehem Steel bought the Union Iron Works and its Potrero plant in 1905. Bethlehem expanded its West Coast shipbuilding operations by acquiring other yards in the Bay Area, at Alameda and Hunter's Point, and a yard at East San Pedro in the Los Angeles harbor. As the Maritime Commission increased the number of contracts it awarded for ships in the late 1930s, Bethlehem's Union Plant received one to build five C-1 cargo ships. Bethlehem also had contracts from the Navy to build twenty destroyers and four cruisers in 1940, necessitating expansion of the Potrero Works on adjoining waterfront land that the Navy purchased.[227]

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[226]Wayne Bonnett's wonderful coffee-table book of photos, *Build Ships: San Francisco Bay Wartime Shipbuilding Photographs* (Sausalito, CA: Windgate Press, 1999), has excellent photos of nearly all the shipyards in the Bay Area, including many of the smaller ones. It also includes photos of remote yards in Stockton. Curiously, the book has very few photos of the Kaiser yards.

[227]"Union Plant, Shipbuilding Division of Bethlehem Steel Company, Inc.," *Pacific Marine Review* 37 (January 1940): 42-45; "National Defense Program Allots Huge Orders to Pacific Coast Shipbuilders," *Pacific Marine Review* 37 (October 1940): 25-26; "Shipbuilding on San Francisco Bay," *Pacific Marine Review* 38 (January 1941): 64-66; Hugo P. Frear, "History of Bethlehem's San Francisco Yard, Formerly the Union Iron Works," *Historical Transactions,*

Mare Island

In November 1850, two months after California became a state, the U.S. government set Mare Island aside as a government reserve. The U.S. Navy began to develop a repair yard at Mare Island in 1854, which included a floating dry dock. In 1854, the Navy laid the keel for the first ship built at Mare Island, the wooden frigate *U.S.S. Saginaw*. The steam engine for the *Saginaw* was built at Peter Donahue's Union Iron Works. The Navy continued to develop the facility through nine decades until the beginning of World War II, when Mare Island had three dry docks with a fourth under construction, extensive shipbuilding facilities for new submarines, destroyers, and larger ships, a 584-bed Naval Hospital, an ammunition depot, and extensive barracks. A three-lane causeway linked Mare Island to Vallejo, the adjacent mainland city. Among the larger ships built at Mare Island were the *U.S.S. California*, a 32,500-ton battleship (keel laid in 1916); the *U.S.S. Montana*, a 43,200-ton battleship (keel laid in 1920); and two cruisers, the *U.S.S. Chicago* and the *U.S.S. San Francisco* (keels laid in 1928 and 1931, respectively). In January 1941, Mare Island was building eight submarines, four submarine tenders, and some Navy auxiliary ships. To supplement the Mare Island facilities, the Navy bought Bethlehem Steel's graving dock at Hunter's Point.[228]

Moore Dry Dock Company

Moore Dry Dock Company, located in Oakland, was the corporate descendent of the Moore Shipbuilding Company, which in turn evolved out of the Moore and Scott Iron Works, founded in 1908. Moore Dry Dock was the first Pacific Coast shipbuilder to secure a contract from the Maritime Commission. Dated 25 January 1939, the contract called for two C-3s. The company launched its first C-3, the *Sea Arrow*, from its Oakland yard on 15 September 1939. Four days later it laid the keel for its next C-3, the *Sea Star*, which was launched on December 22nd and took sixty-three working days to complete. Moore Shipbuilding Company, the predecessor, had built ships during the World War I era for the U.S. Shipping Board. Between 1917 and 1921, the Moore yard grew from one way to eight ways, three floating docks, and accompanying shops. The company gained notoriety in December 1919 by launching six large vessels, three tankers and three cargo ships, within a span of fifty-two minutes. During the lean years of the Great Depression, Moore Dry Dock stayed in business by conducting ship repairs and by fabricating steel for some of the big Bay Area bridge construction projects, including the San Francisco-Oakland Bay Bridge, the Golden Gate Bridge, and the Dumbarton Bridge. Prior to beginning work on its contract with the Maritime Commission to build C-3s, Moore Dry Dock had remodeled its yard to take advantage of the new methods of welding and pre-assembly that helped speed the erection of hulls on the ways. The new yard layout featured a large open space for assembling bulkheads and inner bottoms, and it featured tracks along both sides of the main erecting way to allow portal gantry cranes (whirleys) to lift assemblies of up to 45 tons into

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1893-1943, 238-241.

[228]"Shipbuilding on San Francisco Bay," *Pacific Marine Review* 38 (January 1941): 64; Harold W. Linnehan, "Mare Island, Then and Now," *Historical Transactions, 1893-1943*, 15-16; Frear, "History of Bethlehem's San Francisco Yard," 238.

position for welding to the hull construction. In the early 1940s, Moore Dry Dock also secured contracts with the Navy to build submarine tenders and submarine rescue ships.[229]

Western Pipe & Steel Company

Western Pipe & Steel Company built a shipyard in South San Francisco in 1917 to build ocean-going ships for the Emergency Fleet Corporation during World War I. The company stayed in business between the wars building barges and dredge hulls, but its main source of revenue derived from fabricating large pipe for pipelines. In that market, Western Pipe & Steel acquired lots of welding equipment and its workers developed considerable skill in advanced welding techniques. As the Maritime Commission increased the number of contracts it awarded for ships in the late 1930s, Western Pipe & Steel received one to build five diesel-powered C-1 cargo ships. In 1940, the company received an additional contract for four C-3s with steam turbines. Western Pipe & Steel's shipyard featured four shipways that were parallel to the launching basin, so the yard had to use the sideways launch. The outfitting dock had two finger piers with a total of four berths.[230]

With the outbreak of war, Western Pipe & Steel continued to receive contracts for cargo ships. As was typical throughout the country, contracts had to be revised once construction was underway because the nation's military planners often altered their plans and their demands for supplies to implement them. For example, in late 1942 Western Pipe & Steel was working on a contract to build seven C-3s, when the Maritime Commission informed the yard that the ships were to become Navy auxiliaries rather than cargo ships of the Merchant Marine. The change required negotiations among the Navy's Bureau of Ships, the Maritime Commission, and Western Pipe & Steel to determine which alterations in ship design required to meet Navy specifications would be accomplished in Western Pipe & Steel's yard and which would be accomplished by the Navy after delivery of the ships. Western Pipe & Steel wanted to keep as much of the work as possible, but the key determinant was insuring that delivery of the ships was not greatly delayed.[231]

Joshua Hendy Iron Works

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[229]"Famous Shipbuilding Yard Builds a Notable Steel Shop," *Pacific Marine Review* 34 (November 1937): 34-37, 68; "Remarkable Hull Construction Records Made by Moore Dry Dock Company on Maritime Commission C-3s," *Pacific Marine Review* 37 (January 1940): 50-53; "Shipbuilding on San Francisco Bay," *Pacific Marine Review* 38 (January 1941): 66-67.

[230]"Technical Division of the U.S. Maritime Commission," *Pacific Marine Review* 37 (January 1940): 40; "Shipbuilding on San Francisco Bay," *Pacific Marine Review* 38 (January 1941): 67-68; "Ships & Shipyard, Western Pipe & Steel Co.," drawing dated 1 July 1944, in "West Coast Yards, Shipyards Facilities Index," NARA RG-178, entry 100, box 26.

[231]Minutes of Conference Held at the Western Pipe & Steel Company of California, South San Francisco, dated 11 November 1942, in San Bruno RG-178, box 1, file C.W. Flesher's File 1942.

The Joshua Hendy Iron Works was one of the old San Francisco-based machinery manufacturers that had supplied the mining industry with equipment since the mid-nineteenth century. When the earthquake of 1906 destroyed the Hendy shops, the company moved its operation to Sunnyvale, 40 miles south of San Francisco. The company built its first triple-expansion marine steam engines during World War I when it received a contract to supply eleven of them for the government's cargo ship program. Hendy continued production as a diversified foundry and machine shop through the 1920s and 1930s, making parts for internal combustion engines, tractors, standards for street lamps, gears, and large gates and valves for dams. It supplied gates, for example, for Hoover Dam and Grand Coulee Dam. By the late 1930s, however, the Sunnyvale plant had little work, only sixty employees, and was being taken over by the Bank of California. A man named Charles E. Moore took an option on the plant and equipment in November 1940, with the backing of some of the Six Companies firms. Moore was a machinist who had become a machine tool salesman, eventually forming his own company, Moore Machinery Company. His Six Companies contact was Felix Kahn, of MacDonald & Kahn. Henry J. Kaiser and six other Six Companies entities each took 7.5 percent interest or less in the new venture, Kahn took a 17.5 percent interest, and Moore took the remaining 35 percent. Moore became the new president of Joshua Hendy.[232]

Moore and Kahn traveled to Washington, DC, together and secured a contract with the Navy to produce torpedo-tube mounts at the Sunnyvale plant. Shortly thereafter, as Admiral Vickery was trying to determine where to produce steam engines for the Liberty ships, Kaiser suggested that the Hendy plant was available, and Hendy soon had a contract to build twelve triple-expansion marine steam engines. As already described, the Maritime Commission's program for building Liberty ships grew rapidly in early 1942, and Vickery needed more steam engines. He called Moore to ask if the Hendy plant was capable of doubling the order. As the story goes, Moore responded that it would be as easy to tool up for 100 engines as for a dozen. Hendy got a contract for 118 of them. As the Liberty program continued to expand, so did Hendy's contract for steam engines, and by war's end the plant had manufactured more than 750 of them. Joshua Hendy produced more engines for Liberty ships than any other plant in the country.[233]

Just as Henry Kaiser boasted of the speed with which his Oregon and Richmond shipyards could produce ships, so he boasted of the speed with which the Hendy works produced steam engines for those ships. In an August 1942 speech to the Richmond workers, he told them

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[232]"Shipbuilding on San Francisco Bay," *Pacific Marine Review* 38 (January 1941): 68; "'We Can Junk It or Run It:' How the Six Companies Boys of the West Coast Salvaged Joshua Hendy," *Fortune* 28 (July 1943): 122-123, 170, 172; "General Plan, Joshua Hendy Iron Works," drawing dated 1 July 1945, in D.D. Dick, "Shipyard Facilities Index: West Coast Yards," unpublished report dated 1 July 1945, in NARA RG-178, entry 23, box 1; "The Joshua Hendy Iron Works, 1906-1946, Sunnyvale, California," National Historic Mechanical Engineering Landmark history published by the American Society of Mechanical Engineers, 14 December 1978, pp. 5, 9-11.

[233]"'We Can Junk It or Run It,'" 170; "The Joshua Hendy Iron Works, 1906-1946, Sunnyvale, California," 11-12; Lane, *Ships for Victory*, 397.

the Hendy works had assembled the engine for the *John Fitch* in a mere thirty hours. By the end of the Liberty ship program, the Hendy works was producing thirty of the steam engines per month. To accomplish such a record, Moore devised methods for standardizing the production of parts for engines, rather than meticulously fitting each part for each engine, so that the production routine at Hendy could approach that of an assembly line. Faced with a shortage of skilled machinists, he decided not to have them machining parts for engines. Rather, he had them devise machines and machine controls that would allow relatively unskilled men to accomplish the tasks. At the outset, it took Hendy workers 4,500 hours to assemble a Liberty steam engine, but by 1943 they had reduced that to 1,800 hours.[234]

As the Maritime Commission moved from Liberty ships to Victory ships, the Hendy works attempted to move into the production of turbines and the necessary reduction gears. Doing so required a considerable investment in sophisticated machining capability. The Maritime Commission helped Hendy acquire the necessary capacity because it wanted a plant on the Pacific Coast that could build turbines and cut the gears. By the end of the war, Hendy had produced fifty-three turbines and fifty-three reduction gears, an important contribution to the nation's war effort but far fewer than those produced by the two leading manufacturers of turbines, General Electric and Westinghouse.[235]

Marinship

The last of the Maritime Commission's emergency yards in the Bay Area was Marinship, a Six Companies joint venture sponsored by W.A. Bechtel Company. Although Kaiser had participated with Bechtel in launching the Calship effort in L.A., Kaiser elected not to participate in Marinship. Bechtel signed the contract on 12 March 1942. Construction of the six-way shipyard began on March 28th, and crews laid the keel for the first hull on June 27th and launched it on September 26th. A committee of workers in the yard chose Mrs. Edward Winkler, wife of a Marinship carpenter, to christen the ship the *William A. Richardon*. After building twelve Liberty ships, the Maritime Commission had Marinship convert its operation to building tankers. The Bechtel organization transferred W.E. Waste from Calship to Marinship to serve as general manager. He had been the administrative manager of Calship, which the Bechtel organization was operating for the Six Companies in Los Angeles.[236]

Other Yards

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[234]"'We Can Junk It or Run It,'" 178; "The Joshua Hendy Iron Works, 1906-1946, Sunnyvale, California," 12; Adams, *Mr. Kaiser Goes to Washington*, 115.

[235]"'We Can Junk It or Run It,'" 180-182; "The Joshua Hendy Iron Works, 1906-1946, Sunnyvale, California," 13; Lane, *Ships for Victory*, 399.

[236]K.K. Bechtel to Henry J. Kaiser, letter dated 16 April 1942, and Kaiser to Bechtel, letter dated 17 April 1942, both in HJK 83/42c, box 11, file 46; "Marinship: W.A. Bechtel Co. Builds Large Shipyard in Record Time in Sausalito," *Pacific Marine Review* 39 (August 1942): 42-49; "Marinship Launches Its First Liberty," *Pacific Marine Review* 39 (October 1942): 95; "Marinship Starts Soon on Tanker Construction," *Pacific Marine Review* 39 (October 1942): 96.

Smaller yards in the Bay Area built other ships for the war effort. General Engineering & Dry Dock Company built four anti-submarine net tenders and four mine sweepers. Pacific Bridge Company built a seagoing floating dock for the Navy's Mare Island repair facility capable of towing to sea as needed.[237]

CHAPTER FIVE: KEY FACETS of KAISER SHIPBUILDING METHODS

According to one account, the most important development in the technology available for shipbuilding between the wars was welding, which largely eliminated the bottleneck in the process previously imposed by the need to rivet all the sheets of steel employed in hull construction. The ability to weld joints in turn led to a variety of other opportunities to increase the speed with which ships could be built.[238] Kaiser and his engineers exploited all of these methods, as described in this chapter.

Several of the methods, like welding and lifting of heavy components by means of traveling cranes, involved special equipment, each of which involved its own history of technological development. Other methods involved the organization of work. Foremost among them was the method called pre-assembly or prefabrication. The method was not linked to a particular kind of equipment, as were welding and mechanical hoisting. Rather, it was a method involving the design of ships, the design of shipyard space, and the organization of workers in order to exploit mechanization and scale to the greatest extent. Various key methods employed by the Kaiser organization are described in this chapter in turn.

A. Pre-Assembly

The Industrial Revolution spawned several mass production methods that have greatly speeded production and increased productivity of workers. Those methods include mass production through mechanization, use of interchangeable parts, the assembly line, the time-and-motion studies associated with Frederick Winslow Taylor, and pre-assembly (or prefabrication) of components. Although there are overlapping characteristics of these methods, each refers to a distinct set of principles and practices. Nevertheless, observers may confuse them, using one or the other to generally name the broad array of industrial methods that have increased productivity in industrialized nations since the late eighteenth century. Such is the case with the shipbuilding methods used by American shipyards to produce so many Liberty ships and other cargo vessels during World War II. In that regard, then, many observers loosely but incorrectly referred to what American shipyards were doing as "assembly-line production." With rare exceptions, they were incorrect in doing so. One correct application of the term was in the case of the proposed Higgins shipyard in New Orleans at which hulls under construction were to have traveled along a moving conveyance from station to station, at each of which specific pre-

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[237]"Shipbuilding on San Francisco Bay," *Pacific Marine Review* 38 (January 1941): 68.

[238]Hutchins, "History and Development of the Shipbuilding Industry in the United States," 59.

assembled components were to be moved into place.[239]

Assembly lines consist specifically of a conveyor that moves partially assembled units along the line past work stations where workers add parts or sub-assemblies made on tributary sub-assembly lines.[240] Management set the speed of the moving line, thereby determining the rate at which workers must perform their tasks. Some of the components installed on Liberty ships and supplied by sub-contractors may have been produced on assembly lines, but the World War II shipyards themselves operated on the principle of pre-assembly or prefabrication, not the assembly-line principle.

Although the pre-assembly method received considerable attention in the trade and professional press during World War II in explaining how shipbuilders were able to build ships so fast, the method was certainly not new. One structural engineer, writing a letter of comment to *Engineering News-Record*, remembered that, as a young engineer working for a railroad, he had helped build a nine-span replacement bridge under continuing rail traffic using pre-assembled panels made by a bridge fabricator. He recalled further that shipbuilders during World War I had received assistance from structural steel fabricators in devising methods for pre-assembling components for cargo ships, including floors, bulkheads, deck girders, deck houses, and stern assemblies. Certain shipyards, including Hog Island, had structural components of cargo vessels fabricated at structural steel and bridge fabricating plants elsewhere in the country and then transported to the yard.[241] What was new in World War II, then, was that pre-assembly was exploited far more than ever before.

To exploit the potential for pre-assembly more fully, shipyards needed the physical capability of doing so, and that meant adequate space on which pre-assembled units could be

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[239]For example, "Assembly-Line Ship Production," *Manufacturers Record* 111 (March 1942): 18-19, 54; the article describes methods of pre-assembly used to speed production and to make it possible for pre-assembly to take place at inland facilities some distance from the shipways on the waterfront. From the pre-assembly plant, components were shipped by rail to the ways, where they were hoisted into place and welded or riveted together to eventually erect a complete ship.

Interestingly, the editors of *Steel* knew the difference between an assembly line and a pre-assembly operation. *Steel* published an almost verbatim version of the above article, but with a more apt title: "Pre-assembly Speeds Building of 'Ugly Duckling' Cargo Vessels," *Steel* 110 (23 February 1942): 37-38. The journal correctly used the term "assembly line" when referring to the shipyard that Higgins Industries, Inc., was going to build at New Orleans: "Assembly Line Methods Used to Build 200 Liberty Ships," *Steel* 110 (23 March 1942): 55.

[240]An overview of the development of the assembly line by the Ford Motor Company may be found in Chapter II of HAER No. CA-326-H, Ford Assembly Plant.

[241]Karl W. Lemcke, letter published as "Pre-Assembly Not New" in *Engineering News-Record* 128 (18 June 1942): 74-75. The letter responded to an earlier editorial, "Pre-Assembly Now Standard," *Engineering News-Record* 128 (21 May 1942): 60. See also Philadelphia War History Committee, *Philadelphia in the World War, 1914-1919* (New York: Wynkoop Hallenbeck Crowford Company, 1922), 372.

fabricated. Earlier shipyards had expanded their fabricating shops to increase their capacities to complete more shop assembly, and they provided some limited area between the fabrication shop and the shipways for pre-assembly of larger units. Nevertheless, shipyards rarely got the opportunity to build more than one ship of a particular kind. Old-line shipbuilders therefore had little opportunity to develop extensive pre-assembly schemes and consequently did not envision how important ample space for extensive pre-assembly might be. At the beginning of the programs to build British merchant vessels and Liberty ships, it was the newcomers to shipbuilding, like the Kaiser organization, that were not constrained by earlier practice and who designed relatively spacious pre-assembly areas for their new shipyards.[242]

At the Richmond shipyards, as at emergency shipyards throughout the U.S., efforts were made to conduct as much assembly work as possible on the pre-assembly platforms, or platens, located between the plate shop and the shipways. At Richmond, these were exterior work areas, but they were protected from sun and rain by moveable weather shields, which were large roof structures built of timber trusses and canvas that could be rolled over various work locations. The platens were equipped with elevated jigs and platforms that allowed welders and other workers to conduct their tasks with a minimum of bending or reaching. Whenever possible, welders practiced downhand welding. That meant it was preferable to complete as many downhand welds as possible and then turn a piece of work over for more downhand welds on the opposite side, rather than to have welders complete some of those welds as overhead work. Planners of the work intended that each pre-assembled unit be as complete as possible before it was moved to the shipway. Ideally, the only work remaining would be to weld its perimeter to other pre-assembled units on the way. In 1941 and 1942, then, one of the early challenges was to devise methods that would allow workers to prefabricate ever larger units on the platens. One advance made, for example, eliminated the practice of laying plates of steel for the outer shell on the way individually and then attaching pre-assembled units called inner bottoms, which consisted of inner shell plates and intercostals (transverse beams). Under the new practice, the plates of the outer shell were pre-attached to the inner-bottom units while on the platens. The evolution of these methods involved a close working relationship between the crews working in the platens and the ways and the engineers, architects, and draftsmen working in the production drafting department.[243]

Another important kind of pre-assembly involved the deckhouses. Yards 1 and 2 had practiced the pre-assembly of deckhouses to a limited extent, but the process was greatly enhanced with the construction of the Pre-Fab yard in early 1942. Pre-assembling deckhouse units allowed carpenters, plumbers, electricians, steamfitters, painters, and glazers to complete much of their work well before a ship reached the outfitting dock. With so much finished work installed in the prefabricated deckhouses it was important to give them proper stiffening for transport from the Pre-Fab yard to the ways. This involved careful analysis to find the ideal

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[242]Lane, *Ships for Victory*, 214-224.

[243]"70-Ton Pre-Assemblies Used to Speed Ship Construction," *Engineering News-Record* 129 (13 August 1942): 93-94; Donald L. Hardison, oral history recorded by Fredric L. Quivik and dated 8 November 2001, in Regional Oral History Office, Bancroft Library, University of California at Berkeley, (hereinafter cited as ROHO), 12-15.

bearing points for lifting such heavy units. It also involved installation of temporary braces to resist stresses the deck houses would sustain during transport but to which they would not be subject once installed on a hull. Effective use of pre-assembly methods required attention to many details. For example, to insure that a deckhouse fit into position nicely when it was being lowered to the deck, it was best that it not be suspended horizontally but rather at the same incline as the way. Accordingly, riggers used cables of appropriate lengths when lifting a deckhouse in order to suspend it at the desired declivity.[244] The Pre-Fab yard served only Yards 1 and 2. Deckhouses for C4s at Yard 3 were built on the pre-assembly areas adjacent to the basins. Sub-contractors built deckhouse sections for the ships built at Yard 4.

The time record set at Richmond Yard No. 2 in November 1942 with the construction of Hull No. 440 was possible because of the extent to which managers and workers at the yard exploited the principles of prefabrication. A review of the approach taken in erecting Hull No. 440, then, serves as a good summary of how prefabrication worked. First, it should be repeated, prefabrication served as an alternative to the traditional method of building steel ships, which was to move parts, piece by piece, onto the shipway, where they were held in place against the construction as it existed so far, marked for cutting and shaping, taken back to the shop for cutting and shaping, moved into place again, filed and otherwise fine-tuned for fitting, and then attached to other parts, usually by means of riveting. Prefabrication of ships replaced riveting with welding, to a great extent, and then removed from the shipways much of the work involved in erection. The objective was, to the extent possible, to have burners, flangers, welders, chippers, riveters, pipefitters, and other skilled workers perform their tasks in the shops or on the platens. In the construction of Hull No. 440, then, about 152,000 linear feet of welding took place in prefabrication and only about 57,000 feet of welding remained to be accomplished on the shipway, and 80 percent of the necessary rivets were driven on the platens before units were moved to the shipway. Moreover, most of the hatches, winch foundations, and piping had already been installed in the deck units before they were moved to the way.[245]

Another way to characterize the overall objective of prefabrication in the Richmond shipyards was that the designers and managers strived to reduce the number of pre-assembled units that were moved to the shipways and to make those units as heavy as possible, taking advantage of the capacity of the whirley cranes to execute very heavy lifts. For Hull. No. 440, Kaiser workers were able to pre-assemble hundreds of parts into a total of ninety-seven units that the whirley cranes lifted onto the way. Workers and managers had even devised means to lay the keel as six main units of the bottom shell, not in individual pieces as had been typical even in earlier practice at Yards 1 and 2. Then there were five double-bottom units, the heaviest weighing 110 tons, replacing the dozen units that had been hoisted into place under previous practice. The stern frame was attached to the after peak prior to their being set in place on the way. The reduction in the number of units comprising the deck from twenty-three to seven has already been mentioned in the previous chapter. Wiring, piping, flooring, and built-in furniture were all nearly finished in the deckhouse sections before they were placed atop the deck. Some

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[244]"70-Ton Pre-Assemblies Used to Speed Ship Construction," 94-96.

[245]"Prefabrication at Richmond Shipyard Number Two," unpublished report dated 17 December 1942, in HJK 83/42c, box 289, file 11.

of the methods employed in the erection of Hull. No. 440 were not retained in building subsequent Liberty ships at Yards 1 and 2, but the Kaiser organization claimed that the exercise contributed greatly to an overall increase in speed and efficiency and a reduction in manhours needed in shipbuilding at the Richmond shipyards.[246]

Richmond Yards 1 and 2 were also able to speed shipbuilding by prefabricating the entire piping system for a ship's engine room. The work took place in a mock-up of a Liberty engine room, complete with a wooden dummy engine and with flanges and other connections where piping would be attached to bulkheads. Pipefitters brought lengths of pipe to the mock-up that were already bent to shape, cut them to fit by marking them off in the mock-up, and then flangers welded flanges onto the pipes. The flange at one end of each pipe was completely welded into place, but the flange at the other was only spot-welded so that adjustments could be made when the pre-assembly of pipes was lifted into an actual engine room. Despite their best efforts to have precise dimensions in the mock-up, pipes did not always fit in an actual engine, perhaps because of warping in a bulkhead or other dimensional variations caused during erection. Therefore, spot-welding made it easier to make minor adjustments on the ways to ensure a perfect fit of the finished assembly. Other methods employed in the mock-up added to the efficiency of the operation: crews used labor-saving equipment for welding flanges, and each crew specialized in a different piping system, like fuel oil, salt water, or bilge and ballast. After a complete system of pipes for a particular ship was assembled in the mock-up, all the pieces, totaling about 100 for a Liberty, were marked and disassembled, hauled to the ship, and re-assembled.[247]

Oregonship also used an engine-room mock-up, located in the loft of one of the buildings. Known as the Pipe Assembly Shop, it was a full-scale replica of the machinery space in a Liberty ship. With room and facilities for forty pipefitters and welders, the crew would cut, bend, and assemble about 85 percent of the piping for each ship. The assembled piping could then be hoisted to the ship, lowered into the hull, and attached at the proper connections with appropriate hangers.[248]

Another feature of the Maritime Commission's design for standardized cargo vessels was interchangeability. Suppliers of the shipyards built certain components of ships, like triple-expansion steam engines. Maritime Commission designs and specifications ensured that a steam engine built by any supplier would fit in a Liberty ship being built at any shipyard.[249] Other suppliers made less complex components. For example, the Weber Showcase & Fixture Company had contracts to fabricate 20,000 cowl ventilators for Liberty ships, and later to supply elbows for the exhaust systems in Liberty ships. Weber Showcase & Fixture built its own

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[246]Ibid.

[247]"70-Ton Pre-Assemblies Used to Speed Ship Construction," 92-93.

[248]"Liberty Ship Piping System," *Pacific Marine Review* 39 (June 1942): 46-47.

[249]Howard L. Vickery, "Shipbuilding in World War II," *Marine Engineering and Shipping Review* 48 (April 1943): 185.

hydraulic press to shape those items. Workers fabricated the elbows from 3/8-inch steel plate using a cutting torch, a furnace to heat the steel to 1400^0 F., the hydraulic press, and innovative welding methods. The Los Angeles-based firm shipped the finished cowls and elbows to shipyards throughout the nation.[250]

Not all shipyards had a fabrication plant contiguous to the ways. The giant Bethlehem-Fairfield yard, built on the Baltimore Harbor in the vicinity of Bethlehem's existing naval yard and steel mill at Sparrow's Point, did not have sufficient space on the waterfront to build both shipways and fabrication areas. Consequently, Bethlehem built its thirteen ways next to the water but located its fabricating plant about 2 miles away. At the fabricating plant, workers cut steel and assembled components by welding, making identical sections of up to 10 tons each for ten ships at a time. Crane operators and riggers then moved those sections to outside work areas to be further welded into units of up to 25 tons. A system of cranes, locomotives, railroad cars, and locomotive cranes then transported the pre-assembled units the 2 miles to the yard, which was laid-out in order to efficiently receive and store the pre-assembled units before cranes moved them into position on the ways for erection of the hulls.[251]

One feature of the fabrication process at the Richmond yards that resembled traditional steel shipbuilding practice involved the bending slab, which was used to bend the structural steel shapes (rolled sections like angles, channels, and I-beams) that comprised the frame of a ship and therefore had to be bent to conform to the curvature of the hull's shell. Located in the plate shop, the bending slab was a large, thick steel plate perforated with a grid of square holes, giving the slab the appearance of a waffle. Workers would first place lengths of structural steel in an adjacent furnace, heating each one until it was red hot (about $2{,}000^o$ F.). Removing a steel shape from the forge with tongs, the workers would secure it to the slab by inserting steel dogs and pins in the perforations to wedge the bar in place. Using sledge hammers, the workers would then bend the piece of steel to the required curve or bevel. Because all the ships being built at a given Richmond yard were identical during a particular time period, slab crews were able to bend multiple versions of the same part and stockpile them for future fabrication, thus introducing some features of mass production to the bending slab. For example, there were 531 individual pieces that comprised the frame of a Liberty ship, but since Yards 1 and 2 built nothing but Liberty ships during the first part of the war, the slab crews at each yard could shape several ribs of each kind for storage. In March 1943, for example, the slab crew at Yard 1 had shaped sufficient ribs for fifteen hulls, and the slab at Yard 2 had put ribs for nine hulls in storage.[252]

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[250]W.A. Pruett, "From Showcases to Ship Ventilators," *The Welding Journal* 22 (December 1943): 1005; "Fabrication of Engine Exhaust for EC-2 Cargo Vessels," *The Welding Journal* 24 (March 1945): 266.

[251]Hutchins, "History and Development of the Shipbuilding Industry in the United States," 58-59.

[252]"Pacific Coast Program of the U.S. Maritime Commission," *Pacific Marine Review* 39 (January 1942): 71; "The Slab: Hammers and Hot Steel," *Fore'n'Aft* 2 (18 June 1942): 5; "White Hot," *Fore'n'Aft* 3 (12 March 1943): 3. See also the stunning illustration of workers wielding sledge hammers on the front cover of *Fore'n'Aft* 2 (16 July 1942).

B. Welding

As described in Chapter II, welding was beginning to be used in shipbuilding about the time of World War I. Both the Navy and merchant shippers recognized the potential advantages of welding over riveting, foremost among them the savings in hull weight due to the elimination of seam laps and other extra metal necessary to make riveted joints work. Weight not committed to the hull could be used for armament, in the case of military ships, or additional cargo, in the case of merchant vessels. Although welded shipbuilding was not widely practiced in the U.S. prior to the beginning of the build-up to World War II in 1936, some pioneering shipbuilders did initiate advances in shop welding, welding of large sub-assemblies, and automatic welding machinery. Moreover, other sectors of the engineering field, like those associated with the petroleum industry and dam building, had come to accept welding as a safe and satisfactory means of building articles like pipelines and penstocks that had to function under great pressure. By the time the government decided to embark on an accelerated shipbuilding program, planners recognized that the scale of shipbuilding anticipated would hardly be possible without resorting to extensive use of welding, and the successes of those few pioneers led the Bureau of Marine Inspection and Navigation to conclude that welded hulls would be safe.[253]

The traditional meaning of *welding* referred to something that took place in a forge or blacksmith's shop, where two pieces of like metal are joined by heating them to the temperature of plasticity and then joining them under pressure. Another means of joining two pieces of metal is by *soldering*, in which the two pieces are cemented together by means of a different alloy that is applied to them after being melted, or fused. If two pieces are joined by fusing some of the metal along their junction, that process had traditionally been called *autogenous soldering*, but by World War I autogenous soldering had come to be considered as a form of welding as well.[254]

One of the early concerns with welded joints was that the material laid down with the weld would be hard and brittle, lacking the ductile qualities of steel plate and thereby rendering welded joints incapable of resisting the shock of a strong blow to the hull. In time, however, suppliers of electrodes for electric-arc welding had developed materials that, when deposited during a weld, would have comparable qualities to the parent material being joined.[255]

The American Bureau of Shipping first approved the use of all-welded hulls for shipbuilding in 1927. Working with the American Welding Society, the bureau devised a series of tests to determine whether methods were meeting classification standards for vessels. At the time the only electrodes commonly available for electric-arc welding were uncoated wire, so the bureau focused on tests for ascertaining the skill of individual welding operators, and shipyards

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[253]"Welded Ships Okayed!" *The Welding Engineer* 29 (August 1944): 42; "M.N. Maltseff, "Evolution of Welding in Shipbuilding," *The Welding Journal* 23 (October 1944): 906.

[254]Carmichael, *Practical Ship Production* (1919), 227.

[255]Montgomerie, "Shipbuilding Practice Abroad," 167.

focused on training programs to give workers the skills necessary to meet the testing standards. As new kinds of coated electrodes became available, the bureau began to develop tests as well for welded material.[256]

One of the kinds of welding that took place at shipyards was called thermit welding. One of the first kinds of welding used in shipbuilding, it was used during World War II especially in assembling the castings that comprised stern frames. Ideally a stern frame would be cast in one piece, but few foundries in the U.S. were capable of casting such a large part. As a consequence, there was not enough capacity in the nation to supply all the stern frames necessary for the emergency shipbuilding program unless the frames were cast in pieces. Casting stern frames in parts had an advantage, however: the smaller pieces were easier to ship to yards throughout the country.[257]

Even before Kaiser began building shipyards in Richmond, other emergency shipyards were publicizing claims that they were pioneers in the application of welding methods to shipbuilding. Sun Ship in Chester, Pennsylvania built the first all-welded tanker, and Ingalls built the first all-welded cargo and passenger ships. Western Pipe & Steel, along with Sun Ship, was a pioneer in developing automatic welding machinery. Although these three yards built all-welded ships, most of the emergency yards, including Kaiser's Richmond yards, still used rivets for certain joints. About 85 percent of the joints in American shipyards were welded during World War II.[258]

Welding experts believed that one source of potential problems in welded hulls was the combination of stresses that could develop in welded steel when it was allowed to be heated and cooled unevenly, leading to distortion due to expansion and contraction of the metal. Such distortions, experts believed, would create "locked-in" stresses that under the right conditions could prove damaging. To minimize such distortions and stresses, welding specialists devised welding sequences intended to yield uniform heating and cooling of the metal.[259] The American Welding Society's Committee on Welding in Marine Construction established a Subcommittee on Thermal Stresses and Shrinkage in Welded Ship Construction to examine such problems,

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[256]"Welding Tests," *Shipbuilding and Shipping Record* 44 (9 August 1934): 153-154.

[257]"Thermit Welding in Maritime Commission Work," *The Welding Journal* 22 (December 1943): 977-979.

[258]"Ships for This War," *Fortune* 24 (July 1941): 119; Frederick Simpich, "As 2,000 Ships Are Born," *The National Geographic Magazine* 81 (May 1942): 556.

