TECHNOLOGY AS A FACTOR IN THE GULF COAST SHIPBUILDING INDUSTRY, 1900 - 1945

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ABSTRACT

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Historians who have written about the South since the American Civil War have portrayed the region as economically proverty-stricken and educationally backward until the World War II period. Historical accounts change to a more flattering description during the war and after when the southern economy suddenly blossomed as the federal government awarded lucrative defense contracts to southern entrepreneurs and as the armed forces established training centers in the mild southern climate. Missing from these historical narratives are the causes of the South's transformation other than the massive influx of federal financial aid in funding the establishment and subsequent expansion of the nation's war effort in the South.

The development of such a technical, complicated industry as shipbuilding along the Gulf coast during World War II cannot be explained solely by federal funding and the presence of a favorable climate. Another factor contributed significantly to the South's economic transformation, and that factor was technology in the form of mass-production

principles and welding. The importance of the integration of these two technical advances into the Gulf coast shipyards constitute the purpose of this investigation.

Material about the shipyards and their adoption of the new technology came primarily from the National Archives' records of the government agencies responsible for regulating the nation's shipbuilding effort and from contemporary trade journals. Popular periodicals and newspapers contributed little data because of a lack of shipbuilding knowledge and national security precautions during the war period. Unfortunately, the shipyards destroyed most of their files in the years following the war, including the newspapers that the yards published for their employees. Monographs supplied the secondary source material describing both the South's economic condition and the general development of the shipbuilding business, but none examined the impact of shipbuilding trends on the South.

To show how mass-production principles and welding in shipbuilding altered the economic conditions along the Gulf coast, this investigation relied on a chronological narrative to illustrate the importance of timing in addition to identifying the significant factors causing the changes. The account begins with a description of the Gulf coast shipyards during World War I and ends shortly after World War II. The necessary factors for Gulf coast participation in shipbuilding are developed in two chapters followed by

an evaluation of the specific accomplishments of five Gulf coast shipyards during and after World War II. The effects of the changes in the shipyards on labor are also discussed.

The study concludes that technological advances in welding and mass-production techniques functioned as a critical element in enabling the Gulf coast shipyards to participate in the nation's defense effort. The new technology benefited the Gulf coast laborer as well by giving him a new skill--welding--that became the accepted method of joining metals during and after World War II in all industries. While funding was an important factor in aiding in the expansion of shipbuilding along the coast, it was not the lone factor determining the course of Gulf coast shipbuilding. The new technology played a crucial role in the development of shipbuilding along the Gulf coast.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF TABLES (CONT)

CHAPTER I

EARLY GULF COAST SHIPBUILDING

That such as industry as shipbuilding developed in the South represented a significant departure from the traditional pattern of southern economic development and indicated that important new forces were affecting the direction of southern economic growth. The role of technology in this change has not been clarified by historians and needs elucidation with emphasis on technological advances rather than sociological topics, such as race relations and urban development.[1] Technological progress has been the one factor most neglected in discussions of southern industrial advancement despite the recurrent theme of the South's industrial backwardness in most southern histories. Contributing to the problem is the fact that southern industrial development itself has received slight

[1]Technology can be defined as society's collective knowledge in the industrial arts. While the advance of technology in the early twentieth century became increasingly dependent upon scientific-based discoveries rather than mechanical innovation and ingenuity, this study will distinguish between technological change and scientific advance. Scientific break-throughs stress understanding without any particular use for the solution. Technological progress requires more than just the existence of new information; it demands a practical application of the knowledge often resulting in a new method of producing existing products.

attention, although southern economic evolution since the 1880's has been toward industrialization and away from a traditional agrarian orientation. Dewey Grantham, Clarence Danhof, and Gerald Nash all note the lack of historical interest in southern industrial progress in their studies. Nash even claimed the change was a "fundamental revolution," yet the topic still had not claimed much attention.[2]

The role of technology in southern history has attracted even less attention. Although Eli Whitney's cotton gin was recognized as a fundamental factor in changing ante bellum southern history, recent accounts have not taken notice of subsequent technological developments which may have had a similar effect. Many of the works describing southern industrial development recognize the importance of World War II defense programs, but they neglect the evolution and application of technology as a significant factor in southern contributions to the war effort.

General histories of the South are noncommittal at best on technology's impact on the South. George B. Tindall gave

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[2]Dewey Grantham, "The Twentieth-Century South," in Writing Southern History: Essays in Historiography in Honor of Fletcher M. Green, ed. Arthur S. Link and Rembert W. Patrick (Baton Rouge: Louisiana State University Press, 1966), pp. 436-437; Clarence Danhof, "Four Decades of Thought on the South's Economic Development," in Essays in Southern Economic Development, ed. Melvin L. Greenhut and W. Tate Whitman (Chapel Hill: University of North Carolina Press, 1964), p. 51; Gerald Nash, "Research Opportunities in the Economic History of the South after 1880," Journal of Southern History 32(August, 1966): 308.

credit to the federal government for financial support which created economic possibilities for the South but went no further. Francis B. Simkins and Charles P. Roland offered the same explanation in pointing out that the federal government and private industry spent $4.5 billion in constructing war industries in the South in the 1940's, but why the South adopted them was not discussed. Clarence Danhof described the South's World War II contribution in terms of human and natural resources in return for "large federal disbursements" but stopped there. William B. Hesseltine and David Smiley recognized the South's war contributions without commenting on how they were accomplished.[3]

In the more industrially-oriented southern histories, the avoidance of technological significance is equally pronounced. Harriet Herring stressed labor problems, maintaining that the government had to build in areas outside the Southeast where well-equipped plants and skilled labor already existed. George E. McLaughlin and Stefan Robock emphasized the importance of location of industry after the

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[3]George B. Tindall, The Emergence of the New South, 1913-1945 (Baton Rouge: Louisiana University Press, 1967), pp. 695-696; Francis B. Simkins and Charles P. Roland, A History of the South, 4th ed. (New York: Knopf, 1972) pp. 556-557, 570: Clarence Danhof, "Four Decades," p. 51; William B. Hesseltine and David L. Smiley, The South in American History, 2nd ed. (Englewood Cliffs: Prentice-Hall, 1960), p. 575.

war with no reference to technology. In a later and more incisive account, Calvin Hoover and B. U. Ratchford continued to follow the pioneering interpretations of Howard Odum in his Southern Regions of the United States (1936) and Rupert Vance in Human Geography of the South (1935) and All These People (1945) in accenting the importance of human resources of the South. Hoover and Ratchford differed from Odum and Vance by observing that despite the lack of industrial development the South produced war goods "in one way or another" in substantial quantity, with the greatest contributions coming from shipyards, airplane factories, and munitions plants. A later study by Albert Lepawsky revealed that the individual state planning boards after the war did not consider technology as a factor in southern growth.[4]

Those authors who evaluate technological impact on southern economic development do so obliquely. William Nicholls maintained that the level of industrialization necessary to solve southern economic problems may not be

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[4]Harriet L. Herring, Southern Industry and Regional Development (Chapel Hill: University of North Carolina Press, 1940), p. 79; Glenn McLaughlin and Stefan Robock, Why Industry Moves South, Committee of the South, National Planning Association Report no. 3(Washington, D.C., 1949), p. 23; Calvin B. Hoover and B. U. Ratchford, Economic Resources and Policies of the South (New York: Macmillan, 1951), p. 120; Albert Lepawsky, State Planning and Economic Development in the South, Committee of the South, National Planning Association Report no. 4(Washington, D.C., 1949), p. 22.

achievable due to the South's cultural values. His acceptance of industrialization as a solution to the South's economic difficulties implied a recognition of the necessity of more technology followed by industrial development, but he stressed the cultural factor. Stephen McDonald also noted the beneficial effects of industrialization on the South but feared that continued emphasis on attracting industries might attract only marginally beneficial operations. In the closing remarks of his article, Danhof came closer to evaluating properly technology's role in the South by stating that the South's ability to share in the nation's effort to utilize new technological achievements will largely affect the region's future.[5]

The venerate Walter Prescott Webb, Professor of History at the University of Texas from 1933 through 1963, came closest to recognizing technology's contribution to the South. Limited by his belief in Turner's "frontier thesis," Webb slowly came to appreciate science and technology as a partial solution to the South's problems. In The Great Frontier (1951), Webb acknowledged the fact that science was a solution, but his distrust, and limitation as a scientist, was revealed when he concluded science was not likely to

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[5]William H. Nicholls, Southern Tradition and Regional Progress (Chapel Hill: University of North Carolina Press, 1960), p. 15; Stephan McDonald, "On the South's Recent Economic Development," Southern Economic Journal 27(1961): 34; Danhof, "Four Decades," pp. 66-67.

create a new American frontier nor make much improvement in the world. By 1958 he found new hope for the South, especially the Gulf coast region, where change rested largely on new technology, although Webb only reluctantly gave science the credit. Still clinging to the importance of natural resources, Webb listed the formation of new southern capital, renewable farmland resources, an abundance of fresh-water, and an "unlimited amount of fuel in the form of gas and oil" as the reasons for his renewed optimism. He considered the fuel problem as solved by the new industrial trinity, the hydrocarbons in the form of oil and gas, along with sulphur and fresh-water. Webb erred in considering technological progress solely on the basis of natural resources while completely ignoring the trend toward science-based discoveries.[6]

One year later Webb arrived at his most advanced position concerning technology's impact on the southern economy. In an address to the Texas Council of Social Studies in June, 1959, Webb predicted prosperity for the South based on three forms of wealth: (1) farm and ranch production, (2) trade and manufacturing, and (3) a "silent revolution in technology which has placed the South squarely

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[6]Walter Prescott Webb, The Great Frontier (Austin: University of Texas Press, 1951), p. 302; Walter Prescott Webb, "The South and the Golden Slippers," The Texas Quarterly, 1(1958): 8.

in the path of destiny." Webb went on to describe the changes taking place as ones which made the industrial future of the South "not bright, but brilliant," and he commended science for its contributions to agriculture.[7] In fact, new technology was the major determining factor in the South's shipbuilding participation in World War II.

Although other industries also appeared in the South for the first time during World War II, shipbuilding represented more than any other an industry dependent upon other related industries for success. These other industries, such as the steel companies, were absolutely necessary if the shipbuilding goals of the nation were to be reached. More importantly, their appearance encouraged industrialization of the South at an accelerated rate. Shipbuilding plants during World War II resembled the final step in an assembly line with the many thousands of individual parts coming from specialized manufacturers throughout the country.

The assembly-line approach symbolized a relatively new innovation in an old American industry. Shipbuilding as an American craft dated back to the earliest colonial settlements. Small-scale operations and simple forms of organization characterized a highly decentralized industry in the

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[7]Walter Prescott Webb, "The South's Call to Greatness: Challenge to All Southerners," Texas Business Review, 33(October, 1959): 8.

early days of ship construction. The central economic factor controlling the location and production of the business was simply the timber supply.[8] Only certain types of wood proved suitable for framing ships, and they dictated the location of any shipbuilding concern at that time. White oak was the most desirable wood for shipbuilding in the United States with live oak being second best. Live oak forests existed on the Gulf coast,[9] but growth patterns necessitated cutting individual trees far removed from a waterway, hauling the wood by oxen to a stream, and transporting it to a shipyard, all of which negated the advantage of using this particular wood.[10] Exhaustive use of the limited supply of live oak accessible to ship makers caused a rapid depletion of the available timber, so the Gulf coast did not develop a sizeable industry in shipbuilding nor as a resource area for other regions.[11]

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[8]John G. B. Hutchins, The Maritime Industries and Public Policy, 1789-1914 (Cambridge, Mass.: Harvard University Press, 1941), pp. 71-72.

[9]U.S. Congress, House, Historical Statement on the Use of Live Oak Timber for the Construction of Vessels of the Navy, by Levi P. Woodbury, 22nd Cong., 2d sess., 1832, Doc. No. 23, pp. 195-196.

[10]U.S., Department of Agriculture, "Ship Timber in the United States," by W. W. Bates, Report of the Commissioner of Agriculture for the Year 1866 (Washington, D.C.: Government Printing Office, 1867), pp. 472-475.

[11]Franklin D. Roosevelt, "Our First Frigates, Some Unpublished Facts About Their Construction," in Transactions of the Society of Naval Architects and Marine Engineers 22 (New York: The Society of Naval Architects and Marine Engineers, 1914): 147.

Instead, the industry centered along the middle and upper Atlantic coastline where conditions encouraged the growth of the shipbuilding and shipping industry. Entrepreneurs easily began wooden shipbuilding businesses there because it required little capital, the coastline offered numerous good locations, and plentiful oak timber stands beckoned to anyone desiring them. Builders in that area had important advantages in that they could select and acquire almost any desired size or shape of timber with little effort, and the cost of transportation was negligible. This unique set of conditions lasted until the exhaustion of the timber supply along the Atlantic coast. Depletion of the oak trees was apparent by 1880 and became acute when the wooden-ship program of World War I led to the decimation of much of the remaining reserves along the east and west coasts. The southern coast remained outside such development until World War I because southern forests contained primarily pine or other types of wood not particularly suitable for shipbuilding.[12]

About the time the timber reserves along the mid and northern Atlantic coast began to disappear, significant changes in the shipbuilding industry caused permanent alterations in construction methods which foreshadowed the

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[12]Henry Hall, Report on the Ship-Building Industry of the United States (New York: Library Editions, 1970), pp. 198-199.

World War II yards and allowed the Gulf coast states to join in the shipbuilding industry as never before. The first of these developments was the wholesale use of steel as the principal shipbuilding material, leading to a great increase in the size of ships, a change in propulsion methods, and experimentation with new ways of joining metal. Pre-World War I ships of steel closely resembled the earlier wooden ones in design, varying mainly in the principal construction material. The use of metal simplified construction in that the malleable characteristic of steel allowed production of single pieces of any length, while wood limitations dictated that several shorter pieces be used. Some old builders ignored or failed to recognize the significance of this change and were forced into an early retirement as the metal ships gained ascendancy.[13]

With the adoption of the new method, close tolerance accuracy became a strict and expensive requirement. Wood had the characteristic of being comparatively easy to shape and could be swelled by soaking to fill a seam or caulked by oakum allowing less stringent tolerances at seams and joints. Metal differed in that it required the builder to employ expensive draftsmen and engineers to assure a close

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[13]John G. B. Hutchins, History and Development of the Shipbuilding Industry in the United States, Vol. I in The Shipbuilding Business in the United States of America, ed. F. G. Fassett, Jr. (New York: The Society of Naval Architects and Marine Engineers, 1948), p. 48.

fit of ships' parts. The necessity of having to buy expensive metal-working tools added substantially to the initial costs. A wooden shipyard cost about $20,000 to start, even if the owner bought the latest power-driven tools and invested in a steam power plant to run them. He traditionally bought the large augers for drilling bolt and tree nail holes, a derrick, and a large cross-cut saw, but he avoided the expense for hand tools because workers customarily supplied their own. (Consult the glossary for the definition of a "tree nail" and other technical terms). The metal shipbuilder, in contrast, needed about $60,000 to establish a new yard. In one respect, the metal shipbuilders enjoyed an easy transition. Workmen were recruited from existing machine and boiler shops, as well as from established wooden shipyards. Within six months a builder could retrain and hire a competent workforce of metal workers and begin producing metal ships.[14]

Other equally important changes took place during the pre-World War I era in the form of large-scale production methods and the corporate form of management. Whereas prior to such changes, ship design and construction tended to be informal and slow, now the emphasis was on speed. The old master builder who varied little from his own time-proven design of a small vessel built in a small shipyard employing

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[14]Hall, Report on the Ship-Building Industry, pp. 198-199.

only one to two hundred men gave way to large yards building large ships. Some wooden-ship yards adopted large power-assisted tools such as beveling and shaping machines and pneumatic tools to do much of the boring, fastening, rabbetting, and calking heretofore done by hand, but it was to no avail.[15]

Both Captain Alfred Thayer Mahan, the late nineteenth century author of the popular treatise The Influence of Sea Power Upon History, and President Theodore Roosevelt strongly influenced American military policy which, in turn, aided the transition to the construction of steel ships in the early twentieth century. Mahan's book contained a central idea which emphasized the necessity of maintaining a large naval fleet to protect American commercial interests.[16] Spurred by the influence of Mahan's philosophy and Roosevelt's aggressive policies, the Atlantic coast became the dominant region specializing in the construction of large steel ships. Newport News Shipbuilding and Drydock Company at Norfolk, Virginia, originated in 1886 by Collis P. Huntington, led in this development and became an important builder of all types of vessels for both the American Navy and merchant marine. The New York Shipbuilding Company at Camden, New

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[15]Ibid., p. 48.

[16]James A. Arnold, "Naval Developments in the Late 19th Century," in Sea Power: A Naval History, ed. E. B. Potter and Chester W. Nimitz (Englewood Cliffs, N.J.: Prentice-Hall, 1960), p. 343.

Jersey, started in 1899, had the distinction of being uniquely designed for extensive prefabrication of ships' parts and equipped with an overhead crane system to transfer materials within the shipyard. Fore River Ship and Engine Company at Quincy, Massachusetts, began by building yachts in 1884 and successfully made the transition to large steel ships before being purchased in 1913 by Bethlehem Steel Corporation. After these leaders came the smaller firms of Pusey and Jones Shipbuilding Company at Wilmington, Delaware, an old wooden shipyard that started building ships in 1848 and made the change to steel ships as well as developing a paper-making machinery business, and Bath Iron Works at Bath, Maine, started in 1889 to build torpedo boats, torpedo boat destroyers, yachts, and miscellaneous merchant vessels.[17]

By the beginning of World War I, the typical American shipyard still did most of its work under the protection of several large covered bays. At one end of the yard there would be a storage area for steel, serviced by overhead cranes. Nearby would be the plate and bar furnaces and bending slabs. In the area of a bay designated for finishing platework would be found the various machines, such as drills, punches, rolls, shears, flangers, and scarfing machines. Additional shops in the vicinity contained the blacksmiths, anglesmiths, pipefitters, machinists,

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[17]H. Gerrish Smith, "Histories of Private Shipyards," Marine Engineering, 48(December, 1943): 168-169.

carpenters, and jointers.[18] Although this division of work represented a trend toward specialization, it was not extensive. Shipbuilding employees were still considered craftsmen who now worked with steel rather than with wood. Ship designs remained flexible to allow for customizing, and ship construction remained a long and tedious project involving extensive fitting of parts on the ship. Complete construction of a ship still took a full year or more. While shipbuilders did develop power tools for wood and metal, the time required to construct a steel ship remained about the same as with wooden ship construction.[19]

Power for the machines and tools was supplied by electricity and compressed air. Electricity allowed a better plant layout, greater mobility for large tools, and more efficient crane operation. Prior to the application of electricity to the industry's machinery and tools, power was delivered by a system of overhead shafting and belting from another power source resulting not only in considerable clutter and danger but also large losses in efficiency.[20]

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[18]Charles R. Hanscom, "Description of the Design and Building of the 21,000-ton Steamships Minnesota and Dakota," in Transactions of the Society of Naval Architects and Marine Engineers 11(New York: The Society of Naval Architects and Marine Engineers, 1903): 190.

[19]Hutchins, "History and Development of the Shipbuilding Industry," p. 50.

[20]Walter M. McFarland, "Electricity in Manufacturing Plants," in Transactions of the Society of Naval Architects and Marine Engineers 11(New York: The Society of Naval Architects and Marine Engineers, 1903): 190.

Mechanization of the assembly work itself relied heavily on compressed air. Pneumatic riveting first gained widespread use; then other small hand tools were adapted to air power, such as drills, hammers, chisels, and calking equipment.[21]

The next significant developments in the shipbuilding industry were associated with World War I. In 1917, before the United States entered the war, the industry had already grown to forty-two yards with 154 ways for steel ships over four thousand deadweight tons and twenty-three yards with 102 ways for wooden ships of over three thousand deadweight tons. The American big navy policy, promoted by Mahan and Roosevelt, shared the responsibility with new construction methods in spurring this expansion. By 1919 the industry's capacity rose to seventy-two steel shipyards with 461 ways, eight-seven yards for wooden vessels and seven for concrete vessels--a total of 94 yards with 473 ways.[22] Most of these yards were located on the Atlantic coast and a few on the West coast, but the Gulf coast participated to a limited extent in the wooden-ship program. (See Table I in the Appendix for a complete listing of Gulf coast yards). The ships built during the war period constituted the

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[21]W. I. Babcock, "Portable Pneumatic Riveters in Shipbuilding," in Transactions of the Society of Naval Architects and Marine Engineers 11(New York: The Society of Naval Architects and Marine Engineers, 1903): 121-122.

[22]U.S. Department of Commerce, United States Shipping Board, Third Annual Report, 66th Cong., 2d sess., 1919, p. 58.

majority of the American merchant marine vessels until the construction program of World War II.

The World War I effort represented the first time large-scale production of ships was attempted, and in the larger yards the idea of standardized designs and prefabrication took root with government encouragement. Under this system most of the prefabrication occurred outside the shipyards. Shapes and plates were rolled, bent, and punched at inland plants. Manufacturers produced and assembled propulsion machinery away from the yards. The Emergency Fleet Corporation restricted selected yards to assembly and erection work as far as possible. Edward N. Hurley, chairman of the United States Shipping Board, referred to them as "assembled" ships and credited Henry Sutphen, a naval architect and engineer and vice-president of the Submarine Boat corporation of Bayonne, New Jersey, as the originator of the idea. Sutphen had conceived the method while building wooden sub-chasers for the British Admiralty in 1916.[23] In actuality, suppliers made 96 percent of the prefabricated steel hulls in the standardized ship program outside the yards, but none in yards south of Virginia. The South built only ships of

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[23]Edward N. Hurley, The New Merchant Marine (New York: Century Company, 1920), p. 62. Secretary of Commerce William Redfield is credited with the idea of designing a ship with a maximum number of standardized structural parts and having the parts manufactured in plants scattered throughout the country in Darrell H. Smith and Paul V. Betters, The United States Shipping Board: Its History, Activities and Organization (Washington: Brookings Institution, 1931), p. 28.

pine, and even for this construction southern pine producers simply could not supply the necessary timber in either the necessary quantity or size.[24] By 1915 the United States led in the production of iron and steel; hence, when World War I began, those shipyards nearest the steel mills came to dominate the industry. This caused a shift of focus southward from the New England yards founded upon wood to the steel yards along the Delaware River, a protected, wide, and deep estuary stretching about 102 miles inland from the Atlantic.[25] With the German determination to renew unrestricted submarine warfare in early 1917, Congress created a United States Shipping Board Emergency Fleet Corporation in April, 1917, based on powers contained in the Shipping Act of 1916. The act authorized the Emergency Fleet Corporation to purchase, construct, equip, lease, charter, maintain, and operate merchant ships in the service of the United States.[26]

Ships constructed in the new yards included four general types: concrete, composite materials, wood, and steel. The idea for concrete ships originated with Congress, while the composite ship was a wooden vessel with steel frame

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[24]Smith and Betters, Shipping Board, p. 50.

[25]Malcolm Keir, Manufacturing Industries in America: Fundamental Economic Factors (New York: Ronald Press, 1920), p. 296.