[259]For examples of how important welding sequence was thought to be, see O. Ovregaard, "Sequence in Welding of Ships," *The Welding Journal* 23 (May 1944): 423-432; R.D. Schmidtman, "Coast Guard Inspection of Welding in Shipbuilding," *The Welding Journal* 23 (June 1944): 525-528; Alfred E. Wallen, "Sectional Ship Erection Welding Sequence," *The Welding Journal* 23 (July 1944): 622-623. The Kaiser organization also stressed sequence in its weekly shipyard newspaper; see "Sequence," *Fore'N'Aft* 3 (2 April 1943): 8; "Welding Sequences," *Fore'N'Aft* 3 (7 May 1943): n.p.

especially as they pertained to the needs of the shipbuilding industry. Chaired by H.W. Pierce of the New York Shipbuilding Corporation, the subcommittee issued its report in July 1941, in time for the nation's emergency shipbuilding program. David Arnott of the American Bureau of Shipping chaired the Committee on Welding in Marine Construction and sat on the subcommittee. The rest of the subcommittee consisted of representatives of old-line shipbuilding companies, like Bethlehem, Sun, and Newport News, as well as a representative of the Navy's Bureau of Ships.[260]

The ships being built for the Maritime Commission all followed standardized plans, and in those plans the commission specified, among other things, welding methods and sequences. There was also considerable flexibility in those specifications because the commission encouraged shipyards to devise assembly plans that could save labor or speed production. Thus, each shipyard evolved its own welding methods and sequences, all approved and inspected, of course, by local Maritime Commission officials as well as by the American Bureau of Shipping and the Bureau of Marine Inspection. Welding engineering departments at shipyards also conducted their own testing programs to determine the best methods to use in conjunction with their assembly schemes.[261]

Nevertheless, there were some spectacular failures of welded hulls during the early years of the war. Three of those spectacular failures were built by Kaiser yards: the *Valery Chkalov*, a Liberty ship built at Richmond Shipyard No. 2, delivered to the U.S. government 17 April 1943, and operated by the Soviet Government; the *S.S. John P. Gaines*, a Liberty ship built by Oregonship and delivered 8 July 1943; and the *S.S. Schenectady*, a T2-SE-A1 tanker built by Kaiser at Swan Island and delivered 31 December 1943. The *Schenectady* was an all-welded tanker and was the first ship completed by the Swan Island yard, having just completed her sea trials. The two Liberty ships were all-welded except their frames, which were riveted to the side shells. Apparently there were a relatively large number of failed ships produced in Kaiser yards, which led to a temporary rash of bad publicity for Henry J. Kaiser and his supposed miracle-workers in the Richmond and Oregon yards.[262]

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[260]"Report of Subcommittee on Thermal Stresses and Shrinkage in Welded Ship Construction," report dated 23 July 1941 and published in *The Welding Journal* 20 (September 1941): 587-591; Harry W. Pierce, "Residual Stresses in Welded Ships," *The Welding Journal* 21 (May 1942): 307-314; "Notes on Shipbuilders Technique for Release of Welding Stresses," *Engineering News-Record* 131 (9 September 1943): 107; "Personnel of Committee on Welding in Marine Construction," *The Welding Journal* 22 (December 1943): 984.

[261]Lane, *Ships for Victory*, 556-557, 559-560. For a detailed description of one shipyard's welding practices (Ingalls in Pascagoula, Mississippi), see W.B Bowen, "Planning for Production Welding and Cutting in a Modern Ship," *The Welding Journal* 22 (November 1943): 904-911, and Bowen, "Planning for Production Welding and Cutting in a Modern Ship, Part 2," *The Welding Journal* 22 (December 1943): 1017-1025. For a detailed description of one shipyard's testing of its welding development program, see M.H. MacKusick, J.B. Hiatt, and R.V. Anderson, "Deep Fillet Welding Applied to Ship Construction," *The Welding Journal* 22 (December 1943): 998-1004.

[262]U.S. Coast Guard, "Report of Structural Failure of Inspected Vessel (*Valery Chkalov*),"

The *Valery Chkalov* failed on 11 December 1943 while traveling in ballast between a Siberian port and Akutan, Alaska. At about noon, in heavy seas and with the temperature around freezing, the crew heard a loud sound and found three large cracks near the middle of the hull, two on the starboard side and one on the port side. A Soviet tug took the *Valery Chkalov* in tow, but two days later she broke in two. Bulkheads in the hold kept the two halves from sinking. Thereafter, U.S. Navy tugs towed her to a harbor in Alaska.[263]

When the *Schenectady* failed in the still waters of the Willamette River on 16 January 1943, the fracturing of the hull gave a report that could be heard for a mile. The ship split open, and only the plates running along the keel hold fast. The bottom plates therefore acted as a hinge, as both the bow and the stern settled to the river bottom. Kaiser blamed Carnegie-Illinois for supplying defective steel plate. Although an investigation by the American Bureau of Shipping found that some of the steel in the ship did not meet specification, it concluded that the fault lay with the welding, specifically that adequate welding sequences had not been followed. According to the official report, "The principal cause [of the failure of the hull] was an accumulation of an abnormal amount of internal stress locked into the structure by the process of construction." The ship was repaired and put back in service. The failure of the *Schenectady* led to a re-emphasis in the shipbuilding industry on proper technique.[264]

The failures were enough that the Secretary of the Navy ordered an investigation of design and construction methods used in building merchant vessels. Rear Admiral Vickery (U.S. Maritime Commission), Rear Adm. Harvey Johnson (U.S. Coast Guard), Rear Admiral E.L. Cochrane (U.S. Navy), and David Arnott (V.P. and Chief Surveyor of the American Bureau of Shipping) comprised the Board of Investigation. According to their report, the board found that hull failures of merchant vessels had not caused loss of life except for the case of the *John P. Gaines*, in which ten soldiers and crew died. The Board of Investigation found that small all-welded merchant and naval vessels were giving excellent performances. Fractures were occurring in the larger merchant vessels. They investigated 2,993 ships, finding that 432 of them had experienced a total of 577 authenticated fractures. Of those, ninety-five had been potentially dangerous. Twenty ships had experienced complete fractures of the strength deck, and five of the ships broke in two. Examinations of the fractures showed that neither faulty steel nor faulty welding electrodes were the causes, although broader surveys showed that some poor-quality

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report dated 1 April 1944; U.S. Coast Guard, "Report of Structural Failure of Inspected Vessel (*John P. Gaines*)," report dated 1 April 1944; U.S. Coast Guard, "Report of Structural Failure of Inspected Vessel (*Schenectady*)," report dated 1 April 1944, all three reports reproduced in *The Welding Journal* 23 (September 1944): 798-799, 802-803, and 804-805; Lane, *Ships for Victory*, 544-545, 551-553.

[263]"Report of Structural Failure of Inspected Vessel (*Valery Chkalov*)."

[264]Official report quoted in John Tutin, "Fractures in Welded Ships," *The Welding Journal* 22 (September 1943): 722. See also "Report of Structural Failure of Inspected Vessel (*Schenectady*); "Notes on Shipbuilders Technique for Release of Welding Stresses," 107-108; "The Earth Movers II," 226.

steel was finding its way into shipbuilding. The fact that inferior steel was being supplied to shipyards led to investigations by the Truman Committee and considerable discussion between the Maritime Commission and the American Bureau of Shipping concerning the extent to which they should be inspecting steel mills. After a few months of intense public scrutiny, however, attention on problems of faulty steel subsided by summer 1943, especially after analysis in repair yards of cracked steel showed that for the most part steel that had failed did in fact meet specifications.[265]

Poor design details, sub-standard construction methods, or poor-quality workmanship caused all of the reported fractures. Moreover, many of the fractures appeared to be associated with notches cut in the steel because of a design detail, and nearly all of the fractures occurred during cold weather and/or rough seas. Conditions at sea could not be controlled, especially under the demands of wartime. Although the board's overall conclusions were that welded merchant vessels were safe, they urged shipyards to improve their attention to construction methods and to training, supervision, and inspection. The Board of Investigation also urged continued scientific study to better understand stresses induced by welding steel. The Maritime Commission rectified some design defects, eliminated some notches and modified the design for hatch openings. The original design for Liberty ships featured hatch openings with square corners, a characteristic that had proven satisfactory in riveted ships. Even though the openings were lined, the square corners tended to concentrate stresses, much like a notch. Therefore, the Maritime Commission had reinforcing plates retrofitted onto the hatches of Liberty ships already in service and had such plates added to the design for ships under construction. In an effort to improve welding practice, the Maritime Commission worked with welding experts to develop a welding manual. First issued in August 1943, the "Welding Instructions for Use by Welding Supervisors, Leadermen, etc., of All Crafts Concerning with Shipyard Welding," had its contents approved by both the American Bureau of Shipping and the American Welding Society.[266]

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[265]"Welded Ships Okayed!" 42-44; U.S. Coast Guard, "Report of Structural Failure of Inspected Vessel (*John P. Gaines*), report dated 1 April 1944; "The Structural Reinforcement of Liberty Ships," *The Welding Journal* 23 (September 1944): 789; Board of Investigation, "Design Methods of Construction of Welded Steel Merchant Vessels," interim report dated 3 June 1944 and published in *Marine Engineering and Shipping Review* 49 (July 1944): 157-159 and in *The Welding Journal* 23 (September 1944): 794-797; Lane, *Ships for Victory*, 550-553. The full name of the Board of Investigation was the Board to Investigate the Design and Methods of Construction of Welded Steel Merchant Vessels.

[266]"Welded Ships Okayed!" 42-44; Board of Investigation, "Design Methods of Construction of Welded Steel Merchant Vessels," 794-797; "Welding Instructions for Use by Welding Supervisors, Leadermen, etc., of All Crafts Concerning with Shipyard Welding," *The Welding Journal* 22 (December 1943): 985-998; J. Lewis Luckenbach, "Shipbuilding Industry at Its Peak," *Marine Engineering and Shipping Review* 49 (March 1944): 151; "The Structural Reinforcement of Liberty Ships," *The Welding Journal* 23 (September 1944): 789; Howard L. Vickery, "Welding as an Aid in Shipbuilding Construction," *The Welding Journal* 23 (November 1944): 1013; Lane, *Ships for Victory*, 548-550; H.E. Kennedy, "Welding and Welding Stresses," *Marine Engineering and Shipping Review* 49 (November 1944): 190-196.

The Maritime Commission also sought to exercise greater control over the welding methods shipyards used. For example, Admiral Vickery issued an order prohibiting the use of automatic welding machines in welding main strength members on the ways, limiting the machines' use to pre-assembly work. He believed that automatic welding machines gave weaker welds and also might impart heat to the steel in such a way that it would create excessive locked-in stress. This led to a bit of controversy at Richmond Yard No. 1 in December 1943. Welders at Yard 1 were still using an automatic welding machine to weld the deck to the shell because they believed that, for the particular application, the machine gave a better weld than the manually-applied double fillet the Washington office of the Maritime Commission had ordered. Carl Flesher's Regional Office took the position that its inspectors should only scrutinize the quality of the weld, not what method welders used to make it, unless the American Bureau of Shipping articulated a preference for one weld over the other. This in turn created a problem for inspectors of the American Bureau of Shipping, which approved both types of weld but also knew of Vickery's order. After David Arnott, Chief Surveyor of the American Bureau of Shipping, informed Vickery of the situation in Richmond, Vickery wrote Flesher a letter ordering that his instructions not to use the welding machine be implemented.[267]

The American Welding Society's Subcommittee on Thermal Stresses and Shrinkage in Welded Ship Construction, now renamed the Subcommittee on Hull Construction, continued throughout the war to monitor welding practices and to issue statements stressing the importance of vigilant training, supervision, and inspection to ensure that proper welding practices were being followed in shipyard practice. Meanwhile, the Committee on Welding in Marine Construction had grown in size considerably. In addition to several more representatives of old-line shipbuilders, other members of the committee included representatives of the American Welding Society, the Navy's Bureau of Ships, the U.S. Coast Guard, the U.S. Army Corps of Engineers, the Maritime Commission, Gibbs & Cox, manufacturers of welding supplies and equipment, an insurance company, and steamship and merchant shipping companies. Interestingly, even though emergency shipyards operated by companies other than the old-line shipbuilders had assumed major roles in the nation's merchant shipbuilding program by the end of 1943, only the old-line firms had representatives on the Committee on Welding in Marine Construction. Organizations like Kaiser and Bechtel and shipyards like the Richmond yards and Marinship did not have representatives on the committee.[268]

During the winter of 1943-1944, more Liberty ships suffered serious cracking, again usually in heavy seas and in cold weather. Again it seemed that an inordinate number of the failed ships had been built in Kaiser yards. The recurrence of ship failures led the Maritime Commission and the Board of Investigation to redouble its efforts to understand scientifically the causes of hulls cracking and to implement additional measures to try to stop the problem. All of

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[267]Lane, *Ships for Victory*, 548, 560-561. For a description of the Union-Melt automatic machine, widely used at Richmond and at shipyards elsewhere, see M.H. MacKusick, "Automatic Welding for 'Victory' Ships," *Western Metals* 2 (July 1944): 24-25.

[268]"Structural Failures in Welded Ship Construction," *The Welding Journal* 22 (December 1943): 980-984; "Personnel of Committee on Welding in Marine Construction," 984.

this was done within the overriding wartime demand that shipyards had to keep producing ships and that those merchant vessels already in service had to keep hauling troops and supplies overseas. One of the practical measures intended to reduce the cracking of steel on merchant vessels included the installation of strips of steel, called "crack stoppers," along locations where failed ships had been prone to crack. The Maritime Commission's Technical Division also tried to improve practices for carrying ballast. The typical practice was for ships returning without cargo to place the ballast toward the bow and the stern. This created a relatively heavy load fore and aft but no load amidships, creating a stress in the hull called "hogging." Meanwhile, shipyards and welding experts continued to focus attention on welding sequences, which was necessary to minimize shrinkage and distortion and to control the stresses placed on welded joints.[269]

During World War II, twenty-six people lost their lives in accidents caused by welded ships cracking. Meanwhile, neither Victory ships nor Liberty ships that incorporated corrective features, like crack stoppers, suffered any serious failures. The Board of Investigation did not issue its final report until after the war, in 1947. By then, they had come to understand that locked-in stresses, although a contributing factor in any failure, were not a material cause of the problem. After using a series of controlled experiments to study the behavior of steel during the welding process, the board concluded that neither welding sequence along a joint nor erection sequence of a ship assembly created a problem. Rather, they concluded the source of the problem was notching of steel elements, including virtual notching created by introducing into a ship's design certain structural discontinuities, such as hatch openings in a deck. An associated problem, they concluded was that a characteristic of steel called "notch sensitivity" had not been considered when setting standards for steel. Steel was especially prone to notch failure at lower temperatures, hence the greater incidence of hull failures during winter months. Statistical analysis of ship failures during the war also showed no significant correlation between fractures and shipbuilders. There was a disproportionate number of ships Kaiser had built among those that had failed, but the failures could as easily be explained by the fact that the Kaiser yards' locations along the Pacific Coast meant that a relatively high percentage of them were assigned to service in the North Pacific, where the water was cold and rough.[270]

Despite the notoriety that the failures gave welded ships, other perspectives reflected more favorably on their performance during the war. Many welded merchant vessels suffered enemy attack or collisions and withstood the damage without significant failure of the hull, successfully carrying cargo, passengers, and crew to port under circumstances that many believed a riveted ship could not have survived. Also, once built, the joints of welded ships needed little if any additional attention, unlike the Emergency Fleet of World War I, which required frequent dry docking to repair defective rivets.[271]

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[269]M.H. MacKusick, "Technical Control of Welding in Ship Construction," *The Welding Journal* 24 (March 1945): 247-253; Lane, *Ships for Victory*, 553-556, 559, 565.

[270]R.T. Young, "Strength of Welded Ships," *The Welding Journal* 24 (May 1945): 471-474; Lane, *Ships for Victory*, 553, 565-573.

[271]J. Lewis Luckenbach, "Shipbuilding Industry at Its Peak," *Marine Engineering and Shipping Review* 49 (March 1944): 152; Milton Forman, "Some Fundamentals in All-Welded

Another problem that arose due to extensive use of welding was damage to welders' eyes when they did not wear proper eye protection. California's Industrial Accident Commission began hearing testimony concerning the problem at Bethlehem's Union Iron Works in January 1942 and actually awarded damages to some of the workers. Later that year, a Maritime Commission study showed that flash burns to the eye, caused by the bright light of welding, was a common problem, and new commission rules established standards shipyards had to meet in providing protective equipment for welders (see section below on Safety in chapter VII on Labor).[272]

A related set of skills and methods involved the use of acetylene for cutting. The Richmond yards purchased oxygen from suppliers, who delivered it in tanks on semi-truck trailers that could be hooked to the piping system, which distributed oxygen and acetylene to work stations throughout the yard by means of parallel sets of pipe. Each yard had its own acetylene generating plant.[273]

C. Whirley Cranes

> Whirley crane work is the most spectacular in the shipyards and always is one of the things visitors find most fascinating to watch, especially when two cranes get together for a big double lift.
>
> *Fore'n'Aft*, January 1943[274]

One of the striking characteristics of the Richmond shipyards during their operation was the array of whirley cranes that helped define their skylines. Whirley cranes were also an essential component of the pre-assembly system that allowed Richmond and other emergency yards to produce merchant ships with such speed. Whirleys were of enough note in the Richmond yards that one of them even became a character who appeared frequently in the Kaiser organization's weekly Richmond organ, *Fore'n'Aft*.

Ship Construction," *The Welding Journal* 24 (October 1945): 927-928.

[272]"Serious Eye Malady in Shipyards Uncovered by State Federation of Labor," Contra Costa County *Labor Journal* (23 January 1942): 1-2; "Bethlehem Fights Eye Case Award in Favor of Workers," Contra Costa County *Labor Journal* (10 April 1942): 1-2; Lane, *Ships for Victory*, 447-448.

[273]This paragraph is based on G.V. Slottman, "Production Welding and Cutting at West Coast Yards," *Marine Engineering and Shipping Review* 47 (October 1942): 218-226. It is a good article with excellent photographs on welding practices at the Calship, Oregonship, and Richmond Yards 1, 2, and 3, but it does not specify which yard is being depicted in a given photo.

[274]"Richmond Weight Lifters," *Fore'n'Aft* 3 (8 January 1943): 2.

The whirley crane, sometimes called a whirler crane, replaced the traveling cantilever crane in the period around World War I as a means for lifting and moving items in all three dimensions and out onto the ways. Its development was a part of the larger history of cranes generally. Cranes are devices that employ a combination of mechanical principles to enhance humans' abilities to lift heavy objects and move them in horizontal directions. Simple devices that were precursors to the crane include the rope used for lifting, a pole used as a lever, the windlass or similar winding mechanism, and the block and tackle. Different forms of these devices go back to ancient times in various parts of the world. Combinations of these elements began to appear hundreds of years ago on waterfronts, where they were used to lift cargo and gear on and off ships. Sailors used to be able to fashion such a temporary mechanism out of a spare topmast, used as the pole, in combination with rope, block and tackle, and a barrel for a winch. They called setting up such an arrangement "rigging a derrick." In time, by the seventeenth or eighteenth century, dock workers in Holland, England, and elsewhere had built permanent structures to assist in lifting, giving birth to the crane. These early machines were typically powered by humans or sometimes by horse. They were always fixed in one place, although they typically had a pole or boom that could pivot from side to side, giving the cranes the capability of both lifting and moving objects horizontally.[275]

With the onset of the Industrial Revolution, several improvements became practical, including the replacement of wood with iron as a structural element and the introduction of steam power. Continued attention to mechanical principles also brought refinements, like the introduction of brakes that helped control the lowering of objects that had been lifted, and the introduction of machinery that increased the range of motion available to a crane and its load, even though the crane itself remained stationary. With the advent of the railroad in the early nineteenth century, cranes themselves also became moveable. Various mechanics contrived traversing cranes, which rode along pairs of parallel tracks. Initially the tracks for such traversing cranes were built under the roof of a shed to allow loads merely to be moved back and forth. Soon, a refinement was added, yielding what we now know as the traveling bridge crane, in which the bridge itself can travel even as the hoisting mechanism moves back and forth across the bridge, giving the crane the capability of moving a load to any location within the perimeter of a rectangle defined by the end-points of the rails on which the bridge rides. Traveling bridge cranes could lift very heavy loads and soon became a standard feature in shops that made large marine steam engines. Variants of the traveling bridge crane were also used in outdoor applications, like quarries or bridge construction sites, either by building trestles to carry the tracks for the moving bridge or by setting the tracks on the ground and elevating the bridge on

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[275]Joseph Glynn, *Rudimentary Treatise on the Construction of Cranes and Machinery for Raising Heavy Bodies, for the Erection of Buildings, and for Hoisting Goods* (London: Virtue Brothers & Company, 1866), 1-29; Henry R. Towne, *A Treatise on Cranes* (Stamford, Connecticut: self-published, 1883), 3; Towne, "Cranes: A Study of Types and Details," *Transactions of the American Society of Mechanical Engineers* 4 (1883): 289; Woodward, "Some Recent Developments in the Shipbuilding Art in America," 110-111. In his *Treatise* (p. 3) and "Cranes" (p. 289), Towne offers the following definitions: "A *hoist* is a machine for raising and lowering weights. A *crane* is a hoist with the added capacity of moving the load in a lateral or horizontal direction."

legs that traveled on wheels along the tracks. The latter is called a gantry crane.[276]

Cranes, then, fell into two basic categories: rotating, in which the crane revolved its load around a center column; and rectilinear, in which the crane moved its load in one or more directions but always in straight lines.[277] By the 1880s, the use of cranes in Europe was relatively widespread, and their designs had grown quite sophisticated. In the U.S., on the other hand, "cranes [were] but little used or appreciated, in comparison, at least, with the extent of their application in European countries."[278] That began to change, in shipyards at least, with the installation of large cranes on both coasts in 1884. The Union Iron Works in San Francisco built a timber frame over and around one of its shipways. The framework along the sides and ends of the shipway served to support staging for the erection of vessels on the way. The framework also supported trusses, which spanned the shipway. Those trusses and the framework in turn supported tracks along which traveling bridge cranes could move, thus making it possible to lift and move objects into position anywhere within the perimeter of the framed structure, i.e., anywhere on the shipway. Union Iron Works also equipped the structure with a swinging crane at one end to facilitate moving materials into position for the traveling bridge cranes to hoist them. The cranes had a capacity of only 5 tons. At about the same time, Newport News installed a traveling cantilever crane on tracks that ran between two shipways. It could hoist materials at the ends of the ways and move them out into position on ships being erected on either way.[279]

As the sizes of military ships and their steam engines grew, the weights shipyards needed to lift grew as well. In 1896, Newport News decided that a solution to the problem would be to design and build on one of its piers a fixed, revolving derrick with a capacity of 150 tons. The outer end of the jib (the arm extending from the center pivot) could also be raised and lowered, thereby changing the radius of the circle defined by the rotating derrick. With the jib fully lowered, that radius was 103'- 6". At that reach, however, the crane could only hoist 70 tons. To lift the maximum 150 tons, the jib had to be raised so that its reach was within the range of 44' and 73'-6". The derrick operated under electric power.[280]

During World War I, naval and merchant shipyards in the U.S. used three types of cranes: traveling bridge cranes; traveling, rotating cranes of both the hammerhead and the luffing variety (to "luff" is to move the jib or boom in and out by telescoping); and fixed, rotating cranes

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[276]Glynn, *Rudimentary Treatise on the Construction of Cranes and Machinery*, 28-50.

[277]Towne, *A Treatise on Cranes*, 3.

[278]Towne, *A Treatise on Cranes*, 2.

[279]James Dickie, "Overhead Cranes, Staging, and Riveter-Carrying Appliances in the Shipyard," *Transactions of the Society of Naval Architects and Marine Engineers* 7 (1899): 189-192, plates 57-62.

[280]Walter A. Post, "An Electrically Operated 150-Ton Revolving Derrick," *Transactions of the Society of Naval Architects and Marine Engineers* 6 (1898): 195-204, plate 117.

with capacities of up to 150 tons. Fitting-out cranes used for building warships needed a greater capacity because of the heavy gun turrets that had to be hoisted into position during outfitting. It was yet not practical to build traveling, rotating cranes of such capacity, so outfitting docks at navy shipyards used fixed, rotating cranes, or their close relative, the floating crane of the rotating type. Shipyards also used electric or steam-powered locomotive cranes, which were close relatives of the traveling, rotating cranes. Locomotive cranes were self-propelled, with the rotating crane mechanism sitting on what otherwise appeared to be a small railroad flatcar. The traveling, rotating cranes also ran on wheels along tracks, but they had the crane mechanism atop an elevated structure akin to a gantry crane. They were therefore also called cranes of the tower whirler type. If the tower structure was open at both ends, so that trucks, wagons, or other vehicles could pass through and between the sides of the elevating structure, then it was called a portal crane. If one side of the structure ran on a track affixed to the side of a building and the other side ran on a parallel track along the ground, it was called a semi-portal crane (the pier at the south end of the Ford assemble plant in Richmond used to be equipped with a semi-portal crane). Portal and semi-portal cranes were ideal for shipyards and harbors because they did not block the movement of vehicular traffic.[281]

The application of portal cranes to shipbuilding apparently derived from a related application, the use of such cranes in harbors for loading and unloading ships. They were called harbor cranes, and they were being used by the early years of the twentieth century in the British Isles and Germany. Harbor cranes generally were limited to a lifting capacity of 10 tons, but early portal cranes used for shipbuilding quickly reached the capacity of 50 tons. The capacity of a whirley crane was greater the closer the boom was to the vertical. Consequently, crane operators had to know what load they were expected to lift so that they could be sure the boom was in the proper position.[282] It is not known when portal cranes came to be called whirley cranes or what the derivation of the name is. According to a sidebar accompanying an article about whirley crane operators in *Fore'n'Aft*, the name simply derives from the fact that such a crane can whirl around a 360-degree circle atop it gantry. The sidebar also asserts that Clyde Wiley invented the whirley crane in the early 1920s.[283] As the sources cited in the previous

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[281]William L. Clements, "Locomotive Cranes," *Cassier's Magazine* 7 (March 1895): 369-374; Anton Bottcher, *Cranes: Their Construction, Mechanical Equipment, and Working* (London: Archibald Constable & Company, Ltd., 1908), 73, 75-76, 387-388, 455-456; Henry, "Recent Developments in Shipyard Plants," 178-179, 181-182; Hermann Wilda, *The Design of Cranes and Hoists* (London: Scott, Greenwood & Son, 1925), 147-150.

[282]Vincent Raven, "Middlesborough Dock Electric and Hydraulic Power Plant," *Transactions of the American Society of Mechanical Engineers* 25 (1904): 943-981; Bottcher, *Cranes*, 73-76, 387-388, 457; Claude W. Hill, *Electric Crane Construction* (Philadelphia: J.B. Lippincott Company, 1911), 24-25, 294-295, figs. 25, 326; "Richmond Weight Lifters," *Fore'n'Aft* 3 (8 January 1943): 2. See also the original German edition of Bottcher, *Krane: Ihr allgemeiner Aufbau nebst maschineller Ausrustung, Eingenschaften ihrer Betriebsmittel, einschlagige Maschinen-Elemente und Tragerkonstruktionen* (Berlin: Druck und Verlag von R. Oldenbourg, 1906).

[283]"Wiley's Whirley," sidebar accompanying "Wanna Lift?" *Fore'n'Aft* 4 (4 February 1944): 11.

footnote indicate, however, whirling portal cranes were being used in European shipyards at least a dozen years earlier.

By World War II, shipbuilders throughout the industrialized world were making extensive use of improved mechanized cranes with even greater lifting capacity to facilitate the movement of material throughout the yard. Germany and Holland were particularly known for using powerful mechanized cranes to minimize hand lifting. Cranes in naval shipyards of World War II had to be capable of lifting at least 250 tons, preferably 300, because of the heavy armor and armament involved. Merchant yards required less lifting capacity. By World War II, the steam-powered crane was obsolete, the choice of power being electricity or more likely diesel-electric systems. Traveling cranes were more likely than fixed cranes. Heavier cranes as well as cranes that could work in pairs allowed heavier lifts. Typical portal (whirley) cranes would have 50-ton capacity.[284]

Kaiser obtained whirley cranes for the Richmond shipyards from various sources. Some had been previously used, having seen service on dam construction projects. Kaiser had first used whirleys on the Grand Coulee project. As that job was winding down, seven whirleys were disassembled and shipped to Richmond. Four Grand Coulee whirleys were at Yard No. 2, two were at Yard No. 3, and one was at Yard No. 4. Others were purchased from manufacturers. In either case, cranes were shipped to Richmond in a disassembled state and then erected at the shipyards for use. Manufacturers such as Washington Iron Works, Colby Engineering, American Hoist and Derrick, and Browning made the whirley cranes used by Kaiser. Each crane in the Richmond yards was equipped with a gauge in the cab that allowed the operator to know exactly what the angle of the boom was and therefore what the lifting capacity of the crane was at that particular angle.[285] Each yard had numerous other cranes in addition to the whirleys. Numbers of bridge cranes and truck-mounted cranes in each yard have been provided above in the descriptions of the individual yards. Many of those cranes were described in the *Fore'n'Aft* issue for 8 January 1943.[286]

The Operating Engineers union had jurisdiction over the operation of whirley cranes. Crane operators were said to have had one of the most envied jobs in the shipyards. Most got their start as oilers, where they learned about the equipment itself. Then they would progress to operating smaller equipment, like bulldozers or bridge cranes. Only after at least two years of experience, and usually four, could operating engineers begin to practice on whirley cranes

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[284]Montgomerie, "Shipbuilding Practice Abroad," 153-154; Lemler, "Multiple Yards--Record and Prospect," 251; John F. Metten, "The New York Shipbuilding Corporation," *Historical Transactions, 1893-1943*, 225-227; John F. Metten, "Standard Yards," in *The Shipbuilding Business in the United States of America*, vol. I, ed. F.G. Fassett, Jr. (New York: The Society of Naval Architects and Marine Engineers, 1948), 202, 208.

[285]Henry J. Kaiser, Jr., to Henry J. Kaiser, et al, memorandum dated 4 September 1941, in HJK 83/42c, box 8, file 19; "Richmond Weight Lifters," *Fore'n'Aft* 3 (8 January 1943): 2; "Wiley's Whirley," sidebar accompanying "Wanna Lift?" *Fore'n'Aft* 4 (4 February 1944): 11.

[286]"Richmond Weight Lifters," *Fore'n'Aft* 3 (8 January 1943): 6-8.

under close supervision. Crane operators sat in the cabs of whirley cranes and operated them, but they couldn't do their work without another key class of shipyard workers, the riggers. The riggers were the people who worked with the loads on the ground, estimating how much the loads weighed, working with chain, cable, and rope used in hoisting loads, attaching and unattaching those slings to the loads, using hooks and other devices to secure cables to loads, and signaling to the crane operators the kinds of crane and load movements that were required. In shipyards like Kaiser's Richmond yards, where most of a ship's hull was pre-assembled in units, engineers had already calculated the weights of pre-assembled units and designed appropriate fittings to which riggers could attach slings.[287]

In the early years, crane operators at the Richmond yards arrived with previous experience. For example, two of the crane operators at Yard 3 had run cranes on big construction projects in previous years. Bob "Peewee" Johnson began operating a crane on the Tennessee River in the early 1930s. He went to work at Richmond Shipyard No. 1 in April 1940 and then transferred to Yard 3 when it was built. B.N. "Slim" Goodwin began operating a crane in 1936 at Rock Island Dam. He had also operated a crane at Grand Coulee before moving to Richmond in October 1941.[288]

D. Mold Loft and Ship Models

Shipbuilders used the term "mold" to refer to the wood and paper templates or patterns they used to duplicate desired shapes out of steel. If a mold derived its shape and dimensions from the ship as it was being erected, then the mold had been "lifted." If a mold was made in the mold loft by deriving its shape and dimensions from plans or drawings, then the mold had been "lofted." In mid-twentieth-century parlance, a ship built of pieces made from lofted molds was said to be a fabricated ship. A traditional ship built of lifted molds was not a fabricated ship. Skill in developing drawings and transforming them into lofted molds was, obviously, essential to the growing reliance on pre-assembly in shipbuilding. Thus, the mold loft assumed greater importance in a shipyard as techniques evolved from traditional methods to the methods of fabricating ships and then to prefabricating ships. Shipbuilders used paper molds as templates for pieces made from steel plate and wood molds as patterns for pieces made from structural steel shapes, like angle-sections or I-beams. The easiest shapes to replicate were those that were flat in both directions. Somewhat more complex were shapes that were flat in one direction but curved in the other. Decks, for example, may often be flat in the transverse direction but curved longitudinally. The most complex shapes were ones that were curved in both directions, like a

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[287]"Richmond Weight Lifters," *Fore'n'Aft* 3 (8 January 1943): 2-3; Commonwealth of Pennsylvania, Department of Public Instruction, Division of Industrial Education, *Shipyard Rigging: A Manual of Instruction for Beginning and Advance Training* (Harrisburg: Commonwealth of Pennsylvania, Department of Public Instruction, 1943), 2-3; "Diagram for Shipping Deck House Section with One Crane," drawing dated 9 May 1942, and "Perspective Drawing of Inner Bottom Lifting Tackle," both in NARA RG-178, Photo Album series, Vol. III, p. 45.

[288]"Richmond Weight Lifters," *Fore'n'Aft* 3 (8 January 1943): 3.

deck that has a longitudinal curve as well as a transverse camber. Molds for such shapes had to be laid flat on the mold loft and then tested for accuracy after the piece in question was bent to its proper shape.[289]

Shipyards built plastic scale models of ships for several important reasons, foremost among them for the development of assembly and welding sequences and for training. Model builders lofted the size and shape of each piece of plastic, much as workers in the mold loft and the fabricating shop lofted each piece of steel used in the actual construction of a ship. Then designers, planners, and supervisors tried alternate sequences to assemble the pieces into unit assemblies in order to determine the most efficient sequence for crews to use in the shipyard. Once sequences were selected, trainers used the models to instruct other supervisors and crews in the processes to be followed. As mentioned above, Kaiser's model shop was located in the personnel and training building at Yard 3. The shop was under the direction of Julian Mesic, an artist with previous experience in architecture, sculpture, and painting. Based on drawings provided by naval architects and marine engineers, she and her crew built a model for every type of ship built in the Richmond yards at a scale of 0.5" = 1.0' (1:24). Then if changes were contemplated in the plans of a ship, the modifications were tried first on the model. The model-builders also made models of pre-assembled units (deck houses, forepeaks, afterpeaks, engine rooms, etc.) that could be used to train workers. When the Maritime Commission awarded Kaiser's Vancouver yard a supplemental contract in 1944 to build C-4 troop transports (described above in the section on Yard 3), the Kaiser organization shipped its big C-4 model from Yard 3 to Vancouver to be used there in training supervisors and workers.[290]

E. Launchings

Preparation for the launching of a ship began before the keel was laid, when crews laid varieties of temporary wood structures on the shipway that would support the weight of the ship as it was being erected and that would allow the ship to slide into the water during the launch. Running along the center line of the shipway were the keel blocks, which would carry the keel at

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[289]Woodward, "Some Recent Developments in the Shipbuilding Art in America," 110-111; James Greenhalgh and Angus D. MacDonnell, "The Mold Loft's Place in Production - I," *Marine Engineering and Shipping Review* 47 (March 1942): 120-121; Greenhalgh and MacDonnell, "The Mold Loft's Place in Production - II," *Marine Engineering and Shipping Review* 47 (April 1942): 189; Greenhalgh and "The Mold Loft's Place in Production - III," *Marine Engineering and Shipping Review* 47 (May 1942): 128.