[26]Shipping Act, 1916, 46 U.S. Code 801.

stiffeners in the hull. Neither type proved to be of great importance. Early in 1917 the need for additional ships became apparent as German subs sank an alarming number of allied ships, and, as a result, new ideas for solving the shipping shortage emerged. Authorities disagree about who originally conceived the idea of a wooden ship fleet to augment the war effort. Nevertheless, the Corporation let contracts for more than five hundred wooden vessels during World War I but later canceled orders for two hundred of them as the war drew to an end.[27]

The Emergency Fleet Corporation built mostly cargo steamships out of wood, but it also constructed wooden sailing vessles including barges, tugboats, and a tanker. Theodore E. Ferris, chief architect of the Emergency Fleet Corporation in 1917, designed the cargo steamship which the agency adopted as its basic wooden model. The Ferris model was a single-screw, single-deck vessel equipped with a triple-expansion coal-burning engine and two single-ended Scotch boilers. Some of these ships had water-tube boilers to which twin screws and geared turbine steam propulsion

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[27]William Joe Webb credits F. A. Eustis with presenting the idea to William Denman, chairman of the Shipping Board in February, 1917 in "The United States Wooden Steamship Program During World War I," American Neptune, 35 (October, 1975): 277, 279; W. C. Mattox credits F. Huntington Clark of Roxbury, Connecticut, with orginating the program in Building the Emergency Fleet: A Historical Narrative of the Problems and Achievements of the United States Shipping Board Emergency Fleet Corporation (Cleveland; Penton, 1920), p. 17.

machinery could be installed for greater speed. Ferris model blueprints specified a length of 281½ feet, a beam of 46 feet over planking, a total dead weight of 3,500 tons, and a sea speed of ten knots. Since these ships represented only a temporary expediency, the Corporation chose to build them with timber that often was not ideal for shipbuilding but which was plentiful to a specific shipbuilding region--white pine in Maine yards, long-leaf yellow pine in the South, and Douglas fir on the Pacific coast.[28] Building a standard 3,500-ton Ferris cargo ship required approximately 17,500,000 feet of timber. In addition, the Ferris model used 250 tons of steel; over ninety thousand treenails of pine, cypress, and oak; and thousands of pounds of oakum.[29] The requirements of the wooden ship program allowed the Gulf coast to participate in the war effort but also revealed some limitations of southern shipbuilding.

Two weaknesses in particular stand out in relation to the southern shipbuilding effort in World War I. First, Southern yards appeared almost overnight despite a lack of shipbuilding knowledge or facilities. This phenomenon was

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[28]Theodore E. Ferris, Yellow Pine Ship: Specifications for the Construction of a Standard Wood Steamship, Hull Only, for the United States Shipping Board Emergency Fleet Corporation (Washington: Government Printing Office, 1917), pp. 7-9.

[29]U.S., Department of Commerce, United States Shipping Board, Second Annual Report, 65th Cong., 3d sess., 1918, pp. 139-140.

neither unusual nor restricted to the South; it reflected the national experience on all the coasts. Estimates indicated that 80 percent of all the applicants to the program suffered the same shortcomings but, nevertheless, plunged in soon after the federal government announced the program. Some of the more aggressive companies sent as many as five contract applications per day.[30] Mississippi alone chartered twenty-one shipbuilding companies in an eleven-month period at the low total capitalization of $3,040,000. Ten of these companies suddenly materialized in a four month period from October, 1917, through January, 1918, after a special session of the Mississippi legislature exempted such war plants from taxation.[31] This rush to shipbuilding

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[30]E. T. Hollingsworth, Jr., "The Wooden Ship--The South's Contribution to the New American Merchant Marine," Manufacturer's Record, 74(October 17, 1918): 74.

[31]The twenty-one companies and their capital stocks were the following: Gulfport Shipbuilding Company, $50,000; International Shipbuilding Company, $50,000; City of Pensacola Ship Company, $150,000; City of Houston Ship Company, $200,000; Gulfport Shipbuilding and Manufacturing Company, $5,000; City of Gulfport Shipbuilding Company, $200,000; Biloxi Shipyard and Box Company, $10,000; City of Beaumont Ship Company, $200,000; City of Mobile Ship Company, $200,000; City of Dallas Ship Company, $200,000; Dierks-Blodgett Shipbuilding Company, $150,000; Arrow Boat Company, $25,000; International Shipbuilding Company capital increased to $200,000; Mississippi Shipbuilding Company, $100,000; Hodge Ship Company, $200,000; Coast Ship Company, $100,000; City of Galveston Ship Company, $200,000; City of Lafayette Ship Company, $200,000; City of Orleans Ship Company, $200,000; City of Austin Ship Company, $200,000; and City of Waco Ship Company, $200,000, reported in "Twenty-one Shipbuilding Plants Established on Mississippi Coasts Points Within Year," Manufacturer's Record, 73

in the South produced mixed results; some companies did well while others produced very little.

The second problem with the South's shipbuilding effort lay in the fact that many southern lumbermen overestimated their ability to supply the necessary timber, and apparently the South suffered alone in this respect. Charles N. Crowell reflected the South's early attitude in a speech to the twenty-fifth general meeting of the Society of Naval Architects and Marine Engineers, held in New York City on November 15 and 16, 1917. Crowell boasted that long-leaf pine from Calcasieu Parish, Louisiana, constituted the "best shipbuilding timber in the world." Admitting that some of the new shipbuilders had never built ships before, he declared that they were men of "executive ability who know how to make up an efficient organization." Upon being questioned about the quality of work produced by these yards, Crowell rejected as "rot" criticism about inexperienced builders wasting time and material and doing poor work.[32]

(January 31, 1918): 78c. Henry Piaggio, owner of International Shipbuilding Company, attempted to attract more government contracts by incorporating his ships and thereby increasing capitalization, according to Frank Karppi, naval architect for Levingston Shipbuilding Company, personal interview, in Orange, Texas, on November 7, 1978.

[32]Charles N. Crowell, "Shipbuilding in the Gulf States and the Natural Resources and Facilities Favorable Thereto," Transactions of the Society of Naval Architects and Marine Engineers 25(New York: The Society of Naval Architects and Marine Engineers, 1917): 11-12, 15.

Even the United States Shipping Board fell prey to the infectious optimism of the southerners and agreed to build shipbuilding facilities for the newcomers with government money without requiring either contracts or specifications.[33] The Manufacturer's Record, a longtime supporter of southern business, was filled with promising news and expectations before completion of the facilities on sites which had been mud and weeds and infested with mosquitos only a few weeks before. At Tampa, Florida, in August, 1917, the Tampa Dock Company had contracts for four wooden ships to be finished before September 1, 1918, yet had not finished building the first way of the yard. Two other Tampa firms, Williams Shipbuilding Corporation and Stuart Shipbuilding Corporation, expected to receive contracts for eight ships before they began building their yards. Although the Tampa Dock Company was a local business, the Williams' firm represented New York interests, while the Stuart corporation was a Boston firm.[34]

Despite the glowing expectations and extensive preparations, the wooden ship program encountered problems and delays from the start. Large timbers proved difficult to obtain, lumber dealers failed to deliver sufficient quantities of lumber, railroad cars were scarce, labor shortages

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[33]Mattox, Building the Emergency Fleet, p. 22.

[34]Hollingsworth, "Wooden Ship," pp. 58-59.

hampered efforts, inexperienced shipbuilders floundered, and lumber mills sold choice timber to other buyers. These problems were compounded by design changes, a lack of employee housing, and undercapitalization. Rear Admiral Francis T. Bowles, Chief of the Construction Division, Emergency Fleet Corporation, charged in December, 1917, that lumbermen had delivered only one-third of the timber promised. Later events revealed even more problems related to poor railroad connection.[35]

United States Steel Corporation made important plans to expand in the South through its subsidiary Tennessee Coal, Iron and Railroad Company. Included in its plans were an industrial city at Fairfield, Alabama, a warehouse on the Warrior River, and a large shipbuilding plant at Mobile. Its plan provided for developing an orderly supply of steel ship plates from the corporation's plant in Birmingham to the shipyard in Mobile. Plates, shipped via railroad lines from Birmingham to the warehouse and docks at the head of the Warrior River, would then be loaded aboard barges and ferried down the Warrior to Mobile. At Mobile the company proposed to construct a shipyard similar

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[35]U.S. Congress, Senate, Committee on Commerce, Hearings Directing the Committee to Investigate All Matters Connected With the Building of Merchant Vessels Under the Direction of the United States Shipping Board Emergency Fleet Corporation and Report Its Findings to the Senate, 65th Cong., 2d sess., 22, 23 January and 5 April, 1918, pp. 34, 970-980, 1016-1019.

to the United States Steel shipyard at Hackensack, New Jersey. The yard would cost six million dollars, employ five thousand mechanics, and sport twelve ways.[36]

Pascagoula, Mississippi, experienced the same onslaught of wartime entrepreneurs. One Henry Piaggio, an Italian vice-consul and owner of International Shipbuilding Company, joined the movement after pioneering the construction of a wooden auxiliary-powered sailing ship. Piaggio, for the first time, successfully installed two 2,500 horsepower crude oil engines with twin propellers in a 2,500-ton, five, masted barkentine. At first located in Beaumont, Texas, Piaggio launched the City of Orange from his shipyard on October 26, 1916. Encouraged by this success Piaggio established a new yard in nearby Orange, Texas, later consolidated his operations in Orange and Beaumont, and produced a 3,500-ton auxiliary freighter, the City of Dallas in 1917. Piaggio then purchased over 1,500 feet of frontage on the Pascagoula River in Mississippi with plans to build one hundred more auxiliary freighters on his own account.[37]

Louisiana and Texas joined the rush to shipbuilding but to a lesser extent than Alabama or Mississippi. At Madisonville, Louisiana, across Lake Pontchartrain from New Orleans, the Jahncke Navigation Company had government

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[36]Ibid., pp. 1005-1008.

[37]"New Type of Vessel South's Contribution to Shipping World," Manufacturer's Record, 74(October 17, 1918): 75.

contracts for six wooden ships, while the Slidell Shipbuilding Company, a subsidiary of Salmen Brick and Lumber Company, at Slidell, Louisiana, built five wooden steamships for the government.[38]

Texas had several commitments, but the war ended before most of the contracts could be completed. Orange, Texas, shipyards had twenty-one ships under construction on August 6, 1917, and an additional thirty-five under contract worth $13,915,000.[39] The combined Beaumont, Texas, yards of Howland and Nelson; Piaggio's Beaumont branch of International Shipbuilding Company; A. H. Tarver Shipbuilding Corporation; Lone Star Shipbuilding Company; McBride and Law Shipbuilding Company; J. M. McCamon Shipbuilding Company; and Todd Shipbuilding Company had three ships under construction and contracts for eighteen more ships at the end of the war. Even lumber baron John Henry Kirby organized the Beaumont Shipbuilding and Drydock Company on a sixty-six acre island in the Neches River to build ships on government contract, but the Armistice interrupted his plans. The Houston ship channel harbored several small shipyards holding government contracts for eighteen wooden

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[38]"Work in Louisiana on Ships of Both Wood and Steel--Six Wooden Ships Under Contract for Government," Manufacturer's Record, 72(August 9, 1917): 60.

[39]"Orange, Pioneer in Building of Yellow Pine Ships, Has Two and a Half Years' Contracts Now," Manufacturer's Record, 72(August 9, 1917): 60.

ships and prospects for contracts for twelve more vessels of the same type.[40]

Throughout this period of feverish activity, southern lumbermen organized in preparation for supplying the shipyards with the huge quantities of timber necessary for the building of the projected wooden fleet. Southern sawmills making up the Southern Pine Association, the Georgia-Florida Sawmill Association, the Southern Cypress Manufacturing Association, and the North Carolina Pine Association expected some problems before the program began. The size of the task grew when they realized the magnitude of supplying the new shipyards as well as the United States Army with materials for constructing training camps. A labor shortage, created both by the war effort and by higher wages being paid in other industries stimulated by the war, injected another unexpected difficulty into the supply problem. The various lumber associations created emergency organizations to meet the crisis and to facilitate the purchase and delivery of lumber to the federal government. The United States Shipping Board reciprocated by establishing a lumber department in each district as well as transportation department to work with the lumbermen.[41]

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[40]"More Than Twenty Ships at Beaumont Under Construction and Contracted For, With Additional Great Plant Being Built," Manufacturer's Record, 72(August 9, 1917): 60.

[41]Hollingsworth, "Wooden Ship," p. 74.

Late 1917 was a time of reorganization and adjustment for the southern program. A Senate committee investigation of the wooden ship program resulted in structural changes in the United States Shipping Board and a turnover in management which made E. N. Hurley chairman of the ship-building program. To solve the pine timber shortage, three solutions were proposed. The Shipping Board solved the immediate shortage of timber by ordering the shipment of 1,500 carloads of Oregon fir from the Pacific coast for use on the southern coasts. A three-day meeting between southern lumber industry representatives and the United States Shipping Board in Washington, D.C., in March, 1918, produced two significant actions. The Shipping Board appointed John Henry Kirby, vice-president of the Southern Pine Association, as the federal government's Lumber Administrator for the South to ensure more cooperation and production from lumbermen. The Shipping Board also introduced modifications on the Ferris model cargo ship which eased the difficulties arising from the requirements for large timbers. The Shipping Board architects not only eliminated the use of twenty-four to thirty-four inch wide frame timbers but allowed the use of laminated or "built-up" frame timbers to compensate for the scarcity of natural large timbers in southern pine forests. By relaxing the requirement for large timbers, however, the Shipping Board increased the

severity of the lumber shortage, since shorter pieces increased the amount of lumber required per ship by about 500,000 feet.[42]

The South had not limited its construction to wooden ships. By May, 1919, a total of sixty-four wooden, steel, and concrete ships had been built in southern yards. Before another year passed a total of 600,000 deadweight tons of steel cargo ships and tankers had been built in the region. Thirty wooden and concrete ships came from the Gulf coast district involving the shipyards of Jahncke Shipbuilding Corporation in Madisonville, Louisiana; Louisiana Shipbuilding Company in Slidell, Louisiana; Dantzler Shipbuilding Company and Hodge Ship Company in Moss Point, Mississippi; Dierks-Blodgett Shipbuilding Company in Pascagoula, Mississippi; Mobile Shipbuilding Company, Fred T. Ley Company, and Alabama Shipbuilding Company in Mobile, Alabama; Pensacola Shipbuilding Company in Pensacola, Florida; Tampa Shipbuilding and Engineering Company, Oscar Daniels Company, and Tampa Dock Company in Tampa, Florida. Even Henry Ford showed an interest in establishing a number of southern yards for steel hull fabrication.[43]

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[42]"Present Status of Shipbuilding in Eastern and Southern Yards," Manufacturer's Record, 73(January 3, 1918): 76; "Wooden Shipbuilding Difficulties Apparently All Cleared Away," Manufacturer's Record, 73(January 3, 1918): 77.

[43]"Southern Shipbuilding Activities," International Marine Engineering, 25(May, 1920): 389; "Present Status of Shipbuilding," International Marine Engineering, 25(May, 1920): 76.

Although steel shipbuilding was not extensive in the South, its development there accurately reflected a nation-wide trend in shipbuilding which became critically important in World War II.

Under the United States Shipping Board new contracts called for two types of steel vessels--the standard model and the "fabricated" model. A steel vessel constructed according to a standard blueprint constituted the standard model; the yard holding the contract did all the work within the yard with a minimum of prefabrication. Ships' parts were fitted to the ships in the old shipbuilding manner, resulting in a custom-made ship without a significant decrease in construction time. The practice proved too slow for war needs. The "fabricated" model represented an important innovation and a preview of World War II shipbuilding methods. This method of construction in World War I revolved around the concept of designing a ship with a maximum number of standardized structural parts and having the parts manufactured in plants scattered throughout the country. The parts were then sent to the yards for assembly with little fitting left to be done. Under this procedure, twenty-six steel mills supplied fifty-six fabricating plants from Massachusetts to Virginia with steel ship plates where 96 percent of the hulls underwent fabrication before shipment to Atlantic yards for final assembly.[44]

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[44]Hurley, New Merchant Marine, pp. 66, 71.

Assembly of fabricated ships suffered from three limitations: (1) narrow railway clearances, (2) the inadequacy of the Panama Canal locks to accept traffic over one thousand feet in length or 110 feet in width, and (3) the limited crane capacities of the yards. If these limitations had not been present, even more and larger prefabricated parts could have been constructed, resulting in higher production rates and structurally stronger ships. The Shipping Board designated three shipyards as "agency" yards for this construction experiment: American International Shipbuilding Corporation at Hog Island, Pennsylvania; Submarine Boat Corporation at Bristol, Pennsylvania; and Merchant Shipbuilding Corporation at Newark Bay, New Jersey. Nine other yards received similar contracts for "fabricated" ships wholly or in part, but they were not designated as "agency" yards nor located in the South.[45] By December, 1917, contracts had been let for 330 "fabricated" ships totaling over 2,200,000 deadweight tons.[46]

Peace in 1918 brought the shipbuilding experiment to an abrupt halt and introduced a period of naval and merchant shipbuilding retrenchment that lasted until the beginning of World War II. Although the federal government continued to give aid to the industry in a series of acts, most World

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[45]Mattox, Building the Emergency Fleet, p. 46.

[46]Smith and Betters, United States Shipping Board, p. 29.

War I shipbuilders either went out of business shortly after the war or barely subsisted until 1941. Government support, however, from 1916 through 1936 provided one of the needed ingredients for development of the industry along the Gulf coast.

CHAPTER 2

NATIONAL SHIPBUILDING LEGISLATION, 1916-1936

Congress enacted several pieces of enabling legislation for the shipbuilding industry between 1916 and 1936. The comprehensive character of this legislation attempted to revive the entire maritime industry including operators, longshoremen, merchant sailors, shipbuilding, and ship repair concerns. Each act represented a definite and direct continuation of the American maritime policy first promulgated in the Shipping Act of 1916 and reached its fullest expression in Title I of the Merchant Marine Act of 1936:

> It is necessary for the national defense and development of its foreign and domestic commerce that the United States shall have a merchant marine (a) sufficient to carry its domestic water-borne commerce and a substantial portion of the water-borne export and import foreign commerce of the United States and to provide shipping service essential for maintaining the flow of such domestic and foreign water-born commerce at all times, (b) in time of war or national emergency, (c) owned and operated under the United States flag by citizens of the United States insofar as may be practicable, (d) composed of the best-equipped, safest, and most suitable types of vessels, constructed in the United States and manned with a trained and efficient citizen personnel, and (e) supplemented by efficient facilities for shipbuilding and ship repair. It is hereby declared to be the policy of the United States to foster the development and encourage the maintenance of such a merchant marine.[1]

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[1]Merchant Marine Act, 46 U.S. Code, 1101 (1936). See also Shipping Act, 46 U.S. Code, 801 (1916); Merchant Marine Act, 46 U.S. Code, 861 (1920); and Merchant Marine Act, 46 U.S. Code, 891 (1928).

The four acts most directly concerned with promoting the merchant marine included the Shipping Act of 1916, Merchant Marine Act of 1920, Jones-White Merchant Marine Act of 1928, and Merchant Marine Act of 1936. The National Industrial Recovery Act of 1933 included provisions affecting the shipbuilding industry under the National Recovery Administration even though the legislation aimed at aiding the entire American business structure.

Of these five acts only the first and last amounted to any substantial support for Gulf coast shipbuilders. Each act contained provisions for government displacement of private enterprise in a national emergency, which is what made it financially possible for the Gulf coast to participate in the shipbuilding effort of the United States in both world wars I and II. Basically southern shipbuilding, like so much of shipbuilding's economic growth, depended on government funds to break the hold of outside capital. In order to provide the necessary tonnage in World War I, the Shipping Act of September 7, 1916, created the United States Shipping Board, which in turn was authorized to form the Emergency Fleet Corporation with a capital of fifty million dollars with the United States as the chief stockholder. To this end the Emergency Fleet Corporation organized a District of Columbia corporation on April 16, 1917.[2]

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[2]Webb, "Wooden Steamship," p. 276.

The corporation could purchase, charter, or build ships and could operate them for five years after the war unless private business wanted to purchase them. Once the United States declared war in 1918, the Shipping Board obtained additional emergency powers, and appropriations for the Emergency Fleet Corporation exceeded three billion dollars. The construction program involved building over three thousand ships totaling more than seventeen million dead-weight tons.[3]

The original act of 1916 did not allow unlimited ship-building by the Emergency Fleet Corporation. Instead, the emergency shipping fund in the Urgent Deficiencies Act of June, 1917, gave President Woodrow Wilson the power to requisition, construct, and operate ships limited only by congressional financial restraints. With this financial arrangement, the United States Shipping Board became the sponsoring body of the Emergency Fleet Corporation, but the two had distinctly different areas of responsibility. The Shipping Board concerned itself with three areas of activity: acquisition of ships after construction, operation of these ships, and regulation of shipping. The Shipping Board assigned two functions to the Emergency Fleet Corporation: shipbuilding, as its chief responsibility

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[3]Edward N. Hurley, The Bridge to France (Philadelphia: Lippincott, 1927), p. 37.

along with regulation of shipyards.[4] Under this arrangement the Gulf coast actively participated in the nation's World War I shipbuilding effort in yards located from Florida to Texas. After the war, most of the country's shipyards went out of business, making the Gulf coast's experience comparable to the other shipbuilding regions.

For the next several years the United States Shipping Board faced the task of disposing of government surplus at reduced costs at a time when coal-burning ships were being replaced by oil-burners, reciprocating engines by turbines and turbo-electric drives, and the internal combustion engines by steam-driven engines. Originally, the Shipping Board planned to sell steel cargo ships at $160 to $185 per deadweight ton, less depreciation, but the depression of 1921 forced the price down to about $30 per deadweight ton. Another problem developed when some purchasers returned ships on which they could not make payments. A total of ninety-six ships of 544,154 deadweight tons, representing a net selling price of $61,419,392 unpaid, came back. Cancellations totaling a new unpaid selling price of $18,496,468 for twenty-five ships of 142,365 deadweight tons added to the burden.[5] Under these conditions the Shipping Board developed a new ship sales policy calling for 25 percent of the

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[4]Mattox, Building Emergency Fleet, p. 7.

[5]Manufacturer's Record, 72(August 9, 1917), 58-61.

purchase price in cash with the balance paid in ten equal annual installments carrying 5 percent interest payable semi-annually, all to be secured by first preferred mortgages.[6] The following table shows the record of sales from 1922 through 1927.

TABLE I

ANNUAL SALES RECORD*

Year	No. Sold	Dwd. Tonnage	Selling Price
1922	87	458,495	$10,011,680
1923	382	1,734,213	30,138,906
1924	52	367,063	7,045,684
1925	58	339,000	8,996,464
1926	348	1,699,127	19,666,059
1927	52	346,550	6,989,327
Totals	979	4,944,448	$82,848,120

*Source: United States Shipping Board, Annual Report, 1927, p. 93.

Starting in 1919 the Shipping Board reduced the surplus fleet from 3,444 ships of 19,598,000 deadweight tons to 823 ships weighing only 6,490,239 deadweight tons by 1927.[7]

The Merchant Marine Act of June 5, 1920, provided for the establishment of American lines on critical routes with privately-owned tonnage, if possible, or with government tonnage under private charter to aid in disposing of the surplus tonnage. This act included no provision for

[6]United States Shipping Board, Annual Report, 1921, p. 65.

[7]Ibid., p. 94.

shipbuilding subsidies. nor could provisions have been justified given the large excess of ships at the time. The act did authorize a construction loan fund of $125 million per annum to be derived from the sales receipts and operating revenues of the Shipping Board,[8] which intended for the money to be spent for aid to United States citizens in construction of vessels for shipping lines.[9] Response to the construction loan provision revealed the weakness of the industry. Of the maximum $125 million authorized by the act, Congress allocated only $86,810,000 through 1928, and builders borrowed only $32,800,000 of that amount.[10]

Most of the shipyards closed or turned to building railroad cars, trawlers, or other odd items. The only significant merchant ships built between 1922 and 1928 were thirteen passenger vessels totaling 103,558 gross tons for

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[8]Ibid., 1922, p. 192.

[9]New York Times, April 24, 1928, p. 51. New ships constructed with the Jones Act construction fund included: (1) Twinports and Twincity motorships for service on the Great Lakes, (2) Shawnee, Iroquois, Mohawk, Algonquin, Cherokee, and Seminole for the Clyde line, (3) Boston, New York, Yarmouth, and Evangeline for Eastern Shipping Company in the New York to Boston service, (4) Coama for the New York and Porto Rico Steamship Company, (5) George Washington and Robert E. Lee for the Old Dominion line, and (6) California and Virginia for the Panama Pacific line. Gulf coast yards built none of these.

[10]Julius A. Furer, Administration of the Navy Department in World War II (Washington: Government Printing Office, 1959), p. 214.

limited coastwise and intercoastal lines.[11] Attempts to modify or increase aid to the crippled industry met opposition that kept new legislation from being passed until 1928. The American Federation of Labor led by Samuel Gompers typified this opposition. In 1922 Congress addressed a bill which included a sliding scale subsidy increasing in proportion to the speed of the vessel. Backers of the bill intended to encourage modernization of the fleet by subsidizing the replacement of reciprocating engines with faster and more modern diesel engines in existing ships. The AFL led by Gompers termed the bill "fundamentally wrong in principle" and the "worst example of proposed legislation to come to public attention in many years."[12] Congress soon dropped the bill and avoided passing additional merchant marine legislation until 1928.

The Washington Naval Disarmament Conference of 1922 contributed to the death of naval ship construction from 1921 through 1933. Under the agreement reached in the Five Power Treaty, two of the six battle cruisers being constructed in the United States were converted into the aircraft carriers Lexington and Saratoga. Seven battleships on the ways and two more that received commissions became scrap, leaving a total of eighteen capital ships in the

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[11]Ibid., p. 215.

[12]Samuel Gompers, "Again That Subsidy Ghost," American Federationist, 29(May, 1922): 330.

United States Navy, which represented the treaty's allowance of 500,650 tons. No battleships appeared on American building ways again until the North Carolina's keel took shape in 1937.[13]

By 1933 only six private shipyards capable of constructing ships larger than destroyers and submarines remained in business: Bethlehem Shipbuilding Corporation's Fore River yard at Quincy, Massachusetts; New York Shipbuilding Corporation, Newport News Shipbuilding and Drydock Company; Bath Iron Works Corporation of Bath, Maine; Federal Shipbuilding and Drydock Company of Kearney, New Jersey; and Electric Boat Company of Groton, Connecticut. William Cramp and Sons Ship and Engine Building Company in Philadelphia, one of the larger wartime yards, closed in 1927 when it finished its share of World War I contracts. Bethlehem's Fore River plant successfully endured the difficult years with a small number of naval contracts and the support of its parent steel company. New York Shipbuilding Corporation suffered several reorganizations and subsisted primarily on the conversion of the Saratoga to an aircraft carrier. Newport News Shipbuilding and Drydock Company turned to constructing water turbines, flood gates, cane harvesters, and traffic lights for survival. Bath Iron Works Company closed briefly but reopened quickly after being reorganized

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[13]Furer, Administration of the Navy Department, p. 214.

to construct a single destroyer. It managed to weather the depression through odd jobs as did Federal Shipbuilding and Drydock Company. Electric Boat Company eked out a precarious existence by building submarines one at a time.[14]

The seven navy yards in Portsmouth, New York, Puget Sound, Philadelphia, Boston, Norfolk, and Charleston had some new construction. Mare Island experienced difficult years, and Charlestown, Massachusetts, practically closed down. Following the completion of World War I programs and the post-war conversion of the Lexington and Saratoga, the construction of a few cruisers, destroyers, and submarines represented all new naval construction until 1933. At one time or another after World War I, new construction disappeared entirely from every navy yard except Portsmouth. The New York Navy Yard stood without new construction from 1922 to 1926, and Puget Sound had none from 1924 to 1926. Philadelphia Navy Yard went six years, 1924 to 1930, without new work. Boston Navy Yard completed its World War I contract in 1924 and received no more new work until 1932. Both Norfolk and Charleston navy yards enjoyed new construction from the end of their World War I programs until the National Industrial Recovery Act (NIRA) program of 1933 but on a greatly reduced level.[15]

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[14]Ibid., p. 215.

[15]Ibid.

The Washington treaties did permit the construction of one small aircraft carrier, twenty-five small cruisers, eight destroyers, and six submarines in the navy yards. Of the forty naval ships produced, twenty-two came from navy yards and eighteen from private eastern yards, but none from the Gulf coast.[16] The treaties reflected public and congressional indifference toward the Navy. In a speech to the Senate on July 19, 1930, Senator David Walsh compared the United States' shipbuilding program through 1929 with the major naval powers, and the United States produced the least.[17]

In addition to the reduced building program, some modernization and conversion work occurred throughout the decade. This small volume did little more than allow the existing yards to maintain skeletal working forces. Each year following the passage of the Merchant Marine Act of 1921 saw the proportion of American foreign commerce carried in American ships fall continuously. In 1928 American shipping constituted only 2 percent of the world's total, which placed it tenth, although it had held eighth place for the previous two years according to Lloyd's Register of Shipping.[18] As early as January, 1928, the U.S. Shipping Board called a meeting of American shipbuilders, owners, and

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[16]New York Times, May 30, 1943, p. 5.

[17]U.S. Congress, Senate, Congressional Record, 71st Congl., Special Session of 7-21 July 1930, 73: 320.

[18]New York Times, May 6, 1928, p. 10.

operators to solicit their opinions before making recommendations to the upcoming Seventieth Congress. Two problems in particular received considerable attention. Foreign construction costs undermined American building efforts considerably. H. G. Walker, Secretary of the American Steamship Owners' Association estimated that it cost 59 percent more in the United States than in Great Britain to build a ten thousand ton deadweight cargo steamer capable of attaining nine knots. Add to this estimate the annual fixed charges of insurance at 4 percent per annum, depreciation at 5 percent per annum, and 6 percent per annum on invested capital, and the American-built vessel cost $322,500 in comparison with $108,000 for the British version.[19] Under such conditions prospective American investors hesitated even to enter the business. The other problem complicating a solution for owners and builders alike surfaced soon after passage of the Merchant Marine Act of 1920 in the struggle over government versus private control. Some U.S. Shipping Board members desired government dominance in the field and successfully inserted a by-law to the effect that five of the seven Shipping Board

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[19]Ibid., April 29, 1928, p. 13. Walker extended his comparison to include several types of ships. A 9,850-ton tank steamer cost 60 percent more in American yards, and a combination passenger-cargo steamer of eleven thousand tons cost 54 percent more if American-built. For diesel-powered ships the disparity was even greater; an American ten thousand ton diesel steamship cost $2,150,000 or $215 per ton in contrast to $720,000 or $72 per ton from British yards.

members had to approve a sale to a private operator.[20] President Calvin Coolidge finally reversed this bias in May 1928, by appointing the business-oriented Hutch I. Cone to the Shipping Board to replace the major proponent of government control, W. S. Benson.[21]

Until this change took place, several ship sales failed because of this pro-government attitude, and the problem became part of the struggle between the Democratic and Republican parties. The Democratic party in 1928 took the position that government regulation ensured fair and wise maintenance of the industry. On the other hand, the Republican party apparently preferred private ownership, citing a desire for an "American-owned, American-built, and American-operated" merchant marine fleet.[22]

Congress reviewed the situation and passed the Jones-White Merchant Marine Act of May 22, 1928, which contained provisions intended to complete the sale to private owners of the remaining war-built ships, to revive the merchant marine, and to rejuvenate the shipbuilding business in a comprehensive manner. The act reaffirmed the primary policy of the government to take whatever steps necessary to build and maintain a merchant marine fleet as stated in previous

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[20]Merchant Marine Act, 46 U.S. Code, 863 (1920).

[21]Ibid.

[22]Ibid.

legislation.[23] The act included government assistance to the shipping and shipbuilding industries through construction loans with low interest rates to shipbuilders and interested owners. It also included subsidies to ship owners for the transportation of mail in order to encourage the initiation or maintenance of shipping lines. A construction loan fund of $250 million came under the regulation of the U.S. Shipping Board. Loans granted by the Shipping Board were to be repaid within twenty years in amounts up to three-fourths of the reconditioning cost of an old ship. Indirectly, the ten-year contract mail subsidy aided the shipbuilders by encouraging the construction of faster, larger ships with higher rates of pay as follows.

TABLE II

CLASS RATES*

Class	Speed (Kts.)	Dwd. Tonnage	Rate
1	24	20,000	$12.00
2	20	16,000	10.00
3	18	12,000	8.00
4	16	10,000	6.00
5	13	8,000	4.00
6	10	4,000	2.50
7	10	2,500	1.50

*Source: Merchant Marine Act, 46 U.S. Code, 892(1928).

[23]Shipping Act, 46 U.S. Code, 801(1916); Merchant Marine Act, 46 U.S. Code, 861(1920); 46 U.S. Code, 891(1928).

Line owners and charterers of government tonnage responded by buying 220 of the war-built ships by 1934 which represented 78 percent of the ships under mail contract. Henry Hunter, counsel for the National Council for American Shipbuilders believed the "Jones-White bill is the best bit of legislation that has been enacted for shipbuilding in 75 years. Much good should come from it." Others, such as Charles Pearsall, Vice-President of the Colombian Steamship Company, considered the act a "splendid start," yet he pointed out that the operating cost of any new ships built under the act would exceed by a half million dollars the operating costs of similar ships built and operated by foreign competitors.[24]

In subsequent years interest in the act lessened considerably. Through 1933 new ship construction of the passenger-cargo type vessel amounted to a mere 480,000 gross tons. Between 1928 and 1935 the United States built only eight deep-water cargo tankers for large oil companies.[25] By 1933 even that construction had come to an end, and at one time in 1935 shipyards in the United States had no deep-water ships on the ways except for a few tankers. By then

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[24]New York Times, May 25, 1928, p. 51; New York Times, May 29, 1928, p. 41.

[25]Hutchins, "History and Development of the Shipbuilding Industry," p. 56; Horace N. Gilbert, "The Expansion of Shipbuilding," Harvard Business Review 22(Winter, 1942): 157.

the depression extended to all parts of the globe and in many countries had produced plans for reducing shipbuilding facilities as well as for the subsidized destruction of older ships. The extension of new subsidies to shipping and shipbuilding in old and new maritime countries resulted in an increasingly severe and chronic surplus of tonnage, which brought pressure on liner and charter rates to the detriment of American merchant shippers and builders.[26] A survey of all two thousand-ton vessels or more built by the leading maritime nations between January, 1922, and December, 1936, showed the weakened position of the United States.

TABLE III

WORLD SHIPBUILDING SURVEY*

Country	Tonnage
United Kingdon	9,875,845
Germany	1,984,742
France	1,254,532
Japan	1,195,434
United States	1,073,805
Italy	1,057,682

*Source: H. G. Smith, "A Definite Shipping Replacement Program," United States Naval Institute Proceedings, 44(April, 1938): 544.

The next opportunity for relief from the effects of the Great Depression and American isolationist policies came early in President Roosevelt's first administration in a

[26]Gilbert, "Expansion of Shipbuilding," p. 57.

provision embedded in the National Industrial Recovery Act of 1933. Section 202 of the act authorized new naval construction in cruisers and smaller vessels to full treaty strength. Roosevelt alloted a total of $238 million from the Federal Emergency Administration of Public Works to the Department of the Navy.[27] The money enabled the navy to build the aircraft carriers Yorktown and Enterprise along with five cruisers and several destroyers and submarines.[28] Unfortunately, the bulk of the construction contracts went to government navy yards; hence, the National Industrial Recovery Act failed to revive the ailing private shipbuilding industry. Instead, the act aggravated the tensions between private and government yards and added to the problems of smaller private firms.

From the first the Gulf coast yards could not expect much help from this New Deal legislation. Provisions of the National Recovery Administration Code for Shipbuilders and Shiprepairers restricted the industry's growth along the Gulf coast in three major ways. First, the industry's leaders, who wrote the code for the entire industry, came from the membership of the National Council of American Shipbuilders and did not include Gulf coast representatives to any appreciable degree. (See Table XI in the Appendix

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[27]U.S. Statutes at Large, 202(e).

[28]Potter and Nimitz, Sea Power, p. 484.

for a list of the Council's representatives). Of the ten men selected to compose the code, none came from the Gulf coast.[29] Secondly, framers of the act intended to revitalize existing plants rather than create new ones. Hugh S. Johnson, administrator of the act's National Recovery Administration, characterized the industry's plight as a "great over-capacity of physical facilities" inherited from World War I.[30] Estimates by representatives of the industry indicated that new naval construction and application of the National Recovery Administration code for shipbuilders would raise employment from fifteen thousand to sixty thousand but not create any new yards. Two paragraphs in the code's by-laws revealed the intentions of the industry's

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[29]"Memorandum of July 26, 1933," Record Group 9, Records of the National Recovery Administration, Shipbuilding and Repair Industry, National Archives. (References to the Records of the National Recovery Administration, Shipbuilding and Repair Industry hereinafter cited as Records of the NRA). The following ten men composed the committee to write the shipbuilding and repair industry's code: H. Gerrish Smith (Chairman), President of the National Council of American Shipbuilders; Joseph Haag, Jr., President of Todd Drydock, Engineering and Repair Corporation of Brooklyn, New York; S. W. Wakeman, Vice-president of Newport News Shipbuilding and Drydock Company of Newport News, Virginia; Robert Haig, Vice-president of Sun Shipbuilding and Drydock Company of Chester, Pennsylvania; W. H. Gerhauser, President of the Great Lakes Shipbuilders and Repair Association; Robert L. Hague, Industrial and Consumer Advisor; Joseph S. McDonagh, Labor Advisor; William H. Davis, NRA representative; and Captain Henry Williams, U.S. Navy representative.

[30]Hugh S. Johnson to H. Gerrish Smith, Joseph Haag, and S. W. Wakeman, July 13, 1933, "Exhibit I," Record Group 9, Records of the NRA.

leaders: (1) to provide for an "equitable" distribution of labor and (2) to avoid increasing the number of plants in the industry.[31] Under such restrictions the Gulf coast concerns or other interested parties received no encouragement from this legislation.

No actual conspiracy existed to deprive the Gulf coast shipbuilders of opportunities to better themselves, but the industry's leaders apparently desired to keep shipbuilding limited to a small and exclusive clique. Southern leaders remained sensitive to the allocation of government contracts throughout the war and reacted vigorously when they believed the South was slighted. This sensitivity stemmed from a belief that the South's greatest handicap resulted from an economic subservience to the North, in a system whereby the South provided the raw materials for northern industries to the economic detriment of the South. Later, the concept of the "colonial economy" developed into a conspiracy thesis in which northern industrial leaders deliberately operated to keep the South in a colonial status.[32]

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[31]"Shipbuilding and Repair Industry Code, Exhibit J," Record Group 9, Records of the NRA.

[32]Howard W. Odum, Southern Regions of the United States (Chapel Hill: University of North Carolina Press, 1936), p. 353; Rupert B. Vance, Human Geography of the South: A Study in Regional Resources and Human Adequacy (Chapel Hill: University of North Carolina Press, 1932), pp. 442-448; Walter P. Webb, Divided We Stand: The Crisis of a Frontierless Democracy (New York: Farrar and Rinehart, 1937), pp. 86-87.

The wage and hour constraint of the act contained the third deterrent to Gulf coast participation. In setting the minimum drydocking charges, the code's committee put the Gulf coast at a disadvantage. For the Atlantic division, which represented the strongest members of the shipbuilding industry, the committee charged only twelve cents per ton for hauling a ship into drydock and ten cents per ton per day in drydock. Contrasted to this the Gulf coast yards had to charge sixteen cents and fourteen cents respectively. An offsetting factor for the Southern shipbuilder emerged when the committee also assigned the Gulf coast employees a lower minimum wage rate than in the Atlantic division as the following table shows.

TABLE IV

NRA MINIMUM HOURLY WAGES*

Craft	Gulf	Atlantic	New York
Machinist	$1.32	$1.35	$1.38
Gas Welder	1.32	1.35	1.38
Pipefitter	1.32	1.35	1.38
Laborer	.90	.95	1.07
Helper	1.00	1.05	1.07
Boilermaker	1.32	1.35	1.38
Draftsman	2.24	2.34	2.34
Loftsman	1.49	1.53	1.56

*Source: Exhibit J of Code approval by President Roosevelt, July 26, 1933. "Records of the National Recovery Administration," Record Group 9. National Archives.

Another factor worked to the detriment of the private yards throughout the nation that attempted to attract government contracts. The code limited working hours on goverment vessels in private shipyards to thirty-two hours per week, thirty-six hours per week on merchant vessels, and forty hours per week on repair work.[33] Government navy yards operated on an employment basis of an average of forty hours per week, thereby placing private industry at a disadvantage in securing and maintaining employees due to the possibility of higher weekly earnings on the longer hours in government-owned yards. As a result, even the strongest private builders applied for and won exemptions from the hourly restrictions. Both Newport News Shipbuilding and Drydock Corporation and Bethlehem Shipbuilding Company won two extensions allowing their ship designers and mold loftsmen to work to a maximum of forty-four hours per week instead of thirty-six to build the two aircraft carriers, Yorktown and Enterprise.[34]

Although the National Industrial Recovery Act did improve the industry's position, the Annual Report of the National Council of American Shipbuilders estimated that the private shipbuilding industry operated at 30 percent of

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[33]"Shipbuilding and Repair Industry Code, Exhibit J," Record Group 9, Records of the NRA.

[34]National Recovery Measures in the United States, International Labour Office, Studies and Reports, Series B, no. 19 (Geneva, 1933), p. 107.

its normal capacity in 1934 in comparison with 20 percent in 1933. (See Table XII in the Appendix for a comparative summary). The ship repair industry showed some improvement in 1934 in the larger yards because necessity forced repairs to vessels on which such repairs had been delayed as long as possible. A comparison of the amount of ship repairing performed on merchant vessels in 1933 and 1934 disclosed only a small difference. Merchant vessels delivered during 1933-34 consisted of two cargo ships for the A. H. Bull Steamship Company, three small tankers for the Socony Oil Company, and one small tanker for the Gulf Refining Company.[35]

Overall, the National Industrial Recovery Act did little to revitalize the shipbuilding industry before the Supreme Court ruled the act unconstitutional in 1935. Naval construction continued in government navy yards with government subvention in the form of the Vinson-Trammel Act and the Emergency Construction Act of 1934 authorizing an eight-year replacement building program amounting to 102 ships. From 1934 to 1940 additional congressional appropriations to the Vinson-Trammel program approached one billion dollars annually. The second Vinson Act of 1938 permitted an additional 20 percent increase in total naval tonnage. Two

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[35]H. Gerrish Smith to Hugh S. Johnson, November 2, 1934, Record Group 9, Records of the NRA.

additional bills, the 11 percent and the 70 percent naval expansion acts, passed on June 14 and July 19, 1940, providing support for the two-ocean navy concept of World War II.[36]

The private shipbuilding industry continued to languish nationwide through the 1930's; however, the Merchant Marine Act of 1936 provided the legislation necessary to prepare the industry for the coming war effort. Although the act's authors did not specifically have the Gulf coast in mind when they framed it, the Merchant Marine Act of 1936 provided the fiscal basis for the Gulf coast to join in the nation's shipbuilding program during World War II. The failure of previous legislation to stimulate ship construction, the increasing obsolescence of the war-built fleet, the growing international threat, and the need for more jobs all combined to encourage passage of the act. The act resulted directly from numerous disclosures of scandals involving the mail-subsidy system instituted under the Jones-White Merchant Marine Act of 1928. Instead of stimulating new construction or modernization of the old existing fleet, the Jones-White Act fostered excessive lobbying, discouraged expansion, and encouraged questionable use of the subsidy money. Complaints in 1933 led to investigations by the U.S.

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[36]"Annual Report of the National Council of American Shipbuilders, 1934," p. 21, Record Group 9, Records of the NRA.

Post Office, an Interdepartmental Committee on Shipping Policy, and a special Senate committee, headed by Senator Hugo Black, to Investigate Air-Mail and Ocean-Mail Contracts. These investigations found evidence of collusion, in addition to excessive salaries and service charges by subsidiaries and sub-contractors. Despite the scandals, President Roosevelt indicated his continued support for the American merchant marine.[37]

Roosevelt considered the merchant marine vital to American interests for three reasons: to provide adequate logistic support for the navy, to prevent foreign shipping interests from establishing shipping rates harmful to American to foreign markets, and to insure that American world trade could continue even if foreign shippers withdrew their ships from the American trade in time of war.[38] To accomplish the rebuilding of a merchant marine fleet and to avoid a continuation of the ocean-mail contract scandals, Roosevelt outlined what he wanted in the way of new legislation. He called for the termination of foreign ocean-mail contracts, and the construction loan fund, in addition to ending the undesirable abuses of previous legislation. The President also envisioned the creation of a direct

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[37]Potter and Nimitz, Sea Power, p. 484.

[38]Ellis W. Hawley, The New Deal and the Problem of Monopoly: A Study in Economic Ambivalence (Princeton: Princeton University Press, 1966), p. 236.

government subsidy in three parts to replace the ocean-mail subsidies. One subsidy to be paid to the shipbuilder covered the difference between the American and foreign cost of construction. A second subsidy would be paid to the ship operator to cover the cost of operating the vessel under American and foreign registry, while the third would be a countervailing subsidy to offset foreign competition.[39] With few exceptions all of the President's recommendations were incorporated into the 1936 legislation.[40] The Senate Special Investigating Committee took specific steps to prevent a recurrence of the past abuses which had resulted in differences of opinion concerning continued government support for the American merchant marine. Resolution of those differences had special significance for the Gulf coast.

Following the end of World War I, American sentiment about the plight of the merchant marine could be divided into three categories. One group believed that the government, having built approximately two thousand ships for war needs, would keep control of the merchant fleet and operate it as a government agency. A second group wanted the government to sell all its ships to American citizens as quickly as possible, thus separating itself completely from the

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[39]Ibid., pp. 240-241.

[40]"President Roosevelt Lays Shipping Problem Before Congress," Congressional Digest 15(February, 1936): 46.

private sector. They considered the war an aberration and believed that a fleet built as a result of the war should be disposed of on the best terms possible. A third group, taking a moderate position between these two extremes, recommended that the government well the ships to private operators as quickly as possible with the understanding that the operators had to maintain certain services already established by the war-built fleet. Under their plan government aid to the merchant fleet would continue in the form of a subsidy that would compensate for the difference between the cost of operating American flagships and the cost of operating the ships of its nearest foreign competitors.[41]

From this controversy came provisions in the Merchant Marine Act of 1936, which allowed the government to build ships in direct competition with private industry. Initially, the act emphasized private ownership and operation if possible, with adequate safeguards against a repetition of the scandals of the ocean-mail contract system. Under provisions of the act, the Maritime Commission could not only grant subsidies for the construction-differential handicap of building in American yards, as well as the operating-differential handicap of operating under American registry, but it could also provide a countervailing subsidy

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[41]"Should America Subsidize Her Merchant Marine?" Congressional Digest 15(February, 1936): 36.

to equal aid granted competitive foreign lines by other governments.[42] In essence, the act represented a compromise between those who wanted government ownership and private operation and the proponents of private ownership and operation.