[290]"Victory Know-How," *Fore'n'Aft* 4 (2 June 1944): 12-13; "The Model Shop," *Fore'n'Aft* 4 (1 December 1944): 6-8; "Production Welding for Welded Ship Construction with Paper and Plastic," *The Welding Journal* 24 (April 1945): 347-350. According to the *Fore'n'Aft* article, Julian Mesic and Anne Mitchell received considerable national attention at the beginning of the emergency shipbuilding program as the first women shipbuilders in the country. There are excellent photographs of ship models from the Richmond shipyards at the Richmond Museum. See photo nos. P-468, P-469, P-685, P-686, P-687, Richmond Museum of History, Richmond, California.

least four feet above the ground and support most of the weight of the ship during erection. Crews would remove the keel blocks before launch. Flanking the keel blocks were two lines of skids, called ways, that would carry the weight of the ship as it slid into the water. Each line of ways consisted of two kinds of wood pieces: the ground ways or standing ways sat directly on the shipway itself and remained stationary during launch, and the sliding ways sat on the ground ways and slid down into the water with the hull. After the keel blocks were removed prior to launch, the pair of sliding ways, called the cradle, would support the hull. Additional pieces of wood, called packing and wedges, were placed between the sliding ways and the hull to achieve a proper fit. Crews packed a layer of launching grease, as much as an inch thick, atop the ground ways before putting the sliding ways in place. A trigger would be placed in each ground way to hold the sliding way in place. At launch, a hydraulic ram would knock the trigger out of position, releasing the sliding way. Outward, on either side of the fixed and sliding ways, would be additional rows of shores that would support the bottom of the hull during erection and give the ship stability. The shores would also be removed prior to launch. Because the keel blocks and the ways carried most of the weight of a ship, the pilings beneath the shipway were concentrated along those three lines.[291]

When a ship was ready for launching, workers would first remove the grease irons, which were metal spacers placed approximately every twenty feet in the area filled with grease between the sliding ways and the ground ways. The purpose of the grease irons was to keep any load created by the sliding ways from forcing out the grease. After removing the irons, the crew would drive in the wedges in the sliding ways further, bringing the cradle tight against the hull. Then they would remove the keel blocks and shores, leaving the entire weight of the ship to rest on the cradle. When everything was ready for the launch, someone would activate the hydraulic rams, release the triggers and allow the hull to slide into the water. It was important that the ways extend far enough into the water, because once the stern end and half of the mass of the hull had passed the end of the ways, the hull could begin to tip, putting potentially damaging pressure on the ends of the ways or on the portion of the hull that had become the fulcrum. As the ship slid further into the water it would begin to pivot, meaning that the buoyancy of the hull would lift the stern. At that point, the weight of the vessel was no longer distributed along the cradle but rather was concentrated near the bow. For that reason, the support under the bow needed to be sufficient to carry that much weight. In World War II, the fore poppet, which was a wood cribbed structure, provided the extra support since it was capable of transferring the concentrated weight on the bow to the shipway. As the entire ship slid into the water, it would float on its own, and the fore poppet would drop off the ends of the ways. Consideration of the tides was important in scheduling a launch to preclude excessive tipping or pivoting of the vessel during launch.[292]

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[291]A.W. Carmichael, *Practical Ship Construction* (New York: McGraw-Hill Book Company, Inc., 1941), 161-166, 224; Elijah Baker III, *Introduction to Shipbuilding* (New York: McGraw-Hill Book Company, Inc., 1943), 191-195.

[292]Carmichael, *Practical Ship Construction*, 166-168, 261-265; Baker, *Introduction to Shipbuilding*, 194-201. The Kaiser yards used much the same methods as those described in this paragraph; see "Men Down Under," *Fore'n'Aft* 3 (11 June 1943): 2-3. Nice drawings accompanying the article show details of the ground and sliding ways, poppets, and triggers used at Richmond Yard No. 1.

After launch, a tug would tow the ship to the outfitting dock where the remainder of the equipment would be installed. Even though there was considerable work remaining before the ship would be finished and ready for its sea trial, the launching was the event at which a vessel received her name, signaling time for celebration. According to tradition, at the moment a ship began to slide down the ways, a duly selected woman, called the sponsor, would break a bottle of champaign against the bow and bestow a name upon the ship. The event was called the christening. In order to conduct the christening, shipyard workers would build scaffolding and a temporary platform on which the sponsor and the rest of the launching party could stand. After the launch, the party would adjourn for a meal and more celebration.[293]

Liberty Fleet Day, 27 September 1941, had been a spectacular celebration at many of the nation's shipyards. As already mentioned, President Roosevelt participated in the celebration at Baltimore's Bethlehem-Fairfield yard, and Admiral Land made a nationwide broadcast in which he commended shipping companies for making their ships available for combat service. Other shipyards also had dignitaries present. For example, Richmond Yard No. 1, began its ceremony for the launching of two British cargo ships with some musical selections by the Richmond High School Band. Clay Bedford then introduced Fred Parr served as master of ceremonies. Parr in turn introduced such notables as Richmond's mayor and other local officials, the British Consul General from San Francisco, a representative of the British War Transportation Ministry, a state senator, an admiral and a general, the Maritime Commission's Pacific Coast Director of Operations, and Henry Kaiser. As was traditional in the maritime world, women christened the two ships. Mrs. F.C. Cocks, wife of the special representative of Lloyd's Register of Shipping, christened the first ship *Ocean Voice* at mid-afternoon. Mrs. C.P. Bedford, Clay Bedford's wife, christened the second ship *Ocean Venture* in early evening. Between the two launchings there was music, an infantry demonstration, remarks by some of the dignitaries, and a reading of FDR's radio address from earlier in the day.[294]

Ship launchings had a long tradition in the maritime world, but they were typically private affairs. The company for which the ship was built usually paid for the launching ceremony, selected the sponsor and the sponsor's matron of honor, and provided gifts for the sponsor and other key people. Launchings of Liberty Ships, however, were very public events, intended to honor managers but also to boost morale of the workers and the public generally. The selection of a sponsor was no longer a private matter. The Maritime Commission wanted to make the celebrations for Liberty Fleet Day great public events at each of the shipyards that launched a ship that day, so it was willing to pay for expenses. Thereafter, however, the Maritime Commission decided not to pay for gifts for the sponsors, and it limited the amount it would contribute to the cost of a celebration to $500. After the attack on Pearl Harbor, the Maritime Commission ceased paying for launching celebrations at all. Nevertheless, each ship launching at the Richmond yards, and probably at yards throughout the U.S., continued to be a

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[293]Carmichael, *Practical Ship Construction*, 265.

[294]"'Liberty Fleet Day' along the Pacific Coast," *Pacific Marine Review* 38 (October 1941): 95, 98-99; Lane, *Ships for Victory*, 68.

special event.[295]

Names selected for ships gave the Kaiser yards, and the Maritime Commission more generally, cause to celebrate many facets of American history and of the nation's character that enabled U.S. citizens to respond so vigorously to the demands of war, both on the battlefront and the home front. Those celebrations in turn helped to motivate shipyard workers to maintain the remarkable pace of production. For example, on Labor Day in September 1942, the Maritime Commission arranged to have five launched ships named for labor leaders. They were the *S.S. Andrew Furuseth*, launched at Richmond No. 1; the *S.S. Peter G. MacGuire*, launched at Richmond No. 2; the *S.S. Samuel Gompers*, launched at Calship; the *S.S. James Duncan*, launched at Oregonship; and the *S.S. John Mitchell*, launched at the Bethlehem-Fairfield yard in Baltimore.[296]

The Kaiser organization employed the same pre-assembly mentality to ship launchings that it employed for shipbuilding in general. Richmond Yard No. 2 (and perhaps the other yards as well) had a pre-fabricated launching platform, complete with bandstand, press box, and radio platform, that the whirley cranes could hoist into position at the head of the appropriate way just prior to a launching.[297]

F. Yard Management

> Managerial initiative and ability were no less needed for the success of the shipbuilding program than steel, components, and labor. Indeed, it was managerial initiative and ability that developed the techniques of multiple production, overcame the lack of skilled labor, and thus precipitated the crisis over steel.
>
> Frederic Lane, *Ships for Victory*[298]

Management methods had to change in order to convert the shipbuilding business from one in which shipyards took orders to build individual ships to one in which shipyards signed contracts to build dozens of ships in a short period of time. Sometimes under the old scheme a yard would be building more than one ship at a time, but each ship would typically be of a distinct design. Under the new scheme, all of the dozens of ships being built under a contract were identical. A pair of 1948 articles prepared by Arthur Homer and Carleton Ryan for the Society of Naval Architects and Marine Engineers contrasted the management organizations needed for the two types of shipbuilding business. The two organizational schemes shared the

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[295]Lane, *Ships for Victory*, 68-70.

[296]"Ships for Victory Slide Down Ways on Labor Day in Tribute to Workingmen," Contra Costa County *Labor Journal* (24 September 1942), 6.

[297]Mann, "Richmond Yard No. 2 of the Permanente Metals Corporation," 129, 132.

[298]Lane, *Ships for Victory*, 456.

overall characteristic of breaking tasks into departments for engineering, administration, facilities, and production, with the latter being further divided into hull construction and outfitting. Differences between the two schemes ensued in large part from differences in the labor pool available and necessary for each of them. Standard yards, predicated on the need to build ships one at a time for a diverse array of customers, required a skilled group of workers with overall experience in building ships who could work closely with the engineers to develop a good production procedure for each ship order that came along and then have the flexibility to implement the procedure. Multiple-production yards, such as those established during World War II to build Liberty ships, had to draw upon large pools of labor unskilled in the art and traditions of shipbuilding. Therefore multiple-production yards placed more emphasis on the engineering department to make centralized decisions about a procedure that would be used ship after ship. Then workers could be trained to perform a specialized task rather than to develop a flexible array of skills.[299]

Aside from that overall difference between standard yards and multiple-production yards, there were also more subtle differences among the latter. It had been usual practice in shipyards to locate the warehousing functions along with purchasing in the administrative department, a practice many of the multiple-production yards maintained. Because speedy availability of materials was so important to rapid production in the wartime yards, some companies made the warehousing function subsidiary to the superintendents of both hull construction and outfitting. Still others made materials purchasing, expediting, and warehousing a separate department reporting directly to the general manager. Another area in the organizational structure where multiple-production yards differed was in the production departments. Some yards organized production by crafts and others by areas of work. In the former scheme, all riveters in the yard reported through their respective foremen to the master riveter, all electricians in the yard reported through their respective foremen to the superintendent of electricians, and so forth. In the latter scheme, superintendents had charge of various work areas, and at each of those areas there would be foremen in charge of the particular crafts involved. In the latter scheme, production work was divided into at least two major components, hull construction and outfitting, and thereunder into areas like fabricating shop, shipways, pipe shop, and sea trials. In most multiple-production yards, as in standard yards, the mold loft was subsidiary to the hull construction department, but some multiple-production yards located the mold loft within the hierarchy of the engineering department.[300]

Clay Bedford was Kaiser's general manager for the four Richmond shipyards. Once all the shipyards were built, his office was at Yard No. 3, where he maintained an administrative staff for the Kaiser shipbuilding enterprise in Richmond that included not only an assistant

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[299]Arthur B. Homer, "Shipyard Organization: Standard Yards," in *The Shipbuilding Business in the United States of America*, ed. F.G. Fassett, Jr. (New York: Society of Naval Architects and Marine Engineers, 1948), 256-260; W. Carleton Ryan, "Shipyard Organization: Multiple-Production Yards," in *The Shipbuilding Business in the United States of America*, ed., Fassett, 260-261, 263. On the organization of a standard yard, see also the organizational chart in Carmichael, *Practical Ship Production*, 189.

[300]Ryan, "Shipyard Organization: Multiple-Production Yards," 261-270.

manager and an executive secretary but also a production manager, David Oppenheim, who supervised the centralized progress, production control, and weld checking departments. By 1943, Oppenheim's Progress and Program Department had grown to a staff of some 500 employees, some located in his immediate office and many located in subsidiary Progress Departments at each of the yards, headed by C.L. Granger, Kenneth Haukom, B.W. Shackleford, and Robert L. Andresen at Yards 1 through 4, respectively. Oppenheim's staff gathered data from all the yards, conducted monthly statistical analyses, and produced the very informative charts and graphs that comprise some of the Kaiser collection at the Bancroft Library.[301]

Each yard had two overall divisions that reported to Bedford: a construction division and an administration division. The management structure for Yard 3 is described in the next few paragraphs, followed by a brief discussion of important differences in the management hierarchies at Yards 1 and 2. As will be seen, Kaiser organized the yards by crafts rather than by work area. A few work areas, like hull erection and the plate shop, did have superintendents.

For crafts that were unique to shipbuilding, the Kaiser organization recruited experienced hands to serve as masters, at least in the early years. For crafts, such as rigger, that were similar whether in a shipyard or on a large construction site, Kaiser often elevated men who had worked on other big construction projects in the 1930s. Al S. Fountain, for example, was the master rigger at Yard No. 2 in 1942. Prior to moving to Richmond, he had more that a dozen years experience as a rigger on projects building dams and tunnels. Included in that experience was four years as a rigger foreman on big Kaiser jobs, like Hoover Dam and Grand Coulee. He was assistant master rigger at Yard 2 before being promoted to master rigger late in 1942. In comparison, the master steamfitter at Yard 2 and the master shipfitter at Yard 1 in 1942 were both experienced shipbuilders. W.F. Smith had worked in shipbuilding for more than thirty years before moving to Richmond in late 1941. Bedford made him master steamfitter for Yard 2 in February 1942. Mel Cunningham had eighteen years experience in shipbuilding before moving to Richmond in May 1941 to work in Yard 1 as a shipfitter. Within a few months he had been promoted through the ranks of leaderman, foreman, and quarterman to master shipfitter. By late 1942, he was also superintendent of the plate shop at Yard 1.[302]

The construction division at Yard 3 was in turn divided into two departments, facilities and vessels.[303] The construction superintendent and assistant superintendent had charge of construction and maintenance of all of the facilities at Yard 3, and the general superintendent had charge of the actual shipbuilding activities. Under the construction superintendent were superintendents in charge of such sections as excavation, carpentry, piping, electrical, mechanical, materials, basins, labor and concrete, cranes and rigging, and marine and piling. Under the general superintendent in the vessels department were the yard superintendent, an assistant yard superintendent, hull superintendent, and marine superintendent. Reporting to

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[301]"Figureheads," *Fore'n'Aft* 3 (12 March 1943): 6-7; "Master Organization Chart Richmond Shipyard No. 3," chart reproduced in "Ships for Victory," HJK 83/42c, volume 50.

[302]"Definitely Masculine...," *Fore'n'Aft* 2 (27 November 1942): n.p.

[303]"Master Organization Chart Richmond Shipyard No. 3."

those superintendents were lead men for each of the major job classifications in ship erection and outfitting: master machinist, master shop fabricator, master welder, chief loftsman, hull outfitting superintendent, master pipefitter, master shipwright, master painter, plate shop superintendent, assistant marine superintendent, master riveter & chipper, trial trip engineer, master rigger, hull erection superintendent, master stage rigger, hull assembly superintendent, master shipfitter, warehouse superintendent, labor superintendent, master electrician, steel storage superintendent, master ship joiner, equipment superintendent, and fab steel storage superintendent.

The administration division at Yard 3 was also divided into two departments, engineering and office manager.[304] Two sub-sections in the engineering department mirrored the two departments on the construction side: facilities and vessels. For facilities, there was a chief engineer, chief architect, senior engineer, resident construction engineer, and chief field engineer.[305] For vessels, there was a chief engineer, a hull drafting office, a chief expediter, and a cost estimator. The office manager's department embraced all of the other support functions, including: director of personnel training, purchasing agent, assistant personnel manager, safety department, publicity, paymaster, resident attorney, invoice auditor, chief accountant, superintendent of plant police, and chief cost accountant.

The management charts for Yards 1 and 2 were very similar. Curiously, Yard 1 had no facilities construction or facilities engineering departments. Perhaps those functions were handled from Yard 2. There was a pre-fab plant superintendent, who was part of the vessels construction department of the Yard 2 management chart.[306]

Even though each yard had a yard manager's office that supervised such functions as training, safety, security, and accounting, those activities were actually centralized in the Kaiser organizational structure under an administrative office that reported directly to general manager Clay Bedford, who had charge of all the yards. Thus, Jack Wolf began as the director of personnel training for Shipyard No. 1, but as the other Richmond yards began hiring workers he supervised training programs at all the yards. Similarly, William Kirby was initially the chief safety engineer at Yard 1, but as the other yards developed he became the all-yard safety coordinator. Ray Waddell was in charge of plant protection, which included both fire and police

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[304]"Master Organization Chart Richmond Shipyard No. 3."

[305]Individuals in Kaiser's centralized facilities engineering office in Oakland filled on an as-needed basis the positions of chief engineer, chief architect, and senior engineer.

[306]"Master Organization Chart, Yard # 1, Permanente Metals Corporation" and "Master Organization Chart, Yard # 2, Permanente Metals Corporation," both in HJK 83/42c, volume 50. There are various other minor differences among Yards 1, 2, and 3, and they seem rather arbitrary. Why would only Yard 2 have a traffic manager? Why would only Yard 1 show a master union-melt welder and a sea trial captain? It may be that the charts reflect actual differences among the yards, or it may be that each difference reflects the recollections of that particular yard's superintendent, or it may be that each chart presents an actuate snapshot in time, reflecting changes that were made in all the yards over time.

forces, for all the yards.[307]

It is possible to compare the management structure at the Richmond yards and Calship. Like the Richmond yards, Calship had four departments: administration, engineering, and the two production departments, one for the hull construction and one for outfitting. One can see that production at Calship was organized by work areas rather than by craft. Several divisions fell under the administration department, including purchasing, materials, personnel, and finance. The materials division had three sections: expediting, stores, and materials contracting. Each of the two production departments had its own scheduling and planning section, sections for the actual production crafts, and sections for the facilities that supported the department's production activities. Thus, the hull and yard department had sections for burning and scarfing, chipping, erecting, rigging, welding, riveting, etc., and the outfitting and machinery department had sections for machinery installation, boiler assembly installation, marine plumbing, electrical installation, marine rigging, sub-contractors, etc. In addition, the hull and yard department had sections for the plate shop, shipways, mold loft, inspection, etc. The outfitting and machinery department had sections for the outfitting berths, marine electricians shop, paint shop, pipe shop, sheet metal shop, etc.[308]

Another important aspect of shipyard management was the oversight that the Maritime Commission exercised. While the government was willing to pay millions of dollars to have ships built fast, it was not willing to be profligate in its spending. Admiral Vickery had been fairly successful in stimulating speed by implementing a nationwide system of competition among the various management groups operating shipyards and maintaining his constant prodding of shipyard managers as well. He also tried to create a competitive system to induce managers to bring costs down, but competition was less successful in that realm. Therefore, the Maritime Commission had to establish an elaborate cost accounting system to closely monitor shipyards' spending and to be sure that expenditures were justified. The Maritime Commission maintained a large staff at each shipyard divided into several sections, each headed by an official with a title like Resident Auditor, Principal Hull Inspector, Principal Machinery Inspector, Resident Plant Engineer, Material Coordinator, Purchase Controller, and Supply Officer. Each official reported to a distinct supervisor specializing in that particular area. Although the reporting system was national in scope, four regional offices administered it. In larger yards, the Resident Auditor, Principal Hull Inspector, and Principal Machinery Inspector would each have staffs of several dozen, while the other officials' staffs were less than a half dozen. The on-site officials regularly sent very detailed reports to their supervisors. Examples of the weekly reports of the Maritime Commission officials are available at the National Archives.[309]

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[307]Kramer, "The Story of the Richmond Shipyards," 65-67; "Master Organization Chart, Yard # 1, Permanente Metals Corporation;" "Master Organization Chart, Yard # 2, Permanente Metals Corporation;" "Master Organization Chart Richmond Shipyard No. 3."

[308]"CalShip - California Shipbuilding Corporation, Terminal Island, California," HJK 83/42c, volume 50.

[309]Lane, *Ships for Victory*, 471-487, 703-704. An example of the detail to which the on-site officials monitored shipbuilding activities may be seen in the weekly progress reports submitted jointly by the Hull Inspector and the Machinery Inspector. For each ship, they would complete a

Clay Bedford and Edgar Kaiser made tremendous managerial advances for such young men. Bedford managed four yards and a peak of 92,000 workers at Richmond, and Edgar Kaiser managed 94,000 workers at the three yards in Oregon and Washington. Frank Crowe, their seasoned general manager at Hoover Dam, remembered them in 1943 while he worked at finishing Shasta Dam. Ten years earlier, Edgar Kaiser had been a foreman at Hoover and Bedford was in charge of the garages. "They certainly have gone a long way," he remarked in an interview with a writer for *Fortune* magazine.[310]

The Kaiser organization was known for introducing efficiency measures to the mass production of liberty ships. As described above, that record began to show cracks with the experience at Richmond Yard No. 3. The U.S. House of Representatives held hearings in the Bay Area during June and July 1943 to investigation several issues, including the question of why Yard 3 was having so much difficulty meeting production schedules. One explanation offered by traditional shipbuilders was that the Kaiser organization put too many dam builders in managerial positions at Yard 3 and relied too little on the expertise of experienced shipbuilders. One of those who testified was Ed Hannay, Sr., a long-time shipbuilder brought to Richmond to help superintend the construction and beginnings of shipbuilding at Yards 1 and 2. He had had some experience at Yard 3 as well, but by the time of the 1943 hearing, he was disgruntled and no longer working for Kaiser. In his testimony, he took the position that Yards 1 and 2 had performed well because experienced shipbuilders like himself were in lead positions, and Yard 3 performed poorly because Clay Bedford had chosen to put "cement mixers," men whose experience was limited to mixing cement and building dams, in the top positions. In *Ships for Victory*, Frederic Lane mentions the conflicts that arose between old-line shipbuilders, like Hannay, and the construction men, like the Kaiser team, but he attributes the problems at Yard 3 to other factors, mentioned in the chapter above. Examining the causes of poor performance at Yard 3 would make an interesting subject for further research.[311]

G. Shipyard Layout

Before World War II, yards with multiple ways did not necessarily have provision for cranes between each way. Because speed and ability to lift very heavy pre-assemblies were not

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four-page form, two pages devoted to hull construction and two pages devoted to machinery. The ship would be identified on the form by Maritime Commission hull number and by builder's hull number. The form provided spaces for the inspectors to report work in process or accomplished on a day-by-day basis, whether in the shop, on the ways, or at the outfitting dock. Examples included the documents copied for this project are for Richmond Shipyard No. 2, the week of 4 July 1942, Maritime Commission Hull No. 253 (builder's Hull No. 53) and Maritime Commission Hull No. 256 (builder's Hull No. 56).

[310]"The Earth Movers II," 226.

[311]Edward W. Hannay, Sr., testimony in *Production in Shipbuilding Plants*, 1000-1015; Lane, *Ships for Victory*, 248, 464, 622.

required, it was often sufficient to have a crane serve ways on either side of it.[312]

Layouts for yards producing Liberty ships varied depending on site conditions and improvements that designers of new yards thought they could make over recently-built predecessors. In general, there were two basic configurations for multiple production yards: those with straight-line flow and those with turning flow. Richmond Yards 1, 2, and 3 each follow the basic straight-line configuration, in which materials moved from north to south from storage through the plate shop, where they were cut and shaped, onto the platens, where they were prefabricated into sub-assemblies of the hull, which in turn were hoisted onto the ways for hull erection. Materials in yards with turning flow made that turn following preparation in the plate shop. After having been cut and shaped, pieces of steel plate or structural steel were distributed to one of the platens, which were arranged at right angles to the initial direction of flow. From the platens, sub-assemblies were moved onto the ways. Marinship was an example in the Bay Area of a yard with turning flow.[313]

H. Outfitting

When a ship was launched, it was basically just a hull with deckhouses. It was still lacking most of its machinery and equipment, both above and below decks. After launching, a ship would be towed to the outfitting dock, where crews would install the machinery and equipment and test it in preparation for the sea trial. Compartments of the hull were also tested for water tightness at the outfitting dock. As with the erection of a hull on the way or in a basin, the outfitting of a ship required the work and skill of a vast array of crafts, including electricians, pipefitters, shipfitters, machinists, welders, burners, riggers, and painters. To organize this work, the Kaiser organization had a superintendent for the outfitting dock at each shipyard and a boat foreman for each ship that was being outfitted who was responsible for coordinating the activities of all the crafts. Workers in each of the crafts were under the supervision of a master for that craft, e.g. master electrician, master shipfitter, etc.[314]

Some of the emergency yards developed sophisticated methods for pre-assembling piping, wiring, and other features that were usually not installed until the ship reached the outfitting dock. Such unit assemblies could be installed during erection of the hull rather than adding to the on-board congestion during outfitting. Another feature of some of the emergency yards was a process called "progressive outfitting," in which each ship after launching was moved from station to station along the outfitting dock, with each station specializing in a specific set of outfitting tasks.[315]

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[312]A.W. Carmichael, *Practical Ship Production* (New York: McGraw-Hill Book Company, 1941), 172.

[313]"Plant Layout for Ship Construction," *Engineering News-Record* 130 (20 May 1943): 62-67; Lane, *Ships for Victory*, 221-224.

[314]Jim McCloud, oral history recorded by Fredric L. Quivik, and dated 8 October 2001, in ROHO, 5-12.

[315]Lemler, "Multiple Yards--Record and Prospect," 234.

Among the tasks accomplished at the outfitting dock were the installation of winches and lines for the booms, which allowed Liberty and other ships to load cargo at docks not equipped with harbor cranes. After all the equipment related to the booms had been installed, a barge furnished with several concrete weights would move alongside the ship. Loft riggers would test each boom, whether rated for 5 tons or 50 tons, by hoisting concrete weights from the barge. For example, the 50-ton boom had to lift weights totaling 62 tons.[316]

I. Sea Trials

After a ship was fully outfitted, and before it could be delivered to the customer, a designated crew at the shipyard had to take it on a sea trial. During a sea trial, the crew tested all the equipment and put the ship through a series of exercises to test the propulsion system, the steering system, fuel economy, etc. For assurance that the ship would be able to complete its sea trial, the crew would first put the ship through a series of dock trials in the few days before the ship put to sea. A considerable number of people would be aboard for the sea trial itself, along with a navigating crew of a captain and some mates. A group called the trial board would conduct the actual tests, assisted by data takers, who would read gauges, meters, etc., and record and compute data. There would also be representatives of various groups on board, including the shipyard's engineering department and the production departments. Also represented would be the top shipyard management, the owner (in most cases the Maritime Commission), and representatives of any sub-contractors whose equipment was being tested. Thus, although there would typically be some invited guests aboard, most people on a trial trip were engaged either in operating the ship, conducting the tests, or monitoring them.[317]

Although sea trials were the last step of the shipbuilding process prior to delivery of a vessel, they were also cause for celebratory activity. Such was the case with the sea trial of the *S.S. Major General George O. Squier*, the first ship launched (25 November 1942) and completed by Yard No. 3. Her sea trial trip took place on 27 August 1943. The event was cause for a commemorative book providing a brief history of Yard 3, a biographical sketch of George Squier, a description of the procedures followed during the sea trials, and a list of the ship's roster during the trials. Because of the importance of the event, the roster included, in addition to the Yard 3 sea trial crew under the command of Capt. Ernest Mohr, representatives of the U.S. Maritime Commission, including the Washington, DC, West Coast, and Richmond offices, the Navy and the Army, George G. Sharp Company, Kaiser Company, Inc., the American Board of Shipping, the Coast Guard's Office of Marine Inspection, and numerous guests. Among the guests were U.S. senators and a member of the U.S. House of Representatives, mayors of Richmond, Berkeley, Oakland, and Hollywood, officials from the other Richmond shipyards,

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[316]"Boom Testers," *Fore'n'Aft* 3 (12 March 1943): n.p.

[317]"Liberty Ships Rigidly Tested," *Marine Engineering and Shipping Review* 47 (April 1942): 166-167; Carmichael, *Practical Ship Production*, 268-269; Baker, *Introduction to Steel Shipbuilding*, 207-227; Jim McCloud, oral history recorded by Fredric L. Quivik, and dated 8 October 2001, in ROHO, 18-22.

Kaiser's shipyards at Portland and Vancouver, Marinship and Calship, representatives of the firms comprising the Six Companies group, Yard 3's major suppliers, and reporters for local newspapers, major news services, and newsreel producers. The ship's mess facilities got a trial that day, too, producing three full meals for the ship's roster. Poached filet of sole Marguerite and grilled French lamb chops headlined the lunch menu while dinner featured broiled Kennebec Salmon with Bernaise sauce, prime rib of beef, and Yorkshire pudding.[318]

The sea trial for the *S.S. Major General George O. Squier* was scheduled to take about eleven hours from the time all hands were aboard at 7:30 am to the return to the Yard 3 dock at about 6:30 pm. After a series of initial tests, the ship was to leave the dock at 8:00 am and move out into the San Francisco Bay, operating at 50 percent of maximum speed. At about 9:15, emergency steering tests began, and after about 70 minutes the crew began the anchor tests. At 11:25 am, the crew was to bring the ship up to normal full power of 9000 shaft horsepower (shp), and after an hour and twenty minutes the endurance trial would begin. Lasting exactly three hours, the endurance trial was the test during which fuel economy was calculated. During the endurance run, the crew would also test the other equipment on the ship, like the evaporators, heating system, electrical generators, refrigeration system, and galley. At 3:45 pm, the conclusion of the endurance test, the crew would put *George O. Squier* into maximum power ahead (9900 shp) for an hour and fifteen minutes, during which time the crew would also test the steering system, putting the ship through some circles in its route. At 5:00 pm, the crew would put the ship into emergency power astern (3600 shp), an emergency braking maneuver to see how long it took the ship come to being dead in the water. Then the ship would be put through some emergency astern steering maneuvers. The last test, scheduled for 5:35 pm, was to be test an emergency start ahead, after which the ship would return to its dock at Yard 3, with arrival scheduled for 6:20.[319]

J. Employee Health Care

Note: A related topic to employee health care concerns workplace safety in the Richmond shipyards, which is described in Chapter VII.

Each shipyard had its own first aid station and its own medical director, with the exception of Yard No. 4. The first aid station at Yard 4 was under the direction of Dr. P.J. Barone, medical director at Yard 3. Two nurses staffed the Yard 4 first aid station during the day shift and the swing shift, while only one nurse staffed it during the graveyard shift. Serving a much larger workforce, the medical staff at the Yard 3 first aid station was also larger than that at Yard 4. The day and swing shifts each had a physician on duty at the Yard 3 first aid station. There were seven nurses on duty at the first aid station during the day shift, five during the swing shift, and four during the graveyard shift. In addition, there were two first-aid providers and one

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[318]Kaiser Company, Inc., *Sea Trials for U.S.S. General George O. Squier* (Richmond, CA: Kaiser Company, Inc., 1943), in DLH.

[319]Kaiser Company, Inc., *Sea Trials for U.S.S. General George O. Squier*, pages describing details of the trial procedure.

clerk on duty during each shift. Yard 3 also had a first-aid substation staffed by two nurses during each shift. The first-aid station at Yard 2 had similar staffing levels to Yard 3, while Yard 1, with a slightly smaller workforce, also had a slightly smaller staff at its first-aid station. Nevertheless, there was a physician on duty during both the day and the swing shifts, as at Yards 2 and 3. As with Yard 4, there was no doctor at the Pre-Fab first-aid station, but there was always a nurse on duty. Yard 3 was initially the only one of the four Richmond yards that had a first-aid station equipped with X-ray equipment, which was also used as necessary for workers from Yard 4. Workers requiring X-rays at Yards 1 and 2 were sent to the Field Hospital, which was located relatively close to those yards. Early in 1943, a new first-aid building was built at Yard 1, and it was equipped with X-ray equipment.[320]

Despite the Maritime Commission's efforts to enforce workplace health and safety rules, the Richmond shipyards were deficient in some areas. After the war, as the Richmond yards were winding down their efforts, Commander H.G. Beck of the U.S. Navy Reserve inspected the Richmond yards and noted several deficiencies in his report. He reported that all of the yards lacked programs to protect workers from solvents, like carbon tetrachloride. At Pre-Fab, management did not supply spray painters with appropriate respirators. At Yard No. 2, no care was taken to prevent workers from welding, cutting, and burning steel surfaces coated with red lead paint, so workers were subjected to lead fumes. With the exception of Yard No. 3, the Richmond yards were generally deficient in providing adequate exhaust for enclosed work areas within hulls. At Yard No. 4, workers wore respirators for protection against dusts, but management had not abided by earlier recommendations to sterilize the respirators between uses.[321]

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[320]Robert S. Poos, et al, "Industrial Health Survey of Richmond Shipyard Number One," unpublished report dated 7-14 April 1943, pp. 6, 41, in NARA RG-178, entry 95A, box 529, Richmond Shipyard #1 file; Robert S. Poos and James F. Morgan, "Industrial Health Survey of the Richmond Shipyard Number Three," unpublished report dated 14-19 April 1943, pp. 4-5, in NARA RG-178, entry 95A, box 529, Kaiser Company, Inc., #3 file; F.W. Johnson, et al, "Industrial Health Survey of Richmond Shipyard Number Two," unpublished report dated May 1943, pp. 6-7, in NARA RG-178, entry 95A, box 529, Richmond Shipyard #2 file; Harry G. Beck, "Kaiser Cargo, Inc. (Richmond No. 4)," unpublished Industrial Health and Safety Survey dated February and March 1944, p. 2, in NARA RG-178, entry 95A, box 529, Kaiser Cargo Co. #4 file.

Note that the Industrial Health Surveys for each shipyard are part of a larger report called, "Industrial Health and Safety Survey for Shipyard Number One," etc. The material following the title page of the broader document is very summary in nature, continuing for six or eight pages. The "Industrial Health Survey" for a shipyard follows in each case with new page numbers and contains more detailed narrative descriptions of various facets pertaining to health of workers in the respective shipyard operation. The "Safety Survey" of each shipyard follows the "Industrial Health Survey," but page numbers do not begin anew but rather continue where page numbers for the "Industrial Health Survey" ended.

[321]H.G. Beck, "Final Report: Permanente Metals Corporation, Richmond Shipyard No. 1," unpublished industrial hygiene report dated 13 September 1945; Beck, "Final Report: Permanente Metals Corporation, Richmond Shipyard No. 2," unpublished industrial hygiene report dated 14 September 1945; Beck, "Final Report: Permanente Metals Corporation, Prefabrication Plant," unpublished industrial hygiene report dated 14 September 1945; Beck,

Sub-contractors, including Hopeman Brothers, Harry Dutton, and Bay Cities Asbestos Company, installed fiberglass and asbestos insulation at the shipyards. Workers in the employ of sub-contractor Dutton called themselves "snowbirds," perhaps a reference to the dusty conditions in which they worked. Although official shipyard safety inspections included areas where insulation was installed, the record indicates that there was no special concern over asbestos exposure. Inspectors reported that asbestos pipe insulation was prepared in large sections at a Johns-Mansville plant in Oakland. Those large pieces had to be cut to fit in a small shop at the Richmond yards using a power-driven handsaw. Cutting the asbestos insulation created a lot of dust in that shop, so the shop was ventilated with an exhaust fan and the saw operator wore a "dustproof" mask made by the Pulmosan Safety Equipment Corporation. Apparently, no special provisions for ventilation or individual protection were implemented in areas where asbestos insulation was actually installed.[322]

In another area, however, the Kaiser organization went beyond the Maritime Commission's minimum shipyard health and safety standards by establishing a much more comprehensive system, called the Permanente Health Plan, to help shipyard workers with health-related issues. Established in 1942, the Permanente Health Plan had its origins, first, in the 1930s and the construction of the Colorado River Aqueduct across the Mohave Desert to Los Angeles, a project that was a great distance from established medical facilities, and, second, with Kaiser's work on Grand Coulee Dam, another remote site. Dr. Sidney Garfield established a medical clinic in the desert to serve workers on the aqueduct project, and he eventually came into contact with a Kaiser-owned insurance company that served both the aqueduct project and the Hoover Dam project. Through that contact, Edgar Kaiser induced Garfield to the Grand Coulee job site to provide medical care for workers under a pre-paid plan, with employers paying costs for treating industrial accidents and employees paying seven cents per day to cover costs for other medical care. Shortly thereafter, Kaiser gave workers the option of paying extra to have their families included in the plan.[323]

"Final Report: Kaiser Company, Inc., Richmond Shipyard No. 3," unpublished industrial hygiene report dated 14 September 1945; Beck, "Final Report: Kaiser Cargo, Inc., Richmond Shipyard No. 4," unpublished industrial hygiene report dated 14 September 1945, all in NARA RG-178, entry 89, box 443, USN-USMC-WSA Industrial Health Program Summary of Final Reports file.

[322]"No Lead in the Asbestos Gang," *Fore'n'Aft* 3 (22 January 1943): n.p.; F.W. Johnson, et al, "Industrial Health and Safety Survey of Richmond Shipyard Number Two," unpublished report dated May 1943, pp. 4, 37-38, in NARA RG-178, entry 95A, box 529, Richmond Shipyard #2 file; Harry G. Beck, et al, "Industrial Health Re-Survey of Richmond Shipyard Number Two," unpublished report dated April 1944, p. 6, in NARA RG-178, entry 95A, box 529, Richmond Shipyard #2 file; Beck, "Kaiser Cargo, Inc. (Richmond No. 4)," unpublished Industrial Health and Safety Survey dated February and March 1944, p. 8, in NARA RG-178, entry 95A, box 529, Kaiser Cargo Co. #4 file. Jim McCloud also called the asbestos workers snowbirds; see Jim McCloud, oral history recorded by Fredric L. Quivik, and dated 8 October 2001, in ROHO, 9.

[323]*The Kaiser Story*, 55-57; Foster, *Henry J. Kaiser*, 73, 211-215.

A few years later, with thousands of workers flocking to Henry J. Kaiser's wartime industries, Kaiser formed the Permanente Foundation to operate hospitals in the Bay Area as well as at Vancouver, Washington, for the Portland-area yards and at Fontana, California, for workers at the steel mill. The Kaiser organization again established a plan whereby workers could avail themselves of medical care through a pre-paid system. At the Richmond shipyards, workers could take advantage of first-aid stations and hospitals organized under Dr. Garfield's direction. The first-aid stations were part of the infrastructure at each shipyard. The Maritime Commission built a Field Hospital in Richmond at Cutting Boulevard and 14th Street to provide emergency and short-term hospital care. Ambulance service was provided by both the Richmond Ambulance Company and a fleet of ambulances operated by the Kaiser organization. Henry Kaiser's Permanente Foundation renovated the former Fabiola Hospital at Broadway and MacArthur Boulevard in Oakland to provide a larger facility for long-term care. The Kaiser Permanente Foundation equipped all of the facilities, and Dr. Garfield's medical staff operated them and provided patient care. Kaiser paid medical care for workplace accidents through a workers compensation plan administered by the Hartford Accident and Indemnity Company. Paying fifty cents per week entitled workers to medical care beyond workplace accidents. The plan was so popular among workers that the number using the hospital exceeded its capacity, and Kaiser had to begin refusing new enrollees in late 1942. In February 1943, after expanding the medical facilities, Kaiser again began welcoming new workers into the health plan.[324]

In time, the plan expanded so that workers could gain access to medical care for their families as well. Sources show different costs for this expanded coverage, ranging from eighty cents extra per week, to cover wife and children, to a total of $1.75 per week, for a worker to cover himself, his wife, and three or more children.[325] Because the details of the Health Plan are beyond the scope of this report, I have not tried to find a definitive explanation of the payment structure for the plan.

An important feature of the Health Plan was that it went beyond the workplace. According to a booklet the Kaiser organization provided its Richmond employees: "[The Health Plan's] primary purpose is *to prevent illness* [emphasis in original] through medical treatment

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[324]"A Health Plan," booklet published by the Kaiser organization in 1942, in HJK 83/42c, box 288, file 3; Philip Drinker, et al, "Industrial Health Survey of the Richmond Yard #3," unpublished report dated 28-29 August 1942, p. 7, in NARA RG-178, entry 95A, box 529, Kaiser Company, Inc., #3 file; "The Doctors Look At Lee," *Fore'n'Aft* 3 (5 February 1943): n.p.; "How We're Cared For," *Fore'n'Aft* 4 (14 April 1944): 20-21; Harry G. Beck, "Kaiser Cargo, Inc. (Richmond No. 4)," unpublished Industrial Health and Safety Survey dated February and March 1944, p. 2, in NARA RG-178, entry 95A, box 529, Kaiser Cargo Co. #4 file; Kramer, "The Story of the Richmond Shipyards," 68-69; *The Kaiser Story*, 58; Foster, *Henry J. Kaiser*, 73-74, 215-217; Johnson, *The Second Gold Rush*, 79-82.

[325]International Brotherhood of Boilermakers, Iron Ship Builders and Helpers of America, *Richmond: "Arsenal of Democracy"* (Berkeley, CA: Tam Gibbs Company, Printers, 1946), 25; Foster, *Henry J. Kaiser*, 73-74, 215-217.

and hospitalization for non-occupational illnesses and accidents."[326]

By the beginning of 1943, the Kaiser organization had its system fully in place to provide for shipyard workers' medical needs. Kaiser was apparently unique among American shipbuilders in this regard.[327] During the first half of 1943, the Richmond Field Hospital accommodated 134,049 out-patient visits. During June 1944, the system treated 33,964 patients, made 11,987 laboratory tests, took 8,083 X-rays, and conducted 498 surgeries, 175 of which were major. In June 1944, 87 percent of the Richmond shipyard workers were enrolled in the health plan. By that time, the system included a fully-equipped first aid station at each yard, two medical clinics, the Richmond Field Hospital with 170 beds, and the Permanente Foundation Hospital in Oakland with 300 beds. The Health Plan's staff of 905 included eighty-five doctors and 439 nurses, orderlies, and aids. In addition to providing medical services for shipyard workers, the Field Hospital staffed clinics providing prenatal and pediatric care for workers' families. There was also an addition built on the Field Hospital housing a thirty-five-bed maternity unit and a fifty-bed pediatric unit. This was an important adjunct to the medical care available in Richmond. The city had only one sixty-five-bed hospital and about less than thirty medical doctors in private practice, sufficient for the community before the war but woefully inadequate for the additional population that flocked to Richmond for wartime jobs. With the increase in women workers at the Kaiser yards, the Health Plan's medical staff offered special programs for women, including physical training in improved methods for climbing ladders and lifting loads, and a cancer-detection clinic for women.[328]

As the war drew to a close and enrollment in the Kaiser Health Plan dwindled, Kaiser and the Permanente medical staff laid plans for maintaining the health-plan concept in peacetime, giving birth to Kaiser-Permanente Medical Care Program, which became the largest

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[326]"A Health Plan," quote from the first page of descriptive text following the introductory note from Clay Bedford.

[327]In a November 1942 nationwide shipyard health inspection report, Philip Drinker mentioned only the Kaiser organization's hospitals at Richmond, Portland, and Vancouver. He wrote that workers at other yards availed themselves of the nationwide Blue Cross plan. He did not mention any other employer-sponsored hospitalization plant, but neither did he explicitly say that Kaiser was the only shipbuilder in the country to have one; see Philip Drinker, "Results of Recent Health Inspection - Maritime and Navy Contract Shipyards - With Recommendations," unpublished report dated 5 November 1942, pp. 3-4, in NARA RG-178, entry 95B, box 532, unlabeled file following the "I" divider. See also Drinker, et al, "Industrial Health Survey of the Richmond Yard #3," unpublished report dated 28-29 August 1942, p. 7-9, in NARA RG-178, entry 95A, box 529, Kaiser Company, Inc., #3 file.

[328]"General Reference Data," n.p., HJK 83/42c, box 289, file 11; "Chronological History of Kaiser Company, Inc., Shipyard Number Three," 12; Permanente Metals Corporation, et al, *A Booklet of Illustrated Facts about the Shipyards at Richmond, California*, 35; Richmond Chamber of Commerce, *A History of Richmond, California*, 125; "Richmond Took a Beating," *Fortune* 31 (February 1945): 268; Kramer, "The Story of the Richmond Shipyards," 68-70.

health maintenance organization in the U.S.[329]

K. Kaiser's Weekly Newspaper for the Richmond Shipyards: *Fore'n'Aft*

In mid-1941, the Kaiser organization began publishing a weekly newspaper called *Fore'n'Aft* for all of its Richmond employees. It featured safety tips, articles describing the kinds of work undertaken in various facets of the operation, photos and articles introducing managers and leadermen to the workers, little snippets describing regular workers, news of bowling and other sports teams comprised of shipyard workers. In December 1941, *Fore'n'Aft* opened an office at Yard 2, and in a weekly issue welcomed Yard 2 workers to visit the office: "We're here to get your news, to help you in your problems, to bring you recreation and activity. Whether you have an idea or not, drop in and say hello. Let's get acquainted."[330] Within a short time, *Fore'n'Aft* had developed a characteristic style that included stunning photographic images on the cover and cartoons aimed at improving safety and morale. Nearly all the articles were written in a vernacular style aimed at keeping workers' spirits high. The weekly appeared in magazine format until early 1944, when it switched to three issues per month in tabloid format and one issue per month in the magazine format. By early 1944, Kaiser was printing runs of 80,000 for each issue. Surveys showed that 90 percent of Richmond shipyard workers read the weekly.[331]

The *Fore'n'Aft* editor was Tom Bolster. In the early 1940s, he had been a war correspondent in Hong Kong for the *South China Morning Post*. After a short stint with the *San Francisco Chronicle*, he moved to Richmond to help establish the *Fore'n'Aft* operation. He was also instrumental in helping to organize the Richmond local of the Office Workers' Union. Assistant editor was Bob Pickering, who had previously written for such magazines as *Time*, *Sunset*, and the *New Yorker*. He worked in the Richmond shipyards' safety and personnel departments before joining the *Fore'n'Aft* staff. The staff also had editors for each of the yards, plus an editor who visited the several yards during the swing and graveyard shifts. Yard editors worked with field reporters. Milt Schekofsky, the art editor, had been a commercial artist and free-lance cartoonist before the war. The weekly employed its own photographer, darkroom person, and editorial assistant for paste-up, but Kaiser sent the material out for printing. The entire operation was under the supervision of Norris Nash, Kaiser's public relations director.[332]

All of the yard editors had previous experience in the shipyards. Yard 1 editor was John Delgado. He had earlier been a shipfitter at Yard 1, becoming a leaderman before joining the *Fore'n'Aft* staff. He was also chief shop steward for the Office Workers' Union. Anne Bassage was the Yard 2 editor. She had worked as sheet metal worker and then a draftsman before

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[329] *The Kaiser Story*, 58-59; Foster, *Henry J. Kaiser*, 211, 216-233.

[330] *Fore'n'Aft* 1 (18 December 1941): 4.

[331] "Fore'n'Aft," *Fore'n'Aft* 4 (4 February 1944): 16.

[332] Ibid., 15-17.

becoming a yard editor. Virginia Olney worked in the engineering department at Yard 4 and then as an electrician leaderwoman at Yard 3 before becoming the Yard 3 editor. Yard 4 editor George Creel also covered Prefab. He had been in graduate school at the University of California before joining the time department at the Richmond shipyards, where he worked for fourteen months before becoming a yard editor. Night editor Walt McElroy covered all the yards. Before the war, he had been the California director of the Federal Writers' Project, based in San Francisco. Before joining the *Fore'n'Aft* staff, he worked nine months as a journeyman machinist at Yard 1.[333]

A representative article appeared in the 23 July 1943 issue of *Fore'n'Aft*. Titled, "From 'Chain-Gang' to Prize Crew," the article praised the work and ingenuity exhibited by the rank-and-file members of the crew who built double bottoms at Yard No. 2; provided a profile of Curley Scheer, the crew's leaderman; and offered photographs and drawings illustrating sixteen innovations introduced by the crew to increase productivity in building the double bottoms, which are the two horizontal layers of sheet steel, spaced by welded webs of sheet steel, that comprise the bottom of a hull. When Yard 2 opened, it took 500 men about fifteen days to complete a double bottom in a series of tasks so onerous that workers called the crew the "chain gang," seeking transfers to other jobs as soon as possible. According to the article, Scheer sought recommendations from his workers and foremen. He said that his subordinates came up with sixteen major ideas that he implemented--and the article lists--to make it possible for a crew of 400 to build a double bottom in less than two days. Obviously aimed at fostering cooperation in the shipyards, the article also says that workers on the double-bottom crew, representing numerous shipyard crafts, credited Scheer with the improvements, because he was such a good boss. The article attributed Scheer's good nature to his background. Homeless as a nine-year-old, he had to make his own way to adulthood. Educated in engineering, he had served as lieutenant in World War I, a Scoutmaster, and a 4-H leader in addition to working for the Oregon Highway Department, the Corps of Engineers, the U.S. Public Health Service, and as a surveyor on the Bonneville and Grand Coulee projects before going to work in Richmond, building pile drivers for the construction of Yard No. 1. According to the *Fore'n'Aft* article:

> Curley has shattered the old tradition that you have to be hard-boiled to be a successful boss in shipbuilding. He rules with a smile and not a scowl; his men obey from motives of co-operation, not compulsion. He seems to believe in the old proverb: "You catch more flies with sugar than with vinegar."[334]

The article also mentioned something about Scheer that was always noteworthy in the shipyards: Scheer had members of his immediate family fighting in the war. Two of his sons were in the U.S. Army, one son serving in the merchant marine on a Liberty ship built at Yard 1, and one son working as a welder at Yard 2.

Another exemplary article appeared in the April 14, 1944 anniversary issue. Titled "We Build 500 Ships," it recounts, with wonderful braggadocio, how workers at Richmond had

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[333]Ibid., 15-16.

[334]"From 'Chain-Gang' to Prize Crew," *Fore'n'Aft* 3 (23 July 1943): n.p.

worked through rain and mud to build Yard No. 1, had blasted tons of rock from Potrero Point to build Yard No. 3, and along the way had sometimes enduring almost unbearable hardship:

> The darkest days were the three days when the commissary was out of chawin' tobacco. Construction men and tobacco go together like coffee and cream. Hurry-up Hewer, safety inspector, ran out of Copenhagen and almost went ski-rewey--until he found he could use cigars for in pinch in a pinch.[335]

There are incomplete collections of *Fore'n'Aft* at the Richmond Museum, the Richmond Public Library, and the Bancroft Library at U.C. Berkeley. There is considerable overlap in the collections, and some issues are missing from all three collections, see Appendix A for a necessarily incomplete list of articles about specific crafts at the shipyards.

As the Richmond shipyards began hiring woman for production work in 1942, *Fore'n'Aft* likewise began featuring women on its pages. Some articles seemed designed to dispel stereotypes about women. For example, the 27 November 1942 issue featured short profiles of five women, accompanied by photos of them at work. Next to the photo of Maude Schley and Catherine Chappell hanging doors for the crew quarters on a Liberty ship, a brief text included the following: "What's more, these two women war workers are an example of something that male skeptics find rather hard to believe. Women in industry don't waste much time in feminine gossip. Observers say they actually talk less than the men!"[336] The brief profile also noted that the two women, "like the rest of the ladies" at Pre-Fab, contributed efficiently to the record-setting construction of Hull No. 440, the *Robert E. Peary*. *Fore'n'Aft* continued to celebrate women's accomplishments. For example, a brief note in the 1944 anniversary issue reported:

> Women shipfitters? Unheard of till Dolly Thrash, gray-haired and not long off an Oklahoma farm, became California's first at Yard Four in August '42. But in three months, so well did she work, Dolly was a fitter leaderwoman, America's first.[337]

Articles in *Fore'n'Aft* also sought to celebrate the racially integrated character of the workforce at the Richmond shipyards. An article titled "Democracy at Work" described the launching of the Liberty ship *George Washington Carver*, but it primarily featured photos of integrated crews at work in the Richmond yards. The text also linked integration of the workforce with America's moral standing in the war:

> You will see that spirit [of Christianity, as described by George Washington Carver] among the Negroes in the Richmond shipyards. You will see it among the rank and file and among the leadermen and foremen. It would be

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[335]"We Build 500 Ships," *Fore'n'Aft* 4 (14 April 1944): n.p.

[336]"...Strictly Feminine," *Fore'n'Aft* 2 (27 November 1942): n.p.

[337]"Women Shipfitters?" sidebar at end of "We Build 500 Ships," *Fore'n'Aft* 4 (14 April 1944): n.p.

> inconceivable to the arrogant Nazi mind that in America we should have Negro leadermen and foremen. But we have, just as we have Negro officers in our army, and Negro judges and legislators and congressmen. For this is the way democracy works. And democracy is beating the hell out of the arrogant Nazis.[338]

Other articles featured American Indians who worked in the Richmond yards. One, titled "Americans on the War Path," provided brief profiles of several Indian workers, mentioning their tribal background (Navajo, Apache, Creek, Cherokee, etc.) and states of origin.[339]

An article in 1944's anniversary issue celebrated the diversity of the Richmond shipyard workforce. There were men and women, of course. There were people in the yards from every state and nearly all ages. The Pittman-Leonard family, for example, had moved to Richmond from Ohio and had three generations of members working in the shipyards. And there was broad ethnic diversity, ranging from ships painter Sydney Dempsey, who had been injured while a sergeant in the Army Corps of Engineers during the attack on Pearl Harbor, and driller Augustine Mirabel, who was a Taos Indian from New Mexico, to electricians Minnie and Henrietta Lee from Fresno, who were native-born Americans of Chinese ancestry, and coppersmith Armanac Hairenian, a native of Armenia, where he had learned his trade.[340]

Cartoonists were typically production workers who submitted their work to the editorial staff. For example, Frank Paul moved to Richmond from the Wainwright shipyard in Florida to work in the marine electric layout department at Yard 3. He produced some very distinctive cartoons, one of which featured an animated whirley crane running across Yard 3.[341] A cartoon in November 1942, shortly after women began working in the Richmond yards, showed a mother and daughter standing outside the display window of a toy store, with the girl saying crossly, "I don't want a doll--I want a welding set."[342]

L. Kaiser Methods in Context

> A closer analysis of the whole Kaiser technique will indicate that it is soundly entrenched in a thorough knowledge of moving materials, handling men, and keeping a perspective on the job as a whole instead of being frightened by the magnitude of its huge, separate parts.[343]

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[338]"Democracy at Work," *Fore'n'Aft* 3 (21 May 1943): n.p.

[339]"Americans on the War Path," *Fore'n'Aft* 3 (12 March 1943): 2.

[340]"We Are Here....," *Fore'n'Aft* 4 (14 April 1944): 2-5.

[341]Frank Paul, "Metamorphosis of a Rumor," cartoon in *Fore'n'Aft* 3 (24 September 1943): n.p.

[342]*Fore'n'Aft* 2 (27 November 1942): n.p.

[343]Mann, "Richmond Yard No. 2 of the Permanente Metals Corporation," 127.

Other U.S. shipyards almost universally employed the methods described above and helped the nation achieve an incredible output during World War II. Nevertheless, Kaiser attained perhaps the greatest notoriety of all the nation's emergency shipbuilders. Site constraints and managerial variety led to notable differences among shipyards, large and small. Those differences alone do not account for the tremendous acclaim Kaiser received. He was very adept at promoting his capabilities and accomplishments before bureaucrats, the press, and the public. But he and his top managers also lived up to much of their bluster. They did not build hundreds of ships on bravado alone; they also succeeded in devising a very successful technological system for building those ships in such short order. That technological system gave Kaiser a plausible platform on which he could swagger.

Speaking to a *New York Times* reporter, Kaiser described in broad terms how his enterprise had become successful: "Success in anything depends on three things. First, you must visualize what the need is. Second, you must visualize how and where the need can be met. And third, you must visualize the organization that can meet it."[344] He added that a key aspect of his success was his handing the work over to his key men, who in turn handed it over to leader men in the yards, and they in turn handed the work over to their trained crews. He believed in delegating responsibility to others down through his hierarchy, saying he would forget about them as long as they did their jobs. The delegating included giving people freedom to respond to problems themselves, rather than having him or his top lieutenants micro-managing all that happened. Another key to the system, he said, was motivating workers and leaders to want to accept the responsibility and perform well. In a wartime context, he believed, some of the motivation came from a sense of patriotism. The opportunity to achieve a sense of accomplishment also contributed to motivation. Not content to simply allow those factors to foster motivation, he also strove to stimulate it by building both competition and cooperation into his system. He encouraged all his workers to initiate ideas for performing tasks better. He would acknowledge the accomplishments of successful individuals and teams before the entire workforce, and then he would have managers, foremen, or other representatives of competing crews or divisions observe the methods of successful groups so that those methods could be disseminated and incorporated elsewhere.[345]

CHAPTER SIX: SHIPS KAISER BUILT

Kaiser built several kinds of ships at the Richmond shipyards. The following table lists the principle ships built at Richmond, showing the yard, numbers of ships, and amount of time it took to build them. A few figures from Kaiser's Oregon yards are shown for comparative purposes.

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[344]Lawrence E. Davies, "Henry Kaiser Shows His Ships," *The New York Times Sunday Magazine* (24 January 1943), 6.

[345]Davies, "Henry Kaiser Shows His Ships," 6, 38-39.

Ships Built at Richmond Shipyards[346]

Type	Yard	Number Built	Average Direct Manhours	Average Constr. Days	Lowest Constr. Days	Highest Constr. Days
British	1	30	439,740	127.3	67	252
EC2-S-C1	1	138	324,626	47.3	28	98
(Liberty)	2	351	316,318	40.2	7	204
	Oregonship	330	314,367	43.9	13	256
VC2-S-AP3	1	10	835,704	147.6	128	179
(Victory)	Oregonship	99	465,961	103.9	59	139
VC2-S-AP2	1	43	457,991	85.4	70	116
(Victory)	2	67	397,634	73.9	85	100
VC2-S-AP5	2	22	992.638	125.7	91	154
(Victory	Oregonship	34	745,094	?	58	133
Troop)	Kaiser Vanc.	31	901,554	105.8	58	150
C4-S-A1	3	30	2,713,525	308	176	641
(Troop Trans.)						
C4-S-A3	3	3	1,564,094	216.3	212	220
(Troop)	Kaiser Vanc.	12	1,551,943	281.6	212	328
S4-M2-E2	4	15	671,674	188.9	133	253
LST	Kaiser Vanc.	30	471,842	152.5	126	187
S2-S2-AQ1	4	12	600,196	226	153	394
(Frigate)						
C1-E-AV1	4	24	327,406	150.9	84	293

A. British Cargo Ships and Liberty Ships

The Maritime Commission's intention for the new fleet of C-type vessels it planned to build, beginning in the late 1930s, was that, among other things, they be powered by new propulsion systems, either steam turbines or diesel, and therefore that they be faster than older cargo ships. The Navy was also providing its new warships with advanced propulsion systems. When the Roosevelt administration decided it was essential to embark on an emergency shipbuilding program to aid the British in replacing the tremendous tonnage of shipping that Germany was destroying, the Maritime Commission realized that it could not readily increase the supply of advanced propulsion systems. The nation's industrial capacity to build the propulsion systems was fully committed to meeting the planned schedule for construction and delivery of Navy ships and C-type cargo vessels. Leading manufacturers of steam turbines included Bethlehem Steel, Westinghouse Electric, General Electric, Allis-Chalmers, Farrell-Birmingham, and De Laval. Leading producers of marine diesel engines included Sun

[346]"Recap of Vessels Construction Data," data sheet in HJK 83/42c, box 298, file 21.

Shipbuilding, General Motors, and Hooven, Owens & Rentschler.[347]

On the other hand, if the emergency cargo ships were to be powered by triple-expansion steam engines, a propulsion system many in the shipping world thought to be obsolete, then the Maritime Commission would be able to tap under-utilized industrial facilities to supply the emergency cargo ship program. Companies with the necessary facilities for making steam engines included General Machinery Corporation of Hamilton, Ohio, the Harrisburg Foundry & Machinery Company, Flier & Stowell of Milwaukee, Joshua Hendy Iron Works of Sunnyvale, California, and Clark Brothers of Olean, New York. Therefore, the Maritime Commission decided, at the White House's insistence, to embark on an emergency program of building a fleet of ships that would be almost identical to the sixty ships Todd-Bath and Todd-California were building for the British government. This would make it easy for British as well as American crews to operate the vessels. The most significant difference would be that coal-fired Scotch boilers would power the British ships, while oil-fired water-tube boilers would power the ships of the American emergency fleet.[348]

As described in Chapter III, the cargo ships the Maritime Commission would build under its emergency program were to be based on the British tramp steamer being built by Todd-California at Richmond Yard No. 1. The prototype for that ship was the *Empire Liberty*, built by Joseph L. Thompson & Sons, Ltd., at their North Sands shipyard in Sunderland, England. The American emergency ships would have a length of 441'-6", a deadweight of 10,500 tons, and a design speed of 10-11 knots. Seven bulkheads divided the hull into eight watertight compartments: the forepeak and the afterpeak, five holds, and a machinery space for the boilers and steam engine located between holds 3 and 4. With the exception of the propulsion system, the emergency ships would be very similar to the C-2 cargo ships, which had a length of 459'-6", a deadweight of 8,794 tons, and a design speed of 15.5 knots. The Maritime Commission therefore designated the emergency ships EC-2, for emergency cargo. As already mentioned, they were often called "ugly ducklings" until the national Liberty Fleet Day on 27 September 1941, after which they were called Liberty ships. The Maritime Commission designed the EC-2 to be as simple as possible, in both construction and operation, while still providing excellent sea-worthiness. The design lent itself to extensive use of welding and pre-assembly, methods that were already greatly reducing the time necessary to build a ship.[349]

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[347]"The Liberty Ships," *Marine Engineering and Shipping Review* 46 (October 1941): 72; "Ships for This War," *Fortune* 24 (July 1941): 119.

[348]"The Liberty Ships," *Marine Engineering and Shipping Review* 46 (October 1941): 72; "Ships for This War," *Fortune* 24 (July 1941): 119. On the development of marine watertube boilers, see J.H. King and R.S. Cox, "The Development of Marine Watertube Boilers," *Historical Transactions, 1893-1943*, 476-516.

[349]"The Liberty Ships," *Marine Engineering and Shipping Review* 46 (October 1941): 72; "The EC-2 Design," *Pacific Marine Review* 39 (February 1942): 41; "The Liberty Ship," *Marine Engineering and Shipping Review* 47 (April 1942): 146-165; "British Prototype of the Liberty Ship," *Marine Engineering and Shipping Review* 47 (April 1942): 168-170; "Shipbuilding: An Achievement of Private Enterprise," *Manufacturers Record* 111 (September 1942): 25-28.

In order to facilitate mass production of the Liberty ships, the Maritime Commission simplified the propulsion system and other on-board machinery as much as possible without compromising safety. One consequence of the simplified design was that it became easier for seamen to qualify for positions as engineers in the engine room. The Bureau of Marine Navigation and Inspection set the standards men had to meet in order to qualify for the positions of chief engineer and first, second, and third assistant engineer. The bureau reduced to eighteen months the length of time that a person had to serve as a member of an engine department in order to apply for certification for the position of third assistant engineer on a Liberty ship. Experience requirements were also shortened for other positions. For example, a person had to have served as a first assistant engineer for only six months before qualifying to be a chief engineer.[350]

A few other features of the Liberty ship design are worth noting. The hull of the basic design, designated EC2-S-C1, was divided into six holds by seven bulkheads. There were also fore and aft tanks. Five of the holds were for cargo, and the sixth, located amidships, was for the boilers, steam engine, and other propulsion equipment. The bulkheads were waterproof, an important consideration for wartime duty. There were several instances of Liberty ships being severely damaged by torpedoes but surviving because intact bulkheads prevented leaks from swamping the entire ship. Liberty ships were said to have survived attacks that certainly would have doomed pre-war merchant vessels. The decks of the Liberty ships were designed without obstructions, other than midships deckhouse and the gun platforms, so that the decks, too, could readily carry cargo. Three steel masts were equipped with cargo handling booms and gear that was run by steam-powered winches. The initial intention was that Liberty ships have a crew of forty-five, but that number was increased to fifty-two during the war. In addition, Liberty ships usually carried a gun crew of thirty or more men. The midships deckhouse housed the crew's quarters, including captain's stateroom and office, engineers' and officers' quarters, crew's quarters, galleys, officers' mess and lounge, and crew's mess. The after deckhouse accommodated quarters for the gunners as well as the ship's hospital and medical storeroom. Accommodations on Liberty ships were said to be very modern, although not as spacious as those on the Maritime Commission's C-type vessels.[351]

Of the 2,648 Liberty ships build during World War II, the enemy destroyed more than 200. About fifty Liberty ships were lost on their maiden voyages. Of the Liberty ships built at Richmond Yard No. 1, those destroyed during the war included the *William K. Vanderbilt*, torpedoed by a Japanese submarine near the Fiji Islands, and the *James H. Breasted*, sunk by Japanese bombers in the Philippines. Among the durable Liberty ships built by Yard 1 were the *Alexander Majors* and the *Marcus Daly*, each of which was badly damaged by a Kamikaze airplane in the Philippines. The ships limped back to San Francisco for repairs, and the

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[350]"Machinery of Mass-Produced Cargo Vessels," *Engineering* 154 (28 August 1942): 176.

[351]"The Liberty," 146-165; L.A. Sawyer and W.A. Mitchell, *Liberty Ships* (London: Lloyd's of London Press, 1985), 23-25. This book appears to be a reprint of an earlier edition, published in 1970 by Cornell Maritime Press, Cambridge, MD. See also Lane, *Ships for Victory*, 72-89. Lane, by the way, gives EC2-S-A1 as the designation for the original Liberty design.

Alexander Majors returned to service in the war. Of the Liberty ships built at Richmond Yard No. 2, those destroyed during the war included the *James Otis*, which ran aground and was scuttled off the coast of England, and the *John Adams*, torpedoed by a Japanese submarine near New Caledonia. One of the heroic Liberty ships built by Yard 2 was the *Stephen Hopkins*, which was attacked by a German ship, the *Stier*, in the South Atlantic. Although the *Stier's* guns destroyed the *Stephen Hopkins*, the latter's returning gunfire sank the *Stier* as well. Another of Yard 2's ships, the *William Williams*, was one of those that survived because of its welded construction and waterproof bulkheads. Torpedoed by a Japanese submarine in the Pacific, the ship sustained serious damage to the aft end of the hull and was abandoned by its crew. The bulkheads held, however, and the stern settled no deeper into the water than the deck. After two days, with the after deck awash, the crew re-boarded the *William Williams*, and it was towed to New Zealand for repairs and then to Australia to be refitted as a Navy auxiliary before re-entering service.[352]

When the war ended, the U.S. was left with a mammoth inventory of ships built for the wartime emergency. As mentioned above, the Liberty ships had been considered technologically obsolete from the outset, especially because of their reciprocating steam engines. Nevertheless, the Liberty ships worked very well, and the government had to decide what to do with them. Their relatively new equipment, their excellent record of fuel economy, and their relatively shallow draft made them desirable ships for many nations and shipping companies recovering from the devastation of war. Hoarding the ships would not help the international war recovery effort, but selling or giving too many of the surplus ships to foreign competitors would be unpopular among U.S. shipping companies. Congress struck a balance between the two extremes in the Merchant Ship Sales Act of 1946, agreeing to sell several hundred surplus Liberty ships and other wartime merchant vessels to Greece, France, Norway, China, and Britain. The Act even authorized the U.S. to sell 100 ships to a former enemy, Italy, to help that country re-enter international trade. The U.S. kept other Liberty ships in government service, but private companies operated them. Most of the Liberty ships, however, were transferred to the National Defense Reserve Fleet, also created by Congress in 1946. Most of those ships were eventually sold for scrap. Meanwhile, many of the Liberty ships that went into private foreign hands were remodeled over the years, being retrofitted with marine diesel engines or being converted to new uses as tankers or container ships.[353]

B. C-4 Troop Ships

The Maritime Commission developed its design for the C-4 troop ship by basing it on a cargo steamer built by the American-Hawaiian Steamship Company. The Maritime Commission had given consulting naval architect George C. Sharp the contract to design the ship early in 1941. Sharp and Gibbs & Cox were the nation's two top firms of naval architects, and Sharp had been working with the Maritime Commission on ship design since the development of the standard C-type cargo vessels. Although the American-Hawaiian cargo steamer provided a

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[352]Sawyer and Mitchell, *Liberty Ships*, 133, 138, 141-143.

[353]Sawyer and Mitchell, *Liberty Ships*, 12-17.

model for the C-4, considerable redesign was necessary. For example, the deckhouses were enlarged, and accommodations had to be provided for officers in the midships deckhouse. The Maritime Commission took control of C-4 design in October 1941. The difficulties in developing a final design have already been recounted in the section of chapter IV describing Richmond Yard No. 3.[354]

The C-4 troop ship was much more complex to build that the Liberty ship, as the following table compiled by the Kaiser organization illustrates:

Comparison of the EC2-S-C1 Liberty Ship and the C-4 Troop Ship[355]

	EC2-S-C1 Liberty Ship	C4-S-A1 Troop Ship	C4 Exceeds EC2 By:
Length, overall	441'-6"	522'-10.5"	18%
Breadth, molded	56'-10.75"	71' -6"	28
Shaft, horsepower	2,500	9,000	260
Light weight	3,663 L.T.	10,461 L.T.	156
Gross mill wt., hull steel	3,150.2 S.T.	8,058 S.T.	156
Total # of pieces of steel, incl. pipe hangers, clips, etc.	100,000	400,000	300
Length of welded joints	47.7 miles	161 miles	238
Total wt. of machinery	736,000 lb.	1,847,888 lb.	151
Length of all piping and tubing	6.0 miles	35.5 miles	492
No. of valves	1,127	3,500	211
Length of all wire and cable	4.3 miles	37.3 miles	767
No. of electrical fixtures, fittings, & instruments	909	8,158	797
Complement of vessel	80 persons	4,209 persons	5,160
No. of separate compartments	110	370	236
Paint	2,695 gal.	12,572 gal.	366
Wt. of sheetmetal	49,916 lb.	264,000 lb.	429
Total no. of diff. items	9,600	130,000	1,254
Joiner work	15,000 manhours	190,000 manhours	1,167

(Continued on next page)

An article in *Fore'n'Aft* compared the troop quarters in a C-4 to those of the many older ships that had been converted to troop transports early in the war. Although bunks were stacked several high in the C-4's, there was nevertheless considerably more room for soldiers and their gear than in the crowded quarters crammed into the converted transports. The galleys were

[354]"Chronological History of Kaiser Company, Inc., Shipyard Number Three," 2; Lane, *Ships for Victory*, 617.

[355]"Chronological History of Kaiser Company, Inc., Shipyard Number Three," 19.

equipped with up-to-date machinery and utensils for food preparation. The C-4s also housed gymnasium, movie projection, and study facilities, and had a lounge furnished with "handsome Swedish modern tables and chairs."[356]

C. Victory Ships

The Maritime Commission began making plans in 1942 to design and build a faster, more modern cargo ship to replace the Liberty ship in the emergency shipyards when America's industrial capacity reached the point that it could supply the necessary propulsion systems without interfering with the output of Navy ships. That was already happening in late 1942, when several of the plants the commission had sponsored to build steam turbines began production. Most of those new turbines were allocated to C-type vessels and tankers, but by late 1942 the commission had also modified North Carolina Ship's contract to build C-2s instead of Liberty ships to take advantage to the increased output of steam turbines. The Maritime Commission made the decision to develop a new design in part because Great Britain had already made such a decision. British authorities concluded that they would "lose the peace" if they overproduced slow cargo ships during the war. In other words, if Great Britain had an oversupply of slow ships after the war, that nation would not be able to compete effectively for international shipping trade. The Maritime Commission concluded that the same would be true for the U.S., but the War Production Board impeded the implementation policy of moving toward a faster design. The Maritime Commission's new design for the VC2, a ship that would come to be called the Victory ship, grew out of the Liberty ship (EC2) rather than the C-type cargo ships, because the Liberty was a design predicated on simplicity and efficiency of production, a characteristic the Maritime Commission wanted to maintain in the Victory ship.[357]

Improvements in the Victory ship, as compared to the Liberty ship, would include an extra deck, greater loading capacity on the decks, searchlights and gyrocompasses, longer booms and better winches. Moreover, the Victory ship would be available in several different models, all utilizing the basic hull. Nevertheless, other features were very similar to the Liberty. For example, the main deck house amidships would accommodate most of the crews' quarters and would be configured so that it could be pre-assembled in four sections, like the Richmond yards were doing with the Liberty deckhouses at the Pre-Fab yard. Late in 1942, the Maritime Commission realized that, although the supply of steam turbines was increasing, it would not be possible to supply all of the new ships with turbines if there was a complete conversion from Liberty ships to Victory ships. The commission therefore embarked on a program to design a more powerful reciprocating steam engine as well, one that would be capable of providing Victory ships with their required speed. By April 1943, the Maritime Commission was ready to begin awarding contracts to build Victory ships. Calship and Oregonship received the first two such contracts on April 20th. A few days later, Richmond Yards 1 and 2 and several yards on the East and Gulf coasts also received contracts for VC2s. The first keel to be laid at a

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[356]"Floating Hotel," *Fore'n'Aft* 4 (7 July 1944): 20-21.

[357]Lane, *Ships for Victory*, 574-577, 583.