The Merchant Marine Act of 1936 provided four specific types of financial aid to encourage the construction of ships in American shipyards by American operators: construction-differential subsidies, liberal construction loans, a special tax credit for scrapped ships, and government-sponsored ship mortgage insurance. In addition, since 1922 the tariff had sheltered American yards from foreign competition by charging a 50 percent ad valorem tax on all equipment and repairs purchased overseas, unless the vessel was forced to have emergency work performed for safety or seaworthiness.[43]

Despite such encouragement the act failed to stimulate substantially the shipbuilding industry. By closely limiting the actions of the shipper and by not allowing a large enough profit to shipowners, operators, or shipbuilders, the provisions of the act designed to protect the public interest made it too restrictive to attract the necessary capital. Among these restrictions were requirements

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[42]Merchant Marine Act, 46 U.S. Code, 101, 501-613 (1936).

[43]Paul M. Zeis, American Shipping Policy (Princeton: Princeton University Press, 1938), p. 123.

that plans for subsidized vessels had to pass navy specifications for defense purposes; the Maritime Commission had to approve the subsidy application; and the ships had to follow routes judged essential by the Maritime Commission.[44] If the bids submitted to the United States Maritime Commission, the government agency created to administer the act's provisions, ran too high, navy yards could be utilized. Title V of the act limited the profits of private shipbuilders receiving contracts to 10 percent of the construction price allowing the Commission to recapture all profits over 10 percent. To ensure compliance with this restriction on profits, the act empowered the commission to examine the records of the shipbuilding companies who had to file complete reports of their costs, including overhead expenses and all profits made on government contracts. In addition, the act allowed no administrative salaries over $25,000.[45]

If the incentives provided in the Act of 1936 failed to produce a revival of the American merchant marine, the Act also included a provision, in Title VII, which authorized the Commission to construct new ships and to operate them

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[44]David E. Koskoff, Joseph P. Kennedy: A Life and Times (Englewood Cliffs, N.J.: Prentice-Hall, 1976), p. 89.

[45]Daniel Marx, Jr., "The United States Maritime Commission, 1936-1940," (Ph.D. diss., University of California, 1959), p. 194; Koskoff, Kennedy, p. 89; Merchant Marine Act, 46 U.S. Code, 502(e) and 505 (1936); Richard J. Whalen, The Founding Father: The Story of Joseph P. Kennedy (New York: New American Library, 1964), p. 190.

under the aegis of the federal government.[46] Just as government contracts had provided essential financial backing for the development of the merchant marine during World War I, this provision of the 1936 Act supplied the stimulus needed by Gulf coast shipyards during World War II. Congress included the provision as a last resort, hoping that the various subsidies in the act would be sufficient to revive the industry. The lack of response to the act made it quickly obvious that either the act would have to be changed or the government would have to build the ships. The Commission, headed by Joseph P. Kennedy during its first eighteen months of existence, played an important role in clarifying the weaknesses inherent in the legislation and in proposing changes to strengthen it. Serving with Kennedy on the commission were Emory S. Land, Edward C. Moran, Henry A. Wiley, and Thomas M. Woodward. Soon after its organization, the commission published the Economic Survey of the American Merchant Marine, giving Congress a comprehensive evaluation of the whole industry. In the report the commission representatives found no Gulf coast yards able to assume new work, since prior commitments occupied some yards while others needed to be reconditioned or lengthened before they could construct ocean-going vessels. The report concluded that even with the subsidies provided in the act the

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[46]Merchant Marine Act, 46 U.S. Code, 704, 714 (1936).

disparity between the requirements of the American merchant marine and any "probable" construction appeared to be so great that the government alone would have to build the new fleet. To replace by 1942 all the ships approaching obsolescence at that time would require the construction of 1,305 vessels, totaling 7,502,000 gross tons, or an average of 261 ships per year, costing an estimated $2,500,000,000. The following table demonstrates the obsolete condition of the American merchant fleet in 1937.

TABLE V

AMERICAN MERCHANT FLEET*

Fleet	No. of Vessels	Gross Tons	Percent of Fleet 20 Yrs Old by 1942
Domestic trade	479	2,119,000	94.7
Government-owned, Inactive	188	1,230,000	100.0
Tanker	299	2,060,000	87.2
Foreign trade:			
Privately owned	302	1,886,000	86.8
Government owned	37	207,000	100.0
Total	1,305	7,502,000	93.7 av.

*Source: U.S. Maritime Commission, Economic Survey of the American Merchant Marine (Washington, D.C.: Government Printing Office, 1937) p. 21.

The commission's report failed to recognize the silent revolution occurring in isolated shipyards, a revolution which would make possible the massive buildup of numerous types of ocean-going vessels during World War II. Members

of the Maritime Commission clung to their belief that shipbuilding remained a "craft" industry with no possibility of adopting mass-production techniques such as those used in automobile manufacture. Instead, they encouraged building at a modest rate of five hundred ships in ten years, expecting the yards to use the old shipbuilding techniques; consequently, the program fared poorly. By early 1938 Kennedy had headed the Maritime Commission for eight months, yet neither the Merchant Marine Act's enticements nor Kennedy's business skills drew private investors into partnership with the federal government to any significant degree. Before resigning the chairmanship in February, 1938, to become ambassador to England, Kennedy delivered a critical report to Congress evaluating the situation. In his report Kennedy called the Merchant Marine Act "about the worst thing of its kind I have ever seen." Only one ship was under construction during his tenure as chairman, and he offered no assurance that other ships would be started in the near future.[47] Earlier Kennedy had accurately attributed the lack of enthusiasm for the subsidy program to four conditions: the Merchant Marine Act imposition of excessive restrictions on private investors, the bad labor situation which made creditors hesitate to extend financial support, the fact that many shippers considered expansion either

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[47]"U.S. Must Pay If It Wants Ships," Business Week, November 13, 1937, p. 18.

impractical or uneconomical, and the fear of some shippers that they would eventually be disqualified from government subsidies when Congress chose the best defense routes.[48]

Kennedy suggested a number of changes to the act, revealing his desire to develop an entirely privately-owned merchant fleet free of any government operation. He wanted the required down payments on ships reduced from 25 percent of the domestic cost to 25 percent of the foreign cost; construction permitted in foreign shipyards when the foreign estimated cost represented less than half of the domestic cost; the maximum salary of executives raised above $25,000 per year or abolished; the recapture period extended from five to ten years; and some assurance to shippers that the government would not abandon them later.[49] The report proved accurate and farsighted, but the objectionable provisions of the act remained unchanged.

The appointment of another chairman, who applied the powers of the Merchant Marine Act in a totally different manner, injected new life into the Maritime Commission. Roosevelt chose Rear Admiral Emory Scott Land, USN (Retired), a member of the Maritime Commission, to fill the vacancy. Admiral Land differed from Kennedy both in background and in philosophy concerning the federal government's role in competing with private enterprise. Land had taken post-

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[48]Koskoff, Kennedy, p. 107

[49]Ibid.

graduate courses in naval architecture at Massachusetts Institute of Technology and had worked for many years in the navy's shipbuilding department.[50] Kennedy, in contrast, was a business man with no naval training.

Land's approach to the Commission's duties differed fundamentally from Kennedy's. The admiral especially relied on section 1125(a) of the Merchant Marine Act, which permitted the federal government to construct and to operate ships in the same manner as a private operator.[51] Under Land's leadership the Maritime Commission proceeded to draw up plans for standardized cargo ships, invited bids from shipyards, and awarded contracts, thereby filling the void created by the lack of private enterprise. By August 2, 1939, the Maritime Commission awarded eight-three contracts, and the majority did not involve private operators.[52] Again, in contrast, Kennedy avoided using the power to contract solely for a government fleet.

A second factor, the Second World War, aided Land in his aggressive policy by obscuring the weaknesses of the Merchant Marine Act. War demands increased the need for ships and war materials by the Allies. As world-wide demand

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[50]Frederick C. Lane, Ships for Victory: A History of Shipbuilding Under the United States Maritime Commission in World War II (Baltimore: Johns Hopkins Press, 1951), p. 10.

[51]Merchant Marine Act, 46 U.S. Code, 1125(a) (1936).

[52]"Shipbuilding Upsurge," Business Week, August 26, 1939, p. 14.

increased the need for merchant shipping, American shippers sold their obsolete vessels to the Allies, contracted for new ships, started profitable new routes of trade, and sent charter rates soaring. Freight rates charged by regular service liners for shipments into the war zones almost doubled. The cost of shipping a ton of copper to the United Kingdom rose from $5.50 to $10, while rates for cargo to the Far East and South America rose approximately 20 percent.[53] By 1939 the American merchant marine was able to show a profit as the market mushroomed and demand outdistanced the supply capability.

The merchant marine industry enjoyed the aid of the Maritime Commission under Admiral Land in rescuing shipping lines in financial distress. The Panama Pacific Line, mentioned earlier, was purchased by the government in June, 1938, for $10 million and operated for the government by the Moore-McCormack Lines in service to South America. Similarly, the Maritime Commission assumed controlling interest in the Dollar Steamship Line because its route was considered essential to the national defense. Senator William McAdoo became chairman of the board. Joseph Sheehan, the Maritime Commission's executive director, became the Dollar Line's president after the Maritime Commission acquired 90

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[53]"U.S. Shipping Stages Comeback After Early Blows by the War," Newsweek 15(April 1, 1940): 46.

percent of the company's common stock.[54] The federal government bought other shipping lines vital to the national defense, but the effect of Admiral Land's aggressive policies was to conceal the lack of private investment and temporarily to offset it during the war.

Land's progressive application of Title VII of the Merchant Marine Act of 1936 encouraged the conditions essential for development of Gulf coast shipbuilding. Not only did Land's use of Title VII provide the financial resources for the tremendous expansion of the shipbuilding industry, but it also encouraged the successful application and development of critical technological advances in ship construction. These combined factors allowed the Gulf coast to participate significantly in the war effort while they revolutionized the shipbuilding industry nationwide.

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[54]"Inadequate Merchant Marine Undergoing Rehabilitation," Newsweek, 16(October 10, 1938): 38.

CHAPTER 3

THE TURNING POINT, 1918-1940

Admiral Emory S. Land's chairmanship of the Maritime Commission marked the beginning of an important shift of emphasis in the shipbuilding program for the Gulf coast. Whereas Kennedy's background had been business oriented, Land's training had been in ship construction throughout most of his adult life.[1] As the navy's Fleet Naval Constructor from 1930 through 1932, Admiral Land's primary responsibilities included identifying the weaknesses and deficiencies that existed in the various naval vessels, finding remedies for them, and improving designs, especially among auxiliary support vessels. After a meeting with the

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[1]Land received an appointment to the United States Naval Academy from Wyoming in 1898 and graduated with honors in 1920. After serving for two years aboard the USS Oregon on the Asiatic Station, he became an Assistant Naval Constructor with the rank of lieutenant (junior grade). He then completed the post-graduate course in naval architecture at the Massachusetts Institute of Technology in 1907, receiving the degree of Master of Science. Promotions to Naval Constructor followed with the rank of lieutenant in 1912, lieutenant commander, Construction Corps in August, 1916, and to captain in 1923. From 1914 to 1916 he served as Fleet Naval Constructor on the staff of Admiral Fletcher, Commander-in-Chief, United States Atlantic Fleet.

During World War I Land served in the Bureau of Construction and Repair and in 1918 was assigned to the Allied Naval Armistice Commission. He returned to the Navy Department in 1921 in the Bureau of Construction and Repair and Bureau of Aeronautics. During the 1920's Land acted in various capacities regarding naval construction.

Chief of Naval Operations and the Chief of the Bureau of Engineering in 1933, Land successfully persuaded the Congress to allocate $238 million for naval construction through the Public Works Administration. Land convinced them that building some kind of a navy, not necessarily in anticipation of conflict, bettered raking leaves and would create desperately needed jobs.[2]

When Land assumed the leadership of the Maritime Commission in 1938, he assessed the objectives of the organization at that time as eliminating the system of ocean-mail contracts which had been inefficient and inadequate for the purpose of building or maintaining an American merchant marine; allowing the federal government to withdraw from the operation of ships, an activity it had entered into after World War I when thousands of surplus ships sat idle; and developing a construction program adequate for the commercial and national defense needs of the country. Admiral Land correctly stated the objectives. Under his leadership, the commission then settled the inflated claims of 23 companies representing 32 ocean-mail contracts amounting to approximately $73 million at a cost to the government of only $750,000. By March, 1940, through chartering agreements with private interests based on competitive bids, the

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[2]Admiral Emory S. Land, "The Reminiscences of Emory S. Land," (Oral History Research Office, Columbia University, 1963), pp. 99, 122, and 129.

commission had disposed of all government-operated steamship lines, including both passenger and freight lines. In addition, the commission produced a projected fifty ships a year for the next ten years.[3]

Land's immediate problem involved implementing the third objective, a puzzle with which Kennedy had grappled. Land's predecessor had considered the Merchant Marine Act of 1936 too restrictive for the successful completion of the program of fifty in ten years. Up to 1938 conditions of the market had encouraged the construction or conversion of three types of ships: a large North Atlantic passenger liner for operation between New York and English Channel ports, a type of large high-speed oil tanker, and conversion of one of the laid-up merchant vessels for use in the training of merchant sailors. As a result, the passenger liner America was completed by 1940; in addition, a fleet of twelve twin-screw oil tankers averaging 16,500 tons dead-weight and capable of eighteen knots comprised the bulk of the modern American merchant marine; and the American Seaman served as a training ship for merchant sailors.[4] Other than these ships, the plan to build five hundred

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[3]Admiral Emory S. Land, "Some Policies of the United States Maritime Commission," in Transactions of the Society of Naval Architects and Marine Engineers, 48 (New York: The Society of Naval Architects and Marine Engineers, 1940): 259.

[4]Ibid., p. 261.

merchant ships in ten years had failed to show much promise when Admiral Land took over the commission's chairmanship in 1938.

Given the difficult problem of building the proposed fleet, Admiral Land, under the stimulus of World War II, chose a course of action which allowed the Gulf coast to join in the nation's shipbuilding effort. Land had to choose between two possible methods of fulfilling the program's expectations. One option involved an extensive examination of each trade route in cooperation with private operators to determine the essential characteristics of ships best adapted to a particular service. Although a logical approach, this method entailed an excessive amount of time for study and posed the difficult task of defining essential characteristics. The other choice, which was adopted, required outlining the characteristics of several types of cargo vessels to include a reasonable range of deadweight capacity and satisfactory speeds. Suitable standardized blueprints and specifications could be produced for each vessel. The standard types selected would not meet the exact characteristics desired by each individual operator, but it would be possible to make minor changes to meet the requirements for handling a particular type of cargo.[5]

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[5]Ibid., p. 262.

This approach represented an advance in shipbuilding construction rather than a totally new concept. The idea first appeared during the industry's World War I evolution toward standardization fostered by pressing deadlines. The old method of constructing each individual ship as a unique entity could not satisfy the war demands for shipping and led to some limited experimentation. The "agency" yards and the wooden-ship programs encouraged by the federal government developed primitive but workable standardized ship designs. The end of the war halted further testing and evolution in standardized ship design until the Maritime Commission applied the concept on a large scale beginning in 1938. Still, important differences existed between the "standardized" designs and construction methods of World War I and the Maritime Commission's development of the idea. In the 1918-1919 shipbuilding program, shipyard employees were still craftsmen who performed a number of jobs and worked on all parts of the ship during construction. Although some specialization took place, it was limited. Metal ships constructed in designated "agency" yards were the product of a prefabrication plan whereby outlying plants produced numerous parts of a ship and transported them to the shipyard for assembly. The wooden-ship designs followed the same pattern, but in either instance the lack of experience necessitated a considerable amount of hand

fitting and minor alterations which slowed construction considerably.[6] Mass construction methods remained an untouched idea for the shipbuilding industry and awaited the demands of World War II before development.

Admiral Land, the Maritime Commission, and Gulf coast businessmen capitalized on two important technological changes which evolved during the intervening years between the two wars: the application of assembly-line construction methods based on standardized designs and the application of welding to ship construction in place of riveting. Both of these developments had a profound and permanent effect on shipbuilding and found acceptance among private operators. They allowed shipbuilding to evolve from a labor-intensive handicraft to one emphasizing a strict sequence of highly specialized but simple steps producing a standardized final product. For the Gulf coast particularly, and the shipbuilding industry in general, the development of the assembly-line construction of ships enabled builders within this highly technical field to employ workers who had absolutely no shipyard experience by quickly training them to perform simple repetitive tasks. Such developments had the additional beneficial effect of minimizing the dilution of shipbuilding expertise currently available.[7]

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[6]Land, "Reminiscences of Emory S. Land," p. 126.

[7]Ibid., p. 128.

The benefits of standardizing the ship designs emerged in the evolution of the C-type dry cargo ships, Liberty ships, and Victory (C-3) ships. Table IX shows their principal specifications.

TABLE VI

PRINCIPAL SPECIFICATIONS OF THE STANDARDIZED SHIPS*

Dimensions	Liberty	C-1	C-2	C-3
Overall Length	441'6"	417'9"	459'6"	492'
Molded Beam	56'11"	60'	63'	69'6"
Loaded Draft	27'8"	27'6"	25'9"	28'6"
Dwt Tonnage	10,419	9,075	8,794	12,500
Speed (knots)	11	14	15.5	16.5

*Source: Frederic C. Lane, Ships for Victory: A History of Shipbuilding Under the United States Maritime Commission in World War II (Baltimore: Johns Hopkins Press, 1951), p. 28.

The Maritime Commission designed the C-2 type first as a cargo ship exclusively with comments and engineering input from a number of naval architects, shipbuilders, and ship operators. The C-3 design came next with a capacity for ten thousand tons of cargo and accommodations for about 150 passengers. The Maritime Commission wavered on the decision to make the C-3 a combination passenger-cargo vessel, and outside recommendations confused the issue. A favorable reception by ship operators finally persuaded the Maritime Commission to make the C-3 basically a cargo ship with passenger-carrying capability. Finally, the Maritime

Commission developed a third and more attractive type, especially to Gulf coast concerns. In drawing the plans for this third type, designated C-1, the commission used a different policy. After developing the general plans, the commission asked operators to comment on the plans from the standpoint of the requirements of their particular needs. On the basis of these comments, the commission approved plans for two slightly different types of C-1 vessels. One type, designated C-1A, had a shelter deck which emphasized cubic cargo space and a second, designated C-1B, possessed full-scantling, which emphasized greater deadweight capacity. Table X reveals the close similarity between the two types.

TABLE VII

COMPARISON OF C-1 FULL SCANTLING AND SHELTER DECK VESSELS*

Dimensions	Full	Shelter
Overall Length (ft.)	416	413
Length between perpendiculars	395	390
Molded beam	60	60
Molded depth	37'6"	37'6"
Molded draft	27'6"	23'6"
Deadweight tonnage	9,000	7,400
Gross tonnage	6,750	5,000
Shaft horsepower	4,000	4,000
Speed (knots)	14	14
Crew	43	43
Passengers	8	8

*Source: "C-1 Type Cargo Ships," Marine Engineering and Shipping Review 65(August, 1939): 381.

Before actual construction began, the Maritime Commission made other modifications based on numerous conferences with possible operators to ensure harmony between the government's efforts and the operators' desires. Consequently, the basic C-1 design remained the same with minor changes that would not slow construction time significantly. One set of alterations included the choice of propulsion units. Generally, the C-1's used either steam turbines operating single screws through double-reduction gearing, single diesel engines turning single screws directly, twin diesel engines turning single screws through gearing, or quadruple diesel engines operating single screws through gearing.[8] The type of cargo also forced some changes. Wood ceilings over cargo holds normally satisfied bulk cargo requirements, but when cargoes such as sulphur were carried, the corrosive action of sulphur dictated the use of a reinforced cement top at least two inches thick and weighing about 135 tons. Other special cargoes, such as tobacco leaf, which could suffer damage due to moisture compelled the Maritime Commission to alter ventilation systems.[9]

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[8]Land, "Some Policies of the Maritime Commission," p. 262.

[9]"C-1 Type Cargo Ships," Marine Engineering and Shipping Review 65(August, 1939): 386.

The Maritime Commission built one other type of cargo ship--the Liberty ship--which forced a re-evaluation of Gulf coast shipyard facilities. In September, 1940, the British Merchant Shipbuilding Mission, headed by a representative of the Sunderland shipyard of J. L. Thompson and sons, traveled to the United States in search of shipbuilding facilities. They brought with them a Sunderland design originally conceived in 1879. This vessel of ten thousand tons had a 2,500 horsepower engine capable of achieving only eleven knots maximum speed. Admiral Land at first opposed building such slow vessels and indicated that no yards were available for manufacture of any new-type vessels.[10]

Land and the Maritime Commission earlier had encumbered all existing yard space with C-type cargo vessel contracts. In doing so the commission developed a long-range shipbuilding program with nine basic objectives: (1) to set aside as a charge against national defense those costs properly chargeable to that category, (2) to avoid a shipbuilding boom, (3) to keep shipbuilding costs reasonable, (4) to encourage competition among shipbuilders, (5) to allocate work with consideration of regional building

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[10]L. A. Sawyer and W. H. Mitchell, The Liberty Ships: The History of the Emergency Type Cargo Ships Constructed in the United States During World War II (Cambridge, Md.: Cornell Maritime Press, 1970), p. 12; Land, "Reminiscences of Emory S. Land," p. 167.

conditions, (6) to rehabilitate selected private yards when such actions were economically justified, (7) to build new shipyards of the assembly-line type rather than self-sufficient yards, especially if private builders expressed an interest, with particular reference to regional economic and national needs, (8) to encourage the maximum possible building by private firms, and (9) if private builders failed, for the Maritime Commission to initiate and undertake the construction necessary for national defense. Based on these objectives the Maritime Commission projected the combined needs of the American merchant marine and U.S. navy over a ten-year period to be a total of 533 ships.[11] (See Table XIII in the Appendix for a tabulation of the ten-year program as defined in January, 1938).

Three of the nine basic objectives included factors germane to Gulf coast involvement in the nation's shipbuilding effort. By allocating work considering regional building conditions, the Maritime Commission had to value the availability of many excellent shipyard sites along the Gulf coast and the mild climate of the area, which enabled shipbuilding to take place without the cost of constructing buildings to cover all phases of the work. The decision to build new shipyards of the assembly-line type rather than

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[11]Land, "Some Policies of the Maritime COmmission," p. 264.
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self-contained yards permitted the Gulf coast yards to fill their labor needs using native southerners with no previous shipbuilding experience. Such workers needed little training since standardization reduced the process to simple repetitive activities. Admiral Land's plans to use the Maritime Commission's power to construct ships comprised the third key objective of this early Maritime Commission plan. According to Title VII of the Merchant Marine Act of 1936, the Maritime Commission had the authority to build ships if private business did not take the lead in rebuilding the merchant marine fleet.[12]

Just as in World War I the federal government financed the build-up of the merchant marine. Early in World War II military preparedness forced a shipbuilding expansion necessitating the construction of several new yards, not merely a selective rehabilitation of old private yards or the expansion of existing yards. The Maritime Commission quickly abandoned those objectives which restricted shipbuilding along the Gulf coast. Soon after the declaration of war the United States reached its current maximum shipbuilding capacity, requiring a rapid multiplication of ship construction facilities. When it became apparent that

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[12]Merchant Marine Act, 46 U.S. Code, 702(1936).

expansion was needed, the Maritime Commission did not hesitate to expand, recognizing that national defense required such expansion.[13]

A closely allied and thus far overlooked technical factor of prime importance in shipbuilding nationwide was the development and increasingly exclusive use of welding in place of riveting. Welding of metal developed from an accidental discovery by Elihu Thomson in 1886 who noticed that the wires of an induction coil he used in an experiment had overheated and melted together forming an unusually strong bond. Following this discovery Thomson obtained a patent for general electric welding and organized a company in Boston to manufacture commercial welding machines.[14] Although the railroading industry first recognized the advantage of welding in the United States and adopted a primitive arc welding process in repair shops with considerable success, shipbuilders did not discover the potential of this new invention until World War II. Prior to 1918 shipyards used riveting exclusively in new construction. Shipbuilders tinkered with welding to repair minor ship

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[13]Ibid.