Richmond shipyard was on Way No. 7 at Yard No. 1 in early January 1944.[358]

In 1943, as the Maritime Commission began to gain control of material shortages, it issued contracts to some shipyards to build a new type of cargo ship called the Victory ship. It was very much like the Liberty ship in that its simplified, standardized design lent itself to the mass production methods being employed throughout the nation's shipyards, but it differed in several key respects. The Victory was wider and longer than the Liberty and designed for higher speed. The Victory would achieve higher speed by means of one of three different propulsion systems. The Maritime Commission had developed an improved triple-expansion steam engine with twice the power of the units installed in Liberties, and the Maritime Commission anticipated that supplies of steam turbines and diesel engines would soon be available for use in cargo vessels in addition to the C-types. Therefore, the Maritime Commission designed an engine room for the Victories that could accommodate any of the three possible propulsion systems.[359] The following table shows a comparison of basic characteristics of the Liberty and the Victory:

Comparison of Victory and Liberty Ships[360]

	Victory	Liberty
Length	455'	441'-6"
Beam	62'	57'
Deadweight tonnage	10,800	10,800
Cargo tonnage	9,146	9,146
Engine horsepower	6,000 or more	2,500
Propulsion power	steam turbine	steam reciprocating
Decks	3	2
Speed	15 knots	11 knots

D. Landing Ship Tank (LST)

The Landing Ship Tank (LST) was one of the largest of the dozen or so kinds of ships designed and built especially for amphibious landings of military forces. It had a length of 327'-9" and a very shallow draft (7.5'). Powered by diesel engines and twin screws, its design speed was 10 knots. Even though an LST was only about one-fifth the dead weight of a Liberty ship (2,286 tons and 10,600 tons, respectively), it took more manhours to build than a Liberty ship because of complexities in the LST design. The Maritime Commission began the LST program, but because the Navy controlled the allocation of diesel engines and would not relinquish any of its control to the commission for the LST program, the commission soon turned design and development of the LST over to the Navy. The design of the LST grew out of modifications made to an existing tanker, which had its bow retrofitted with a hinged door that could drop to

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[358]Lane, *Ships for Victory*, 577-586; "An End and a Beginning, 1943, 1944," *Fore'n'Aft* 3 (31 December 1943): n.p.; "The Anatomy of a Lady," *Fore'n'Aft* 4 (7 July 1944): n.p.

[359]Howard L. Vickery, "Shipbuilding in World War II," *Marine Engineering and Shipping Review* 48 (April 1943): 183.

[360]"Victory Steamer Design Emerges," *Pacific Marine Review* 40 (September 1943): 77.

serve as a landing ramp. The Navy awarded LST contracts to many of the yards with which the Maritime Commission had been negotiating for that work, including inland yards such as Dravo Corporation, which had long experience building barges on Neville Island in Pittsburgh, Pennsylvania, for the Ohio River trade. The Navy assigned the Maritime Commission ninety LSTs, to be built at existing yards. Forty-five of those LSTs were assigned to the Bethlehem-Fairfield yard in Baltimore and forty-five to Kaiser, but Kaiser was allowed to build a new yard, No. 4 in Richmond, to fulfill that contract.[361]

CHAPTER SEVEN: WORKING CONDITIONS AT THE RICHMOND SHIPYARDS

> This is the moment to place credit where it is due. First, as regards the ships, always and everywhere, the highest praise belongs to the men who work with their hands. The devoted effort of labor and its wholehearted cooperation is the prime force under the entire output.[362]
>
> *Henry J. Kaiser in a speech delivered at the blowing in of the blast furnace at the Fontana steelmill, 30 December 1942*

The workers at the Richmond shipyards were a diverse lot. Less than half of them (44.7 percent) were from California. Of the immigrants, Oklahoma contributed the most (19.3 percent of the immigrants, 10.7 percent of the total shipyard work force). Arkansas and Texas also contributed more than 5 percent of the shipyard work force. Minnesota, Missouri, Illinois, Iowa, and New Mexico each contributed between 2 percent and 5 percent of the workforce at the Richmond shipyards. The rest moved to the Bay Area from other parts of the country for the wartime work. After the war, many of the newcomers stayed.[363]

A. Patriotism

> In building ships, don't overlook the fact that an emotional patriotism is guiding these men. But there is, along with it, the pride of achievement, which is, I should think, also emotional.
>
> Henry J. Kaiser, 1943[364]

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[361]C.M. Taylor, "The LST--Kingpin of Invasion Fleet," *Welding Journal* 24 (April 1945): 360; Land, *Ships for Victory*, 609-611.

[362]Henry J. Kaiser, speech delivered 30 December 1942 at the blowing-in of the blast furnace at the Fontana steelmill, in HJK 83/42c, box 12, file 12.

[363]Permanente Metals Corporation, et al, *A Booklet of Illustrated Facts about the Shipyards at Richmond, California*, 32-33.

[364]Kaiser quoted in Lawrence E. Davies, "Henry Kaiser Shows His Ships," *The New York Times Sunday Magazine* (24 January 1943), 38.

This comment by Henry Kaiser characterizes much about the experience of workers in the Richmond shipyards. They may have learned new skills in dangerous work; they may have gained an appreciation (or not!) for unfamiliar on-the-job colleagues, like people of the opposite sex, or other races, or from distant parts of the country; they may have accomplished amazing things as integral parts of a complex technological system. Whatever the experience, it was couched in wartime patriotism, and corporate and government officials sought keep the fire of patriotism alive.

Foreign officials sought to keep pride and patriotism alive as well. Lord Halifax, who visited Richmond and Berkeley on 19 July 1941 applauded the efforts of workers in the East Bay. He told workers that the British people were the only thing standing between Hitler and domination of Europe. Halifax also told workers that, at the time, losses to German attacks at sea were greater than the rate at which American, Canadian, and British shipyards were building new merchant ships, yet he praised the workers for the speed with which they had built the yard and progressed toward the first launching, scheduled for less than a month away. About half of the 3,500 employees at the Todd-California yard heard Halifax's speech, and they responded to him with cheers.[365]

The U.S. Maritime Commission sought to instill patriotism and a sense of pride in accomplishment by awarding "M" flags to shipyards for meritorious production. Richmond Shipyard No. 1 received an "M" flag on 22 July 1942, during the launching of a Liberty ship, the *Joaquin Miller*, the thirty-second ship and the second Liberty ship launched by the yard. (In shipbuilding, the Maritime Commission's "M" flag was comparable to the Army-Navy "E" flag awarded to ordnance manufacturers for excellence in production. Ford's Richmond plant won the "E" award four times, receiving the initial "E" flag and then three additional stars.) Admiral Vickery was present at the launching to make the award, calling the Todd-California yard the nation's number one shipbuilder. During the ceremony, workers at Yard 1 also witnessed the commissioning of the *Ocean Victory*, the thirtieth and last British merchant vessel, as Todd-California turned the completed ship over to F.C. Cocks, local representative of the British Purchasing Commission. In keeping with the productive spirit of the day, before the tugboats had tied up to the new hull after its launch, crews at Yard 1 had already begun laying the keel for the next Liberty ship to be built on the shipway down which the *Joaquin Miller* had glided.[366]

As ships from the Richmond yards began to see service in the war, their exploits were communicated back to Richmond to inspire the workers. For example, newspapers published accounts of the *O. Henry*, built by Yard No. 1. In March 1943, the *O. Henry* was part of a convoy of ships bound for the island of Malta. The captain of the *O. Henry* was said to have loaded the ship's deck with oranges for Malta's children. On the way to Malta, German airplanes attacked the convoy, but gunners on the *O. Henry* shot down a dive bomber. The ship delivered its cargo to Malta without losing a single member of its crew. Wanting to be sure that workers in Richmond knew the story, Admiral Land sent them a telegram, closing it with, "I know every worker at your yard will take personal pride and satisfaction in knowing that your ship reached

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[365]"Halifax Calls Todd Shipyard 'A Miracle'," *Oakland Tribune* (20 July 1941), 1.

[366]"New Records Go to Todd Shipyard," *Richmond Independent* (23 July 1942), 1 and 2.

Malta and gave new courage to its brave people in their heroic fight against the Axis."[367]

In another instance, Land telegraphed the workers at Yard No. 2 in August 1943 to relay to them communications he had received from the officers of the *George B. Seldon* praising its performance and the quality of its construction. The *George B. Seldon* had just returned from North Africa with a cargo of captured German and Italian materiel. After traveling across the Pacific and Atlantic oceans and through the Mediterranean Sea, the ship's master reported that the ship's steering was superb, her speed was above average, and she had economical fuel consumption. The first assistant engineer also praised the ship's speed and fuel efficiency and expressed his appreciation for the quality of construction evident in the keel, engines, and bearings. The master of the *George B. Seldon* closed his remarks by writing, "My deep appreciation to the men and women who built her for this outstanding job of what these days is a rush order."[368]

Praises of work by shipyard workers could also include praise for elements of the Liberty design. For example, Admiral Land telegraphed the Yard 2 workers in November 1943 to convey a report by the master of the *James Smith*, launched at Yard 2 on the Fourth of July 1942.

> She has taken it on the chin plenty and is back for more. In convoy through the South Atlantic she was one of seven ships torpedoed during night of March 9th killing six of the merchant crew and five of her armed guard who were sleeping on deck. .....Large holes in deck made it look like perforated tin can. All survivors were taken off by the Navy except five volunteers who stayed with her for the five day tow into a West Indies port. Temporarily repaired she was towed to repair dock at a United States port manned by 19 surviving members of crew. Now she turns up at New York seven months later under a new master who says the *James Smith* "certainly has a sturdy hull[,] a welded-riveted job at that[,] has withstood all kinds of weather and torpedoing and still has no cracks or leaks. Navigation equipment thoroughly satisfactory. Davits OK steering engine very good. And she answers helm beautifully. Very little vibration engine room equipment absolutely OK, boilers easy steaming and economical. Evaporators, feed water heaters, all auxiliary equipment everything that one could desire. No mechanical trouble of any kind whatsoever. The *James Smith* is all a master could want - a rough tough customer - I'm proud of her. My complements to the workers for a grand job." Signed, Bernard G. Kuckens, Master. I bespeak the pride of all Americans in this remarkable tribute to the *James Smith* and the teamwork of the men who built her and the men who sail her. It proves that

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[367]Admiral Land to The Workers of Richmond Shipyard No. 1, telegram dated 22 March 1943 in HJK 83/42c, box 25, file 26. A copy of Land's telegram also appeared on the cover the 2 April 1943 issue of *Fore'n'Aft*, superimposed on a photograph of the hull of the *O. Henry* at her launching.

[368]Admiral Land to The Workers of Richmond Shipyard No. 2, telegram dated 5 August 1943 in HJK 83/42c, box 25, file 26.

together we've got what it takes to win.[369]

Fore'n'Aft was also an important vehicle in conveying stories to shipyard workers about the exploits of ships they had built at Richmond. For example, issues in the spring of 1944 carried installments of escapades of the *Robert E. Peary*, the Liberty ship Yard No. 2 had launched in just over four days in November 1942. The *Robert E. Peary's* chief cook wrote the chronicle as the ship plied the waters of the South Pacific.[370]

In July 1943, when members of the Labor Movement committee at Yard 3 learned of General Eisenhower's announcement that the Allied offensive in Europe was about to begin with the invasion of Sicily, they composed a pledge which they sent him, but not before they collected the signatures of more than a thousand of their fellow workers. The pledge stated: "I want to get in on the invasion. I will do my damndest to step up production in this shipyard 20 percent or more." Organizers of the pledge were: George Elliott, spokesman, Yard 3 field engineer; Bob Weissman, shipfitter; Charles Miles, welder; Bob Sea, flanger; Frank Rovere, shipfitter; Jacqueline Von Sicherer, expediter; Bob Pickering, office worker; and Virginia Olney, marine electrician. Clay Bedford endorsed the idea, saying:

> It shows what kind of people Richmond shipyard workers really are. It is men like Elliott and his committee who are making headaches for Hitler in the Mediterranean and who are prefabricating headaches for Hitler in the Kaiser shipyards.[371]

Another method used in the Kaiser yards to bolster the spirit of patriotism was to have wounded veterans, who had returned to the U.S. from battle, visit with shipyard workers during lunch breaks. The military visitors would tell of their experiences in the war, refreshing the shipyard workers' sense of the importance of their work.[372]

B. Organized Labor in the Shipyards

At the onset of the Hoover Dam project, Kaiser, like his partners in the Six Companies, operated Kaiser Paving as an open shop. During construction of the dam, the Six Companies worked assiduously to keep labor unions from organizing its employees. At the same time, to speed progress on construction of the dam, Six Companies' managers often imposed unsafe conditions on workers. Explosives were not stored and transported safely, and workers suffered

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[369]Admiral Land to The Workers of Richmond Shipyard No. 2, telegram dated 15 November 1943 in HJK 83/42c, box 25, file 26.

[370]"A Cook's Tour of the Pacific, or What Happens to Our Ships," *Fore'n'Aft* 4 (14 and 21 April 1944).

[371]"Production To Be Increased by 20 Per Cent," *Richmond Independent* (12 July 1943): 1; "Our Second Front," *Fore'n'Aft* 3 (23 July 1943): n.p.

[372]Jim McCloud, oral history recorded by Fredric L. Quivik, and dated 8 October 2001, in ROHO, 13.

poisoning from carbon monoxide because tunnels were poorly ventilated. The Six Companies succeeded in preventing the Industrial Workers of the World (IWW) from organizing workers at the Boulder Dam project, but eventually several locals affiliated with American Federation of Labor (AFL) craft unions formed in Boulder City to represent such trades as carpenters, steelworkers, machinists, and electrical workers. In July 1935, carpenters and steelworkers even staged a successful walkout to protest a change in the shift schedule. By the time of the Grand Coulee project, Kaiser had learned the advantages of paying his workers well and of establishing cordial relationships with their unions. He was thus in a good position to accept the strict labor-relations requirements that the Maritime Commission instituted on the West Coast when the emergency shipbuilding program began.[373]

There was variety in the extent to which unions represented shipyard workers throughout the U.S. in 1940. Thirteen craft unions that were coordinated within the AFL's Metal Trades Department represented shipyard workers in most yards on the West Coast and the Great Lakes as well as in some on the Gulf and the East Coast. The Congress of Industrial Organizations (CIO) had a single union, the Industrial Union of Marine and Shipbuilding Workers of America, that represented all crafts involved in shipbuilding. The Industrial Union had been founded in 1933 during a strike against New York Shipbuilding in Camden, NJ, and it affiliated with the CIO in 1936. The CIO affiliate was strong in yards in the ports of New York, Philadelphia, Wilmington, and Baltimore; it also represented workers in a few yards in New England and the Great Lakes, on the Gulf, and in southern California. Other eastern yards, including Bath Iron Works, Bethlehem, Newport News, Sun Ship, and the Todd repair yards, had independent unions. As the Maritime Commission embarked on its emergency shipbuilding program, Admiral Land and others knew that they had to comply with the National Labor Relations Act. They also remembered one of the lessons of World War I: that an unregulated labor market, featuring labor shortages caused by swift expansion of the industry, could lead to spiraling wage rates and rapid turnover at individual yards as competing yards enticed workers away. On the other hand, Land and other government officials did not want to enforce onerous regulations that would force workers to remain with their initial employers. Land and the others also wanted to cooperate with both national and independent unions in an effort to forestall strikes, another problem that had impeded production during World War I.[374]

During the summer of 1940 Admiral Land approached Sidney Hillman with the idea of having the government coordinate labor relations between workers and shipbuilders. Hillman was president of the Amalgamated Clothing Workers union and one of the most prominent CIO officials in the country. President Roosevelt had also put him in charge of labor matters with the National Defense Advisory Commission (NDAC) and the Office of Production Management (OPM). Under the auspices of the NDAC, Hillman appointed a Shipbuilding Stabilization Committee in September 1940. He made his aide, Morris L. Cooke, chair of the committee. Representing labor on the committee were two top AFL officials and two top CIO officials.

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[373]Foster, *Henry J. Kaiser*, 53-55, 78-80; Stevens, *Hoover Dam*, 154-155, 204-214, 231-241; Lane, *Ships for Victory*, 277.

[374]Herbert R. Northrup, "Negroes in A War Industry: The Case of Shipbuilding," *The Journal of Business* 16 (July 1943): 166; Lane, *Ships for Victory*, 268-273.

Current officials of shipbuilding companies were not appointed to the committee. Indeed, executives of companies like Bethlehem, Sun, and Newport News, which had their own independent unions, did not want to participate in an official body that would have them negotiating with representatives of national unions. Representing the shipbuilding industry instead were an academic, two attorneys, and H. Gerrish Smith, the president of the National Council of American Shipbuilders who had been president of Bethlehem Shipbuilding back in the World War I era. Admiral Land represented the Maritime Commission on the committee, and Joseph W. Powell represented the Navy. The first step the committee took was to get industry and labor to make a "no strike" pledge. The labor leaders said that their pledge was conditional on employers abiding by subsequent recommendations of the NDAC and its committee.[375]

The committee next moved to stabilize the labor market in the shipbuilding industry by establishing blanket labor agreements in each of the four shipbuilding regions: Pacific Coast, Atlantic Coast, Gulf Coast, and Great Lakes. To set those rates, the Shipbuilding Stabilization Committee convened zonal collective bargaining conferences. The Pacific Coast conference was the first to convene, with the first meeting taking place on 3 February 1941. The blanket agreements set uniform base wages to discourage labor from migrating yard to yard in search of higher wages. The parties reached an agreement in March, and the uniform minimum wage for shipyard workers on the Pacific Coast was set at $1.12 per hour. The agreement was formally implemented in April when representatives of the AFL's Pacific Coast Metal Trades Council met in Seattle with representatives of shipbuilders from the major cities on the West Coast to sign an accord that set wage scales and banned strikes and lockouts for the duration of the emergency shipbuilding program. By July, the other three zones had also reached agreements. The uniform hourly minimum on the Gulf Coast was set at $1.07, while the East Coast and the Great Lakes matched the Pacific Coast with uniform minimums of $1.12. The zonal agreements also included provisions for collective bargaining, overtime pay, fixing wage raises, grievance procedures, and eliminating lockouts and strikes. The Pacific Coast agreement included a provision for a closed shop in each of the shipyards. Concerned that an agreement with the unions would set a precedent for after the war, Bethlehem's Union Yard in San Francisco initially refused to comply with the closed-shop provision, but a May 1941 strike instigated by the Machinists' unions (including locals affiliated with both the AFL and the CIO) against shipbuilders throughout the Bay Area finally induced Bethlehem to accept the closed shop.[376]

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[375]Lane, *Ships for Victory*, 270-274.

[376]"Unions and Employers in Shipbuilding Industry Confer Here on Proposal for Coast Agreement," *Labor Clarion* (7 February 1941), 1-2; "Shipbuilding Agreement on Pacific Coast to Set Model for Other Contracts," *Labor Clarion* (25 April 1941), 1; "Ship Building Pact for Five Yards Adopted," Contra Costa County *Labor Journal* (25 April 1941), 1; "Strike of Machinists in Bay Area Halts Work in Big Shipbuilding Plants," *Labor Clarion* (16 May 1941), 1, 3; "Working Agreement for West Coast Shipbuilding Industry," *Monthly Labor Review* 52 (May 1941): 1162-1163; "San Francisco Machinists Vote Ending of Strike," *Labor Clarion* (27 June 1941), 2; "Working Agreements for Shipbuilding Industry," *Monthly Labor Review* 53 (October 1941): 880-881; Gilbert, "The Expansion of Shipbuilding," 167; Lane, *Ships for Victory*, 269, 274-290. For coverage of the May 1941 strike, see the *Oakland Tribune* (9 May 1941), 1, (10 May 1941), 1 and 3, (11 May 1941), 1 and 9, (12 May 1941), 1 and 8, (13 May

Henry Kaiser's good relationship with the AFL unions apparently played an important role in helping the Shipbuilding Stabilization Committee negotiate an agreement with the other shipbuilders on the Pacific Coast and then in bringing them all into the blanket agreement. Kaiser was beginning his shipbuilding enterprise from scratch, and he needed skilled workers. At the beginning of January 1941, the AFL in California announced that Kaiser and Todd had reached an agreement with sixteen unions concerning hours and working conditions and that all work at the Todd-California yard in Richmond would be done by union members. Then word began to circulate along the coast that the Kaiser organization was willing to pay any rate required to lure workers from other yards.[377] Attorney Harry Morton, who negotiated Kaiser's agreements with the AFL unions, recalled at an AFL convention in 1943:

> My principles were to go into each port on the Pacific Coast in the shipyards. We did not have a labor force. We wanted some experienced shipbuilders, and the rest of them knew it well. We would have welcomed every one of them into our shipyards, and if they wanted to retain their forces they had to come into the stabilization picture.[378]

Henry Kaiser publicly advocated good labor relations during the war. Speaking in September 1942 before a group of industrialists and government officials in Washington, DC, Kaiser said, "It is 100 percent union with me." He went on to chide his fellow capitalists:

> If you spend as much time and as much money on keeping advised as to how your labor feels and thinks and what it needs and wants, as you do about the development of your industry and your sales, you wouldn't have any problems.[379]

Even before the zonal agreement was reached, Todd and Kaiser hired a former union official to serve as Todd-California's personnel man. Clyde Jackson was a former business agent for Teamsters Local 70. His job at the shipyard, as stipulated by the agreement signed between Todd-California and the AFL unions, was to notify the appropriate union locals any time the

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1941), 1 and 15, (14 May 1941), 1, (15 May 1941), 1 and 12, (16 May 1941), 1 and 13; *Richmond Independent* (10 May 1941), 1 and 2, (11 May 1941), 1 and 2, (14 May 1941), 1, (16 May 1941), 1 and 2. The strike apparently did not affect the Richmond yards, because construction of ships had not yet begun.

[377]"Pact with 18 Units Assures 100 Per Cent AFL Operations on Todd Shipyard in Richmond," Contra Costa County *Labor Journal* (3 January 1941), 1; Lane, *Ships for Victory*, 277. The article in the *Labor Journal* lists all of the representatives of union locals who signed the agreement with Todd and Kaiser.

[378]Lane, *Ships for Victory*, 277-278.

[379]"Henry Kaiser's Record of Achievement Shows Union Help Is Good Investment," Contra Costa County *Labor Journal* (2 October 1942): 5.

shipyard had a need to hire men.[380]

Not surprisingly, when the Kaiser-Todd consortium announced the contract with the Maritime Commission to build and operate Richmond Yard No. 2, they also announced that Kaiser had signed a contract with the local AFL unions covering all work at the yard.[381]

The following table lists the various locals that represented workers at the Richmond shipyards and the job classifications their members held in the yards:

Job Definitions by Union Local[382]

Blacksmiths, local 168 (S.F.), local 171 (Oakland)	blacksmith, tool dresser, tool grinder operator, blacksmith II, forger, drop-hammer operator, heater forge, heavy hammer operator
Boilermakers, local 513 (Richmond) local 6 (S.F.) local 39 (Oakland)	acetylene-burner operator (flame planer, planograph, oxygraph, travagraph, oxyacetylene cutting machine), boilermaker (boiler erection), portable grinder, power-press operator, punch & shear operator in plate shop, chipper, driller, reamer, flanger, shipfitter, bolter, flanger-shrinker, heater flanger-turner, flanging press operator, rivet heater, holder-on, loft rigger, ship rigger, machine rigger, crane rigger (basins & outfitting dock), planer man, crane rigger, plate rigger, plate hanger, pressman, bending & rolling (plate shop), punch & shear operator, pneumatic riveter operator, electric & acetylene welder, unionmelt welder, production welder in ways, basins, & aboard ship, examiner
Carpenters, locals 622 & 642	cut-off saw operator, carpenter maintenance, saw-filer, table-saw operator

[380]"Jackson Elected to Shipyard Post," Contra Costa *Labor Journal* (17 January 1941): 1.

[381]"AFL Unions Get Contract for New Yards," Contra Costa *Labor Journal* (18 April 1941): 1.

[382] The data in this listing is derived from J.N. Bowman, "Job Descriptions, Kaiser Shipyards, Richmond, California, 1943-1945," Vol. I, "Vessels Positions, Job Definitions," unpublished book produced by the Kaiser organization, at Bancroft Library, University of California at Berkeley. See also Vol. II, "Craft Work Descriptions, Journeyman, Helper," and Richmond Shipbuilding Corporation, "Craft Work Descriptions, Richmond Shipyards" (1944), both unpublished books at the Bancroft Library.

Carpenters & Joiners, Dry Dockers, Waysmen, & Stage Riggers, local 2116	stage rigger, carpenter stage rigger, dockman, waysman (launching)
Coppersmiths, local 438	coppersmith
I.B.E.W., local 301 (A or B)	marine electrician, running cable, installing & fabricating conduit, electrician shop machine operator, wiring fixtures, testing, maintenance & repair
Ironworkers, local 378 (Oakland)	cable inspector, rivet heater
Laborers, local 886	laborer
Loftsmen, Shipwrights, Joiners and Boat Builders, local 1149	carpenter-joiner, shipwright
Machinists, local 824	marine machinist, machine operator I, body & fender man, maintenance, machine maintenance welder, machinist welder (in machine shop),
Operating Engineers, local 3	air-compressor operator, pump operator, engineer apprentice, oiler, marine engine oiler, crane operator, switchman, tug hoist operator (aboard ship), gas plant (acetylene & oxygen) operator, compressor house operator, gantry crane operator (whirley), locomotive (gasoline-dinky) engineer, truck crane operator
Painters, local 560	hand-brush painter, marine electric
Ship Painters, local 961	painter, paint mixer, spraypainter, sign painter
Sheet Metal Workers, local 216	flanging press operator, sheet metal power shear, sheet metal installer, sheet metal punch & shear operator, sheet metal welder
Shipfitters, local 9	loftsman, template maker II, layout man, shipfitter, erection shipfitter, steel checker, template storage man
Steamfitters, local 590	pipefitter, lead burner, pipe hanger, pipe-threading machine operator, pipe welder, marine plumber
Teamsters, local 315	hyster driver/operator, jeep driver, tractor operator

Warehousemen, local 315 warehouseman

The Boilermakers Local No. 513 represented more Richmond shipyard workers than any other union. The crafts of boilermaker and welder had more workers in the Richmond yards than any of the other crafts (each at about 20 percent of the production workforce), and the Boilermakers union represented workers in both crafts. When Kaiser first started developing the Richmond yards in early 1941, he negotiated through the AFL with the Boilermakers' two locals based in Oakland, No. 39 and No. 681. Workers in Richmond had to travel 18 miles to get clearance from the union to work in the yards, so they began petitioning the international union to charter a local in Richmond. On 31 July 1942, the Boilermakers chartered Local No. 513 as a subordinate lodge. Located in the Moose Hall, the new local immediately started processing members' records that were shipped to Richmond from Oakland, despite the fact that the office was initially furnished only with a 2" x 12" board resting on two saw-horses. Shortly thereafter, Local No. 513 started receiving members who had been recruited by the Kaiser organization in the Twin Cities and elsewhere in the U.S. (see section below on recruiting).[383]

Despite Henry Kaiser's overall cooperation with organized labor in the shipyards, there were occasional instances of disagreement. In March 1942, for example, about 1,000 men walked off the job at Richmond Yard No. 1 in response to the implementation of a work schedule that kept production going seven days a week, 24 hours a day. Some workers were therefore scheduled to work regular Sunday shifts without the benefit of overtime pay. Rumors that other shipyards were paying higher wages and that Kaiser was profiteering on his shipyard contracts fueled the workers' ire. The walkout was short-lived, as Kaiser assured workers that all profits from Yards 1 and 2 were going to amortize the Reconstruction Finance Corporation's loan with which he had built the magnesium plant and that the seven-day work week had been implemented only after reaching agreement through the war labor stabilization committee. He also asserted that the overriding consideration for everyone involved, himself and all the workers, was how to best maximize production in support of the war effort.[384]

Another source of labor unrest was the on-going strife between the AFL and the CIO over how to best represent shipyard workers, through the traditional craft unions (the AFL position) or through a single industrial union (the CIO position). The AFL-versus-CIO contest for union representation had played a role in the 1941 Bay Area strike, even though Bethlehem was the main target. Regarding Kaiser shipyards, discord between the AFL and the CIO was exhibited more at the Portland-area yards than the Richmond yards, and so will not be covered in

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[383] *Labor Journal* (3 January 1941), 1; Tables V & VI in U.S. Maritime Commission Manpower Survey Board, "Richmond Shipyards," unpublished report dated May 1944, in NARA RG-178, entry 88, box 437 Richmond Shipyards file; International Brotherhood of Boilermakers, Iron Ship Builders and Helpers of America, *Richmond: "Arsenal of Democracy"* (Berkeley, CA: Tam Gibbs Company, Printers, 1946), 31-45.

[384] "Kaiser Denounces Work Halt As Due to Pay Misunderstanding," *Alameda Times-Star* (20 March 1942).

this report.[385] One area, though, in which the CIO did play a role regarding the Richmond yards involved the issue of African-American workers access to full membership in AFL unions, specifically the Boilermakers. That issue will be covered in a subsequent section of this chapter.

Labor unrest also emanated from within the AFL as crafts fought over jurisdiction. In the Richmond shipyards, the biggest conflict arose between the Boilermakers and the Shipwrights, who were affiliated with the Carpenters union. Shipwrights had traditionally been on top of the pecking order among the crafts that built ships of wood. Not only did they possess carpentry skills, but also they were the ones who had the skills to assemble pieces of a ship on a sloping way so that those pieces would deviate from the horizontal or the vertical to the correct amount once the ship was launched and righted in the water. Steel-hulled ships were also often built on sloping ways, but the construction of steel-hulled ships involved the metal trades and not carpenters. Because the assembly of steel plate and structural steel involved riveting (and later welding), the Boilermakers union tried to claim that work. The Shipwrights union believed that they should retain the work, because of the complexity of assembling those pieces during construction. According to Archie Green, who had been a member of the Shipwrights union during the war, the Shipwrights were able to retain the work in the established yards in the Bay Area, like Western Pipe & Steel and Moore Dry Dock, while the Boilermakers were more successful at gaining jurisdiction over construction on the ways in the new yards. Green recalls that the Shipwrights lost the most jurisdiction to the Boilermakers at Marinship and lost less at the Kaiser yards in Richmond. In their post-war publication, *Richmond: "Arsenal of Democracy,"* the Boilermakers, on the other hand, called the Shipwrights' claims to jurisdiction in the Richmond yards nothing more than a "predatory" act by the Carpenters.[386]

At the Richmond yards, the Shipwrights union maintained jurisdiction over key tasks occurring throughout the construction of a ship. Prior to laying the keel, shipwrights placed keel blocks on the way. During the process of erection, as pre-assembled units were being moved into position, it was the shipwrights' responsibility to make sure that bulkheads, decks, deck houses and other components of the ship were faired-up, meaning that they were in the proper deviation from the vertical or the horizontal on the sloping way (called a declension) so that they would be in the proper relationship to the vertical or the horizontal once the ship was afloat. Shipwrights faired the ship and its components by installing and manipulating shoring and jacks. To be sure that pre-assembled units were faired up, Kaiser also employed shipwrights in Pre-Fab. Shipwrights were responsible for most of the tasks involved in launching. Two hours before a scheduled launch, they would begin the work of transferring the weight of the hull from the keel blocks to the sliding ways. The Richmond yards used a system of collapsible sandboxes in the keel blocks. During erection, the weight on the keel blocks was supported by sand within the sandboxes. Prior to launch, shipwrights would remove plugs in the sandboxes and allow the sand to drain out until it and the sandboxes were no longer supporting the weight of the hull. After the preliminary ceremonies up above, the master shipwright would release the trigger at

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[385]Lane, *Ships for Victory*, 296; Foster, *Henry J. Kaiser*, 78-79.

[386]Archie Green, oral history conducted by Fredric L. Quivik and dated 12 November 2001, in ROHO, 11-15; "Men Down Under," *Fore'n'Aft* 3 (11 June 1943): 2-3; Boilermakers, *Richmond: "Arsenal of Democracy,"* 68.

the same time as the ship's sponsor christened the bow with the bottle of champagne. The released hull would then slide down the way into the water, and the shipwrights would lay keel blocks for the next the ship.[387]

The only known set of union local records pertaining to work in the Richmond yards is those of the Shipwrights, Joiners and Boat Builders Local No. 1149, an Oakland-based local founded in 1857. Correspondence in the Shipwrights records sheds light on several issues. Some of the letters address the jurisdictional struggles that took place at the Richmond yards. They show that the Shipwrights had disagreements with unions other than the Boilermakers. For example, disputes arose concerning whether Shipwrights or Machinists should lay-out port holes, who should drill holes for and install port lights, and who should install winch foundations on the decks of ships. Other letters show how the Kaiser organization dove-tailed with the unions in implementing the management structure, which was organized by craft, as described in an earlier section. Thus, new workers assigned to work as shipwrights held the title shipwright helper. In time, if a worker's performance was satisfactory, a shipwright supervisor with a title like shipwright superintendent, master shipwright, quarterman, or shipwright foreman would write a letter to the business agent at Local No. 1149 recommending that the individual be promoted from helper to shipwright journeyman. Such letters were typed on official shipyard stationary of the Kaiser organization, i.e., Permanente Metals Corporation for Yards 1 and 2 and Kaiser Company, Inc., at Yard 3. The letters show that women as well as men were advancing in the union.[388]

Some of the letters to the Shipwrights were from Hopeman Brothers, Inc., a sub-contractor that installed insulation and finishings in deckhouses.[389] Other contractors worked at the Richmond shipyards as well. For example, William Lee Company had a contract to install magnesite flooring in the quarters and passageways of Liberty ships, and Rigney Brothers Tile had a sub-contract to install tile flooring in galleys, sculleries, and lavoratories.[390] Contractors and sub-contractors had to abide by the same work rules in shipyards as did the Kaiser organization, and that included the closed shop.

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[387]"From Noah to Now," *Fore'n'Aft* 2 (31 December 1942): n.p.; Carmichael, *Practical Ship Construction*, 265; Baker, *Introduction to Shipbuilding*, 200-201.

[388]See Records of the Shipwrights, Joiners and Boat Builders Local 1149, Acc. No. 1991/077, San Francisco Labor Archives and Research Center. On the jurisdiction disputes, see minute of meeting held at Office of the AFL Coordinator and dated 1 March 1943, in box 4, file 49; Albert B. Nelson to Local 1149, letter dated 13 March 1944, in box 4, file 44; Shipwrights press release dated 13 May 1944, in box 4, file 46; George Miller, Jr., to Stan Lore, letters dated 22 November 1944 and 13 January 1945, in box 4, file 49. For examples of letters recommending promotion, see box 5, files 10, 11, and 12. For letters recommending women for advancement, see box 5, file 12.

[389]See, for example, P.R. Boland to Local #2116, memorandum dated 22 June 1944, and Gus Razzaia, memorandum dated 7 August 1944, both in LARC, Records of Shipwrights Local 1149, box 5, folder 12.

[390]"Redmen of Richmond," *Fore'n'Aft* 3 (15 January 1943): 3.

The average shipyard worker in Richmond earned $61 per week in 1944.[391]

C. Women in the Shipyards

The experience of women working in the shipyards was not wholly new during World War II. Women were also a distinctive presence in many shipyards of the World War I era. There were three kinds of jobs that women filled during the First World War. Most women working in shipyards were in clerical and nursing jobs. Those engaged in production work usually assumed tasks considered well-suited to women's particular skills, like spinning oakum used for caulking joints. Some women, however, did take jobs that used machines and were directly involved in ship assembly and erection.[392] Women's experiences in World War II were distinctive, then, because they comprised a much larger portion of the workforce in shipyards, and because they entered many more facets of production than they had in World War I. This chapter provides an overview of the Richmond experience.

When the emergency shipbuilding program first began to make a noticeable increase in shipyard employment in 1940, yards were able to recruit workers from other manufacturing industries, from the non-manufacturing sector, and from the ranks of the unemployed. Yards were also generally able to find the majority of their new hires in close proximity, geographically speaking. Government labor officials recognized that some of the manufacturers from which the shipyards were drawing recruits were themselves performing defense-related work. Labor analysts recognized that continued expansion of industrial production would cause severe shortages of skilled workers in shipbuilding and other manufacturing sectors alike, but no one was prepared for tapping a ready source of labor: women. One notorious old-line shipyard was so opposed to hiring women that as late as July 1941 it would not even hire women to work as office secretaries. That quickly changed as labor shortages grew dire, with the nation's rapidly expanding industrial infrastructure competing with the Selective Service for suddenly scarce, able-bodied males. By 1943, about 10 percent of the nation's shipyard workers were female, and in some yards women were approaching one quarter of the workforce.[393]

Government analysts in U.S. Department of Labor's Women's Bureau recognized that the most difficult adjustment had not been physical, like providing adequate restrooms for women, nor administrative, like initiating training programs for women not accustomed to industrial work, but psychological. Men in the male-dominated world of shipbuilding had had a difficult time adjusting to women in their domain, and women often had to withstand scorn and ridicule.