[14]American Iron and Steel Association, Bulletin 25 (April 15, 1891): 107; (July 29, 1891): 221; and 26(March 9, 1899): 66.

parts or, when they had someone who knew how to weld, to reclaim, in an emergency, worn out or badly-fitted parts.[15]

When scarcity of trained riveters disrupted shipbuilding schedules, the Emergency Fleet Corporation turned to welding as a feasible solution. The shipbuilding demands of World War I forced the Emergency Fleet Corporation to appoint a special committee in March, 1918, to investigate and to report to it on the developments in electric welding and their possible application in hastening the completion of the floundering steel ship program. The Emergency Fleet Corporation chose Dr. Comfort Adams, Professor of Electrical Engineering at Harvard University, to chair the special investigating committee because of his special interest in welding and because of his experience in organizing a similar sub-committee for the Research Committee of the American Institute of Electrical Engineers. Adams' subcommittee had already collected information on the subject in 1917 and had arranged with the U.S. Shipping Board for British shipbuilding representatives to meet with interested groups in the United States to explain not only the methods

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[15]H. A. Hornor, "Electric Welding--A New Industry," the eighth in a series of discussions delivered in the Auditorium of the Engineers' Club of Philadelphia, June 26, 1918. sponsored by the Electric Welding Branch of the Education and Training Section of the U.S. Shipping Board, Emergency Fleet Corporation. Record Group 287, Records of the Electric Welding Branch, National Archives.

but also the extent to which welding had been applied in British yards.[16]

Two elements combined to hinder the application and development of electric welding during the World War I period. The armistice itself in November, 1918, ended most government-backed experimentation, leaving further development to private business, which continued their efforts through the American Welding Society formed in 1919. After the war any additional experimentation by the federal government took place under the auspices of the navy's Bureau of Construction and Repair. The Bureau carried on limited tests at Newport News Shipbuilding and Drydock Company in 1919 by constructing identical practice targets--one welded and one riveted. The welded target broke in half in 1922 while being towed to Bermuda for fleet practice.[17] The second hindrance involved the number of restrictions built into the government's shipbuilding program. In those

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[16]James W. Owens, "The Scientific Application of Welding to Ship Construction," in Transactions of the Society of Naval Architects and Marine Engineers 36(New York: The Society of Naval Architects and Marine Engineers, 1928): 1; David Arnott, "Some Observations on Ship Welding," in Transactions of the Society of Naval Architects and Marine Engineers 50(New York: The Society of Naval Architects and Marine Engineers, 1942): 327; James B. Hunter, "Some Effects of Welding on Ship Construction," in Transactions of the Society of Naval Architects and Marine Engineers 45(New York: The Society of Naval Architects and Marine Engineers, 1937): 11.

[17]Arnott, "Some Observations on Ship Welding," p. 327; Owens, "The Scientific Application of Welding," p. 27.

industries that used welding extensively, such as railroad shops and munitions shops, including bomb and grenade manufacturers, the decision concerning the use of welding techniques remained with the particular shop and was subject to few government guidelines.[18]

In the shipbuilding industry, on the other hand, at least three agents participated in determining those ships' parts that could be welded: the shipbuilder himself, whose interests paralled those of the railroads and other manufacturers; a representative of the United States Shipping Board, whose purpose was to protect the interests of the eventual owner; and the industry-wide organizations, the American Bureau of Shipping and Lloyd's Register of Shipping. The two latter groups jointly issued a circular letter listing the number and parts of a vessel on which they approved electric welding. With this maze of impediments the procedure to obtain approval for innovative welding on ships required three time-consuming steps. The first involved approval by the yard's structural engineer or other yard official having responsibility for making such a decision; the second required reference to an approval list published by the welding societies and, if the welding operations were not on their list, had to be submitted to the

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[18] J. H. Anderton, "Time Saving in Steel Ship Construction," pp. 8-9, Record Group 287, Records of the Electric Welding Branch, National Archives.

particular society for its approval; and the third necessitated approval by an authorized representative of the United States Shipping Board.[19]

After World War I both the use of welding and assembly-line construction methods in shipbuilding developed together and in many ways complimented each other. Several technical and economic factors played important roles in shaping the limited ship construction industry during the lean years between the two wars. The principal object in merchant ship construction was to attempt to reduce costs. In constructing the ships, the navy emphasized weight reduction to avoid violating the Washington Conference treaties, yet attempted simultaneously to produce faster, more powerful warships with increased cruising range. Naval construction efforts redoubled when Germany surprised the world in 1931 by successfully mounting eleven-inch guns on welded nine thousand ton cruisers appropriately dubbed "pocket battleships." Economic hardships imposed by the Great Depression necessitated reduced costs to offset higher wages and materials costs, hence lessening the construction differential that had favored construction of ships abroad. Demands for higher standards of comfort, safety, and economy had reduced shipbuilding profits so greatly that by 1938 adoption of new technologies and methods was the only way

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[19]Ibid., pp. 13-14.

to remain in business. The lack of ship building work between the wars forced even the largest yards into the related side operations of producing structural steel, car parts, hydraulic turbines, pressure vessels, and into repairing locomotives in order to keep valuable craftsmen employed. Even these measures did not suffice, thereby producing a chain reaction in which the pool of skilled workmen shrank. This lack of skilled artisans accelerated the introduction of automated and semi-automated machinery, encouraged an improvement in accuracy, and minimized the heretofore heavy dependence on hand-fitted craftsmanship.[20]

Advances in propulsion methods, the introduction of new building materials, and improved hull and propeller design all affected construction from a technical standpoint, but welding brought the greatest changes. Welding offered a multitide of advantages, resulting in reduced weight, reduced costs, and a better finished product. These advantages permanently permeated every important facet of the shipbuilding industry. Welding caused changes in ship design, mold loft and fabricating shop operations, erection and fabrication sequences, and outfitting and completion procedures. In design, welding eliminated fayed flanges

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[20]John B. Woodward, "Some Recent Developments in the Shipbuilding Art in America," in Transactions of the Society of Naval Architects and Marine Engineers 39 (New York: The Society of Naval Architects and Marine Engineers, 1931): 109.

(joined edges by riveting) and laps, resulting in a considerable weight-saving factor. One estimate claimed that the Maritime Commission saved, through the use of welding, more than one-half million tons of steel in the construction of 705 standardized ships, for an average saving of 21 percent in weight. If the same ships had been built during World War I, they would have required 2,775,000 tons whereas the new welding method used only 2,196,000 tons.[21]

Designers also eliminated rivet holes in hull and deck connections, providing almost 100 percent strength through a frame line as compared with approximately 85 percent strength with rivets.[22] Welding also focused attention on developing shipbuilding more through assembly-line methods than through the development of a skilled labor force. It became feasible to divide shop construction into workable erection groups to emphasize standardized molds and templates in the mold lofts, which allowed quicker and more accurate layouts. From the mold lofts the marked steel plates next went to the fabricating shops where much of the fitting and welding occurred. Here welding greatly facilitated partial assembly of such ships' parts as decks, frames, girders, bulkheads, casings, trunks, fan-tail sterns, and other sizeable components.[23]

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[21]Edward C. Powers, "Welded Ships Save One-Fifth," Metal Progress 40(September, 1941): 318.

[22]Hunter, "Some Effects of Welding," p. 9.

[23]Ibid.

Cutting torches replaced the costly and scarce shearing and punching machinery necessary in riveted construction. Flame cutting introduced several advantages over the older methods. Not only did it speed production, but the availability of equipment, its lower cost, its low power usage, and the low investment charges for new equipment outmoded shearing and punching practices almost immediately. At first the shipyards limited welding experiments primarily to smaller vessels designed to carry oil since these vessels were most subject to damage against docks. Welding produced tighter, more efficient joints than did rivets on such ships. At first, however, not even on these vessels was welding utilized throughout. Usually only oil-carrying tank spaces were welded, while rivets held the other parts. Welded parts comprised the bulkheads and small decks on larger vessels, but construction of these ships took place on the ways, not in fabricating shops. Of the shipyards in operation during the lean years of the 1920's, Newport News Shipbuilding and Drydock Company used welding in the building of the S. S. Pennsylvania, launched July 10, 1929, along with her sister ships, S. S. California and S. S. Virginia, launched a short time later. In 1930 Federal Shipbuilding and Drydock Company of Kearny, New Jersey, completed five all-welded channel scows about 116 feet long and thirty-four feet wide, while Electric Boat Company

at New London, Connecticut, built a welded one thousand-ton cargo deck barge 118 feet long and 10½ feet wide.[24]

By 1941 advances in welding had produced a fully-automated electric welding process called Unionmelt, first developed by the Linde Air Products Company. Shipbuilders on the Gulf coast found this process particularly advantageous because it enabled operators with little training to make high-quality welds safely and at high speeds. The quality of the weld depended almost entirely on whether the machine was a large, permanently-installed one in an assembly-line layout or a small, portable unit on the shipway guided by a portable track. Electric controls regulated welding voltage, electric current, speed of operation, and rod feed, depending upon the kind of material being welded, its thickness, the type of prepared edges on the plates to be welded, the desired depth of fusion, and the shape and reinforcement of the weld. Unionmelt offered additional advantages in that the process imposed no external loads on the plate being welded, eliminating the heavy holding clamps, large tool-driving motors, and massive foundations standard in riveted construction; Unionmelt welding took place without any visible arc, sparks, smoke, flash, or gas-forming

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[24]"Welding Developments in 1929," Journal of the American Welding Society 9(January, 1930): 46-51.

contaminants in the fusion zone; and Unionmelt made possible the welding of thick plates in one pass.[25]

Because of its versatility and efficiency, shipbuilders used the Uniomelt process for the prefabrication of structural sections in the shop or assembly yard and for the assembly of the various sections on the shipways. The procedure varied slightly from yard to yard, but the general practice was to fabricate tanktop, bulkhead, and deck units in as large sections as could be handled by the crane facilities. The cranes then carried these fabricated units to the shipway where workers welded them to the bottom shell, tank tops, margin plates, side shells, or adjoining deck plates. Builders also applied Unionmelt to smaller but critical parts such as the structural members of boiler foundations, the shaft-alley, machinery deck, and casing assemblies.[26] Unionmelt received its greatest impetus in 1940 when Sun Shipbuilding and Drydock Company of Chester, Pennsylvania, a subsidiary of Sun Oil Company, built the 521-foot, 18,000-ton tanker J. W. Van Dyke for Atlantic Refining Company, using this process extensively.[27]

The adoption of assembly-line methods advanced simultaneously with welding applications in ship construction.

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[25] Ibid.

[26] F. G. Outcalt, "Unionmelt Welding Expedites Building of Merchant Ships," Machinery 148(November, 1941): 176-177.

[27] J. M. Keir, "Survey of Welding and Cutting in Ship Construction," Welding Journal 21(January, 1942): 5.

Previously a shipyard layout had been confined to a water-front location composed of considerable scaffolding and with cranes sprawled along the water's edge. A single hull or a few hulls at various stages of construction occupied the major portion of the entire shipyard. With the adoption of the assembly-line method of ship construction, the hull erection area became only one common division of the ship-yard between equally important pre-fabrication stations and the final out-fitting stages. A World War II shipyard's physical facilities usually extended far back from the ways encompassing personnel and engineering offices, processing shops, storage facilities, and trnasportation equipment.[28]

The layout of the fabrication shops changed drastically with the construction of sub-assemblies in the fabrication shop area rather than on the way itself, as had been done under the old ship construction method. Instead of being an area where flat work was easily and compactly stacked before transfer to the way, the fabricating shop became a spacious work area filled with special equipment such as steel assembly floors, tilting surface tables, and numerous jigs. Welding dominated each aspect of the fabricating shop. Laying out in the fabrication shop to accommodate

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[28]Woodward, "Some Recent Developments in Shipbuilding," p. 110; George F. Wolfe, "Production Line Welding Plant Apeeds the War Program," in Transactions of the Society of Naval Architects and Marine Engineers 50(New York: The Society of Naval Architects and Marine Engineers, 1940): 259.

welding meant fewer holes but more marking to insure accurate outlines and location of welds. Mold loftsmen added several check marks used to properly locate pieces during erection. Welding necessitated a large floor area for construction of the sub-assemblies; it encouraged the use of tilting tables to make downhand welding more possible because vertical or overhead welding was at once more difficult and of poorer quality; and it allowed the production of much more uniform work through the use of jigs.[29]

This expanded working area came without any increase in the amount of river frontage which older construction methods would have necessitated. Once the company had laid out its yard according to assembly-line techniques and had installed welding machines, building standardized ships became primarily a matter of scheduling for the issue of individual drawings, the securing of materials, and then fabricating ship sections in proper sequence. Gradually engineers integrated welding more and more into the ship construction process. Oxy-acetylene burning torches, rather than slow, expensive machining methods came into general use to remove excess metal. Even welded-metal erection scaffolding replaced wooden ones on the ways as suitable lumber became scarce. Builders discovered steel stage poles

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[29]Wolfe, "Production Line Welding," p. 15.

and standards more durable, easier to erect, and more secure than wood.[30]

The degree of standardization of parts varied from yard to yard. Older yards commonly manufactured almost every part of a ship, but Gulf coast and other new yards bought standardized parts such as motors, generators, diesel engines, boilers, and propellors from war-time entrepreneurs, who specialized in manufacturing them. This method freed the new yards from having to acquire expensive and scarce machinery and from having to find skilled workmen to operate it. Specialization by manufacturers presented several advantages for the new yards. For example, specialty plants supplied some yards with an adequate volume of material which could not have been made efficiently at the yard, while purchasing standard items from outside sources allowed a yard to concentrate on those phases of ship construction which it did most efficiently, making available more actual ship construction capacity for the yard. In addition, specialization intensified control and refinement over the remaining manufacturing operations, resulting in further savings. Subcontracting did cause some production problems, but the benefits generally out-weighed the difficulties encountered.[31]

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[30]Arnott, "Some Observations on Welding," p. 342; Hunter, "Some Effects of Welding," p. 11.

[31]"Technology Progress," pp. 1-3. Record Group 254, Records of the Shipbuilding Stabilization Committee, National Archives.

Shipbuilders found widespread use for assembly-line techniques, especially among the Gulf coast yards. The mild climate permitted expansion away from the river front without necessitating the construction of buildings to cover the work areas. Assembly-line methods awaited not only the introduction of the standardized ship design but also the need for erection of several vessels simultaneously. Careful plant layout maximized the application of assembly-line methods, especially in facilitating the flow of materials and in reduction of handling costs. Gulf coast yards capitalized on the assembly-line method much more than older established yards because the Gulf coast yards were not hindered by older buildings and tools. Some yards revamped their older tools enabling them to operate at higher feeds and speeds, while the adaptation of general equipment to specialized work by the increased use of jigs and fixtures helped older yards to reduce lengthy processing cycles.[32]

Limitations of the assembly-line method became apparent when the size of the sub-assembly reached a point of diminishing returns. Despite the mass production techniques which specialized tooling provided, shipbuilding could not be completely automated. Yard cranes could lift only so much weight, and at a certain point sub-assemblies had to become part of the whole ship. Large pier cranes and bridge

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[32]Ibid., p. 5.

cranes underwent continual modification and refinement as ships grew in size and as ever larger units of diesel and electric propelling machinery as well as structural parts arrived for installation. At some point the final erection work could only be accomplished on the way itself. To an extent Gulf coast builders solved the crane problem by assembling some sections on portable floors mounted on rollers in tracks. The section could then be towed to a crane with the capacity to lift it. Another innovation which increased crane capacity was the use of a submerged basin instead of the usual inclined land way. Builders constructed concrete drydocks below the water level and pumped the water out of them. After building the ship in the dry basin, water would be slowly introduced into the basin, launching the ship. With this method cranes merely had to swing loads horizontally rather than lift them, enhancing the crane's load capacity. This method also had the advantages of eliminating the angle of declivity inherent in inclined land ways and made possible safer launches.[33]

The entire assembly-line process rested on a proper sequence of construction events; yet building for the merchant fleet and the navy did differ in sequence, because weight saving was secondary to cost and difficulty of assembly in merchant ships while military builders put a

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[33]Ibid., p. 10.

premium on weight saving. The sequences, however, did not differ enough to make them significantly dissimilar. Builders generally assembled the double bottom first in sections, up to forty tons per section, which constituted one-half the breadth of the ship, but comprised the full length of the ship. Fabrication of the main transverse bulkheads took place on the ground and, when erected into place on the inner bottom, the resulting structure established definite points for the placement of side framing and side shell plates. Builders fashioned decks in panels on the ground with the beams and girders welded to the plating in an inverted position, after which the sub-assembly was turned over and lifted into place for finishing welds by Unionmelt machines. Welding modified this process even more, since it eliminated rivet holes as well as flanges for fastening individual parts together. Also the need to avoid locked-in stresses brought changes in the construction process.[34]

The erection of welded sub-assemblies on the ways required various attachments for lifting that had been an integral part of riveted construction. After welding the temporary lifting attachments had to be removed. In riveted construction, rivet holes in plates provided a convenience for cranes to hold the work being moved. In welded

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[34]Ibid., p. 15.

construction, workers had to weld temporary hooks to that part being moved which then had to be removed once the part was placed. Extraordinary attention to sequence at this point in the erection procedure helped avoid introducing distortion and stresses peculiar to welded structures. This contrasted to riveted construction in which riveters worked all over a ship simultaneously without producing such effects. The assembly-line process enabled builders to eliminate most stresses, both by permitting more people to work on a given vessel throughout the shipyard and also by allowing more semi-automatic welding on the ground aided by special jigs and fixtures. Had old methods of construction been used to weld ships on the ways, it would have meant completion of fewer ships, since such methods would have increased distortion and locked-in stresses, in addition to severely limiting the number of workers on each vessel. The use of jigs and fixtures maximized welding in the most efficient down-hand position and maximized speed and accuracy with the application of semi-automatic welding machines.[35]

Welding and the assembly-line process permeated the outfitting and completion stages in shipbuilding, also. When the yard launched a ship, it resembled little more than a shell with 30 to 50 percent of the work still to be

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[35]Ibid., p. 13.

done before it was ready for sea trials. Up to this point the work comprised the main structural components, but much of the engineering and all of the outfitting remained to be done. The sheet metal and pipe shops of the yard reflected the myriad of welding applications involved in the finishing of a sea-going vessel. Welders manufactured hundreds of small but necessary ships' parts such as ladders, lockers, dressers, sheet metal doors, tables, scoops, and label plates. On board the ship propulsion machinery received final attention as to location and alignment; steering mechanisms were installed along with auxiliary motors, generators, condensers, and refrigeration units. Shipfitters installed miles of piping for water and fuel, electric wiring, ventilating and galley equipment, berths, and communication systems. In each step of the outfitting procedure, the assembly-line process dominated the builders' efforts, and anywhere a part needed fastening, welding became the first method tried in preference to riveting.[36]

American shipyards, large and small, used the assembly-line method and welding universally throughout the war period, but the Gulf coast yards benefited most of all. Where the New Deal brought dramatic changes in southern agriculture, World War II brought equally dramatic changes in southern industrial development. Southerners had tried

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[36]Ibid., p. 16.

on several occasions to further industrialization during the depression years with little success. President Herbert Hoover's Committee on Industrial Decentralization and Housing backed government sponsorship of a southern industrialization, and President Franklin D. Roosevelt used industrial decentralization as one of the justifications for creation of the Tennessee Valley Authority.[37] Some southern states attempted to further their industrial cause when representatives of six south-eastern states met with President Roosevelt at Warm Springs, Georgia, on November 21, 1934, to seek an answer to the industrially-related freight rate discrimination against the South and subsequently formed the Southeastern Governors' Conference to fight for additional concessions for the South.[38]

More successfully the "Columbia method" of Mississippi governor Hugh L. White served as the model for southern industrial development in the 1930's leading to the establishment of the "Balance Agriculture with Industry" (BAWI) program in 1936. Mississippi state legislators created a

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[37]Danhof, "Four Decades of Thought," pp. 10, 27.

[38]Walter R. McDonald, The Southern Governors' Conference, 1934-1959 (n.p.: State of North Carolina, 1969), p. 3 The representatives who met with Roosevelt at Warm Springs, Georgia, were Governor Eugene Talmadge of Georgia, Governor-elect Olin D. Johnson and Governor Ibra C. Blackwood of South Carolina, Lieutenant-Governor A. H. Graham representing Governor J. C. B. Ehringhaus of North Carolina, Governor-elect Bibb Graves of Alabama, and Governor Dave Sholtz of Florida.

state industrial commission to oversee the selection of applicants and to authorize the bond issues in arrangements with desirable industries. In the first four years of operation, the commission authorized $980,500 in bonds and attracted twelve businesses. The principle benefactor in this program, Ingalls Shipbuilding Corporation of Pascagoula, reciprocated by generating more than two thirds of the $43,539,361 total wages paid through the second quarter of 1943.[39]

With mixed results other states initiated similar programs involving other industries. The Southern Policy Committee represented an attempt by some interested southern leaders to lead in the formation of public policies advantageous to the South. One result was the publication of a series of the Southern Policy Papers with one specifically concerning industry. In "Industrial Social Security in the South" by Robin Hood, the Southern Policy Committee took a decidedly pessimistic view of industry's future in the South, stating that "dynamic industrial expansion has probably run its course."[40] The Southern Policy Committee

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[39]Ernest J. Hopkins, Mississippi's BAWI Plan: Balance Agriculture with Industry: An Experiment in Industrial Subsidization (Atlanta: Federal Reserve Bank, 1944), pp. 11-13, 16-20, 22-24.

[40]Robin Hood, Industrial Social Security in the South (Chapel Hill: University of North Carolina Press, 1936), p.17.

made a common mistake of that time, by basing its predictions of the South's potential for growth almost entirely on the abundance and availability of natural resources. The South's economy did depend heavily on its supply of natural resources, but the South also had an abundance of human resources that could be used in cooperation with technological advances. Southern leaders, however, thought exclusively in terms of an extractive economy and believed the South's economic position resembled a colonial colonial economy manipulated by large northern businessess.[41]

With the approach and subsequent involvement of the United States in World War II, the development of the Gulf coast shipyards demonstrated that natural resources did not represent the only hope for southern development. When the Gulf coast yards adopted the new technology in welding and applied assembly-line techniques to the construction of ships, labor became the primary determinant. Abundant, unskilled, and inexpensive labor the Gulf coast yards did have, which they developed into shipbuilders. Prior to American entry into World War II, shipbuilding centered around five northeastern companies: Newport News Shipbuilding and Drydock Company, Federal Shipbuilding and Drydock Company, Sun Shipbuilding and Drydock Company, New York Shipbuilding Company, and Bethlehem Shipbuilding

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[41]Ibid., p. 22.

Company. For these five companies to supply the shipbuilding expertise when the nation had to expand its shipbuilding capability posed an insurmountable problem. Seven essentially new yards opened in 1940: three were located on the Gulf coast: Tampa Shipbuilding and Engineering Company of Tampa, Florida; Ingalls Shipbuilding Corporation of Pascagoula, Mississippi; and Pennsylvania Shipyards Incorporated of Beaumont, Texas.[42]

That the Gulf coast desired to encourage development of such a high-wage industry as shipbuilding aroused no opposition among the leading shipbuilders, but the chief problem centered on the lack of shipbuilding knowledge. Business leaders across the nation failed to recognize the magnitude of technological changes that had transformed shipbuilding between 1915 and 1940, changes which had neutralized the labor problem and provided a way to energize this old, established industry for the war effort. The changes had come slowly and randomly which helped disguise their importance. The switch from skills concentrated on metallurgy, machine tools, steam power, and engineering in the late nineteenth century to science-based technological change in the twentieth century, based on the expansion of scientific knowledge, also aided in delaying the recognition of important advances.

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[42]Lane, Ships for Victory, pp. 33-34.

Gulf coast shipbuilding concerns during World War II reflected the interest in new technologies and welcomed the changes wholeheartedly. The advances gained even greater acceptance in the Deep South as they eliminated the major obstacles to Gulf coast participation in the shipbuilding effort. Gulf coast shipbuilders capitalized on the new advances which gave them more modern plants than the five major shipyards, although the Gulf coast yards were smaller. The major problem for Gulf coast yards centered around the unavailability of materials, which limited production from time to time. Under wartime administration two separate shipbuilding programs developed simultaneously administered by two agencies, the Navy Department and the U.S. Maritime Commission, and both programs depended upon the performance of a limited group of shipyards, equipment and components factories, and metal mills.[43]

The Gulf coast yards produced primarily the standardized cargo ships designed by the Maritime Commission, because they lacked the heavy equipment and specialized technical knowledge to build the ships required by the navy. That the Gulf coast yards developed at all revealed that new forces in the economy operated to the advantage of that area.

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[43]U.S., Department of the Navy, Operational Archives Branch, War Production Board, Shipbuilding Activities of the National Defense Advisory Commission and Office of Production Management, July, 1940 to December, 1941, prepared by Charles H. Coleman, War Production Board Special Study no. 18, July 25, 1945, p. 3.

The Gulf coast yards provide an excellent example of a segment of the changing southern economy during and after World War II. Brief histories of selected Gulf coast shipyards can help illustrate the new forces active within the southern economy.

CHAPTER 4

THE GULF COAST YARDS

All the Gulf coast shipyards, by necessity, utilized similar assembly-line methods of production and welding to the greatest extent possible. They shared common problems as well. Because the Gulf coast yards built vessels mostly for the U.S. Maritime Commission, they suffered relative to naval contractors after January, 1941. Since a constant production factor in naval and maritime shipbuilding programs throughout the war developed from their similarity of needs on such matters as facilities, tools, materials, components, and labor, a procurement rivalry developed between the two programs, which the Maritime Commission usually lost. After the Japanese attack on Pearl Harbor the problem resolved itself, but prior to that time the Maritime Commission's program, and, consequently, the Gulf coast shipyards received little attention.

The Maritime Commission occupied a peculiar position in the defense effort. Its program, essential to the build-up of American power for military operations on foreign territory, was also essential for delivering aid to American allies. Unfortunately, this particular maritime need lacked the popular appeal of the military and naval programs.

As a result, the merchant shipbuilding program had to yield to the needs of the army and navy until the summer of 1941. In addition to a great psychological appeal, the navy had two other advantages over the Maritime Commission in any competition for facilities and components. First of all, the naval shipbuilding expansion had begun earlier than the Maritime Commission's emergency ship program, giving the navy first choice of the available resources for shipbuilding; secondly, under the Vinson Act the priorities system permitted mandatory priorities for naval orders dating from June, 1940, while Maritime Commission orders received no mandatory priorities until August, 1941.[1]

The first conflict between the needs of the navy and the Maritime Commission appeared in the fall of 1940. Passage of the Seventy-Percent Expansion Act in July increased the authorized tonnage of the navy from 1,724,480 tons to 3,049,480 tons while providing for construction of twenty-one auxiliary vessels for the navy by the Maritime Commission. Admiral Land, chairman of the Maritime Commission, suggested either changing the priorities of some of the combatant vessel contracts, so that the auxiliaries could be built by existing shipyards, or converting some merchant ships

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[1]U.S., Department of the Navy, Operational Archives Branch, War Production Board, Shipbuilding Activities of the National Defense Advisory Commission and Office of Production Management, July, 1940 to December, 1941, prepared by Charles H. Coleman, War Production Board Special Study no. 18, July 25, 1945, pp. 84-85.

already under contract into auxiliaries to avoid building new shipyards.[2] At that time the twenty commercial yards in the United States had eighty of their eighty-two ways in use. In addition to the active shipways, the Maritime Commission counted forty more partially dismantled ways that could be activated in an emergency. Of the eight located on the Gulf coast, reconditioning would have entailed considerable cost.[3] While no important shortages of facilities occurred prior to the passage of the Seventy-Percent Expansion Act, the act made major enlargement of naval shipbuilding sites necessary and allocated $150,000,000 for that purpose. The expansion not only affected existing yards but also forced the development of new ones. For the Gulf coast the navy planned a new shipyard at New Orleans, Louisiana.[4]

Generally, Gulf coast locations received little consideration under the Maritime Commission's policy to resist the creation of new yards until war demands forced a change in that policy. Concern over the scarcity of skilled labor and white-collar personnel in the South, along with the cost of building new shipyards, had convinced Admiral Land that

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[2]Ibid., p. 85; Land, "Some Policies of the Maritime Commission," p. 264.

[3]U.S., Department of the Navy, Operational Archives Branch, Shipbuilding Activities of the National Defense Advisory Commission, pp. 6, 7, 10-12.

[4]Ibid., p. 93.

expansion of new yards in the South could only result in waste and inefficiency. Land estimated that each new way could cost between $800,000 and $1,200,000 based on the federal government's Hog Island experience of World War I. At Hog Island the government spent a total of $63 million: $2 million (3.1%) for land, $39 million (61.9%) for plant equipment, and for fifty ways and buildings, $22 million. Instead of making such a risky investment in the South, Land wanted either to rearrange navy priorities or expand existing yards which already had contracts.[5] In 1941 the growing American concern for aiding Allied efforts to resist Nazi aggression prompted cargo ship construction under three emergency programs, in addition to accelerating naval needs. The first of these plans, started in January, 1941, called for construction of sixty ships for the British and two hundred for the United States. The second phase came in April, 1941, when Congress approved the Lend-Lease agreement in the Defense Aid Supplemental Appropriation Act, which included funding for over three hundred more cargo ships. Demands for more shipping continued to mount even after this additional funding and brought a third expansion of the

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[5]Admiral Land to President Roosevelt, November 18 and December 2, 1940, Record Group 178, Records of the U.S. Maritime Commission, Vickery Reading File 503-54, National Archives (References to the Records of the U.S. Maritime Commission, Vickery Reading File 503-54, hereafter cited as Records of USMC, Vickery File).

Maritime Commission's shipbuilding effort, even before the Japanese attack on Pearl Harbor.[6]

Once these programs developed, the Gulf coast yards received the support needed to expand their operations or to start new ones. Admiral Land's main concerns in choosing new shipyard sites centered around the problems of rail transportation and the availability of labor and management, especially the case of the Gulf coast. If the transportation network was adequate, Land reasoned that housing would not become a problem. Land's objections faded, however, with the realization that the Gulf coast had a favorable year-round climate, adequate transportation facilities, and a protected coastline.[7] Certain of Admiral Land's concerns proved largely unfounded when mass production techniques and welding minimized the need for many skilled workers. When the Gulf coast yards first began production under Maritime Commission contracts, the initial results discouraged Land. The Maritime Commission's earlier experience with Tampa Shipbuilding and Engineering Company had produced some labor-related racial problems and few ships.[8]

Yet, Mobile, Pascagoula, New Orleans, Beaumont, and Houston collectively gave the Gulf coast a sizeable stake

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[6]Land, Ships for Victory, p.40.

[7]Ibid., pp.48-50.

[8]Ibid., p.49.

in the nation's shipbuilding effort during World War II. The shipyards in all these cities had shared three common characteristics which enabled them to contribute significantly to the total war effort, characteristics which alone made their existence possible: all five yards utilized mass production techniques to the fullest extent, all used welding to its maximum, and all benefited from the Merchant Marine Act of 1936, which supplied heretofore scarce working capital. These factors combined to being the expensive, highly-technical shipbuilding industry to the Gulf coast by simplifying the process of shipbuilding to a point whereby native unskilled or semiskilled labor could produce an acceptable product.

Two Gulf coast shipyards dominated on the coast east of the Mississippi River, Alabama Drydock and Shipbuilding Company at Mobile and Ingalls Shipbuilding Corporation at Pascagoula, Mississippi. Both yards benefited from their location near the Ingalls Iron Works of Birmingham. Both also had histories of building small craft, which provided some expertise in the World War II effort. These factors helped overcome the Maritime Commission's reluctance to build new yards on the Gulf coast.[9]

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[9]Charles G. Summersell, Mobile: History of a Seaport Town (University, Alabama: University of Alabama Press, 1949), p.21.

A small but typical World War II shipyard on the Gulf coast, the Alabama Drydock and Shipbuilding Company had been founded by D. R. Dunlap at Mobile in January, 1917. Located where Pinto Island formed the east bank of the Mobile River, it also occupied about one mile of waterfront along the west bank of the same river. Prior to World War I, this property had belonged to four different companies, the Ollinger and Bruce Dry Docks Company, the Gulf Dry Dock Company, the Alabama Iron Works, and the Gulf City Boiler Works. The Dunlap family purchased all four businesses with the intention of performing repair work for the federal government during World War I, rather than compete with three other shipbuilding concerns at Mobile--Henderson Shipbuilding Company, Kelly-Atkinson Construction Company, and Muran Shipbuilding Corporation. When federal appropriations paid for the digging of a ship channel, allowing twenty-eight foot draft vessels to reach Mobile by 1917, Dunlap built the first heavy drydock constructed in the United States since 1904 to take advantage of the vast amount of repair work expected as a result of the American war effort.[10]

Even during World War I, Alabama Drydock and Shipbuilding Company experimented with an assembly-line technique on the ships it built at the extreme southern end of the yard, which had previously contained the Gulf Drydocks

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[10]Ibid., p. 53.

Company. In that part of the shipyard, Dunlap constructed Ferris wooden steamers of 3,500 tons deadweight. Because the Ferris design approached being a standardized ship, the yard constructed a mold loft, a fabricating shop, an angle-smith shop, and three ways in what the company considered the best configuration for standardized construction. Two Crandall marine railways of 1,500 tons each provided crane service on the Louisville and Nashville Railroad line running from the north end of the plant to the south, with sidings running into each department. Motor truck service paralleled the railroad tracks on Water and Royal streets. Using this early version of mass construction, Alabama Drydock and Shipbuilding Company built about 130,000 tons of ships during World War I years.[11]

The two companies found more difficulty in obtaining the Maritime Commission's approval for participation in its standardized cargo ship construction program during World War II than had been the experience of Gulf coast firms during World War I. During the 1930's the Maritime Commission limited shipyard expansion until wartime demands forced a change of policy in 1942. The commission had, at the urging of its subcommittee, the Shipyard Site Planning Committee, contended that expansion of shipbuilding in

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[11]G.F.S. Mann, "A Southern Shipbuilding and Repair Plant," International Marine Engineering 24(April, 1919): 251, 253, and 254.

1940-1941 could best be accomplished by expanding existing shipyard facilities rather than building new yards. The commission further recommended against expenditure of government funds for the establishment of new shipbuilding plants, while permitting new shipyards constructed by private capital to receive government contracts, provided they met the commission's requirements for adequate technical, managerial, and financial resources.[12]

When the Maritime Commission did give Alabama Drydock serious consideration for participation in its program in August, 1941, commission inspectors differed on the company's ability to provide the necessary skilled personnel. The commission opposed assigning large numbers of skilled men from the existing shipyards for fear of not having enough skilled personnel in any shipyard. At Alabama Drydock, as at the other Gulf coast shipyards, concern over the scarcity of skilled workers proved much less crucial than expected. Heavy reliance on welding rather than riveting and on mass production to build the standardized C-2 cargo ships for the commission practically eliminated the labor problem.[13]

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[12]"Memorandum of November 10, 1939," Record Group 178, Minutes of the U.S. Maritime Commission, Records of the U.S. Maritime Commission, National Archives (References to the Minutes of the U.S. Maritime Commission, Records of the U.S. Maritime Commission hereafter cited as Minutes, Records of the USMC).

[13]"Memorandum of August 4, 1941," Record Group 178, Records of USMC, Vickery File.

One of the inspectors, L. U. (Casey) Noland, specifically pointed out in his report to the Shipyard Site Planning Committee that Alabama Drydock's plant layout could be altered from a riveting to a welding operation with minor changes and at a minimum cost. William Green, President of the American Federation of Labor, and W. A. Calvin, Vice-President of the International Brotherhood of Boilermakers, Iron Ship Builders and Helpers of America, assured the Maritime Commission that the unions could supply the necessary skilled labor without pirating labor from other shipyards.[14] Although labor representatives probably overstated their case, Commodore Ernest Lee Jahncke, a former Assistant Secretary of the Navy, had submitted an earlier report on the site in June, 1941, agreeing with the labor leaders' assertion and also pointing out that prefabricated steel was available from the Ingalls' Birmingham steel mill by truck and barge within sixteen hours.[15]

Alabama congressmen joined the controversy which revealed the political character of vying for government wartime contracts. First, Representative Frank W. Boykin of Alabama, with support from local labor leaders, joined the fray in late August, 1941, declaring that no shortage of labor existed in the Mobile area. Boykin asserted that

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[14]Ibid.

[15]Commodore Jahncke to Admiral Land, New Orleans, Louisiana, June 7, 1941, ibid.

laborers from the cotton fields in the area could be trained for mass production shipbuilding through a vocational training school sponsored by the Federal Security Agency, which would concentrate specifically on supplying labor needs for shipbuilding at Mobile.[16]

Senator John H. Bankhead of Alabama took issue with the Maritime Commission's apparent favoritism in awarding government defense contracts to shipbuilders except the Alabama concerns. Bankhead claimed that in awarding contracts totaling over $640,000,000 for the expansion of shipyards, the federal government had excluded Mobile despite that city's excellent potential for increasing its shipbuilding activities. This exceeded the total value of the entire American cotton crop for 1939 or 1940, Bankhead noted. The Alabama senator further compared Mobile census records with those of Pascagoula, Mississippi, and Orange, Texas, to demonstrate that Mobile could provide ample labor resources. According to figures compiled by Senator Bankhead, Mobile had a 1940 population of 110,950 and government contracts totaling only $55,182,804. On the other hand, Ingalls Corporation had $91,477,000 in contracts in Pascagoula, population 5,900, while Consolidated Steel

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[16]Representative Boykin to Admiral Land, Washington, D.C., June 1, 1941, ibid.

Corporation at Orange, population only 7,472, had $92,587,912 in government contracts.[17]

Urged by local Gulf coast leaders and pressed by the necessity to build more ships, the Maritime Commission agreed to expand Alabama Drydock to eight ways and awarded it a contract to build thirteen C-2 cargo vessels totaling $19,500,000. The C-2 cargo vessel, or liberty ship, originally developed from a British design similar to that of sixty freighters ordered by England from the United States in the fall of 1940. The liberty ship weighed approximately 10,500 deadweight tons and traveled at about eleven knots with its simple, and generally available, triple-expansion engine. Gibbs and Cox of New York drew the final plans for the liberty ship altering the British design to permit maximum application of mass production techniques and welding.[18] Before Alabama Drydock could build the ships, the Maritime Commission had to commit substantial appropriations for the plant's expansion. The commission appropriated $1,322,500 for expansion of Alabama Drydock's yard, specifying that the yard be designed to maximize use of mass production and welding techniques and to permit the placement of assembly

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[17]Ibid.; Senator Bankhead to Admiral Land, Washington, D.C., June 17, 1941, Record Group 178, Records of the USMC, Vickery File.

[18]Hutchins, History and Development of the Shipbuilding Industry, p. 58.

platens between the ways. This arrangement of the shipyard facilitated the transfer of subassemblies by cranes from the platens to the shipways. Throughout the war period the Maritime Commission continued to support expansion of the Alabama yard and spent a total of $14,436,122 developing the yard's assembly-line method of production and welding.[19]

Because the Maritime Commission assigned Alabama Drydock basically to build the same type of ship, the yard made extensive use of assembly jigging on its platens at every stage of construction, Making it both unique in its relationship to other Gulf coast shipyards and more productive as well. Essentially, the yard was an assembly and erection plant, depending on the steel fabricating ability of the Ingalls Iron Works in Birmingham, Alabama, to supply the needed steel plates.[20]

Assembly of the steel plates began in the mold loft and prefabrication shop where 75 percent of the assembly took place on two platens 90 feet wide and 600 feet long. Ship sections weighing up to ten tons assembled on the two platens before three overhead cranes moved the sections to four larger platens outside, which measured 150 feet wide and 800 feet long. On these larger platens employees welded

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[19]Lane, Ships for Victory, p. 223; "Memorandum of August 16, 1941," Record Group 178, "Minutes," Records of the USMC.

[20]A. J. Grassick, "Shipbuilding on a Production Basis," Steel 107(July 8, 1940): 45.

the ten-ton sections into even larger sections weighing up to twenty-five tons. From the larger platens cranes then moved the sections to the ways for final assembly on the hull. Throughout this building process, Alabama Drydock workers laid out, flame cut, and welded enough material to build five ships simultaneously.[21]

Because of the widely differing quantities needed for various parts of each ship, which ranged from one to several hundred pieces of a kind, all departments of the Alabama firm jigged or positioned their work as much as possible. Careful jigging of the piece to be welded allowed faster down-hand welding when automatic welding machines could not be used. The Alabama shipyard made the most extensive use of shop-made welded X-frame positioners on shelter-deck beam sections, girders, intercostals, and other similar sections which lent themselves to easy repositioning for welding on the opposite side. Welders utilized larger fixed-angel positioners, singly or in groups, for deep-tank hatch covers, girder sections, or other large and reasonable flat pieces. Some sections, such as the fidley tops, required little or no positioning which allowed continuous welding in any location. In a thirty-foot long jig Alabama Drydock welders completed both starboard and port side units at one time. Serrated floor beams and bottom stiffeners formed the

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[21] Ibid.

jig's side rails in the open inner bottom floor sections. This construction was followed by positioning of the bilge end plates and vertical stiffeners. Once welders had constructed this much of the fidley top, a gantry crane carried it to another platen equipped with a Unionmelt automatic welding machine for the final welding passes. Such painstaking attention to jigging and positioning became an Alabama Drydock trademark among the shipyards, and the firm used the same method of construction throughout the war.[22]

At Alabama Drydock, as at the other Gulf coast shipyards, gantry cranes of assorted sizes ferried the subassemblies from the platens to the shipways for integration into the erection work progressing on the individual ways. The Alabama yard had eight such gantry cranes each standing seventy feet tall with a lifting capacity within a radius of sixty-five feet. Alabama Drydock uniquely placed its platens between its ways, rather than at the head of the ways, so that these cranes traveled very short distances with their loads, thus facilitating and accelerating production. The cranes could also travel to the far end of the yard to pick up prefabricated parts directly from the railroad cars, if the need arose.[23]

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[22]Ibid.

[23]Ibid., p.80.

In every possible way, Alabama Drydock substituted Unionmelt automatic welding machines capable of producing a maximum of twenty-two inches of welding per minute for manual welding with its maximum capability of eight inches per minute.[24] Alabama Drydock made the greatest use of automated welding on the ways rather than on the platens. Once the prefabrication of subassemblies reached a point where Alabama Drydock had enough material accumulated, shipfitters laid the entire bottom shell plating of the flat keels on the way using Unionmelt machines. Erection of the whole flat portion of the bottom shell together with eighty rolled plates followed the laying of the keel in the yard's erection procedure. Welders then connected the inner bottom assemblies forming the remainder of the foundation of the vessel on which shores and rib bands joined the transverse and longitudinal bulkheads. This construction pattern provided a means of attaching the ground assemblies of the side shell plating and framing to the ship's foundation. After this basic structure was in place, addition of the hull plates and the superstructure completed the primary work on the ways. Nearly all this work on the way utilized automated welding machines leaving only occasional welding jobs requiring manual welding. Alabama Drydock then launched

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[24]J.G. Magrath, "Welded Ships From the Singing River," Marine Engineering 48(November, 1943): 168.

the ships and moved them around to the outfitting docks for the finishing work. Using this procedure Alabama Drydock built 124 standardized C-2 cargo ships within a four year period totaling 1,951,000 deadweight tons.[25]

To the west of Mobile, at Pascagoula, Mississippi, the Ingalls Shipbuilding Corporation followed the same general pattern in establishing itself on the Gulf coast. Historically, the area around Pascagoula had a record of shipbuilding dating back to 1838. In that year Ebenezer Clark, a ship's carpenter, built a shipyard on Clark's Bayou, located near the Pascagoula River, a short distance above where Ingalls' yard was later established. Here Clark constructed and repaired about two hundred flat-bottomed schooners, seventy-five feet long, for the coastal trade.[26]

Following the death of Clark in the 1850's, Meguel Pol started at the same location a shipyard to build barges for a booming lumber trade. In 1878 Pol joined in partnership with George Frentz to form the Frentz Shipbuilding Company. Also in the 1870's an Italian immigrant founded the DeAngelo yard on the Escatawpa River, a tributary of the Pascagoula, near present day Moss Point. DeAngelo constructed three-masted ocean-going schooners as well as small fishing smacks

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[25]William L. Ziglar, "Shipbuilding on the Pascagoula River," Journal of Mississippi History 36(February, 1974): 3-4.

[26]Ibid., pp.4-5; Magrath, "Welded Ships," p.168.

and barges. In 1906 M.M. Fletchas, Sr., started the largest shipyard in the area, employing twenty-five to one hundred men in building mostly three-masted schooners. The next year the Poitevant Brothers Shipyard began operation in competition with Fletchas.[27] None of these yards grew to any appreciable size nor survived for very long, but their significance lies in the nucleus of shipbuilding experience they provided for the World War I shipbuilding activity.

In 1917 the International Shipbuilding Company opened a six-way yard at Pascagoula with backing from the Italian government. Henry Piaggio, the Italian consul in New Orleans with shipyard interest in Texas, and A.L. Staples, a Mobile banker, organized the yard which at first built only wooden schooners. During World War I and throughout 1920 when it closed, International Shipbuilding Company expanded and built both wooden schooners and steel cargo ships of 370 foot length and six thousand deadweight tonnage, while employing about 2,400 men. Farther upstream the Dierks-Blodgett Shipyard built wooden and steel vessels on a smaller scale than International. About seven miles above the International and Dierks-Blodgett shipyards, the United States Emergency Fleet Corporation helped establish during World War I both the Dantzler Shipbuilding and Drydock Company and the Hodge Shipbuilding Company for the construction of ships at Moss Point.

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[27]Ziglar, "Shipbuilding on the Pascagoula," pp.3-4.