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[391]Permanente Metals Corporation, et al, *A Booklet of Illustrated Facts about the Shipyards at Richmond, California*, 33.

[392]Graves, "Ships for the Seven Seas," 178-179.

[393]"Characteristics of Recently Hired Shipbuilding Labor," *Monthly Labor Review* 52 (May 1941): 1142-1145; Dorothy K. Newman, *Employing Women in Shipyards*, Bulletin of the Women's Bureau No. 192-6 (Washington, DC: Government Printing Office, 1944), 1.

By 1943, with the length of the war's duration still unknown, the government was issuing guidelines to help employers ensure that introducing women to the workplace did not hamper production or place undue hardship on women workers. Some of the guidelines aimed at assuring that women were treated equally with men in terms of pay scales and advancement, work schedules, and safety training. Other guidelines responded to the still new situations that women in industrial workplaces were creating. For example, the guidelines recommended that shipyard managers obtain the cooperation of male supervisors and workers, that they be discerning about the women they hire for various jobs, that they provide women with preliminary indoctrination into the nature of the industrial workplace and environment, and that they initiate a special counseling system for their female employees.[394]

Kaiser began hiring women to work in the Richmond shipyards in July 1942. Kaiser's Oregonship operation in Portland was one of the first in the nation to start training women for shipyard work, starting in January 1942. In April, Oregonship hired two women welders, the first shipyard in the nation to do so. By December 1942, about 15 percent of the workers at Richmond Yard No. 3 were women, while about 11 percent of the workers at Yards 1 and 2 were women. And by early 1943, women were working in the last of the all-male domains, hull erection. Peak payroll at the Richmond yards occurred in July 1943, at which time 24 percent of the workers were women. The Kaiser organization was quick to provide ample toilet and locker facilities for the women, building women's restrooms at locations throughout the production areas of the shipyards well in excess of the numbers of women working on any given shift. For example, by May 1943, Yard No. 2 had sufficient toilet facilities for as many as 3,500 women workers on a shift, but the maximum number of women working a shift at Yard 2 was 2,000. One area where Kaiser evidently provided inadequate toilet facilities, at least initially, was the Pre-Fab yard, where a men's toilet area was merely re-designated for women. Urinals were left in place, and they quickly became receptacles for trash. Toilet stalls, which had no doors for men, were retrofitted with canvas curtains for women, but the curtains quickly became soiled. After 1943, the overall level of employment began to gradually decline, but the percentage of women in the shipyard workforce continued to increase until it reach its peak during June, July, and August 1944, when 27.5 percent of the Richmond shipyard workers were women.[395]

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[394]Newman, *Employing Women in Shipyards*, 3, 6.

[395]Robert S. Poos, et al, "Industrial Health Survey of Richmond Shipyard Number One," unpublished report dated 7-14 April 1943, pp. 57, in NARA RG-178, entry 95A, box 529, Richmond Shipyard #1 file; F.W. Johnson, et al, "Industrial Health and Safety Survey of Richmond Shipyard Number Two," unpublished report dated May 1943, pp. 31-32, in NARA RG-178, entry 95A, box 529, Richmond Shipyard #2 file; "Chronological History of Kaiser Company, Inc., Shipyard Number Three," 6, 11; "Every Day is Ladies Day at Richmond," *Fore'n'Aft* 4 (2 June 1944): 8-9; Permanente Metals Corporation, et al, *A Booklet of Illustrated Facts about the Shipyards at Richmond, California*, 36; "Total Payroll & Percent Women on Payroll" (as of last day of month), a collection of unpublished graphs in HJK 83/42c, box 289, folder 1; Karen Beck Skold, "The Job He Left Behind: American Women in the Shipyards During World War II," in *Women, War, & Revolution*, ed. Carol R. Berkin and Clara M. Lovett (New York: Holmes & Meier, 1980), 56.

Women were not evenly distributed among the various job classifications. In February 1943, women comprised 13.7 percent of all production workers at the Richmond shipyards, including 40.7 percent of all laborers, 37.1 percent of boilermakers, 19.4 percent of welders, and 18.8 percent of burners, 11.5 percent shipfitters, and only 4 percent of other production job categories. In addition, 48.2 percent of the office and clerical workers at the Richmond yards were women. Yard 2 had the highest percentage of women workers, both in production jobs (17.3 percent) and office and clerical jobs (62.1 percent). In June 1944, women comprised 70 percent of all laborers at the Richmond shipyards, 41.1 percent of welders, and 33.4 percent of burners, while only 19.1 percent shipfitters and 17 percent of machinists were women. Peaks for the individual shipyards varied. Peak employment at Yard No. 1 took place in July 1943, when there were 27,500 on the payroll. Women reached 27 percent of the Yard 1 workforce in November 1943 and again in September 1944. Yard 2's peak employment was 34,500 in May 1943. The number of women workers reached a peak at Yard 2 at 30 percent in November 1943. Employment at Yard 3 peaked at 26,000 during June, July, and August 1943, and the percentage of women workers peaked in April 1944 at 29.5 percent. Yard 4 reached its peak of employment at 6,000 in December 1942 and January 1943. The percentage of women workers at Yard 4 peaked in July and August 1944 at 27 percent.[396]

Although much attention during and after the war was given to women working in blue-collar industrial jobs, like welding, there were also women working in professional jobs. Don Hardison recalls in his oral history that one of the women who worked in his production drafting department in the hull engineering office at Yard No. 3 was Lois Goetz, one of his classmates at the University of California at Berkeley. They had both graduated with degrees in architecture in 1938. Hardison also remembered some of the women who worked as draftsmen in his department. He hired one of them right out of high school. She had learned drafting in high school and wanted to attend architecture school after the war. Because she was still under eighteen at the time she was hired, Kaiser had to get her father's signed authorization before it could put her on the payroll. Another woman, who worked the swing shift in Hardison's drafting department, was also trained as a pilot. She worked that schedule because it fit the requirements of her other job, ferrying military planes from West Coast manufacturers to East Coast military bases on their way to the European theatre.[397]

Just as Henry Kaiser differed from many of his capitalist peers in his attitude toward labor unions, he also had different views regarding women in the workplace after the war ended. He did not view them as temporary workers whose employment should end with the wartime emergency.[398]

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[396]"Richmond Shipyards: Women on Payroll," table dated 27 February 1943 and attached to S.D. Bechtel to Clay P. Bedford, letter dated 27 February 1943, in HJK 83/42c, box 16, file 18; "Total Payroll & Percent Women on Payroll."

[397]Donald L. Hardison, oral history recorded by Fredric L. Quivik and dated 8 November 2001, in ROHO, 15-16, 26-27.

[398]Foster, *Henry J. Kaiser*, 131-132.

D. African-Americans in the Shipyards

In 1940, Richmond had a population of 23,642 persons, of whom 270 (1 percent) were African-American. Both of those numbers changed dramatically with the construction of the Kaiser shipyards, as tens of thousands of workers, many of them black, flocked to Richmond to find employment. About 90 percent of the African-Americans who worked in the Richmond shipyards were from the South. Although a large proportion of the black newcomers from the south had rural backgrounds, many of them had made intermediate stops in large cities of the South, where they had been introduced to urban-industrial culture and had gained some industrial skills. According to a 1947 University of California study of a limited sample of black wartime shipyard workers, only 10 percent of them claimed an agricultural job immediately prior to their shipyard employment. Although the wartime work in the shipyards presented many of the black immigrants to Richmond with a wide array of opportunities, including increased income, skills, and status, the experience was also fraught with hardship due to prevailing racism in the U.S.[399]

That blacks' experiences in Richmond were as positive as they were was due in no small part to a national wartime policy of welcoming African-American workers into the workforce without discrimination in order to maximize the labor pool for the war effort. President Roosevelt issued Executive Order No. 8802 in June 1941 prohibiting racial discrimination on the part of contractors performing war-industry work for the United States. Thereafter, the Maritime Commission inserted a clause in each of its contracts which read, "*Fair Employment Practice:* The Contractor agrees that in the performance of the work under this contract, it will not discriminate against any worker because of race, creed, color or national origin."[400] The government also established a Fair Employment Practices Commission (FEPC) to inspect job sites as a means of enforcing FDR's order.

As a consequence, many African-Americans during the war found jobs and gained skills in shipyards, which were workplaces that had previously been closed to blacks for all but unskilled jobs. Some parts of the country had relatively little racial strife in the shipyards. Others had considerable problems integrating African-Americans into a traditionally prejudiced white labor force. In the South, where most black shipyard workers were employed before World War II, albeit in unskilled jobs, the experience varied from city to city. At some yards, hiring practices during the war were fairly open, especially were CIO locals represented workers. Other yards and AFL locals excluded blacks despite Roosevelt's Executive Order. In the most egregious examples, the Boilermakers and Machinists unions, with the help of the Ku Klux Klan, reversed pre-war conditions and compelled employers to dismiss or demote skilled black workers who had worked in the yards for many years. Some yards hired blacks for skilled jobs but kept them segregated from white employees. Alabama Dry Dock and Shipbuilding Company in Mobile, for example, imported white workers even though there was a sizeable

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[399]Moore, *To Place Our Deeds*, 12, 51-70.

[400]Quoted in Lane, *Ships for Victory*, 252, note 3. See also Moore, *To Place Our Deeds*, 40-41.

black population living in the city available for employment. Under pressure from the Maritime Commission, Alabama Ship finally began hiring large numbers of blacks but segregating them to specific shipways. Under pressure from the FEPC, Alabama Ship started promoting skilled black workers and placing them on shipways that had previously been white-only. Tensions rose, sparking a race riot that injured several black workers and closed the shipyard for several days. Because of the need to maintain production, the government finally reached a settlement with the yard whereby black workers would once again be segregated on specific shipways.[401]

The Kaiser organization tried to act immediately to prevent segregation once the Kaiser yards began hiring large numbers of African-Americans in 1942. The Portland shipyards sent recruiters to New York and provided train fare to recruits who would move cross-country to Portland. Many of those recruits were blacks, and many of the Metal Trades unions had racially discriminatory practices, even though that was not overall AFL policy. The Machinists, for example, excluded blacks completely, and the Boilermakers effectively banned black members by establishing parallel auxiliary organizations. As recruits began to arrive in Portland, the Maritime Commission, Kaiser organization, and the AFL sponsored a mass meeting at which workers were addressed by Daniel Ring, director of the Maritime Commission's Division of Marine Personnel; by John Frey, president of the AFL's Metal Trades Division; and by Edgar Kaiser. The workers were told that the main objective of the emergency shipbuilding program was production. As the story goes, when Edgar Kaiser was asked whether he could maintain production if there was racial segregation in the Oregon shipyards, he responded, "No."[402] Nevertheless, an unsavory business agent for the Boilermakers local, Tom Ray, set matters back when he started demoting black workers within the union job classification scheme. It took the combined efforts of the War Manpower Commission, Shipbuilding Stabilization Committee, War Production Board, and National Labor Relations Board to investigate Ray's wrong-doing and eventually convince the national AFL to force him out of the local.[403]

Racial problems arose in Kaiser's Richmond shipyards, due primarily to the discriminatory policies and practices of the Boilermakers, the union with the most members in the shipyards. As mentioned above, the Boilermakers and Machinists were both whites-only organizations, yet federal regulations prohibited racial discrimination in the workplace. FDR intervened personally to compel the Machinists locals to issue certificates to qualified black workers. The Boilermakers initially granted waivers to prospective black workers so that the shipyards could hire them without discrimination. As the percentage of black workers grew, however, they could no longer be overlooked, because under the Pacific Coast Master Agreement between the unions and the shipbuilders each yard was a closed shop. Moreover, Kaiser had given the Boilermakers authority over the hiring of workers in the skill areas under

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[401]Northrup, "Negroes in A War Industry," 163-165, 168-170; Lane, *Ships for Victory*, 252-253, 255-256.

[402]Lane, *Ships for Victory*, 254.

[403]John Frey to Henry Kaiser and Harry Morton to Henry Kaiser, telegrams dated 22 October 1942, both in HJK 83/42c, box 13, file 30; Northrup, "Negroes in A War Industry," 161-163, 165; Foster, *Henry J. Kaiser*, 79-80.

the Boilermakers' jurisdiction. A fundamental conflict therefore arose at Kaiser and the other Bay Area shipyards. The Boilermakers tried to resolve the problem by implementing a 1937 amendment to the union's constitution and creating auxiliary organizations, attached to the union locals, which blacks could join. Each auxiliary was subsidiary to its Boilermaker local, and the local controlled all the dues collected by the auxiliary from black members. Blacks could join and pay dues to the auxiliaries and thereby gain admittance to employment in the shipyards, but the auxiliary could not represent black workers in grievance proceedings and black auxiliary members had no rights to vote or otherwise participate in the affairs of the Boilermaker locals themselves. Black members also received smaller insurance benefits. The National Association for the Advancement of Colored People (NAACP) filed a complaint with the National Labor Relations Board (NLRB), but the NLRB did nothing more than criticize the Boilermakers' practice.[404]

The exclusionary practices of the Boilermakers quickly put the AFL in a difficult position, and officials tried calm the waters without impinging on the Boilermakers. Responding to the discord, the Contra Costa County *Labor Journal* quoted FDR on its front page in September 1942: "Remember the Nazi technique: "Pit race against race, religion against religion, prejudice against prejudice. Divide and conquer." We must not let that happen here. We remember what we are defending: liberty, decency, justice."[405] The secretary of the California State Federation of Labor also tried to calm the waters, making a vague statement urging against the inflammation of racial antagonism, stressing that the AFL and African-American groups were working together to counter racial animosity and suggesting that those who emphasized points of disagreement rather than agreement were foes of the labor movement. He said that it was the policy of the AFL that blacks be given equal opportunities to work.[406] Interestingly, he did not say that it was AFL policy for blacks to have equal access to union membership.

Workers at Marinship in Sausalito took the lead in resisting the Boilermakers' racist policies regarding union membership. Headed by Joseph James, Marinship workers and others

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[404]Charles Wollenberg, "James vs. Marinship: Trouble on the New Black Frontier," *California History* 60 (Fall 1981): 267. The article appears in slightly revised form as chapter 7, "Blacks and Whites," in Charles Wollenberg, *Marinship at War: Shipbuilding and Social Change in Wartime Sausalito* (Berkeley, CA: Western Heritage Press, 1990), 70-84. The article was reprinted in its original form under the original title in Daniel Cornford, ed., *Working People in California* (Berkeley: University of California Press, 1995), 159-179. See also Northrup, "Negroes in A War Industry," 165.

[405]FDR quoted in "Race Prejudice Must Go!" Contra Costa County *Labor Journal* (25 September 1942): 5.

[406]"Haggerty Says Labor Solving Race Question," Contra Costa County *Labor Journal* (17 December 1942): 6. Haggerty's statement also appears as an essay entitled, "Fanning of Racial Antagonism Must Be Stopped," in *Weekly Newsletter from California State Federation of Labor* (1 December 1942): 5, which is available at San Francisco Labor Archives and Research Center, San Francisco State University (hereinafter cited as LARC).

formed the San Francisco Committee Against Segregation and Discrimination to organize opposition to the Boilermakers' discrimination. James was an accomplished musician and active member of the NAACP who went to work at Marinship in 1942 and quickly became a skilled welder. In addition to helping form the Committee Against Segregation and Discrimination, James headed a Negro Advisory Board at Marinship, which worked with management to try to diffuse racial tensions at the yard and to urge workers of all races to unite in their efforts to defeat fascism. Meanwhile, half of the Marinship's black workers doing jobs under Boilermakers' jurisdiction refused to join the auxiliary. In November 1943, the union ordered Marinship to fire all black workers who had not joined the auxiliary. The Committee Against Segregation and Discrimination voted to support the continued boycott of the auxiliary. On November 26th, management began informing black workers reporting to work that the union had withdrawn their clearances and that they could no longer work at Marinship under the closed-shop agreement without joining the auxiliary. In response, hundreds of workers staged a demonstration outside the shipyard gates, a demonstration that remained peaceful with the help of black deputies of the law enforcement agencies. There were conflicting reports in various media outlets, with some reporting that most blacks walked off the job and others reporting that a majority of blacks continued working at Marinship.[407]

News of the disruption reached Admiral Land, who urged black workers at Marinship to join the auxiliary under protest while they continued building ships. When workers refused, Land asked Marinship to postpone the layoffs, but management said it was compelled by the agreement with the union to enforce the union's demands. James and seventeen other workers filed suit in federal court, asserting that their fight was not against organized labor but against discrimination. The San Francisco law firm of Andersen & Resner with assistance from Thurgood Marshall, attorney for the NAACP, represented James and his colleagues. James argued that the Boilermakers' whites-only policy really discriminated against blacks, because the union did admit members of Chinese and American Indian ancestry. Indeed, the business agent for Local No. 6, Ed Rainbow, was an Indian. The judge issued a temporary restraining order to suspend the layoffs until the trial. During the trial in December, the Boilermakers argued that the courts had no jurisdiction in the matter. The court agreed and dismissed the case on 6 January 1944. The plaintiffs next filed a case under state law in Marin County Superior Court, and the judge there issued another restraining order to forestall the layoffs.[408]

Meanwhile, FDR's Fair Employment Practice Commission (FEPC) investigated the Boilermakers' policy in December 1943, ordering the union to cease all racially discriminatory practices and ordering five shipbuilders on the Pacific Coast, including Calship (jointly owned by Bechtel and Kaiser), to cease enforcing provisions of the closed-shop agreement that resulted in discrimination. The employers appealed the order. The appeal process took a year, during

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[407]Wollenberg, "James vs. Marinship," 269-270; Albert S. Broussard, *Black San Francisco: The Struggle for Radical Equality in the West, 1900-1954* (Lawrence: University Press of Kansas, 1993), 158-165.

[408]Wollenberg, "James vs. Marinship," 270-272; Brief for Respondent in *Joseph James v. Marinship, et al*, S.F. No. 17,015 in the Supreme Court of the State of California, dated 10 July 1944.

which time the commission suspended the order. The commission did not, however, drop its advocacy to end discrimination by the Boilermakers. The FEPC's chairman attended the Boilermakers' annual international convention at Kansas City and urged the union to change its policies and practices. One of the Boilermakers locals in the East Bay, No. 681, sent a resolution to the convention urging the international to admit members without regard to race or other factors. Supporters of the resolution gathered signatures from about 6,000 workers at Bay Area shipyards. FDR and more than twenty prominent black citizens also sent appeals to the convention that the union open its membership policies, and AFL president William Green advocated the change in a speech on the convention floor. The only change the Boilermakers made, however, was to give auxiliary members more rights and benefits. The union still insisted that blacks join auxiliaries, and the union still limited membership in auxiliaries to less than full union membership. From the east side of the bay, William Smith, a black leader of the Richmond auxiliary, addressed the convention (in a break with previous rules precluding auxiliary representation to the international convention) saying he welcomed the change.[409]

The Marin County Superior Court did not find the Boilermakers' change in policy compelling, however. In February 1944, Judge Edward Butler ruled that Boilermakers policy was discriminatory and consequently in conflict with the policy of the State of California. He therefore ordered the union not to require blacks to join the local auxiliary and ordered Marinship not to terminate workers who refused to join the auxiliary. The Boilermakers and Marinship appealed Judge Butler's decision to the California Supreme Court. In their brief presented to the Supreme Court, James' attorneys argued:

> The placing of Negroes in auxiliaries is like putting Jews in Ghettos. It is the vilest, most barbarian form of discrimination and is based on nothing but blind prejudice and hatred. That men should harbor such thoughts in a day and age when we are fighting a great war to liberate the world of such practices is a disgraceful and disturbing thing to contemplate.[410]

Meanwhile, the Boilermakers continued not admitting blacks as members, Marinship continued to employ blacks who did not join the auxiliary, and black workers at other Bay Area yards filed similar complaints in local courts. On 2 January 1945, the California Supreme Court issued a unanimous opinion upholding Judge Butler's decision. Not only did the justices find that the Boilermakers' policy was in violation of California statute, but they also found that Marinship, in its hiring practices, was obligated under statute not to abide by the Boilermakers' discriminatory policy. In the aftermath of the Supreme Court opinion, Joseph James issued a statement:

> We have obtained in this decision what we were fighting for--that is, the privilege of coming to the union not as Negroes but as Americans. We have conducted our

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[409]Wollenberg, "James vs. Marinship," 272-274. On the parallel struggle for black workers at Calship to gain full membership in the Boilermakers, see Josh Sides, "Battle on the Home Front: African American Shipyard Workers in World War II Los Angeles," *California History* 75 (Fall 1996): 250-263.

[410]Brief for Respondent in *Joseph James v. Marinship*, 15.

> battle strictly on a pro-union basis. We engaged in no underhanded knocks at the Boilermakers' union or of the labor movement.[411]

Numerous editorialists emphasized that the decision was in opposition to discrimination, not the closed shop. The Boilermakers complied with the court decision, but the union's initial intent was to create segregated locals, giving all locals equal status within the union. Whether that solution would have satisfied the courts in California was never tested, because in practice all of the Boilermaker locals in the Bay Area quickly became fully integrated.[412]

Although *James v. Marinship*, was the most prominent case in the Bay Area, discrimination by the Boilermakers hampered blacks' efforts to gain employment in Richmond as well. As the migration of African-Americans to Richmond accelerated, the Boilermakers tried to keep blacks out of the Kaiser yards by requiring that they show proof of having lived in Contra Costa County for a year, a requirement that did not apply to white workers. The rule also prevented long-time black residents of Alameda County or other Bay Area communities from gaining certification by the union. As the need for workers grew, however, Boilermakers Local No. 513, the Richmond local, established Auxiliary No. A-36 in February 1943 for African-American workers in jobs under its jurisdiction. Previously, black workers at the Kaiser yards had been referred to No. A-26 in Oakland, the first Boilermakers auxiliary in the Bay Area. As with other Boilermakers' auxiliaries, members of No. A-36 could not vote on union matters but still had to comply with union decisions on their behalf. Moreover, Auxiliary No. A-36 could not refer prospective black workers to Kaiser for employment, even though one of Local 513's important functions was to refer white members to the shipyards' personnel office for employment. Rather, Auxiliary No. A-36 merely served the function of collecting dues from black workers whom Kaiser had hired through other channels. For that reason, a man named Williams named Boilermakers Local 513 and the Kaiser shipyards in a complaint filed in the wake of victory in the *James v. Marinship* case.[413]

Despite the auxiliary's role in the Boilermakers' system of discriminatory practices, it nevertheless helped its members to develop a strong sense of union consciousness, something that had heretofore been denied them because of their absolute exclusion from so many labor organizations. Headed by Rev. William Smith, who had moved to Richmond from Texas, Auxiliary No. A-36 gave African-Americans an institution in the community where they could meet and learn the skills of working together effectively for social change, not only in the workplace but also in the community. Through the auxiliary, black workers in Richmond were able to organize and join groups like the Shipyard Workers Committee against Discrimination,

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[411]"Marinship Fight Won by Negroes," *People's World* (3 January 1945), 1; also quoted in "Negroes Must Have Equality in Unions Says Supreme Court," *Labor Herald* (5 January 1945), 4.

[412]Wollenberg, "James vs. Marinship," 274-276.

[413]Johnson, *The Second Gold Rush*, 72-73; Moore, *To Place Our Deeds*, 59; Ray Thompson, oral history conducted by Jesse J. Warr and dated 11 October and 6 November 1978, in LARC, p. 59.

which specifically worked on such local issues as ending segregation within Boilermakers Local No. 513 and improving housing for black families, and the United Negro Labor Council (UNLC), which helped fight discrimination by the Boilermakers at the regional and national levels. Ray Thompson, a San Francisco native educated at the Tuskegee Institute, founded the Shipyard Workers Committee against Discrimination in 1942, housing its offices in his Berkeley home. Cleophas Brown, a leaderman at Richmond Yard 2, was prominent in the activities of the UNLC and the Richmond branch of the National Association for the Advancement of Colored People.[414]

As Shirley Ann Wilson Moore describes, African-American women working in the Richmond shipyards "faced dual discrimination" because of their race and their gender. In *To Place Our Deeds*, Moore recounts several instances of black women, like Flora Hilliard, Elmira Ake, and Frances Mary Albrier, who as individuals mounted heroic challenges to the Boilermakers and other unions, which were focusing their discriminatory practices on keeping black men out of the workplace while ignoring completely the fact that there were also black women with the skills and desire to work at other than menial jobs in the shipyards. Under pressure from employers and the government, the Boilermakers had begun admitting women to membership in September 1942, but the overriding racist attitude of the union still precluded black women from full membership.[415]

Blacks were not the only minority groups to find employment in the shipyards during the war. Chinese-Americans, American Indians, and Hispanics were also represented, but African-Americans were by far the largest minority group. Although Chinese-Americans had sustained discrimination in California for nearly a century, those old feelings were overwhelmed during World War II because both China and the U.S. were allied in the fight against Japan. American Indians formed a very cohesive community in Richmond, despite the fact that they came from many tribal backgrounds and parts of the country. They even had their own intertribal governing council that was willing to send unruly individuals back to their reservations as a means of maintaining good order within the Richmond community. The Kaiser organization eventually worked to celebrate the diversity of its shipyard workforce, especially through the weekly newspaper, *Fore'n'Aft*. Despite the public display of support for minorities and women in its workforce, the Kaiser organization did little to overturn the Boilermakers' discriminatory policies and also brought pressure to bear on black employees and discouraged them from becoming too bold in their advocacy. For example, Kaiser fired black counselor Don H. Gipson in early 1943 for challenging layoffs of black workers and for attending a meeting of the Shipyard Workers Committee.[416] In early 1944, when the regional director of the Fair Employment Practices Commission praised the Kaiser organization, both in Richmond and Oregon, for its exemplary record in hiring minorities without discrimination, the FEPC may have been seeking to publicly encourage fair practices through positive reinforcement rather than

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[414]Caption under photo of C. Brown in Jane Marx, "Lincoln Knew," *Fore'n'Aft* 5 (9 February 1945): 3; Johnson, *The Second Gold Rush*, 72-73; Moore, *To Place Our Deeds*, 59-63.

[415]Moore, *To Place Our Deeds*, 57-59. See also Johnson, *The Second Gold Rush*, 71-72.

[416]Wollenberg, *Marinship at War*, 72; Johnson, *The Second Gold Rush*, 57-58, 78.

create a negative atmosphere by criticizing any shortcomings the Kaiser organization may have exhibited.[417]

During the war, the Maritime Commission, the Department of Labor, and other government agencies did not collect as many statistics concerning African-American workers in the shipyards as they did for women in the shipyards. Statistics concerning percentages of black workers in some specific shipyards are available, but overall figures are lacking, especially for such details as the extent to which blacks were admitted to skilled or supervisory jobs, their rates of advancement, and the extent to which shipyards tended to form either segregated or integrated crews. In the Bay Area, the percentage of black workers in the shipyards steadily grew from essentially zero at the beginning of the emergency shipbuilding program to about 3 percent in 1942, 7 percent in 1943, and 10 percent by the end of the war. Seventy percent of the black workers who migrated to the Bay Area during the war worked in the shipyards.[418]

The government did several things to try to recognize the contributions of African-Americans to the war effort and to American history. The first Liberty ship named for an African-American was the *Booker T. Washington*, launched at Calship on 29 September 1942. Renowned singer Marian Anderson christened the ship, and Mary McLeod Bethune, National Director of Negro Affairs for the National Youth Administration gave the main address at the launching ceremony. The Maritime Commission also planned that, after the sea trial, Calship would deliver the *Booker T. Washington* to the command of Captain Hugh Malzac, the only African-American in the nation to hold a master's certificate. The Richmond yards built four ships that were named in honor of African-Americans. Three were named for individuals: the *Robert S. Abbott*, the *John Hope*, and the *George Washington Carver*. The *Fisk Victory* was named to honor Fisk University, the black university in Nashville.[419]

As mentioned above, Andrew Higgins had proposed having segregated black and white crews compete against each other as a means of stimulating productivity at his innovative New Orleans shipyard. Because the yard was never built, his idea for having the two races compete against each other was never tried. Nevertheless, it arose again in Richmond. Jim Bains worked for the Kaiser organization at Yard No. 2 as a "Negro Counselor" (it is not known whether Mr. Bains was African-American, and it is difficult to tell from his letter). In an October 1943 letter to Henry J. Kaiser, he suggested transferring all black workers from Yards 2, 3, and 4 and from Pre-Fab to Yard No. 1 and establishing it as an all-black yard. To execute the plan, he acknowledged, Kaiser would have to obtain approval to operate Yard 1 as an open shop from the various craft unions, especially the Boilermakers who did not admit blacks as members. His

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[417]"Minority Group Actions of Kaiser Lauded," *Richmond Independent* (7 January 1944), 9. For brief mention of some of Kaiser's shortcomings and citations to sources, see Richard Boyden, "'Where Outsized Paychecks Grow on Trees,' War Workers in San Francisco Shipyards," *Prologue: Quarterly of the National Archives* 23 (Fall 1991): 253-259.

[418]Lane, *Ships for Victory*, 256-257; Wollenberg, *Marinship at War*, 71-72.

[419]"Liberty Named for Noted Negro," *Pacific Marine Review* 39 (October 1942): 99; "Democracy at Work," *Fore'n'Aft* 3 (21 May 1943): n.p.; Moore, *To Place Our Deeds*, 65-66.

reasons for segregating workers were numerous: an all-black yard might inspire black workers to perform better because they would have better opportunities in that yard for advancement; segregating workers would end racial friction due to the large number of white workers who had moved to Richmond from the South; and obtaining a waiver from the craft unions and thereby freeing blacks from the necessity of joining unions would expand the supply of workers available to the Richmond yards.[420] Kaiser referred the matter to Clay Bedford, who, after conferring with Edgar Kaiser, decided that the disadvantages of the proposal outweighed any possible advantages. Among other things, Bedford was concerned that segregation might allow an inadvertent occurrence to escalate into race riots: "If the black commuter train ever got in the way of the white's commuter train, there would be the biggest riot you ever saw."[421]

E. Workplace Safety

Shipyards were very dangerous places to work. Workers moved, cut, shaped, welded, and riveted large pieces of steel using big, sharp, and hot pieces of equipment. As a consequence, they were subject to head injuries, eye injuries, injuries to limbs and digits, and abdominal injuries; to cuts, fractures, bruises, strains, sprains, and burns; to slips and falls and to falling, flying, or moving objects. They also came into contact with hazardous substances. Shipyard workers received safety training and safety equipment. Nevertheless many workers were injured because they were careless. Other injuries resulted from carelessness by workmates, faulty equipment, or accident. According to government studies, the shipyard was considered more hazardous than the average industrial workplace. Therefore, virtually every shipyard had a safety department in charge of safety training and safety inspections. Initially, the Maritime Commission left safety matters in the hands of each shipyard, specifying only that each yard put a resident plant engineer in charge of inspection to insure that safety measures were being implemented. With all the new people being employed in shipyards, however, reports began to circulate in the summer of 1942 that accidents were increasing more rapidly than employment. Following a formal study sponsored by the Maritime Commission, the commission asked the Navy to help formulate a minimum set of safety standards. New rules were promulgated in February 1943, after which the commission sent consultants to shipyards to enforce the rules.[422]

According to a British observer in the 1930s, the United States pioneered the implementation of safety measures and safety equipment for shipyard workers. Notable

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[420]Jim Bains to Henry J. Kaiser, letter dated 3 October 1943, in HJK 83/42c, box 16, file 18; Lane, *Ships for Victory*, 252.

[421]Clay Bedford to E.E. Trefethen, memorandum dated 8 October 1943, in HJK 83/42c, box 16, file 18.

[422]Frank S. McElroy and George R. McCormack, "Shipyard Injuries and Their Causes, 1941," *Monthly Labor Review* 55 (October 1942): 680-684; Frank S. McElroy and George R. McCormack, "Fatal Work Injuries in Shipyards, 1943 and 1944," *Monthly Labor Review* 61 (July 1945): 75-87; Lane, *Ships for Victory*, 446-448.

American shipyard practices not often seen in other countries included workers wearing hardhats to protect against head injury and wearing steel-toed shoes to protect against foot injury. Another innovative practice was to have workers on staging wear a safety harness attached to a rope to prevent serious falls.[423]

The Kaiser organization initiated its safety program for the Richmond yards immediately upon beginning construction of Yard 1. Kaiser transferred William Kirby from Permanente Cement to Yard 1 at the beginning of February 1941 to take charge of the safety program. His first task was to inspect all construction machinery being assembled to be sure it was equipped with necessary guards and that movable equipment, like trucks and cranes, was equipped with appropriate warning signals. Kaiser provided all construction workers in the Richmond shipyards with goggles and safety hats (hard hats), and the practice continued once workers involved in shipbuilding began to arrive. Kaiser issued such paraphernalia to each employee upon hiring, and the articles remained in possession of the worker until termination of employment. The employer also provided other articles, like safety belts and respirators, on an as-needed basis. Articles could be checked out from the warehouse like any other tool. An employee was responsible for replacing lost goggles, hard hat, or other safety equipment, but Kaiser replaced any safety equipment damaged during work.[424]

The safety hats worn in the Richmond yards were aluminum and were known as McDonald hard hats. The Kaiser organization used insignia on the hard hats to identify the workers' crafts and rank. All of the insignia featured the standard logo for the Richmond shipyards, indicating whether the worker was at Yard 1, 2, 3, or 4. Accompanying the logo would be a symbol, depending on whether a worker was a marine electrician (clenched fist with emanating bolts of electrical energy), a boilermaker (crossed ball-peen hammers), a riveter (three black rivets), an operating engineer (a crane), a janitor (two crossed brooms), etc. Riggers insignia featured a color-coded band and star, depending on whether a normal rigger (blue), a stage rigger (yellow), or a slinger and plate hanger (light green). Supervisors wore stars in the area above the craft designation indicating whether they were leadermen (one star), foremen (two stars), or superintendents (three stars). In February 1942, Clay Bedford sent Admirals Land and Vickery each a Mcdonald safety hat with the Richmond shipyards logo. Instead of the symbol for one of the crafts, Land's hat carried a crown and Vickery's hat exhibited a broad ax, which Bedford wrote Vickery was able to handle well. Both hats carried four stars, for "Big Chief."[425]

As Kaiser developed additional yards at Richmond, William Kirby moved from having charge of safety at Yard 1 to being the all-yard safety coordinator. Each yard had its own safety

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[423]Montgomerie, "Shipbuilding Practice Abroad," 166-167.

[424]Kaiser Company, Inc., *Richmond Shipyard Number Three-A*, 26; Kramer, "The Story of the Richmond Shipyards," 65-66.