These two yards employed approximately 1,200 men each, but both yards closed soon after the war ended.[28]

The smaller shipyards in the Pascagoula area experienced various fates during the war. Gandy's Boat Yard, a family-operated business building small crafts at Moss Point, closed at the beginning of the war, and most of the employees joined the International Shipbuilding Company. Later in the war the Frentz Shipbuilding Company sold its plant to A.F. Dantzler, H.H. Colle, and F.B. Walker, who formed the Gulf Ship Company. Walker bought out his partners in 1932, renamed the yard F.B. Walker and Sons Boatyard, and survived the Great Depression only to be swallowed up later by Ingalls' Company. In 1933 the Poitevant brothers closed their yard, and two years later the Fletchas yard ceased operation.[29] International Shipbuilding Company (Dierks-Blodgett Shipyard) closed its doors in 1919 when government contracts stopped, never to reopen. The Italian government had hoped to use International Shipbuilding to rebuild its war-ravaged merchant fleet and also develop trade routes to Latin America. When the Italian economy faltered in 1919, International Shipbuilding and the housing developments around it were auctioned publicly in late 1920. The site housed a vocational training school for

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[28]Magrath, "Welded Ships," p.169.

[29]Ibid., p.170.

World War I veterans and a paper-bag company for several years before Ingalls Shipbuilding Company acquired the property in 1939.[30]

Robert Ingersoll Ingalls, Sr., came to Birmingham, Alabama, in 1910 from Ohio to establish the Ingalls Iron Works Company with offices in Birmingham and Pittsburgh.[31] In 1930, Ingalls leased a part of a World War I Pascagoula shipyard from the United States Steel Corporation to enter the shipbuilding industry for the first time, and in 1933 added facilities at Decatur, Alabama, on the Tennessee River for building barges and self-propelled shallow draft vessels. Ingalls' yard began experimenting with welding in constructing these barges, using a shielded arc-welding technique; hence, Ingalls developed the first all-welded barges. As far back as 1925 Ingalls' engineers had contended that containers for liquids and air as well as ship hulls could be welded.[32]

As the parent company of Birmingham Tank Company and the Steel Construction Company of Birmingham, the Ingalls company experimented with welding techniques in several ways: in providing railroad maintenance service; in general plate work; in fabricating boilers, oil field equipment, as well as in

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[30]Ibid., p.168.

[31]Robert I. Ingalls, Sr., Shipbuilding (New York: The Newcomen Society, 1947), p.10.

[32]Ibid., p.42.

other structural fabrications in the late 1920's. With the onset of the Great Depression a slump in business activity forced Ingalls to branch out into other fields, such as the barge and tanker business. Ingalls won a joint contract with Alabama Drydock Company of Mobile in 1933 to construct ten of sixty barges ordered by the Federal Barge Lines. Ingalls' firm prefabricated sections of the barges at its Birmingham plants and shipped the sections to Alabama Drydock for final assembly at the Mobile yard. In 1933 Ingalls expanded by buying yards at Decatur, Alabama, on the Tennessee River and at Mobile on Mobile Bay for the building of barges. At its Mobile facility, known as the Chickasaw yard until Ingalls moved the plant to Pascagoula, in 1938 he completed the first all-welded ship constructed in the United States, the 1,500-ton oil tanker Transoil which later became an ice breaker on the Great Lakes.[33]

In 1938 two factors lured Ingalls to Pascagoula. The passage of the Merchant Marine Act of 1936 with its construction subsidies interested him enough to send company representatives to the Gulf coast to hunt for suitable shipyard locations. The company planned to start a new yard both as an outlet for its fabricated steel products and to

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[33]Robert F. Couch, "The Ingalls Story in Mississippi 1938-1958," Journal of Mississippi History 26(February, 1964): 193-194.

provide it with a means for bidding on United States merchant contracts for standardized, all-welded ships. Ingalls became aware of the Maritime Commission's plans when the commission included Ingalls' naval architects in the design of a C-3 type cargo ship, which was 429 feet long, 69 feet wide, and had a displacement of 17,000 deadweight tons.[34] In searching for a Gulf coast location capable of building such a ship, Ingalls' representatives initially narrowed the choice to two locations, Pensacola or Panama City, Florida. Before the company made a final decision, Ingalls received an invitation from Jackson County, Mississippi, officials to consider an old abandoned World War I shipbuilding site at Pascagoula in Jackson County, where Henry Piaggio's International Shipbuilding Company had been located.[35]

In an attempt to combat the problems of depression, the state of Mississippi had initiated in 1936 a program to attract industries through the use of subsidies. This program called "Balance Agriculture with Industry," established a state industrial commission to screen industries applying for subsidies and to authorize local bond issues related to industrial development. In Ingalls' case, officials of Jackson County offered him a $50,000 subsidy and later doubled it to $100,000 when Pensacola attempted to attract

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[34]Magrath, "Welded Ships," p.169.

[35]Ibid.

Ingalls with a counter offer. He accepted the Jackson County offer contingent on two stipulations: that local officials pay for clearing the shipyard site and for deepening the Pascagoula River channel and that the city build a railroad spur track to the shipyard. In November, 1938, Jackson County voters easily approved a bond issue to clear the chosen shipyard location. Also, the Louisville and Nashville Railroad agreed to build the spur track. With this support, Ingalls purchased 46 acres of land with three thousand feet of water front on the Pascagoula river, transferred the company's barge-building equipment from the Chickasaw yard in Mobile, and began there all-welded barge construction in 1939.[36]

Never intending to remain a small barge-building concern, Ingalls built the Pascagoula shipyard specifically for the construction of standardized ships. On July 15, 1939, the Maritime Commission awarded his firm a contract to build four standardized 16,600-ton C-3 type cargo ships; and on September 28, 1940, Ingalls' yard received an additional contract for four more C-3's, bringing the total of the contracts to $20,600,000.[37]

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[36]Ernest J. Hopkins, Mississippi's BAWI Plan: An Experiment in Industrial Subsidization (Atlanta: Federal Reserve Bank of Atlanta, 1944), pp.43-44; "All-Welded Shipbuilding in Mississippi," Manufacturer's Record 94 (September 21, 1940): 28.

[37]Couch, "Ingalls Story," p.198.

Anticipating these contracts, Ingalls designed a 350-mile assembly system that stretched from Ingalls Iron Works in Birmingham, Alabama, to Ingalls' shipyard at Pascagoula. Assisted by cranes the Birmingham shop featured automated cutting and welding processes within an assembly-line lay out. The switch from land-based fabrication to marine subassembly fabrication at Ingalls' Birmingham plant resulted in 70 percent of the plant's shop area performing oxyacetylene cutting and arc-welding operations. For its gas-cutting operations, the plant made extensive use of small portable Airco Radiagraph welding machines mounted on portable tracks. Oxygen and acetylene traveled through overhead pipelines and came down to "drop" stations at convenient H-column girders which protected the gas lines from damage. Ingalls' plant used only two models of the Airco Radiagraph for its cutting operations--the lighter No. 10 machine for single or double torch cutting and the heavier No. 4 for multiple-torch cutting. Both machines utilized portable tracks which could be positioned for straight-line flame cutting, or, with the attachment of a radius rod, could cut arcs or circles such as lightening holes in double bottom floor sections. The machines used resulted in quicker, more accurate work performed by an employee who had a minimum knowledge of and skill in welding and shipbuilding. The welding machines and mass production techniques at Ingalls'

plant minimized the craftsmanship required to produce an acceptable product.[38]

Once the Birmingham plant had constructed the subassembly, the product began a 350-mile trip to the Pascagoula shipyard by either rail, truck, or water. Subassemblies traveled in large sections limited only by the plant's crane capacity and railway restriction. The largest single subassembly, the forward section of the funnel which weighed about fourteen tons, Ingalls Iron Works shipped to Pascagoula aboard railroad flat cars. Bulkheads, deck sections, and bottom floors went in railroad gondolas along with small hatches, sea chests, brackets, and foundations. Each shaft-alley section occupied an entire flatcar because of its length. Upon arrival at Pascagoula, shipyard inspectors directed the unloading of the cars and decided whether the subassemblies went to storage, to the platens, or to the ways.[39]

Ingalls in operating the Pascagoula shipyard took full advantage of the assembly-line method, welding and flame cutting of steel, and the construction subsidy provisions of the Merchant Marine Act of 1936. Ingalls approached shipbuilding as an assembly enterprise utilizing subcontractors and prefabrication to the maximum. The use of mass

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[38]Magrath, "Welded Ships," p.183.

[39]Ibid., p.181.

production techniques minimized Ingalls' difficulty in finding enough workers with shipbuilding experience to work in his yard. He acquired the nucleus of his Pascagoula staff in 1938 when Bethlehem Steel Corporation bought United Shipbuilding Company of Staten Island, New York. Numerous United employees chose not to work for Bethlehem, and the Ingalls Company managed to attract the trained employees needed for building standardized ships.[40]

In building C-3 cargo ships the shipyard laid out, sheared, formed or flame cut, and fed enough steel plates through the system to build five ships at a time. Welding generators replaced punches, compressors, and riveting guns; oxyacetylene cutting torches replaced shears and planers; and platen prefabrication areas replaced much ship way erection. At the subassembly points cranes positioned and transported the work from one area to another. Bridge cranes of ten and fifteen-ton capacity serviced the plate and storage areas; five and ten-ton cranes operated in the welding and loading zones; three and five-ton cranes served in the fitting and tacking bays; and one-ton cranes moved over the cutting tables and lay out areas. Auxiliary one and two-ton cranes along with narrow-gauge dolly tracks completed the transportation system inside the fabrication and welding shops.[41]

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[40]Couch, "Ingalls Story," pp. 194-195.

[41]Ibid., p.197.

At Ingalls' Pascagoula facility the bulk of oxyacetylene flame cutting and subassembly took place either on the five open-yard platens or in the plate fabrication shop, which resembled a T-shaped structure with the mold loft forming the top of the figure. The bottom part of the T-shaped building measured 66 feet wide and 320 feet in length. The structure housed a steel welding platen 30 feet wide and 180 feet long and a fifteen-ton overhead bridge crane.[42]

As at the Birmingham plant, the Pascagoula shops depended entirely on the Airco Radiagraph welders mounted on portable tracks to perform all the straight-line, circular, and beveling operations. Some of the machines could be fitted with three machine cutting-torches for simultaneous parallel cutting operations. Ingalls' yard made frequent use of automatic welding on the platens to join stiffeners to transverse and longitudinal bulkheads, partitions, and inner bottoms, work which had previously been confined to the ways. Indicative of the heavy reliance on welding at Pascagoula, the shop's employees included twelve fitters, twelve tack welders, four oxyacetylene machine cutters, five hand burners, six automatic machine welders, and five crane operators on the day shift. Similarly, the shipyard's evening crew consisted of thirty welders and two crane operators. Day crews performed enough

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[42]Magrath, "Welded Ships," p.187.

layout, fitting and tacking to keep the night welders busy throughout their shift.[43]

The five open-yard platens held the larger subassemblies prior to their erection on the ways. Three of these platens adjoined the plate fabrication shop and functioned as a subassembly point for smaller pieces coming directly from the fabrication shop. The other two open-yard platens received most of the primary assemblies and shaped plates unloaded from the Birmingham railway cars and served as subassembly points as well. On all five platens, comprising a total work area of almost 100,000 square feet, Ingalls' employees constructed the largest subassemblies possible before actual erection on the ways, such as large decks, inner bottoms, bulkheads, shell sections, stern assemblies, hatch assemblies and platforms, and numerous flats and foundations. All platens had oxygen and acetylene outlets at every other work bay for incidental manual and machine cutting. Each work bay contained two welding-generator outlets supplying 400 and 500-ampere capacity to the welders.[44]

Ingalls' mold loftsmen minimized errors by making welding and construction information on the subassemblies for the

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[43]U.S. Maritime Commission, A Statistical Summary of Shipbuilding Under the U.S. Maritime Commission During World War II, by Gerald J. Fischer, Historical Reports of the War Administration, no.2. (Washington, D.C.: Government Printing Office, 1949), p.94.

[44]Magrath, "Welded Ships," pp.171-172.

welders to avoid distortion problems and locked-in stresses resulting from welding mistakes. As a general rule, to eliminate stresses, welding proceeded from fixed-point positions to points free to move.[45] Marking the welding and construction information on the subassemblies before hand also resulted in minimizing the training requirements for shipyard employees, especially the welders. The use of Unionmelt automatic welding machines at Ingalls' yard not only reduced labor requirements further but provided such efficient welding that very little shrinkage occurred in the process.[46]

Upon completion of the subassemblies on the platens, the sections either went directly to the ways or were stored temporarily at the ends of the ways. Overhead bridge cranes of ten and twenty-ton capacity moved the finished sections to key staging areas. Standard gauge railroad tracks throughout the shipyard provided direct rail transport from outside delivery to storage areas, platens, shops, ways, and fitting-out docks. On the ways, which represented the next-to-last step in the assembly process, Ingalls' yard used welding exclusively. Staging at the ways consisted of lightweight metal lattices assembled in sections corresponding to the height of work on the ship's hull so that the cranes had an unobstructed swing for the entire length of the hull.

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[45]Ibid., pp.196-197.

[46]Ibid., pp.167.

Oxygen and acetylene outlets from a common pipeline system located at eight or nine points along each side of the way provided welding gas. Pipeline extensions with threaded couplings joined the pipeline system to the vertical sections, which were equipped with regulators for hose connections. Five banks of three 1,500-ampere welding generators supplied two of the ways. From each bank 120 welders could work. Even the fitting-out piers had five or six oxygen and acetylene outlets located on each side for welding and burning.[47]

Construction on the ways followed a strict pattern dictated by welding requirements. Following the laying of the keel, welders either tacked or automatically welded the bottom shell plates, welding by hand only where necessary. Welding started amidships, then moved both forward and aft on the longitudinal seams to within twelve inches of the first transverse seam. Welding of the transverse seam for the complete width of the plate assembly comprised the next step, followed by welding of the next longitudinal seam to within twelve inches of the subsequent transverse seam. Welders repeated the process until all the seams were welded. Atop the bottom shell plates workers placed the double-bottom sections and repeated the welding process. Other subassemblies fitted on top of this foundation since construction generally progressed from the bottom up and from aft to

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[47]Leigh, "First All-Welded Cargo Ship," p.161.

forward. Welders first finished work aft because of the greater amount of additional work required in the forward part of the ship, such as installing and aligning the ship's engine.[48] At every step of the construction process, Ingalls' shipyard used some form of welding. Automatic welding took preference over hand welding and down-hand welding over either vertical or overhead welding. While rigid adherence to automated and downhand welding by the Ingalls' yard minimized welding distortion, it relegated the welder from a craftsman to a laborer.[49]

From the inception of the process at Birmingham through the launching of the craft at Pascagoula, Ingalls' mass production approach to the building of ships placed a premium on eliminating the human factor in construction. Extensive jigging and hold-down fixtures at the Birmingham plant held the prefabricated work while welding machines and burners shaped it; the same procedure applied at Pascagoula. Welders joined the subassemblies on the platens and the ways, relying on various holding devices to position the work during welding. Using this method of mass production, Ingalls' firm constructed a total of seventy C-3 cargo ships for the Maritime Commission during the war.[50]

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[48]Magrath, "Welded Ships," p.169.

[49]Ibid.

[50]Ibid., p.170.

The Ingalls company produced fewer ships than did Alabama Drydock, mostly because changing wartime needs necessitated alterations in ship designs which slowed production. Periodically the maritime commissioners approved changes in standardized cargo ship specifications in response to the military's needs for different types of logistical support ships. For example, as the United States prepared for its final thrust at Japan in 1945, more troop transport ships and their tenders were needed for the planned island invasions. Prior to 1944 Ingalls' yard had constructed cargo ships for use in the European theater, but the Maritime Commission later altered the C-3 design in order to convert the cargo ships into crafts needed for the Pacific invasions. The C-2 cargo ship, built by Alabama Drydock, could not be converted to military uses as easily as the C-3's; consequently, Ingalls' yard converted many C-3's into troop and attack transports, small aircraft carriers, and submarine and seaplane tenders. Such changes in the standardized design complicated Ingalls' production problems and resulted in the construction of fewer ships by that yard.[51] (See Tables XIV and XV for Alabama Drydock's and Ingalls' production statistics, 1939-1945).

Alabama Drydock and Ingalls' Pascagoula yard dominated the Gulf coast shipbuilding industry east of the Mississippi River during World War II largely because they successfully

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[51]Ibid., pp. 169-172.

combined new technology with government funding. Before welding, mass production techniques, and the Merchant Marine Act of 1936, these two Gulf coast shipyards could not have developed as major shipbuilding concerns. Once federal funding made possible the expansion of shipyards based on assembly-line methods and welding, such yards prospered. West of the Mississippi, the three Gulf coast shipyards that took advantage of these same opportunities had similar wartime production histories.

CHAPTER 5

THE HIGGINS, PENNSYLVANIA, AND TODD-HOUSTON YARDS

Three Gulf coast shipbuilding companies achieved prominence west of the Mississippi River during World War II. Like Alabama Drydock and Ingalls Shipbuilding Company east of the Mississippi, they capitalized on the availability of federal funds to build mass production shipyards. Each of the five Gulf yards differed slightly in the layout of their yard, the type of standardized ship they produced, and in their emphasis on welding, yet all of them had remarkably similar wartime histories. The three yards west of the Mississippi--Higgins Shipbuilding Corporation, Pennsylvania Shipyard, and Todd-Houston Shipyard Corporation--matched the general pattern of their eastern neighbors by using both welding and assembly-line techniques to build cargo ships for the Martime Commission. With the exception of Higgins Shipbuilding, the three western Gulf coast yards compiled respectable production records and fully participated in the nation's shipbuilding effort during World War II. Although it appeared, at first, that the Higgins yard would be the most productive of all Gulf coast yards, it failed to produce any standardized cargo ships. Owned by Andrew Jackson Higgins, the ill-fated shipyard had been the

most successful of the three shipyards in the construction of water craft.

Higgins began his career in 1922 as the owner of the Higgins Lumber and Export Company of New Orleans. Unable to locate competent maintenance service in the New Orleans area for his company's schooners and brigantines, he quickly recognized the need for a ship repair facility for his own vessels. As a result, Higgins established his own ship repair plant on the New Orleans Industrial Canal. As Higgins' lumber and export business prospered, he decided to convert his ship repair plant into a complete shipbuilding facility. To carry his lumber into the bayous, swamps, and marshes of the Gulf coast region, Higgins recognized the need for construction of smaller water craft, such as tugs and barges. Transportation of lumber through the shallow waters of coastal and inland Louisiana required construction of unique shallow-draft vessel. Higgins successfully designed and built such a boat which he also sold to other lumbermen, oil drillers, and fur trappers who operated in the coastal area.[1] Oil companies showed a special interest in Higgins' vessels as their increased drilling activities necessitated a boat capable of ferrying equipment and employees to drilling sites deep within the Louisiana swamp.[2]

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[1]"The Boss," Fortune 28(July, 1943): 210.

[2]Jerry E. Strahan, "Higgins: The Man, The Boat, The Industry" (MA thesis, University of New Orleans, 1979), p.14.

By 1925 Higgins had developed a rugged, shallow-draft boat called the Eureka, a direct predecessor of World War II landing craft. The boat had four distinct features which made it an exceptional vessel and which attracted the military's attention as the United States entered World War II. First, it had a wide spoon-bill bow made from solid pine wood. In an amphibious assault this innovation allowed for unloading more men and materials over the boat's bow instead of forcing soldiers to debark in deeper water from the side of the boat and then wade ashore. Secondly, the boat's hull design trapped aerated water under the bow lessening the friction when the boat moved, thus permitting it to achieve higher speeds with smaller engines. Thirdly, the aerated water under the bow created a roller-bearing effect which allowed the boat to turn in its own length. In an amphibious operation such a capability enabled the vessel when withdrawing from the beach to turn around before oncoming waves could capsize or beach it. Finally, Higgins' hull design, with the propeller and shaft enclosed in a tunnel, pushed the aerated water along the outer edges of the hull aft of midship, allowing only solid water to reach the propeller. Such a design enabled the boat to navigate freely through debris and dense vegetation without reducing speed.[3]

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[3]Ibid., pp. 17-19.

With the Eureka Higgins gained experience, insight, and a reputation as an innovative, imaginative businessman, yet throughout the 1920's and the early 1930's Higgins' achievement went unrecognized by the military. At various times the Army Corps of Engineers, the Biological Survey Agency, and the Coast Guard purchased a few of Higgins' Eureka-type boats. Some industries also bought the boat in limited quantities for specialized purposes. Because foreign governments recognized the value of Higgins' boat more readily than purchasers in the United States, Higgins sold most of his boats to the governments in Africa, South America, and the Near East, as well as to the Chinese. Continuing to experiment with the amphibious-type craft, Higgins also developed a P.T. (propeller-torpedo) boat, but it was the Eureka Higgins hoped to sell to the American military. In 1936, Higgins offered the Eureka to the navy as a landing boat. The navy not only indicated it had no interest in the Eureka, but that it had no funds for purchasing landing craft.[4] On the other hand, Finland and Britain purchased several P.T. boats as well as several Eureka's from Higgins in 1939.[5]

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[4]Kenneth J. Clifford, Progress and Purpose: A Developmental History of the United States Marine Corps, 1900-1970 (Washington, D.C.: Government Printing Office, 1973), pp. 48-50.

[5]"Boss," p. 241.

The navy did need a type of amphibious craft with which Higgins had not experimented. Throughout the 1920's the navy attempted to develop or purchase a boat, known as a tank landing craft or tank lighter, capable of transferring tanks and artillery pieces from a fleet at sea to enemy-held beaches. All early models of tank lighters had proved unsuitable. Although Higgins had not experimented with such craft, he entered one of his improved thirty-foot long Eureka landing craft in an amphibious exercise conducted by the navy in September, 1940. The navy held such exercises periodically to test experimental models submitted for consideration by interested boat manufacturers and inventors. Surpassing all expectations the Eureka's performance led to increasing lucrative navy contracts for the boat.[6]

By late 1940 Higgins recognized the need to expand his plant facilities to satisify the increasing demand for both his Eureka landing craft and his P.T. boats. While the plant on St. Charles Avenue in New Orleans sufficed for the construction of commercial boats, the increasing demand for the Eureka and the P.T. boats forced Higgins to acquire another building. Purchasing the Albert Weiblen building on City Park Avenue, Higgins used it to institute the first assembly-line for the production of combat landing craft.[7]

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[6]Holland M. Smith, Coral and Brass (New York: C. Scribner's Sons, 1949), p. 80.

[7]Strahan, "Higgins," p. 40.

On the basis of this early experience, Higgins, in calculating future expansion plans, followed the practice of other Gulf coast shipyards by relying on welding and mass production to meet wartime demands.

In the spring of 1942 the Maritime Commission awarded Higgins a $385 million contract to construct two hundred Liberty ships, basing its decision primarily on Higgins' reputation as a builder of lighters for the navy. Higgins received this award from the commission because his experience as a small boat builder more closely approximated that of a shipbuilder than any other applicant in 1942. Undoubtedly, the fact that President Roosevelt had expressed a desire to encourage industrialization of the South enhanced Higgins' application.[8]

Earlier, in February, 1942, Higgins had refused a contract to build Liberty ships, convinced not only that his plants were operating at maximum capacity but that the military would soon request that he build more tank landing craft.[9] His applications for government contracts had proved more successful than he had expected, and to build Liberty ships would entail a new commitment for facilities. In March, 1942, however, Maritime Commissioner Howard L.

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[8]Lane, Ships for Victory, p. 184.

[9]U.S., Congress, House, Committee on Merchant Marine and Fisheries, Higgins Contracts, 77th Cong., 2d sess., 1942, p. 20.