[425]Clay Bedford to Admiral Land and Bedford to Admiral Vickery, letters dated 16 February 1942 in HJK 83/42c, box 25, file 26; Kaiser Company, Inc., *Richmond Shipyard Number Three-A*, 116-117.

engineer, who reported to Kirby. They were Mel Sartain at Yard 1, James E. McDonald at Yard 2, David Kaye at Yard 3, and Sam Jackson at Yard 4. Kaye, who had also performed safety work for Kaiser on the Grand Coulee project, eventually became the all-yard safety coordinator for the Richmond yards, supervising a total of 143 safety engineers and safety inspectors as of October 1943. Despite the attention to safety, there were eighty-five fatalities at the Richmond shipyards between January 1941 and October 1945. During that period, the Richmond yards logged 557,347,000 manhours of work, meaning there was one fatality for every 6,550,000 manhours.[426]

The Records of the U.S. Maritime Commission at the National Archives include reports describing fatalities. A few examples from Yard No. 3 may be representative. In March 1944, a loft rigger was arranging sandbags in a lifeboat during a davit test. The lifeboat was hanging over the side of a ship moored at the outfitting dock. A weld in a stabilizing line broke, causing the lifeboat to shift and tossing the rigger out. He fell 36 feet to the water, hitting his head on the way down, which knocked him unconscious. Consequently, he drowned in the water. In September 1944, a plant police officer at Yard 3 was directing traffic when a bus struck him. In February 1945, a rigger was riding on the sideboard of a truck crane. The crane operator moved the boom in order to avoid a telegraph pole. As the boom swung around, the counterbalance of the crane crushed the rigger against the gas tank of the truck. The next month, a shipwright helper was loosening a turnbuckle when a connecting piece came loose, fell, and crushed his skull. Each accident report included actions Kaiser's safety organization took to prevent such accidents in future. After the crane accident, for example, the safety staff reminded all employees to heed the "No Riders" signs posted on all moving equipment, and all moving-equipment operators were reminded that they were not to move their equipment until after they had checked to see that there were no riders.[427]

In addition to fatalities, the Maritime Commission also recorded the frequency of lost-time accidents per million manhours of work at each of its shipyards. In 1942, the national frequency rate was 37.91, and the rate in yards on the Pacific Coast was 37.37. In Richmond, Yard No. 1 had a rate of 28.88, Yard 2 had a rate of 21.19, and Yard 3 had a rate of 17.60.[428]

F. Plant Protection (Fire & Police) and Sanitary

A program related to safety at the Richmond shipyards was plant protection, which included both in-house fire and in-house police departments, supervised by a fire warden and a

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[426]John Roche, "Kaiser Company, Inc., Richmond Shipyard No. 3," unpublished Accident Prevention Survey report dated 28 August 1942, in NARA RG-178, entry 95A, box 529, Kaiser Company, Inc. #3 file; Kramer, "The Story of the Richmond Shipyards," 67.

[427]Report attached to David Kaye to U.S. Maritime Commission, letter dated 20 April 1945, in NARA RG-178, entry 95C, box 536, Lee O. Hughes Regional Safety Consultant file.

[428]Table no. 2 attached to "Accident Experience," unpublished, undated report in NARA RG-178, entry 95C, box 534, file "A".

police warden, respectively. Ray Waddell had overall charge of plant protection for the four Richmond yards. In 1943, when employment was at its peak, the plant protection departments at the yards had a total of 864 employees, of whom 285 were women. Duties of the plant protection staff included patrolling the yards, guard duty in guard towers and at entry gates, and directing traffic. Staffs had training in police procedures, fire protection, safety, and first aid. There was not a single major fire at the Richmond yards during World War II.[429]

The training, safety, and plant protection departments cooperated to be sure that every new employee hired at the Richmond yards received training in overall yard layout, police and fire protection, safety, and industrial hygiene. Women in the safety department provided special training to new women shipyard workers to cover such topics as protective clothing, shoes, and equipment, rules for wearing bandannas, and the prohibition of wearing jewelry.[430]

Safety and health inspectors were also concerned with the water supply and sewage disposal. The shipyards were supplied with potable water by Richmond's municipal water system. The shipyards discharged untreated sewage into the San Francisco Bay.[431] The following statement sums up the difference between standard practice in the 1940s and standard practice at the beginning of the twenty-first century: "As it is customary for all industrial plants of this area, the shipyard [no. 4] discharges all sewage via septic tanks into the Bay."[432] Because Yard 4 was at the head of the Santa Fe Channel, the septic tanks were needed to haul sewage to the bay. Yards 2 and 3 were more conveniently located, so sewage could be piped from toilet buildings, by means of eleven lines in the case of Yard 2 and about twenty lines in the case of Yard 3, directly into the bay. The practice of piping sewage directly to the bay proved problematic at the Pre-Fab plant, where rain and high tide could cause the sewage system to back up to the yard, causing sewer odors to spread through the Pre-Fab work areas. In 1943, the State of California asked the Kaiser to implement a "new and improved" method of sewage disposal at Yard No. 2, but it merely entailed linking all the discharge lines to a single trunk line, which would convey sewage to the City of Richmond's discharge line west of the yard. The system involved no sewage treatment before discharge into the bay.[433]

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[429]Kramer, "The Story of the Richmond Shipyards," 66, 68.

[430]Kramer, "The Story of the Richmond Shipyards," 67.

[431]Philip Drinker, et al, "Industrial Health Survey of the Richmond Yard #3," unpublished report dated 28-29 August 1942, p. 5, in NARA RG-178, entry 95A, box 529, Kaiser Company, Inc., #3 file.

[432]Harry G. Beck, "Kaiser Cargo, Inc. (Richmond No. 4)," unpublished Industrial Health and Safety Survey dated February and March 1944, p. 4, in NARA RG-178, entry 95A, box 529, Kaiser Cargo Co. #4 file.

[433]Robert S. Poos, et al, "Industrial Health Survey of Richmond Shipyard Number One," unpublished report dated 7-14 April 1943, p. 60, in NARA RG-178, entry 95A, box 529, Richmond Shipyard #1 file; Robert S. Poos and James F. Morgan, "Industrial Health Survey of the Richmond Shipyard Number Three," unpublished report dated 14-19 April 1943, p. 30, in NARA RG-178, entry 95A, box 529, Kaiser Company, Inc., #3 file; F.W. Johnson, et al,

G. Recruiting

During World War I, the greatly expanded shipbuilding industry necessitated a major effort by the federal government and by the industry to recruit new workers to the shipyards. To coordinate recruiting efforts at the national level, the government created the U.S. Employment Bureau within the Department of Labor. The Employment Bureau in turn established Community Labor Boards in industrial cities where shipyards and other munitions plants were located. Each local board consisted of three persons: an employee of the Employment Bureau who chaired the board, a representative of industry, and a representative of labor. Government and industry mounted a publicity campaign that included advertisements and articles in newspapers and labor journals, widely distributed posters, and a network of labor scouts and recruiters. In addition to recruiting new workers to industry, the local boards were supposed to try to curtail the practice during World War I of one shipyard luring workers from nearby yards or other essential munitions plants.[434]

The shipbuilding industry faced tremendous labor shortages during World War II as well. The problem was exacerbated because the United States' involvement in the war was greater than it had been in World War I, and it lasted longer. During the course of the war, the United States mobilized more the 16,000,000 people into military service, more than 98 percent of whom were men. The War Manpower Commission had the responsibility of setting policies aimed at ensuring that the various sectors of the economy had adequate labor resources to produce necessary supplies for the war effort, but the commission did not have authority over several agencies that were empowered to secure recruits for their own programs or sectors of the economy. For example, the Selective Service System was independent of the commission in drafting men for military service. Other labor classes that the commission could not control included agricultural workers, the Civil Service, railroad workers, and the merchant marine. As a consequence, during the height of wartime production, the nation underwent severe labor shortages in some regions and some sectors of the economy, such as the Pacific Coast, where many of the emergency shipyards and airplane factories were located. Not until the creation of the Office of War Mobilization did a federal agency have the authority to regulate the movement of workers among regions and sectors of the economy. The challenge for federal planners and policy-makers was how to regulate that movement without restricting individual workers' freedom to move from job to job.[435]

As described in a previous chapter, the rate with which the government placed orders for new merchant ships accelerated in 1941 and 1942 beyond the rate at which Admiral Land believed the Maritime Commission's contract shipyards could recruit and train workers with the requisite skills. Correspondingly, the actual demand for workers accelerated as well. Initially,

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"Industrial Health and Safety Survey of Richmond Shipyard Number Two," unpublished report dated May 1943, pp. 40, in NARA RG-178, entry 95A, box 529, Richmond Shipyard #2 file.

[434]Graves, "Ships for the Seven Seas," 183-185.

[435]Donald H. Davenport, "War Demands on the Labor Supply," *Harvard Business Review* 19 (Summer 1941): 451; Gropman, "Industrial Mobilization," 60-65.

in early 1941, the government thought the nation's shipyards would have to hire an estimated 260,000 new shipyard workers and that more than half of them would be required in the New England and mid-Atlantic shipyards (Boston, New York, and Philadelphia areas), where the largest share of the initial Navy ships were to be built. Three months later, the Bureau of Labor Statistics revised its estimates, based on knowledge of contracts to build sixty cargo ships for the British and FDR's decision to build the Liberty Fleet. Instead of estimating that the nation's shipyards would need a total of about 300,000 shipyard workers by the end of 1942, the government estimated that existing and newly built yards would need more than 550,000 employees. An increasing proportion of those new workers would be needed in the Great Lakes, on the Gulf Coast, and especially the Pacific Coast as the Maritime Commission de-emphasized the industrialized centers of the Atlantic Coast as locations for new shipyards. Because the Pacific Coast had not been very industrialized prior to the war, shipbuilders there faced a challenge in recruiting workers. The expansion of the aircraft manufacturing industry on the Pacific Coast made recruiting even more difficult.[436]

During the first few years of World War II, the labor shortages in the shipyards were especially for workers with requisite skills. Those shortages existed in the overall context of unemployment as the nation was still pulling itself out of the Depression. The labor shortage could be addressed by designing the shipbuilding program so that it could be executed by workers with more specialized sets of skills and by training workers in the specialized skills to accomplish those tasks. As the war progressed, however, there was an absolute shortage of available workers. The onset of the new problem was delayed by the hiring of women, beginning in 1942, but by mid-1943, the combined influences of an on-going draft by the Selective Service and the continuing demand for workers in other sectors of the economy began to drain workers from the shipbuilding industry faster than the industry could recruit new ones. One significant drain on shipyard workers was the growth in the ship repair industry as the war progressed. Repair yards offered lots of overtime, so workers willing to log many hours could make much more money. Shipyards contributed to the problem as well when they used the transition from Liberty ships to Victory ships as a pretext to discharge workers they considered undesirable, often because their skill levels did not meet employer expectations for an efficient operation. Despite difficulties, Maritime Commission shipyards had generally met or bettered their production schedules in 1943, but after January 1944 overall shipyard performance began to slip. The experience of the Richmond yards paralleled the nationwide trend in terms of employment levels.[437]

To learn the origins of new shipyard workers, both geographically and in terms of previous employment, the Labor Department conducted a survey of workers hired during June 1942 by shipyards on the Pacific Coast. In the San Francisco Bay Area, 26.6 percent of

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[436]"Labor Requirements for Shipbuilding Industry under Defense Program," *Monthly Labor Review* 52 (March 1941): 571-576; "Labor Requirements for Shipbuilding Industry under Defense Program," *Monthly Labor Review* 52 (June 1941): 1375-1380; "Sources of Labor Supply in West Coast Shipyards and Aircraft-Parts Plants," *Monthly Labor Review* 55 (November 1942): 926.

[437]Lane, *Ships for Victory*, 654-662.

shipbuilders' new employees came from elsewhere in the manufacturing sector, with 44.7 percent of that group (11.9 percent of the total) having prior shipbuilding experience. Just over 50 percent of the new shipyard workers came from non-manufacturing jobs, including 7.2 percent from wholesale or retail trades, 5.0 percent from farming, and 9.7 percent from government employment. Of the new hires, 10.4 percent had previously been unemployed and 6.2 percent were students. For the shipyards in the San Francisco area (including Richmond), 40.8 percent of the new hires that month came from the Bay Area, 24.1 percent came from elsewhere in California, 15.9 percent came from outside California, and 19.2 percent did not provide information on their geographic location before being hired.[438]

High turnover exacerbated the recruiting difficulties faced by the Richmond shipyards. For example, by December 1942 the payroll at Yard No. 3 had grown to 21,264, but to reach that level the yard had had to hire 39,823 persons. One of the sources of the high turnover was the military draft. In recent weeks, the Richmond yards had lost 2,800 men to the draft but had only been able to hire 2,000 new workers.[439]

Although many workers migrated to Richmond to find work in the shipyards, especially from places like Oklahoma, Texas, and Arkansas, the Kaiser organization also sent recruiters to select cities to find workers, offering railroad fare to Richmond as an inducement. Recruiters in Minneapolis sent more workers to Richmond (3,619 as of February 1943) than all Kaiser's other recruiters combined. Other cities sending more than one hundred recruits to Richmond by February 1943 were Memphis (588), Little Rock (501), St. Louis (430), and Phoenix (157).[440]

H. Worker Skills and Training

> A Wellesley graduate and University of Pennsylvania Ph.D.; several prize fighters, two professional golfers, a circus man; a former Wall Street investment banker whose home is on Park Avenue, New York; a former jockey who for twelve years raced in every state that has a track; thirteen clergymen, four of whom are colored; big league baseball players; women who used to run chicken farms; farmers who used to raise hogs; mushroom and rice growers; beauticians and barbers; chefs, waitresses and bus boys; lawyers, actors, artists and camera men; an entire colored troupe--"The Original Silas Green New Orleans Shows." Here within the confines of the 480 acres on Oglethorpe Bay, over which the yard extends, is a vivid demonstration of democracy at work during war-time.

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[438]"Sources of Labor Supply in West Coast Shipyards and Aircraft-Parts Plants," 927-928.

[439]"Urge Labor to Go 'All Out' in Drive for Workers to Turn out Boats at Uncle Sam's Richmond Shipyards!" Contra Costa County *Labor Journal* (27 November 1942), 1; "Chronological History of Kaiser Company, Inc., Shipyard Number Three," 12.

[440]"List of Figures for Men Recruited - Through Feb. 10, 1943," table attached to Charles H. Day to C.P. Bedford, memorandum dated 11 February 1943, in HJK 83/42c, box 16, file 18.

from "Training a Democracy to Build Liberty Ships," by John A. Yankey[441]

The nation's rapidly expanding shipbuilding industry required a rapidly expanding workforce. Not only did people need to be recruited to work in the shipyards, but also they needed to be trained to do the work. Many new shipyard workers had never worked in heavy industrial production jobs before. Those who did have experience working in shipyards, or perhaps experience using requisite skills in other settings, were quickly elevated to supervisory positions. Many new supervisors did not, however, have the training or experience to be effective supervisors. Therefore, the Maritime Commission and the shipyards had a huge educational task before them in 1941 and 1942. They met their training needs by instituting programs at the individual shipyards and by working with local schools and other outside organizations who provided training in cooperation with the Maritime Commission. To coordinate training programs around the country, the Maritime Commission appointed a three-man committee, one of whom was Jack Wolff, who had been Director of Personnel Training at Richmond Yard No. 1. In September 1942, the commission named Wolff its national training director. The Maritime Commission drew heavily on the training program developed in 1940 at Bethlehem in Baltimore. To help shipyard organizations throughout the country train supervisors, the Maritime Commission utilized a program developed in the Office of Production Management for industries of all sorts. Through a series of short courses, the program taught prospective supervisors some fundamentals in human relations as well as how to teach a job to untrained workers and how to organize the job.[442]

Wolf had inaugurated a diverse training program at Richmond. He worked closely with private occupational schools, public schools in the community, and the University of California to provide elementary training in each of the numerous skills and crafts required for shipbuilding, including welding, burning, pipefitting, shipfitting, reading blueprints, and first aid. Some classes were held in classrooms outside the yards, some were held at the yards at times convenient to the beginning and ending of shifts, and some were even held on the ferry, which took about an hour to travel from San Francisco to Richmond. The latter came to be called the ferry-boat college.[443]

There was an extraordinary burst of training activity at the Richmond yards during 1942, the year that Yards 1 and 2 reached full production (although additional shipways were under construction at yard 2), that the Pre-Fab yard was being built to speed production further at Yards 1 and 2, and that Yards 3 and 4 were under construction and building toward full production. The Kaiser organization used Yards 1 and 2 for training workers who would eventually be transferred to Yard 3. For this reason, there appeared to be excessive loafing at

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[441]John A. Yankey, "Training a Democracy to Build Liberty Ships," *Marine Engineering and Shipping Review* 48 (November 1943): 188.

[442]Lane, *Ships for Victory*, 258-267.

[443]Slottman, "Production Welding and Cutting at West Coast Yards," 222; Kramer, "The Story of the Richmond Shipyards," 66.

Yards 1 and 2. Regional director Flesher reported to Admiral Vickery in May 1942:

> Of all the yards on the coast, I find more loafing here than any place else. Part of this, of course, is caused by the fact that Mr. Bedford is using this yard [Flesher referred to yards 1 and 2 as a single unit] as a means of training men for the Kaiser yard [yard 3] and he is attempting to build ships and train men at the same time, fearful that he will be unable to get men later in the year when he needs them in the Kaiser yard and also for their additional facilities in Richmond no. 2. This adds greatly to confusion and while we generally term it as loafing, I believe a great percentage of it is due to improper supervision and lack of knowledge on the part of the men as to what they should do and possibly lack of ability to do it.[444]

By March 1943, Yard 2, which had the greatest number of welders to train, had built a school just outside the east gate. The school had six buildings, including separate buildings for men's and women's toilet facilities. The administration building was equipped with a lecture hall that could project motion pictures and seat 100. The welding building had 187 booths where students could practice welding.[445]

The nation's shipyards required a tremendous number of welders, and their training meant that many hours of welding and significant quantities of welding rod were consumed in the training process. The Maritime Commission was also concerned that the quality of training be standardized throughout the emergency shipyards. Admiral Vickery therefore arranged a meeting in April 1943 with James Lincoln, head of the Lincoln Electrical Company of Cleveland, to discuss having Lincoln Electric work under contract to the commission and send teams of welding engineers to shipyards to evaluate training programs and help the yards make improvements toward a standardized set of norms. Attending the meeting were Jack Wolff, the Maritime Commission's supervisor of shipyard training, and James Wilson, the commission's head welding engineer. Soon thereafter, the commission accepted Lincoln's proposal to conduct such a program. Lincoln tried to help shipyards incorporate welding training as much as possible into actual assembly work and therefore maximize the amount of productive welding that could be accomplished during the expenditure of manhours and welding rod in training. Some yards around the country resisted the recommendations Lincoln made, while others embraced the ideas. In a report to the Maritime Commission, Lincoln said that Richmond Yard No. 3 was one of those that fully adopted his company's recommendations.[446] Prior to that, Yard No. 1 was the only Richmond shipyard that was integrating its welding training into on-going

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[444]C.W. Flesher to H.L. Vickery, letter dated 9 May 1942, in San Bruno, RG-178, box 2, Vickery file.

[445]"Welding School in Two Weeks," *Fore'n'Aft* 3 (12 March 1943): n.p.

[446]Jack Wolff to Director of Division of Shipyard Labor Relations, letter dated 24 April 1943, and Wolff to Assistant Supervisors Shipyard Training, memorandum dated 30 December 1943, both in NARA RG-178, entry 89, box 439, "To All Training Supervisors" file; Lane, *Ships for Victory*, 561-565.

production.[447]

The Personnel Training Department at Yard No. 1 was the first to sponsor training on its ferries, the so-called ferryboat college, and Yard No. 3 followed soon thereafter. As of March 1943, Yard No. 2 was just beginning to offer a ferryboat college. Yard 2's delay in adopting the idea is an interesting indication of the independence each yard had from the others, even though Clay Bedford was general manager of all of them, and oversight of training at all the yards was centralized under the supervision.[448]

The vast array of skills employed in building ships at the Richmond yards is evident in an unpublished book compiled by the Kaiser organization called, "Vessels, Craftwork Descriptions, Richmond Shipyard." The book provides each of the job classifications with a name and number, both a summary and a detailed description of the work done, and a specification of the level of supervision required. The degree of specialized training (as opposed to broad, flexible skill sets) is clear from the descriptions. For example, a joiner might be one of the following: band-saw operator, table-saw and joiner operator, bulkhead installer, grating maker, cargo batten and grating installer, door installer, furniture installer, furring and insulation installer, hardware installer, refrigeration insulation installer, troop-berthing installer, material man, or shop man. There were several kinds of riggers. Loft riggers made the wire and manila rope used aboard ship for shroud, boom, or mooring lines. Ship riggers installed those lines on a ship, and they also installed anchors and anchor chains. Stage riggers erected, maintained, serviced, and dismantled the scaffolding around hulls and pre-assembly work. Crane riggers attached slings to loads and to crane hooks. There were three levels of skill for crane riggers. The least skilled were slingers, who were qualified to attach slings to steel in storage or to some steel in the shop. Plate hangers were skilled enough to attach slings to plates and assembled units ready to be positioned on hulls. Machine riggers had the highest level of skill, being qualified to attach slings to machinery, much of which was considered delicate. Among welders, some were certified for unlimited electric welding and some for limited electric welding; some were certified for unlimited acetylene welding and some for limited acetylene welding; some specialized in operating union-melt welders, etc.[449]

Another important facet of the training was having shipyard supervisors who were used to a production system predicated on training a local work force in the skills necessary for the

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[447]Frank S. Raines to Jack Wolff, letter dated 5 October 1943 and attached to Wolff to Assistant Supervisors of Shipyard Training, letter dated 25 October 1943, in NARA RG-178, entry 89, box 439, "To All Training Supervisors" file. Raines was a welding trainer at the Richmond shipyards with many years of training experience prior to the war. His characterization of the difference in welding training between Yard No. 1 and the other three yards is interesting given the effort by Clay Bedford to operate all four yards in like manner.

[448]"Ferry-Boat College," *Fore'N'Aft* 3 (12 March 1943): n.p.

[449]Richmond Shipbuilding Corporation, "Vessels, Craftwork Descriptions, Richmond Shipyard," unpublished book (1944) held by the Bancroft Library in its book collection, rather than in HJK 83/42c.

job at hand. For example, at Oregonship in Portland, the superintendent of welding was L.T. Blackford. He had received his own training at Moore Dry Docks, and one of his important accomplishments before Oregonship was supervising the welding of a pipeline between Mosul and Tripoli for the Anglo-Iranian Oil Company. On that job, he had charge of training workers who spoke a different language.[450]

A brief profile of Sal Macia in the *Fore'n'Aft* issue for 10 December 1942 illustrated how continued training allowed ambitious workers to move up in the shipyard hierarchy. Born in Hawaii to Spanish-immigrant parents in 1914, Macia moved with his family to San Francisco five years later. After graduating high school, he worked in a variety of industries. When the U.S. entered the war, his older brothers were already in the armed forces. Macia could not join the military as he provided the sole support for his parents. To help in the war effort, he went to work in the Richmond shipyards, beginning as a shipfitter helper. He availed himself assiduously of the various training courses offered at Yard 2 either before or after shifts (7:15 am following the graveyard shift, 1:15 prior to the swing shift, and 3:45 following the day shift) and quickly added skills. He took a blueprint class to qualify to become a shipfitter trainee. Then he took a seven-week course in shipfitting and qualified as a first-class journeyman shipfitter. By November 1942, he was an alternate leaderman and was enrolled in a course to learn training methods so that he could become a leaderman.[451]

Workers also had the opportunity to move into engineering fields by receiving training through the University of California's War Training Office. The university enlisted the skills of engineers at the Richmond shipyards to teach such courses. For example, in the summer of 1943, the university offered a course on "Shipbuilding and Ship Design Practice." The course met on the Berkeley campus, two hours per class, two classes per week, for sixteen weeks, and was open to high school graduates whose mathematics courses extended through trigonometry and who had at least one year's experience in engineering drafting, computing (which in those days meant making hand computations), or construction. All five instructors for the course, including Don Hardison, worked at Richmond Shipyard No. 3. The university's announcement stated that students who completed the course would be eligible for employment in the engineering department at a shipyard and were "virtually assured of a position" at one of the shipyards in the Bay Area.[452]

I. Meals and Other Amenities in the Shipyards

One of the surviving buildings at Richmond Shipyard No. 3 is the cafeteria, which gives the impression that shipyard workers had a pleasant environment for a meal at mid-shift.

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[450]Henry W. Young, "Welding a Ship a Week," *Steel* 110 (2 March 1942): 78.

[451]"Building a Shipbuilder," *Fore'n'Aft* 2 (10 December 1942): n.p.

[452]"Shipbuilding and Ship Design Practice," University of California course announcement dated 1943, and M.P. O'Brien to Donald Hardison, letter dated 28 July 1943, both in the collection of Donald Hardison, El Cerrito, CA.

Actually, the cafeteria was not available to union shift workers. Rather, it was for officials, supervisors, and exempt employees (those who were exempt from federal overtime regulations). A description of the regulations governing the cafeteria at Yard 3 have not surfaced, but a description of the cafeteria at Yard 2 may have applied to Yard 3 as well, because Yard 3 workers who wanted cafeteria service had to use the one at Yard 2 until the Yard 3 cafeteria opened in September 1943.[453]

The cafeteria at Yard No. 2 was located outside the gates and was operated for the Kaiser organization by Brennan Commissaries, a caterer based in San Francisco. The cafeteria operated on a strict schedule while serving full dinners in a dining room that seated 250. The dining room opened each day at 11:00 am. During the first forty-five minutes it served only superintendents, quartermen, leadermen, and officials of the Maritime Commission. Then from 11:45 until 5:00 pm the dining room was open to exempt employees of the shipyards, employees of the Maritime Commission, and any shipyard workers who were not working. According to a 1943 report, the line for people waiting to dine at 11:45 extended as long as 150 feet. It took as much as twenty minutes for people in that line to get their food, an acceptable length of time because as exempt employees they had an hour for lunch. There were more than 1,500 exempt employees at Yard 2. The cafeteria served about 3,000 meals each day, so the cafeteria must have been serving quite a number of exempt shipyard employees from other yards and Maritime Commission employees as well. The caterer also operated two lunch stands outside the gates that were available to shift workers either on their way to work or after completing a shift. The stands sold box lunches, cigarettes and cigars, chewing tobacco, candy and chewing gum, and ice cream. A box lunch contained three sandwiches, some salad in a paper cup, a piece of fruit, and a cookie or piece of cake.[454]

The caterer serving Yard No. 1 was the Duchess Lunch Company of Oakland, which initially served hot meals but then discontinued the practice in early 1942. Thereafter, the caterer sold only box lunches, sandwiches, salads, pies, pastries, milk, and coffee at Yard 1. Food was prepared at the Duchess Company's plant in Oakland and trucked to a depot in Richmond just beyond Yard 1's east boundary, where it was transferred to smaller service trucks. For each shift, caterer's crews wheeled the trucks into position at various locations within the yard. During the lunch break, workers could pass by either side of a truck and select items from shelves, pour cups of coffee, and then move to cashiers' stands to pay for food. According to a report, lines moved quickly, and within ten minutes all workers who wished to purchase lunch were served. Most workers brought their own lunches to work with them. The caterer also operated a small kiosk stocked with peanuts, tobacco products, candy and gum, sale of which

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[453]F.W. Johnson, et al, "Industrial Health and Safety Survey of Richmond Shipyard Number Two," unpublished report dated May 1943, pp. 28-30, in NARA RG-178, entry 95A, box 529, Richmond Shipyard #2 file; data sheet accompanying Kaiser Company, Inc., "Cafeteria," drawing dated 30 June 1944.

[454]Johnson, et al, "Industrial Health and Safety Survey of Richmond Shipyard Number Two," pp. 28-30; Table V in U.S. Maritime Commission Manpower Survey Board, "Richmond Shipyards," unpublished report dated May 1944, in NARA RG-178, entry 88, box 437 Richmond Shipyards file.

therefore did not interfere with operation of the lunch trucks. The Duchess Lunch Company also used the trucks to sell lunches outside the gate at Pre-Fab.[455]

J. Richmond Community

Richmond was one of the municipalities in the U.S. most dramatically altered by wartime industrial mobilization. The city's population jumped from 25,000 at the beginning of the war to an estimated 139,000 in mid-1943. The impact of the Kaiser shipyards on Richmond was more profound than the impact on any other city that hosted new shipyards.[456] The impact was so devastating to the community that, as Roger Lotchin points out, Richmond was alone among California municipalities in seeking compensation from the federal government for damages, rather than seeing the increase in jobs and economic activity as "war winnings."[457]

When the emergency shipbuilding program began, the Maritime Commission was not prepared to deal with something so tangential to building ships as housing. Henry J. Kaiser had been one of the first shipbuilders to ask the commission for help in August 1941, but the commission simply suggested that he ask local housing authorities to address the problem. After Pearl Harbor, FDR created two new offices to deal with problems associated with providing wartime industries with needed labor: the Office of Defense Transportation, to try ensure that existing transportation infrastructure was being used effectively to get workers to the job in industrial communities; and the National Housing Agency (NHA), to coordinate the work of existing groups that were supposed to be developing housing, like the Federal Public Housing Authority (FPHA). By March 1942, the Maritime Commission was taking direct action to rectify transportation problems (described in the next section) and housing problems. For a time, the Maritime Commission also paid for housing through its shipyard contracts, in part because the War Production Board (WPB) was not giving NHA housing projects located near Maritime Commission shipyards high enough priority in the regulated war-time market for the acquisition of construction materials (the WPB gave NHA housing projects near Navy shipyards, on the other hand, top priority).[458]

Kaiser was early in requesting that the Maritime Commission help address the housing shortage in Richmond because it made recruiting and retaining employees for the Kaiser shipyards difficult. Lack of housing also contributed to a relatively high rate of absenteeism, as workers often took days off to try finding work closer to where they lived. The Maritime

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[455]Robert S. Poos, et al, "Industrial Health Survey of Richmond Shipyard Number One," unpublished report dated 7-14 April 1943, pp. 29-30, 56, in NARA RG-178, entry 95A, box 529, Richmond Shipyard #1 file.

[456]"Time on Your Hands," *Fore'n'Aft* 3 (4 June 1943): n.p.; "Richmond Took a Beating: From Civic Chaos Came Ships for Ware and Some Hope for the Future," *Fortune* 31 (February 1945): 262-269; Lane, *Ships for Victory*, 442-445; Moore, *To Place Our Deeds*, 71-93.

[457]Roger W. Lotchin, *Fortress California, 1910-1961: From Warfare to Welfare* (New York: Oxford University Press, 1992), 165-166.

[458]Lane, *Ships for Victory*, 427-446.

Commission made several addenda to the Kaiser Company's overall Yard 3 contract in order to build housing, schools, and other community facilities. The first contract addendum, awarded 10 September 1942 and worth $13,191,000, was to build 6,000 units of housing (900 two-bedroom, 4000 one-bedroom, and 1100 one-room) and a school. Said to be the largest housing project in the U.S., its first units were ready for families to occupy by late November. The next addendum, dated 17 December 1942 and worth $2,500,000, was for another 6,000 units of housing. A third awarded in early 1943 and worth $11,869,250 called for 4,000 more units of housing, 4,000 dormitory rooms, schools and nurseries, a market, hospital, and a community center. Because the increasing population in Richmond so overwhelmed community facilities, the government also helped to build five supermarkets and five cafeterias.[459]

In 1943, even with the increased housing available in Richmond, the Kaiser yards continued to rely heavily on workers living in nearby communities. Clay Bedford had the turnover rate in the Richmond shipyards analyzed in early 1943 and found that the monthly turnover for the last six months of 1942 was less than 1 percent among employees who lived in Richmond but it exceeded 20 percent among workers who lived outside Richmond. For February 1943, the four Richmond yards again showed a turnover of less than 1 percent for employees who lived in Richmond's federal housing projects. There was a turnover rate of 15.31 percent for workers living in other East Bay communities and of 20.46 percent among those living in San Francisco. Another study at that time showed that only 19.28 percent of the approximately 85,000 Richmond shipyard workers lived in Richmond, while 29.66 percent lived in Oakland, 24.92 percent lived in San Francisco, 10.78 percent lived in Berkeley, and the remainder lived in other East Bay communities.[460]

The City of Richmond incorporated its Housing Authority on 24 January 1941 to manage the new housing projects. Harry Barbour was the first executive director. The Housing Authority's first two projects, Triangle Court and Nystrom Village, were funded under a slum clearance program and were intended to provide housing for Richmond's general low-income population. The next project, Atchison Village, was built expressly for new workers arriving in Richmond to work in industries preparing for war. Families began moving into Nystrom Village in December 1941 and into Atchison Village on March 1st. These first three projects were built to be permanent. Thereafter, the Maritime Commission began funding construction of temporary housing projects.[461] Following is a list of the housing developments built in

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[459]C.W. Flesher to H.L. Vickery, letter dated 9 May 1942, in San Bruno, RG-178, box 2, Vickery file; "Moving Day," *Fore'n'Aft* 2 (27 November 1942): n.p.; Clay P. Bedford to Henry J. Kaiser, telegram dated 14 January 1943 in HJK 83/42c, box 16, file 18; "The Transportation and Housing Problem As It Affects Labor Turnover in the Richmond Shipyards," unpublished report dated February 1943, in HJK 83/42c, box 288, file 6; "History of Kaiser Organizations," Vol. III, 380; Permanente Metals Corporation, et al, *A Booklet of Illustrated Facts about the Shipyards at Richmond, California*, 34; Starr, *Embattled Dreams*, 151-152.

[460]Clay P. Bedford to Henry J. Kaiser, telegram dated 14 January 1943 in HJK 83/42c, box 16, file 18; "The Transportation and Housing Problem As It Affects Labor Turnover in the Richmond Shipyards," unpublished report dated February 1943, in HJK 83/42c, box 288, file 6;

[461]"Richmond, California: A City Earns the Purple Heart," booklet published by the

Richmond during the war and completed by 1944:

World War II Housing in Richmond[462]

Name	Date Completed	No. of Units
Triangle Court	6-15-41	98
Atchison Village	3-14-42	102
Nystrom Village	7-01-42	450
Esmeralda Court	8-29-42	94
Richmond Dormitories		1,986
Atchison Annex	8-29-42	100
Harbor Gate		806
Canal Apartments		1,312
Canal Dormitories		1,008
Richmond Terrace Apartments		688
Canal Addition		800
Cutting Apartments		1,200
Richmond Trailer Park		334
Cutting Dormitories		2,600
Cutting War Apartments Addition		242
Seaport War Apartments		494
Pullman War Apartments		368
Maritime War Apartments, Div. 1		1,983
Division 2		1,637
Division 3		1,644
Division 4		733
Division 5		1,162
Division 6		1,582
Division 7		420

Other entities, both government agencies and non-governmental organizations, worked together to provide the services required by such a large influx of residents. The City of Richmond's Health Department expanded its programs to provide services, including well-baby and pre-school pediatric care, in the new housing projects. As already mentioned, the Richmond Field Hospital staffed prenatal and pediatric clinics. A group called the Richmond Area Church Defense Council organized a program called the United Church Ministry, which helped to conduct worship services in a variety of community buildings constructed in or near the new housing projects. The Richmond Board of Education organized recreation programs for community centers and playgrounds that included not only athletics but music, dancing, and crafts as well. Richmond's police and fire departments increased their workforces and acquired new equipment so they were able to provide protection for the expanded community. Richmond's population of school-aged children grew from about 6,300 in 1940 to more than

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California State Reconstruction and Reemployment Commission and dated August 1944, pp. 6-7, in possession of Don Hardison; *A History of Richmond, California*, 122-125.

[462]"The Transportation and Housing Problem As It Affects Labor Turnover in the Richmond Shipyards," n.p.; Richmond Chamber of Commerce, *A History of Richmond, California*, 122-125.

20,000 in 1944. Although new schools were built to alleviate crowding, the school system also had children attend school in shifts (morning and afternoon) to keep class sizes as reasonable as possible.[463]

Richmond was not the only community in which the Maritime Commission built housing for an influx of shipyard workers and their families. In New Brunswick, Georgia, where J.A. Jones Construction Company was operating one of the six-way yards, for example, the Maritime Commission had built over 7,800 units of housing by late 1943, with the assistance of the Federal Public Housing Authority, and was building another 1,800. Nationwide, however, the FPHA built many more units (67,000 by April 1943) than did the Maritime Commission (9,000 units by that time). The government built many more units in Richmond than in any other community in the country. During the war, all told, the FPHA built about 14,000 units in Richmond and the Maritime Commission about 10,000 units. The private sector paid for another 6,000 new units during those years.[464]

There were problems with discrimination in the Richmond wartime housing developments. As mentioned above, Cleophas Brown of the NAACP was one of the leaders in the Richmond fight against housing discrimination. That history is beyond the scope of this report.[465]

K. Key System

Another reason for high turnover was the difficulty employees not living in Richmond had in getting to work. Although the Maritime Commission authorized some money to improve roads that gave access to the Richmond shipyards, it also invested heavily in improved public transportation. The commission gave Kaiser Company, Inc., an addendum to build ferry terminals (one at San Francisco and one at Yard No. 3 in Richmond), to acquire ferryboats requisitioned through the War Shipping Administration, and to build a 14-mile extension of the Key System from Oakland to Richmond. The Maritime Commission also purchased ninety motor coaches for use by the Key System to provide bus service to Richmond. Wilmington

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[463]Richmond Chamber of Commerce, *A History of Richmond, California*, 125-126; "Richmond: A City Earns the Purple Heart," 10-12.

[464]Yankey, "Training a Democracy to Build Liberty Ships," 193; Lane, *Ships for Victory*, 434, 438, 442-445.

[465]For contemporary newspaper articles on this topic, especially in the wake of the California Supreme Court's decision in *James v. Marinship*, see "United Negroes Threaten Rent Strike in Richmond," *Richmond Independent* (8 January 1945), 1; "Negroes Protest Housing Ouster," *Richmond Independent* (9 January 1945), 9; "Richmond Negroes Fight Double Jim Crow," *People's World* (10 January 1945), 1; "Federal Housing Problems Aired at Meeting Here" and "Negroes Hit Rent Strike," *Richmond Independent* (12 January 1945), 1 and 2; "Richmond NAACP Hits Rent Strike," *People's World* (13 January 1945), 1;

Transportation Company operated the ferries.[466]

The Key System was a street railway serving the Bay Area with tracks that crossed the Bay Bridge between Oakland and San Francisco. The Richmond extension was often called the "Shipyard Railway." Officials of the Key System had played an important role in convincing the Maritime Commission to authorize construction of the extension. The commission was worried that with resources being concentrated on wartime production there would be insufficient resources to build a railroad. Recognizing that existing bus service between Oakland and Richmond was insufficient to meet demand, Key System officials gathered a list of second-hand materials that could be used in construction of the line. To provide rolling stock for increased ridership on the Key System, the Maritime Commission helped acquire old cars from the former Second Avenue El in New York City. The Key System retrofitted the New York cars at its Emeryville shops, for example replacing third-rail shoes with pantographs necessary to operate on the Key System. Unused rails were collected from as far away as Los Angeles and Seattle in order to lay down track for the Shipyard Railway.[467]

Construction of the Richmond Shipyard Railway began in August 1942, and regularly-scheduled trains started delivering workers to Richmond Shipyard No. 2 on 18 January 1943. Service to the other yards began on February 8th. Early in the construction period, there were some delays and controversies over who had jurisdiction over construction, the regional director or the Maritime Commission's headquarters in Washington. Another issue was who should build the new line, the Key System, Kaiser, or some other contractor. Ultimately, Kaiser did the purchasing, and Key System supervised the construction, performed by sub-contractors. One of the largest structures built in association with the Shipyard Railroad was a timber trestle, 1,692' in length, over the Southern Pacific's main line. As with other features of the Shipyard Railway, much of the trestle was built of recycled materials. Much of the timber came from an old Key System pier. The 80' main span carrying the Shipyard Railroad's double tracks over the Southern Pacific tracks consisted of old turntables provided by the Southern Pacific. The Key System also took over some old interurban street railway tracks in Oakland to provide train service to Moore Dry Dock's shipyard. The Richmond Shipyard Railway incurred an operating deficit of about $448,000 during its period of service, which ended on 30 September 1945. The Maritime Commission dismantled the track and other facilities in 1946, restoring properties along the

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[466]C.W. Flesher to H.L. Vickery, letter dated 9 May 1942, in San Bruno, RG-178, box 2, Vickery file; "Ferry-Boat College," *Fore'n'Aft* 3 (12 March 1943): n.p.; "Richmond Yard No. 3, General Yard Plan," no date, in D.D. Dick, "Shipyard Facilities Index: West Coast Yards," unpublished report dated 1 July 1945, in NARA RG-178, entry 23, box 1; "History of Kaiser Organizations," vol. III, 381; Permanente Metals Corporation, et al, *A Booklet of Illustrated Facts about the Shipyards at Richmond, California*, 34; U.S. Maritime Commission, "Report on Transportation Facilities," unpublished report dated 2 May 1946, pp. 7, 9, in NARA RG-178, entry 99, box 14, Richmond Shipyard Railway file; Lane, *Ships for Victory*, 443.

[467]"Richmond Took a Beating," *Fortune* (February 1945), 264-265; "A Railroad - Built for and Named for Shipyards," in *Western Shipbuilders in World War II*, ed. Marshall Maslin (Oakland, CA: Shipbuilding Review Publishing Association, 1947), 59-60; Lane, *Ships for Victory*, 443.

right-of-way to their former condition.[468]

Despite the improved public transportation facilities, most workers at the Richmond shipyards continued to drive automobiles. A survey in January 1944 showed that 7 percent rode the Key System, 6 percent rode the ferry, 6 percent took the bus, and 66 percent went to work in automobiles. To accommodate all those cars, the four Richmond yards had a total of about 17 acres devoted to parking lots.[469]

CHAPTER EIGHT: RICHMOND SHIPYARDS AFTER THE PEAK OF SHIPBUILDING

Toward the end of the war, Kaiser and the Maritime Commission began to make plans for Yard No. 3 in the post-war period. The first phase was the winding down of shipbuilding at Yard 3 and the other Richmond yards. Then Yard 3 served briefly as a repair facility, which had been the intention that generated its equipment with permanent buildings. After the war, most of the temporary and some of the permanent buildings were demolished, and virtually all the equipment was removed, including, significantly, the whirley cranes. This chapter summarizes the history of the closure of Yard 3 and its brief record as a ship-repair facility. The chapter ends with a description of Richmond Shipyard No. 3 as it exists today.

A. Winding-Down of Shipbuilding in 1945

The Maritime Commission began laying plans for the end of the war well before the Axis powers surrendered. One early bit of planning involved the need to maintain order in shipyard communities when the formal end of hostilities arrived. Toward this end, Carl Flesher sent a confidential letter to shipyard managers along the Pacific Coast with the following instructions:

> When the Armistice of World War I was announced, the majority of war plants throughout the country closed down immediately. In order to assist in every way

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[468]Condensed Minutes of Conference Held in Office of the Regional Director, 8 September 1942, and Condensed Minutes of Conference Held in Office of the Regional Director, 17 September 1942, both in San Bruno, RG-178, box 1, C.W. Flesher's 1942 file; Minutes of Meeting No. 1 held at the Key Systems Offices, 1 October 1942, Minutes of Meeting No. 2 held at the Key Systems Offices, 2 October 1942, both in both in San Bruno, RG-178, box 1, C.W. Flesher's 1942 file; "General Reference Data," n.p., HJK 83/42c, box 289, file 11; "All Aboard for Richmond," *Fore'n'Aft* 3 (15 January 1943): n.p.; L.R. Sanford to U.S. Maritime Commission via H.L. Vickery, memorandum dated 10 December 1945, in NARA RG-178, entry 99, box 10, unlabeled file following "Permanente 1 & 2" divider; U.S. Maritime Commission, "Report on Transportation Facilities," unpublished report dated 2 May 1946, p. 9; "A Railroad - Built for and Named for Shipyards," 60.

[469]"General Reference Data," n.p., HJK 83/42c, box 289, file 11; Land, *Ships for Victory*, 443.

> the law enforcement officers of the communities in which your shipyard is located and which surround the shipyard, when the Armistice of World War II is made known the shipyards should not declare a holiday until so directed by this office.
> This letter is not being written because an early Armistice is expected, but because it is necessary that we plan for such developments, and to make certain that those individuals responsible for law enforcement have all the cooperation possible so that disturbances and property damage will be held to a minimum.[470]

As 1945 dawned and the Allies grew certain of victory, many people in government and the shipbuilding industry turned more of their attention to the aftermath of war. Everyone understood that most of the emergency shipyards would be liquidated. Questions remained as to what role some of the shipbuilding infrastructure might play in the postwar economy, either for producing new ships or in the repair industry, and what the nation should do to keep itself prepared for war. Another prominent question concerned the future of thousands of demobilized shipyard workers. Employment at Pacific Coast shipyards had reached a peak of about 300,000 workers. By May 1945, that number had dropped to 200,000, of whom about 85,000 worked in Bay Area shipyards.[471] The War Manpower Commission conducted exit interviews with thousands of workers terminating employment at Bay Area shipyards in spring 1945, finding that about 25 percent of laid-off shipyard workers planned to leave the area. Relatively more women and non-white workers were losing their jobs. Proportionally more white workers than non-white workers planned to leave.[472]

The four Richmond yards began a precipitous reduction in force during the summer of 1945, as the following table shows:

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[470]C.W. Flesher to Clay Bedford, letter dated 17 July 1944 in San Bruno, RG-178, box 4, file C.W. Flesher Confidential 1944. Flesher sent identical letters to the Oakland Chief of Police, K.K. Bechtel at Marinship, Edgar Kaiser at Oregonship, John McCone at Calship, and the managers of other shipyards along the Pacific Coast.

[471]H. Gerrish Smith, "Postwar Status of Shipbuilding Industry," *Marine Engineering and Shipping Review* 50 (May 1945): 142-144; C.W. Flesher, "Future for Pacific Coast Shipbuilding and Ship Repair," *Pacific Marine Review* 42 (May 1945): 262.

[472]War Manpower Commission, "Analysis of Exit Interviews," unpublished reports dated 29 March, 24 April, 22 June, and 12 July 1945, in LARC, Ephemera files, WWII shipyards (from the California Division of Labor Statistics Collection).

Employment at the Richmond Shipyards by Month[473]

Yard No. 1		**Yard No. 2**	
April 1943	23,000	January 1943	32,000
April 1944	16,000	January 1944	27,000
August 1945	1,900	January 1945	24,000
		Sept. 1945	4,000
Pre-Fab			
April 1943	6,500		
July 1944	5,400		
August 1945	150		
		Yard No. 4	
Yard No. 3		July 1943	4,600
January 1943	20,000	August 1944	4,500
January 1944	20,000	February 1945	4,500
Sept. 1945	9,500	Sept. 1945	900

As described in Chapter IV, Yard No. 3 was designed and built to be a permanent facility, available for ship repair after the war. To better fit the yard for that function, the Maritime Commission authorized modifications to Yard 3 in early 1945. As shipbuilding crews finished erecting hulls for the last of the C-4s in March, construction crews began demolishing the bottoms of basins 2 and 3 so that they could be deepened. That made them suitable for not just ship construction but for use as dry docks as well. Other crews began construction of two finger piers west of the basins. By mid-June, twenty ships, mostly Liberties, had been dry docked in basins 2 and 3 for repairs. The Maritime Commission's Regional Office in San Francisco and the Navy's Bureau of Ships also made plans for other additional ship repair facilities in the Bay Area, including facilities at San Francisco, Oakland, and Alameda.[474]

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[473]H.G. Beck, "Final Report: Permanente Metals Corporation, Richmond Shipyard No. 1," unpublished industrial hygiene report dated 13 September 1945; Beck, "Final Report: Permanente Metals Corporation, Richmond Shipyard No. 2," unpublished industrial hygiene report dated 14 September 1945; Beck, "Final Report: Permanente Metals Corporation, Prefabrication Plant," unpublished industrial hygiene report dated 14 September 1945; Beck, "Final Report: Kaiser Company, Inc., Richmond Shipyard No. 3," unpublished industrial hygiene report dated 14 September 1945; Beck, "Final Report: Kaiser Cargo, Inc., Richmond Shipyard No. 4," unpublished industrial hygiene report dated 14 September 1945, all in NARA RG-178, entry 89, box 443, USN-USMC-WSA Industrial Health Program Summary of Final Reports file.

[474]Facilities Officer to Assistant Industrial Manager, memorandum dated 25 May 1944 in San Bruno, RG-178, box 4, file C.W. Flesher Confidential 1944; "Bigger, Better Basins," *Fore'n'Aft* 5 (16 March 1945): 1, 3; "The Business of Drydocking," *Fore'n'Aft* 5 (15 June 1945): 1-2.

Meanwhile, Richmond Yards 1, 2, and 4 each delivered its last ship to the Maritime Commission in September 1945. Thereafter, Kaiser Company, Inc., used the outfitting docks at Yards 1 and 2 to outfit two C-4s that were due for delivery in November.[475]

Even though merchant shipbuilding at Richmond ceased thereafter, Kaiser had some additional work for his remnant crews, including building four floating dry docks for the Navy and 180 barges for the Army.[476]

Kaiser crews launched the 747th and last ship from the Richmond shipyards on 13 August 1945. A C-4 troop ship, the *S.S. Marine Snapper*, it was also the thirty-fifth and last ship launched at Yard No. 3. Mrs. Clay Bedford was the sponsor for the ship. The program included songs by a glee club of women shipyard workers called the Harmonettes, speeches by Henry J. Kaiser and others. One unusual name on the speakers list was Harold Walker, who was chosen to represent the thousands of workers who had accomplished the shipbuilding remarkable record at Richmond. The *Marine Snapper* was not actually completed and delivered to the Maritime Commission until early 1946. The new ship would see service not in carrying troops overseas to war but in bringing America's victorious soldiers home. A list by name of each of the 747 ships built by Kaiser at Richmond appears in a February 1946 issue of Kaiser's employee newspaper, *Fore'N'Aft*.[477]

Overall, Henry Kaiser's shipyards boasted a remarkable record of achievement during World War II, producing 1490 ocean-going vessels. The following table shows the numbers of each of several types of ships the Kaiser yards built:

Ships Built by Kaiser Shipyards during World War II, all Locations[478]

Type	Number
Liberty ships	821
Victory ships	219
Tankers	147
VC2-S-AP5 combat transport ships	87

[475]L.R. Sanford to U.S. Maritime Commission via H.L. Vickery, memorandum dated 3 October 1945, in NARA RG-178, entry 99, box 10, unlabeled file following "Permanente 1 & 2" divider; L.R. Sanford to Howard J. Marsden, memorandum dated 18 July 1946, in NARA RG-178, entry 99, box 14, Permanente Metals Corporation, Richmond Yard No. 2 file.

[476]"Kaiser Launches 747th Wartime Ship," *Oakland Tribune* (13 August 1945): 13.

[477]"Kaiser Launches 747th Wartime Ship," *Oakland Tribune* (13 August 1945): 13; "747 Ships," *Fore'N'Aft* 6 (1 February 1946): 2-11.

[478]"Kaiser Shipbuilding during World War II," and "Shipbuilding," both of which are unpublished reports in HJK Papers 83/42c, box 285, file 11.

Escort aircraft carriers (baby flat tops)	50
Troop transport ships	55
Landing ship tank (LSTs)	45
British cargo ships	30
C-1 coastal cargo ships	24
Frigates	12

The table on the next page shows how those 1,490 ships were distributed among Kaiser's seven shipyards:

Ships Built by Kaiser Shipyards during World War II, by Location[479]

Richmond No. 1		**Total: 221 ships**
British cargo ships	30	
Liberty ships	138	
Victory ships	53	
Richmond No. 2		**Total: 440 ships**
Liberty ships	351	
Victory ships	67	
VC2-S-AP5 combat transports	22	
Richmond No. 3		**Total: 35 ships**
C-4 troop transports	35	
Richmond no. 4		**Total: 51 ships**
C-1 coastal cargo ships	24	
LSTs	15	
Frigates	12	
Portland (Oregon Ship)		**Total: 463 ships**
Liberty ships	330	
Victory ships	99	
VC2-S-AP5 combat transports	34	
Swan Island (Portland, OR)		**Total: 147 ships**
Tankers	147	
Vancouver, WA		**Total: 133 ships**
Escort carriers	50	
VC2-S-AP5 combat transports	31	

[479]"Shipbuilding," unpublished report in HJK Papers 83/42c, box 285, file 11; "Kaiser Shipbuilding Experience during World War II," report in HJK Papers 83/42c, box 287, file 6. See also Gerald J. Fischer, *A Statistical Summary of Shipbuilding under the U.S. Maritime Commission during World War II*, Historical Reports of War Administration, U.S. Maritime Commission No. 2 (Washington, DC: Government Printing Office, 1949), 64, 65, 67, 68, 75. Fischer shows only thirty-three C-4s for Richmond Yard No. 3 because his tables are only complete through 1945. The last two C-4s were delivered in 1946. Likewise, the Vancouver yard delivered 125 of its ships before the close of 1945 and delivered eight C-4s in 1946.

LSTs	30
C-4 troop transports	20
Liberty ships	2

Federal planners had to consider the future disposition of America's suddenly very large fleet of merchant vessels. By the end of the war, the U.S. would have about 5,500 cargo ships, a fleet five times the size of the nation's pre-war fleet. Of the fleet at war's end, more than half, about 3,300 ships representing about 33,500,000 tons of capacity, would be aged ships and the relatively new but already obsolete Liberty ships. The other 2,200 ships, representing about 24,000,000 tons of shipping, would be the fast and economical Victory ships, tankers, and C-type vessels built by the Maritime Commission during the war.[480]

As already mentioned, Richmond Yards 1, 2, and 4 delivered their last ships to the Maritime Commission in September 1945. Thereafter, the commission gave Permanente Metals and then Kaiser Company, Inc., the Kaiser entity operating Yard 3, the task of preparing the other three yards, plus Pre-Fab, for disposal as surplus property. Because Yard No. 3 had been designed to continue operating after the war as a repair facility, and because the Kaiser organization had integrated the operations of the four shipyards and Pre-Fab into a single system, the Maritime Commission also authorized Kaiser Company, Inc., to move facilities or equipment from the other Richmond yards to Yard 3, as necessary, to allow Yard 3 to stand alone as a viable operation. The "laying-up" of the surplus yards was complete in July 1946, at which time the Maritime Commission terminated all of Kaiser Company's responsibility for those three yards and began taking steps to transfer them to the War Assets Administration for further disposal. John R. Jago became the Maritime Commission's resident plant engineer for Yards 1 and 2. The commission declared Yards 1 and 2 surplus on 29 August 1946 and delivered the land and improvements to the War Assets Administration. The commission executed the same transaction for Yard 4 in early September.[481]

As mentioned in chapter IV, Admiral Vickery had suffered a heart attack in 1944 and had to take a leave of absence for several months. Upon his return to work in February 1945, he resumed his energetic shepherding of the nation's merchant shipbuilding program. Shortly after the end of the war, Vickery's health forced him to retire. He died of a heart attack in March

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[480]Flesher, "Future for Pacific Coast Shipbuilding and Ship Repair," 262.

[481]"Three Richmond Yards Turned Back to USMC," *Fore'n'Aft* 6 (August 1946): 2; R.P. Strough to T.A. Bedford, letter dated 23 September 1945, in NARA RG-178, entry 99, box 10, unlabeled file following "Permanente 1 & 2" divider; L.R. Sanford to Howard J. Marsden, memorandum dated 18 July 1946; R.P. Strough to All Commission Personnel in Yards 1 & 2, memorandum dated 29 July 1946; Resident Plant Engineer Directive No. 1 to All Employees at Yards 1 & 2, memorandum dated 1 August 1946, all in NARA RG-178, entry 99, box 14, Permanente Metals Corporation, Richmond Yard No. 2 file; Marsden to W.W. Smith and the other Commissioners, undated letter; Ward B. Freeman to John M. Carmody, teletype dated 3 September 1946, both in NARA RG-178, entry 27, box 15, "Kaiser Richmond No. 3" file.

1946.[482]

B. Shipyard No. 3 As a Repair Facility

After the war, Henry Kaiser's stable of enterprises underwent a radical change as he and his managers sought to find new footings in the peacetime economy. One of Kaiser's plans was to enter the automobile manufacturing business, so he entered a partnership with Joe Frazer to form the Kaiser-Frazer Corporation. Frazer had been an executive at Willys-Overland, which owned the rights for civilian production of the jeep, the popular Army vehicle developed early in the war (see HAER No. CA-326-J for more information on jeep production). Kaiser negotiated with the federal government's Reconstruction Finance Corporation to purchase the Willow Run plant outside Detroit. The Ford Motor Company had used the plant to assemble bombers during the war, but the plant was now surplus property. Kaiser-Frazer intended to produce jeeps for the civilian market and to introduce new lines of passenger cars. In October 1945, Clay Bedford moved from Richmond to Detroit to become vice president of Kaiser-Frazer. His brother Tim took charge of the Richmond shipyards. As mentioned in Chapter II, the Kaiser organization operated the Fontana steel mill until 1980. Other Kaiser enterprises that emerged from World War II included Kaiser Aluminum & Chemical Corporation, Kaiser Metal Products, Inc., Kaiser Gypsum, Permanente Cement Company, Kaiser Community Homes of Los Angeles, Kaiser Engineers, and the Kaiser-Permanente health services organization. The latter two entities are the only ones that exist today in any recognizable semblance of their 1950s predecessors. Histories of the enterprises beyond the shipyards are beyond the scope of this report.[483]

After the war ended, Maritime Commission figures showed that the land, buildings, and equipment at Yard No. 3 represented an investment by the government of more than $25,000,000. The Kaiser organization began bidding on ship repair work, using Yard No. 3 as its repair facility. About 10 percent of the work Kaiser received in 1946 was on private vessels. The remainder of the work was on Army and Navy ships, some of which required repairs after the war and some of which needed to be altered to suit post-war uses. For example, Kaiser received a contract in early 1946 to convert eight C-4s from troop transports to passenger ships appropriate for ferrying families of military personnel overseas. These were families of Army soldiers who would have long-term assignments as occupying forces in Europe. Because of the urgency of winding up the war effort (transporting troops home, etc.), the government allowed Kaiser to use Yard 3 for those purposes even though all contracts to operate the Richmond yards had expired and the government had not advertised for bids on a new contract to use Yard 3 for repair purposes. In mid-August, Kaiser had about 3,500 workers at Yard 3 employed at ship repair. There were thirteen vessels at the yard, including five in the basins, four at the outfitting docks, and four at the finger piers.[484]

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[482]"Admiral Vickery Dies," *Fore'n'Aft* 6 (29 March 1946): n.p.; Lane, *Ships for Victory*, 794.

[483]"The Bedfords Change Jobs," *Fore'n'Aft* 5 (5 October 1945): 1; "The Arrival of Henry Kaiser," *Fortune* 44 (July 1951): 69.

[484]"Kaiser Yard Awarded New Business," *Fore'n'Aft* 6 (10 May 1946): 4; Ward B. Freeman to Commissioner Carmody, memorandum dated 15 August 1946 and teletype dated 3 September

The Kaiser organization had submitted a proposal to the Maritime Commission in June 1946 to lease Richmond Yard 3 and convert it to a diverse array of peacetime industrial uses including ship repair, commercial machine-shop and sheet-metal work, steel and aluminum fabrication, and motor vehicle assembly. As the post-war economy began to take shape, some at the Maritime Commission believed that there was not a sufficient market in the Bay Area for a new ship repair facility. Meanwhile, the nation's steel mills were crying for scrap steel, of which the excess supply of merchant ships could be an obvious source. Therefore, there was a market for ship-breaking facilities. Kaiser had requested permission to use Yard 3 to break a single ship in July 1946. In August, the Maritime Commission ordered that Yard 3 be used only for ship-breaking purposes, not for ship repair, and that use of the yard for ship breaking be awarded to a successful bidder. Both Henry and Edgar Kaiser protested this decision vociferously, arguing that terminating ship repair would force the Kaiser Company to lay-off many of its workers, striking a blow to the economic prospects for the city of Richmond, and that the other three Richmond yards were still in such a state that they could be used for ship breaking. The Kaisers also argued that Moore Dry Dock was overwhelmed with repair work, that there was a need for competition in the ship-repair market, and that such competition would effect a savings to taxpayers, because of the significant quantity of ship repair that the government still required in the Bay Area. Richmond's city attorney also appealed on Kaiser's behalf that the Kaiser organization be authorized to continue using Yard 3 to do ship repair and thereby maintain employment levels in the city. Meanwhile, Commissioner John Carmody, a member of the Maritime Commission, stressed to all concerned that the federal government still owned Yard No. 3, and the government could not permanently hand the yard or its operation over to Kaiser without proper public bidding.[485]

On 29 August 1946, the Maritime Commission formally decided to terminate, effective on 30 September 1946, its temporary agreement with Kaiser Company, Inc., which had allowed Kaiser to use Yard 3 for ship repair and other purposes. The commission also ordered that competitive bids be solicited for use of the yard thereafter, despite U.S. Senator Sheridan's appeal to the commission on behalf of the City of Richmond. John R. Steelman, director of the Office of War Mobilization and Reconversion also disapproved of the commission's plan. He

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1946; John Carmody to U.S. Maritime Commission, memorandum dated 19 August 1946; Carmody to Thomas Carlson, letter dated 22 August 1946; J.A. Hull to Burton Hunter, telegram dated 28 August 1946, all in NARA RG-178, entry 27, box 15, "Kaiser Richmond No. 3" file.

[485]Kaiser Company, Inc., "Richmond Shipyard No. 3," unpublished book dated 1 June 1946 in HJK 83/42c, box 289, file 1; Henry J. Kaiser to Oscar Cox and Fred Drews, teletype and attached report dated 12 August 1946; John R. Tankard to John M. Carmody, memorandum dated 14 August 1946; John Carmody to U.S. Maritime Commission, memorandum dated 19 August 1946; Carmody to Thomas Carlson, letter dated 22 August 1946 and telegram dated 24 August 1946; Carlson to Carmody, telegrams dated 24 and 25 August 1946, Edgar Kaiser to U.S. Maritime Commission, letter dated 26 August 1946 and teletype dated 26 August 1946, all in NARA RG-178, entry 27, box 15, "Kaiser Richmond No. 3" file. There is also a collection of the some of the same and related correspondence in HJK, box 29, file 29; see especially Edgar Kaiser to U.S. Maritime Commission, letter dated 26 August 1946.

was especially concerned that nothing impede Yard 3's resources from being used to scrap ships and therefore help address the pressing steel shortage. He therefore recommended that the commission build more flexibility into the uses allowed under the planned lease of Yard 3 and that the temporary agreement with Kaiser be extended until a leaser took over, thereby precluding an interruption of ship breaking at Yard 3. Meanwhile, the Kaiser organization continued to try to convince the Maritime Commission to allow it to use Shipyard 3, and other local officials tried to lobby the President and other government bodies.[486] On 22 October 1946, Henry J. Kaiser announced to Richmond's mayor that the Kaiser organization would abandon further efforts to convert Yard 3 to peacetime uses, thus ending the era of shipbuilding at the Richmond shipyards.[487]

C. Shipyard No. 3 Today

This section describes the overall condition of Richmond Shipyard No. 3 and then each structure in turn.

Shipyard Grounds

The grounds of Richmond Shipyard No. 3 clearly present themselves as a site of waterfront industry, but the site is not necessarily recognizable as a shipyard specifically. Comparing present-day views to historical views demonstrates the importance of the whirley cranes in conveying a maritime image. Another crucial feature that is missing is the plate shop, which housed facilities for cutting and shaping steel on the ground level and the mold loft, rooms for draftsmen, and engineering offices on the upper level. The plate shop served to spatially define the large open area, north of the basins, where plates of steel and structural shapes, having been cut and shaped in the plate shop, were welded together to form the pre-assembled units that so greatly speeded the shipbuilding process in the Richmond shipyards and other facilities throughout the nation. The Port of Richmond demolished the plate shop in 1985 to create more room for storing imported automobiles after they were off-loaded from ships.[488] Without the whirley cranes and the plate shop, it is hard to visualize the processes that once took place in Yard No. 3, when thousands of shift workers fabricated steel parts, welded them into giant pre-assembled components, erected those components in the basins to create the hulls of C-4 troop transports, and equipped the hulls along the outfitting dock to finish the shipbuilding sequence.

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[486]U.S. Maritime Press Release dated 29 August 1946; Sen Sheridan to John Carmody, telegram dated 29 August 1946; John R. Steelman to Admiral W.W. Smith, letter dated 11 September 1946, all in NARA RG-178, entry 27, box 15, "Kaiser Richmond No. 3" file. See also HJK, box 29, file 29, especially Amos B. Hinkley and Thomas M. Carlson to The President of the United States, letter dated 26 August 1946.

[487]Henry J. Kaiser to Amos B. Hinkley, et al, letter dated 22 October 1946, in HJK, box 29, file 29.

[488]"WWII Kaiser Plate Shop Will Be Razed," *West* (Contra Costa) *County Times* (4 August 1985), 1A, 2A.

Most of the other key structures employed in shipbuilding at Yard 3 survive. When the yard was an active shipbuilding facility, there were also a couple dozen smaller ancillary buildings scattered throughout the site. All are gone now except the first aid building and the cafeteria. Although the yard grounds are now strewn with an assortment of materials and containers associated with the yard's present function as a facility for receiving imported goods, those imported items bear little resemblance to the vast store of materials that occupied the storage areas when the yard was building ships, and the volume of stored material now is considerably smaller than during World War II.

The World War II condition of Yard No. 3 and its buildings and structures was described in an earlier section of this report. Following are descriptions of the surviving buildings and structures.

The Basins

The five basins at Yard No. 3 are relatively intact with the significant exception of their gates, which have been removed. The basins are therefore permanently flooded, with no possibility of closing the gates and pumping out the seawater. The basins are now used to store boats, barges, and ships and/or to make ship repairs that do not require that the ships be elevated out of the water. Given the variety of activities taking place in the basin, the craneways between the basins are crowded with materials, trailers, truck-mounted cranes, and other equipment. The galleries beneath the craneways are largely open. Some of the partitions that once defined storerooms or shops for various shipbuilding crafts are still in place. Concrete stairs that once provided pedestrian access from the craneways to the galleries and to the bottoms of the basins are still in place, although several are in advanced stages of deterioration.

General Warehouse

The general warehouse is still as impressive as it was during World War II (see HAER No. CA-326-B). Because the plate shop is gone, the general warehouse now is also the most massive. A four-story structure of reinforced concrete in the Moderne style, the building features projecting central bays along the front and rear elevations. Those bays extend above the roofline of the main body of the warehouse and give the warehouse facades a classical, symmetrical composition. The bays also represent the location of the freight elevators, so the portion of each bay that extends above the roofline houses the elevator mechanisms. Typical of the Moderne style, the bays are unadorned with features like pedestals, columns, cornices, or pediments. The only semblance of embellishment is the pair of vertical rows of circular windows that flank the bay on the front (east) elevation. Although there are large, roll-up doors throughout the perimeter of the warehouse, there is a concentration of doors at the base of each of the projecting bays. For each bay, there is a centrally-located door to the freight elevator flanked by a set of double pedestrian doors. The elevator doors are the kind that part in the middle horizontally, so that the top half raises and the bottom half drops as the doors open.

The front and rear bays provide the only vertical elements to a building that is otherwise

dominated by horizontal lines. A loading dock with cantilevered canopy surrounds the entire building, defining the first floor. Each of the upper three floors are defined along the facades by six horizontal rows of small rectangular vent openings, one row near the floor and one near the ceiling for each floor. Additionally, there are three bands of horizontal grooves cast into the concrete between pairs of vent rows around the front half of the building (the front half comprising the front elevation and the front half of each side elevation). The rest of the facade is smooth, unfinished concrete exhibiting nothing more than the texture of the concrete forms.

The interior of the warehouse is largely open storage space. All floors are poured-in-place concrete. Concrete columns with spread, inverted pyramid caps provide support. The dimensions of the columns in section decrease progressively from the first to the second to the third floors. The columns on the fourth floor are wood, rather than concrete, and they support a conventional wood roof structure of beams, joints, flat roof deck, and built-up roofing.

Machine Shop

The machine shop (see HAER No. CA-326-C) is a conventional steel-frame industrial building designed in a basilican form, with a long, open central bay flanked by side aisles with clerestory windows overhead. The south end of the machine shop, facing the general warehouse, is enclosed in its original configuration, with only a single, centrally-located roll-up industrial door. Windows along the side aisles, the clerestory, and the south end are standard steel industrial sash. The rest of the side walls and the south end wall are sheathed in corrugated steel siding. The north end of the machine shop was originally open, and the craneway, which is attached to the main columns on either side of the main bay at an elevation midway along the clerestory windows, used to extend out the open north end on tracks supported by steel trestles. The trestled craneway extended as far as the north wall of the forge shop to the east. The trestles and the extension of the craneway have been removed, and the north end has been enclosed with corrugated steel siding from the ground up to a level just above the door headers and with corrugated fiberglass sheathing in the upper portion of what was once the opening.

Inside the machine shop, the traveling bridge cranes are gone from the craneway, but the jib cranes are still in place, attached to some of the columns along the east side of the center bay. The entire east side aisle is open. The west side aisle is open along its south half and is divided into some storage, toilet, and office rooms along its north half. Stairs lead to additional rooms at a mezzanine level. These rooms appear to be in the same configuration as shown in the original drawings and probably have not been altered since World War II.[489]

Forge Shop

The forge shop (see HAER No. CA-326-K) is a simple steel building, rectangular in plan, with corrugated steel siding and industrial steel sash. Originally open along its west side, the

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[489]Data sheet accompanying Kaiser Company, Inc., "Machine Shop," drawing dated 30 June 1944.

Forge Shop is now enclosed on all four sides.

Riggers Loft/Paint Shop/Sheet Metal Shop

This building is comprised of two halves, divided by an east-west bearing wall the runs between the two halves (see HAER No. CA-326-J). The south half is 70' wide and just over 220' long. A room (40' x 70') at the west end housed a women's toilet and rest room. The rest of the south half housed the sheet metal shop. The north half is 62' wide and 180' long, with the east 99' housing the riggers loft and the west 81' housing the paint shop. The paint shop has reinforced concrete walls, while the rest of the building is of wood frame with corrugated steel siding. Wood Pratt truss spanning 62' and 70' from the side walls to the center dividing wall support the roof structure. The roof over the paint shop has collapsed. There are industrial steel sash throughout.

Outfitting Dock

The outfitting dock used to occupy the east side of Yard No. 3 as well as the portion of the south end that is east of the basins. Tracks for whirley cranes ran along the edge of the dock, and there were several buildings located between the dock and the general warehouse, machine shop, forge shop, and first aid station. Those buildings included (from south to north) a pipe shop, electrical shop, fittings office, matron's building, and fittings warehouse. None of those buildings survive. The edge of the yard is, however, still a dock, and cargo ships still berth there.

First Aid Building

The first aid building is a rectangular, wood-frame building with flat roof and wood siding (see HAER No. CA-326-A). It is an excellent example of the simple moderne styling that Morris Wortman's office gave to buildings in the Richmond yards. The exterior is largely unaltered, although the garage extension on the south side is no longer a garage. The garage door has been replaced with a crude plywood exterior wall, a pedestrian door, and a simple wood stoop. Original concrete stoops for entrances to the main body of the building are intact. They each include a simple flat-roof canopy supported by pipe columns. The condition of the interior is unknown.

Cafeteria

Like the first aid building, the cafeteria is a wood-frame building with flat roof and wood siding exhibiting Wortman's simple moderne styling (see HAER No. CA-326-E). Larger than the first aid building, it also has a more complex footprint. The core of the building housed the kitchen and related spaces, like walk-in refrigerators, chef's office, and men's and women's locker rooms for the kitchen staff. North of the kitchen core is a wing housing a large storage room and related spaces. East of the core is an area with rooms for private dining and private

meetings. South of the core is the large, open dining room. The food service and fountain areas were located between the kitchen and the dining room. All kitchen and food service equipment has been removed from the building, and those areas are now open office areas used by Pasha, the main tenant of Yard No. 3 (at the time this report was written). The exterior of the building is largely intact, including the long porch along the east side of the dining room. The main entry is recessed, providing access to the building adjacent to the former fountain and food service areas. A prominent feature of the entry is the curved corner wall of the dining room, a characteristic of the moderne style.

Appendix A
Crafts and Jobs Profiled in *Fore'n'Aft*

Craft or Job	Issue	Craft or Job	Issue
slab crew	6-18-42	ship's engineers	11-05-42
stage riggers	12-17-42	shipwrights	12-31-42
crane operators	1-08-43	flooring installers	1-15-43
pipefitters	1-15-43	asbestos installers	1-22-43
maintenance electricians	2-05-43	marine electricians	2-26-43
slab crew	3-12-43	progress & program dept.	3-12-43
boom testers	3-12-43	tank testers	3-19-43
shipwrights	6-11-43	scarfers (burners)	7-09-43
tank testers	7-16-43	chippers	7-30-43
riveters	8-13-43	stud welders	8-20-43
steel expediters	8-27-43	prefab pipe shop	9-10-43
boilermakers	11-05-43	flangers	12-24-43
whirley crane operators	2-04-44	thermit welders	8-04-44

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