Vickery visited Higgins in New Orleans and persuaded him to undertake construction of the Liberty ships. In recalling the occasion Vickery remembered:

> At first Mr. Higgins was not very much interested in it, but at the end of the talks why I think I got a little under his hide because I questioned his ability as to whether he thought he could do it or not, whereupon he took the bit in his teeth and found he could do it.[10]

Higgins accepted Admiral Vickery's challenge with certain stipulations that reflected the forces at work in all the Gulf coast shipyards. Like the other Gulf coast shipyard owners, Higgins requested that the federal government finance the construction of a new shipyard site to accommodate the additional work, claiming he did not possess the capital to build such a facility. Consequently, the Maritime Commission entered into Facility Contract No. MCc-2480 with the Higgins corporation on March 13, 1942, for the construction of a shipbuilding plant at a New Orleans site. By 1943, the vouchers paid and chargeable to the contract totaled $9,261,976.[11]

Higgins' second stipulation concerned the new plant's layout. Anticipating the trend toward the assembly-line method of shipbuilding, near the end of 1941, Higgins hired a consulting engineer, Walter B. Moses, to help design an

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[10]Lane, Ships for Victory, pp. 185-186.

[11]"Memorandum of April 30, 1943," Record Group 178, Records of USMC, Vickery File.

assembly-line for construction of large ships.[12] Higgins, with Moses' help, planned a yard in which ships could be welded together in eight individually complete sections from the keel to the upper deck. The sections were constructed in separate buildings which contained a total of 4,280 portable welding machines. Each building contained an independent erection plant for constructing its particular section of the ship. Steel plates for all eight of the erection plants came from a centrally-located prefabricating shop, located in some cases over half a mile from a particular assembly building. Higgins spaced the buildings so that the ship sections, starting with the midship section which included the main engine and boilers, traveled along a moving platform.[13]

As the partially completed vessel moved along the track past the erection plants, workers welded on each new section until the complete ship emerged at the water's edge. This method permitted workmen to stay in one place and to do only one kind of work. With four assembly lines, two on each side of each building, Higgins calculated he had a shipyard equivalent to forty-four ways, because the yard

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[12]Committee on Merchant Marine and Fisheries, Higgins Contracts, p. 215.

[13]Ibid., p. 307; Lane, Ships for Victory, p. 185; "Memorandum of June 20, 1942," Record Group 178, Records of USMC, Vickery File.

could contain that many ships at one time in various stages of construction. The Maritime Commission considered it a twenty-eight way yard, although the novel arrangement of the yard defied description in traditional terminology.[14] Higgins optimistically estimated the yard would complete a ship daily (thirty times faster than the average shipyard), cutting man-hours by 50 percent and reducing costs by $250,000 per ship.[15]

Higgins finally demanded that the government assure delivery of all materials by specified dates. Since Higgins' proposed operation required large amounts of steel, he would not accept a contract without some guarantee that the materials would be made available. Although the document contained no such stipulation, Higgins considered the fact that the Maritime Commission offered him a contract as agreement to his demands.[16]

The Maritime Commission approved two contracts for Higgins on March 13, 1942. First, Facility Contract No. MCc-2480 authorized construction of the shipyard at New Orleans. The site chosen later generated considerable controversy, since it required about ten million yards of fill

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[14]"Boss," p. 214.

[15]Committee on Merchant Marine and Fisheries, Higgins Contracts, p. 21.

[16]"Memorandum of April 30, 1943," Record Group 178, Records of USMC, Vickery File.

dirt and two hundred thousand pilings to provide a solid foundation. Also on March 13, the Maritime Commission awarded to Higgins Vessel Contract No. MCc-2480 for construction, on a cost-plus-fixed-fee basis, of two hundred Liberty ships. It allowed for a fee of $110,000 per vessel subject to increases based on the actual number of man-hours needed to construct each vessel.[17]

Higgins had completed approximately 35 percent of the yard before L. R. Sanford, regional director for the Maritime Commission, telephoned him on July 10, 1942, to halt all work on the facility. Sanford claimed that a shortage of steel forced the Maritime Commission to cancel the contract, but Higgins suspected that representatives of the big eastern shipyards had exerted political pressure on the Commission in order to eliminate a possible competitor after the war.[18] Believing he could render all other yards obsolete by producing a ship every one or two days as he predicted, Higgins rushed to Washington, D.C. to request a government investigation. Even after both Senate and House investigations, the order to cancel the contract remained.[19]

It is possible that a shortage of steel resulting from an improper allocation of materials as well as some pressure

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[17]Committee on Merchant Marine and Fisheries, Higgins Contracts, pp. 22-23.

[18]Ibid., pp. 76, 84, and 90.

[19]Ibid., pp. 30, 92.

from the large influential eastern shipyards had affected the decision. In reality, three other explanations seem more probable. First of all, in March, 1942, the original cost of the new Higgins yard had been estimated at $29 million. Although by the end of June, the actual cost had risen to $59 million, this $30 million overrun by Higgins paralleled similar overruns by other shipyards designed and constructed during the war. In most instances such excesses resulted from rising prices, wage increases, transportation costs, and other unexpected expenses. In Higgins' case, the major portion of the increase developed from the need to construct a separate power plant and sewage disposal system. The lack of available housing also contributed slightly to the cost overrun, since New Orleans did not have adequate housing to accommodate the huge influx of shipyard employees. Time and money could have alleviated the problem, but the Maritime Commission decided not to make the investment.[20]

Secondly and most importantly in the Maritime Commission's decision to cancel Higgins' contract was the Commission's underestimation of the number of ships that existing yards could produce in 1942. President Roosevelt had set production goals for 1942 at nine million tons of merchant shipping, with an additional twenty-four million tons for the period 1942-1943.[21] When Higgins received his

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[20]Ibid., p. 94. [21]Lane, Ships for Victory, pp. 173-176.

contract in March, 1942, American shipyards had completed only forty-two ships weighing 448,000 tons. At that time it took an average of 207 days to build a Liberty ship; by April it took 177 days, and by June the time had shrunk to 118 days. In considering this development in the shipyards' ability to produce merchant ships, the Maritime Commission estimated that the yards could produce twenty-eight million tons by 1943--four million tons more than President Roosevelt's stated goal. Faced with this situation, the Maritime Commission decided to cancel Higgins' shipbuilding contract.[22]

Higgins soon turned to another project in an effort to make use of the unfinished shipyard. He had heard rumors that American military planners were considering the idea of building a large fleet of giant transport planes to ferry cargo to war zones in place of merchant shipping, thereby elimimating the German submarine hazard; therefore, in late 1941 Higgins opened negotiations with the army for a contract to convert his shipbuilding plant into an army aircraft factory. In November, 1942, he bid for and received a contract for $212 million from the army to build 1,200 plywood cargo planes; the contract allocated $30 million of the total amount for the conversion of the shipyard into an assembly-line aircraft factory. Higgins'

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[22]"Memorandum of July 10, 1941," Record Group 178, Minutes, Records of the USMC.

plans went awry when, after having finished his aircraft plant in October, 1943, the War Department cancelled the order for wooden planes and decided to build aluminum planes at other factories.[23] After this turn of events Higgins unsuccessfully attempted to negotiate with government representatives to convert an unused part of the shipyard into a national airline terminal with connections to Central and South America.[24]

Although Higgins built neither Liberty ships nor any plywood cargo planes, he had responded to the wartime situation in a manner similar to that of Alabama Drydock and Ingalls Shipbuilding Corporation. All three companies had relied on government funding to expand their plants; all of them had used welding extensively to construct their ships; and all of them had applied assembly-line techniques to the manufacture of large numbers of ships. This combination of government funding and technology occurred at two other yards on the Gulf coast on a less spectacular scale but in just the same manner. Had they not followed the examples of Alabama Drydock, Ingalls Shipbuilding, or Higgins Shipbuilding Corporation in utilizing federal funds

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[23]"Higgins Outlines Big Plane Program," New York Times, November 7, 1942, p. 9.

[24]Clinton D. Winant, Chairman of the Higgins Liquidating Committee, to Admiral Land, November 10, 1942, New Orleans, Louisiana, Record Group 178, Records of the USMC, Vickery File.

and current technological improvements, neither Pennsylvania Shipyard of Beaumont nor Todd-Houston Shipyard would have developed in Texas.

Originally known as the Beaumont Shipbuilding and Drydock Company from 1910 to 1922, Pennsylvania Shipyard developed as a subsidiary of American Republics Corporation after 1922. Bounded on all sides by water--the Neches River, Brakes Bayou, and the John Henry Kirby Canal--the shipyard formed an island. Because the city of Beaumont considered making a park of the property soon after World War I, local maps and legal documents referred to the area as Island Park for many years thereafter.[25] In 1922 following acquisition of the property by the American Republics Corporation, Pennsylvania Shipyard competed with another small company on Island Park in the construction of water craft. The following year Pennsylvania's competitor sold out to American Republics Corporation, and the entire island became the property of Pennsylvania Shipyard.[26]

Although one of the smaller Gulf coast shipbuilding enterprises during World War II, Pennsylvania's size did not prevent its application of federal funding and its use

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[25]The historical facts about Pennsylvania Shipyard were taken from an unpublished printed speech made by J. O. Crooke, General Manager of Bethlehem Shipyard and from a subsequent personal interview with Mr. Crooke on July 1, 1969, in Beaumont, Texas.

[26]Ibid.

of technology for expansion of the yard. In early 1941 Pennsylvania Shipyard applied for government funding for expansion that would permit it to build standardized cargo ships for the Maritime Commission. The Commission responded in April, 1941, by authorizing Facilities Contract DA-3 for $1,250,000 to build three shipways at the Beaumont site. (See Table XVI in the Appendix for Pennsylvania Shipyard's facility contract estimates). Only four months later, in July, 1941, the contractor asked for and received $1,200,000 in addition to the original estimate because of inaccurate estimates for materials, bringing the total spent by the Maritime Commission on facilities at Pennsylvania Shipyard to a total of $4,975,000.[27]

As with the other shipyards on the Gulf coast, Pennsylvania Shipyard's layout copied their assembly-line techniques and relied on welding rather than riveting for ship construction. Pennsylvania had two active shipways, one 800 feet long and the other 500 feet long, which allowed both the construction and side launching of four ships at one time. This layout required careful planning to assure that the ships nearest the water reached completion first. Layout and welded-assembly shops laid alongside each way where welders flame-cut material to size, assembled sections into ten and twenty ton sections, and transferred the

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[27]"Memorandum of July 22, 1946," Record Group 178, Minutes, Records of the USMC.

sections to storage platens alongside the ways for erection at the proper time. Four cranes, three of fifty-ton capacity and one of thirty-ton capacity, serviced the two ways. About ten miles of standard gauge railroad track and hard-surfaced roads inside the yard provided the transportation network to the two ways. After launching the ships, workmen moved them across to adjacent outfitting piers totaling 3,500 feet in length. Seven cranes served these piers, six of fifty-ton capacity along with one seventy-five-ton floating crane.[28]

Next to the shipways lay a furnace and forge shop, 100 feet long and 135 feet wide, consisting of a fifty-foot oil furnace and a smaller plate furnace for heating and bending shell plates. In the forge shop, Pennsylvania had a two hundred-ton hydraulically-operated keel bender capable of bending plates up to fifteen feet in length. To facilitate the handling of the heaviest materials in this shop, the company installed an electrically-operated bridge crane equipped with auxiliary outlets for small tools and winches. For smaller ships' sections each shop in this yard contained electric hoist cranes each with a five-ton capacity.[29]

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[28]Carl A. Goren, production engineer, Pennsylvania Shipbuilding Company, personal interview, Beaumont, Texas, June 3, 1969.

[29]John Breaux, a foreman in the layout department, Pennsylvania Shipbuilding Company, personal interview, Beaumont, Texas, January 20, 1968.

Pennsylvania Shipyard followed a welding sequence similar to that used in other Gulf coast yards engaged in building standardized ships for the Maritime Commission. Welding began on the bottom plating simultaneously on the port and starboard seams. After welders finished the bottom shell, the inner bottom sections, measuring the full width of the ship and about twenty feet in length, were fitted into place. Pennsylvania Shipyard prefabricated these inner bottom sections upside down on the platens. Welders first joined the inverted bottom plates and then added the vertical floors and longitudinals to complete this particular ship section. Most of the welding was done with Unionmelt automatic welders, but some of the longitudinals required manual welds. By this procedure, Pennsylvania Shipyard almost eliminated the least desirable and weakest type of weld, the overhead, manual weld, in building these ship sections. Once welders had finished a section, including all inner bottom piping, cranes righted the section, and welders began adding the plate seams, bulkheads, and side shell sections. After this section of the ship had been completed prefabrication cranes lifted it into place on the way for final welding as an integral part of the ship.[30]

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[30]Thurman O. Thompson, welding supervisor, Pennsylvania Shipbuilding Company, personal interview, Beaumont, Texas, October 15, 1969.

Taking an average of six weeks to prepare a ship for launch, the first week of work on a ship at the Pennsylvania yard consisted of erecting sections totaling about 1,200 tons, including the bottom plating; inner bottom sections; bulkheads 68, 88, 108, and 116; settling tanks, bilge plates, the second deck and side shell from frome 68 to 116; and the shaft tunnel. Welders then added the bulkheads, shell panels, and the stern frame during the second week, bringing the total weight to about four hundred tons. The third week's work included installation of the upper shell, the upper deck amidships, hatch coamings, the bow section, and the boilers. During the fourth week welders attached the remaining upper shell and decks, the stern section, and some of the deck houses to the emerging structure. The completion of the superstructure consumed most of the fifth week. Deck machinery, various fittings, bulwarks, and miscellaneous items went into the ship in the sixth week, while, at the same time, laborers prepared the ship for launching. About 40 percent of the welding in the construction sequence took place in the shops or on outside welding platens. At Pennsylvania Shipyard the total amount of welding on a C-1 cargo ship came to approximately 207,000 linear feet, of which 41,500 feet was accomplished by the automatic Unionmelt process. Limited crane capacity precluded complete installation of the main engine on the ways,

so the remaining work occurred at the outfitting piers, along with other general outfitting procedures. A dock trial at the yard and a sea trial the following day completed the cycle.[31]

Most ships constructed at Pennsylvania Shipyard followed the basic C-1 cargo vessel configuration of the United States Maritime Commission--417 feet long with a 60-foot beam, a deadweight of nine thousand tons, and diesel engines capable of a sustained fourteen knots. Eight other shipyards in the United States also produced C-1 cargo ships, but Pennsylvania Shipyard was the only C-1 builder on the Gulf coast. The other shipyards constructing C-1's were located either on the Atlantic or Pacific coasts: Bethlehem Steel Company at the United Plant, Staten Island, New York; Federal Shipbuilding and Drydock Company at Kearny, New Jersey; Pusey and Jones Corporation at Wilmington, Delaware; Sparrows Point at Baltimore, Maryland; Consolidated Steel Corporation (Craig Yard) at Los Angeles, California; Seattle-Tacoma Shipbuilding Corporation at Seattle, Washington; and Western Pipe and Steel Company and Union Plant both at San Francisco, California.[32]

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[31]This information came from a booklet given to the author, Bethlehem at Beaumont, published by Bethlehem Steel Company in 1953.

[32]"Progress of the Maritime Commission's National Defense Program," Marine Engineering and Shipping Review 46(July, 1941): 56.

Pennsylvania Shipyard alone accounted for 25 percent of the C-1 cargo ships constructed in 1941, while the other eight firms built the remaining 75 percent. The primary reason for Pennsylvania's high percentage of C-1 production stemmed from the fact that Pennsylvania constructed only that C-type ship whereas the other yards were more diversified. For example, Federal Shipbuilding and Drydock Company built only five C-1's but also constructed forty-seven C-2's, six C-3's, as well as three tankers.[33]

Pennsylvania Shipyard received its first Maritime Commission contract for ten C-1 cargo ships at a total cost of $19,900,000 in October, 1939.[34] To ensure that Pennsylvania Shipyard could tow the finished ships to sea, the War Department in January, 1940, allocated $27,000 for dredging a ship channel to the shipyard. Army engineers recommended a depth of thirty feet and a width of two hundred feet to Secretary of War, Henry L. Stimson; approval rapidly followed.[35]

On January 25, 1941, Pennsylvania Shipyard launched its first C-1 cargo vessel. Christened the Cape Lookout by its Beaumont sponsor, Mrs. John A. Boehch, the launching

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[33]Ibid.

[34]"Quarterly report of Merchant Vessel Construction Under Way in American Yards--July 1, 1940--Including Only Vessels of 2,000 Gross Tons and Over," Marine Engineering and Shipping Review 45(July, 1940): 79.

attracted nation-wide attention and over six thousand spectators when the vessel slid into the water on rails greased by seven thousand pounds of ripe bananas.[36] A practice that originated somewhere in Italy, Pennsylvania officials decided to use it in some of the yard's launching in order to conserve petroleum. Since banana boats from South America docked regularly in Beaumont the fruit was cheap.[37] On at least one other accasion in 1941 bananas greased the Pennsylvania ways, when nine thousand pounds of bananas helped launch the Cape St. George.[38] Described by one old time Beaumont resident as a stunt to attract the attention of the Maritime Commission, which it did, the practice did not result in any contracts for the shipyard. Eventually, Pennsylvania Shipyard discontinued the practice for several reasons. Too many employees and spectators delayed launches by trying to get a banana to eat just when officials were ready to launch a ship, not to mention the stench of scorched and overripe bananas after the launch![39]

Although Pennsylvania Shipyard primarily constructed the C-1 cargo ship, the yard did build other types of

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[36]"Gulf Coast Shipbuilding," Life 10(May 26, 1941): p. 93; New York Times, February 22, 1942, p. 7; Beaumont Enterprise, February 22, 1942, p. 1.

[37]Breaux interview.

[38]Beaumont Enterprise, March 7, 1942, p. 1.

[39]Bill Roe, a Pennsylvania Shipyard welder, personal interview, Beaumont, Texas, April 15, 1968.

vessels for the navy and the Maritime Commission. In October, 1941, the yard received a government contract to build four minesweepers. The designs specified a vessel 221 feet long with a 32-foot beam, a deadweight of 890 tons, a twin-screw diesel-electric engine, and with a top speed of eighteen knots. These minesweepers were unique in that they had steel hulls rather than wooden hulls, the usual construction material for such vessels. Steel hulls made them more durable and seaworthy but, at the same time, rendered them vulnerable to magnetic mines,[40] a fact made evident when one of them, the USS Portent, sank after striking a magnetic mine off the coast of Anzio, Italy, on January 25, 1944. The three other steel-hulled minesweepers built by Pennsylvania--USS Prevail, USS Pilot, and USS Pioneer--participated in various theaters during the war, escaping serious damage despite several near misses.[41]

Pennsylvania Shipyard also built some ocean-going tugs (V4-M-A1), coastal cargo ships (N3-S-A1), partly-refrigerated cargo ships (C1-M-AV1), and completely-refrigerated cargo ships (C1-M-AV3) before the war ended. The eight tugs

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[40]Taken from an unpublished report of the ships built at the Beaumont yard from 1926 to 1953 compiled by the Central Technical Department of Bethlehem Steel Company in Bethlehem, Pennsylvania, and given to the author.

[41]Taken from an unpublished mimeographed copy of the ships' histories sent to the author from the Division of Naval History, Ships' Histories Section, U.S. Navy Department.

built by Pennsylvania comprised the smaller portion of a government contract for forty-nine of the vessels, the balance of which were constructed by Great Lakes shipyards. Although originally intended by the Maritime Commission for towing concrete barges, the navy used the tugs to tow sections of an artificial breakwater from Britain to Omaha Beach on the coast of France for V Corps of the American army at the invasion of Normandy on June 6, 1944.[42]

In late 1944 Pennsylvania Shipyard and Consolidated Steel Corporation of Wilmington, Delaware, received Maritime Commission contracts for construction of a series of coastal cargo vessels. Actually a C-1 design altered to carry refrigerated cargo, Pennsylvania Shipyard had already assembled nine similar vessels under an earlier contract. The commission planned to purchase 125 ships of this design for the War Shipping Administration. In addition, Pennsylvania Shipyard also received a contract to build seventeen completely-refrigerated cargo ships (C1-M-AV1) for the commission; these were the last ships constructed at Pennsylvania Shipyard for the war effort.[43]

Although Pennsylvania built a total of forty-six C-1 cargo ships during the war, its production developed slowly at first completing only two of the vessels in 1941. Improved

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[42]Lane, Ships for Victory, p. 636.

[43]Unpublished report compiled by Bethlehem Steel Company's Central Technical Department, and given to the author.

production techniques quickly helped the Pennsylvania yard increase its production rate in 1942 when thirteen ships slid down the ways. Peak production of the C-1 type ship came in 1943 when Pennsylvania launched seventeen, while in 1944 the yard constructed fourteen more.[44]

As in the other Gulf coast shipyards, output increased greatly as Pennsylvania improved its mass production and welding techniques. While it took 304 days in 1941 to complete its first C-1, the Cape Lookout, in 1944 Pennsylvania took only 57 days to build the Cape Pembroke.[45] Throughout the war, Pennsylvania Shipyard and the other Gulf coast yards that relied on government funding for expansion continued to apply mass production methods and to refine their welding technology in an attempt to maximize production volume while minimizing their dependence on skilled labor. Pennsylvania did all this on a smaller scale than any of the other yards, but the methods remained the same, as did the results.

Another Texas yard--Todd-Houston Shipbuilding Corporation--located at Houston, Texas, represented the only other yard on the Gulf coast constructing standardized

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[44]Fischer, A Statistical Summary of Shipbuilding During World War II, p. 87.

[45]Letter to the author from the American Bureau of Shipping written October 11, 1968, by Edwin M. Hood, President, American Bureau of Shipping. It listed all the merchant ships registered with the Bureau which had been constructed by Pennsylvania.

vessels weighing over ten thousand deadweight tons. The Houston firm responded to the war effort through the Todd Corporation with its extensive nationwide shipbuilding and repair facilities. In 1921 the Todd Corporation's holdings in the United States alone comprised more than two hundred acres of land and water service area, including two graving docks, nineteen floating drydocks, twelve shipbuilding ways, 110 shops, eight power plants, twenty-five piers, ten service vessels and considerable floating repair equipment, as well as 17,000 employees.[46]

During the 1920's and 1930's Todd Corporation continued its growth by acquiring new repair facilities in Mobile, Alabama; New Orleans, Louisiana; and Galveston, Texas. Todd-Mobile Drydocks became the first of Todd's Gulf coast acquisitions. Purchased in 1934 from Mobile Shipbuilding Company, Todd leased the plant in January, 1937, to Alabama Drydock and Shipbuilding Company for its war effort. The New Orleans plant, originally known as Todd Engineering Drydock and Repair Company, merged with the former Johnson Iron Works, Drydock and Shipbuilding Company of New Orleans in 1935 and subsequently operated as a ship repair firm under the name Todd-Johnson Drydocks Incorporated. Principally, the Todd Corporation used the New Orleans plant for

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[46]Taken from an unpublished report written by Todd Shipyards Corporation in Houston, Texas, and given to the author.

conversion and repair work rather than for shipbuilding purposes. Its holdings included four drydocks and wharves totaling 6,600 linear feet paralleling the Mississippi River adjacent to the New Orleans Inner Harbor Navigation Canal. After organizing its New Orleans acquisitions, Todd Corporation purchased the Galveston Drydock and Construction Company at Galveston, Texas, in 1935. Located on Pelican Island at the northern side of Galveston Channel, this yard operated as a repair facility with its four drydocks and five piers totaling over 5,400 linear feet.[47]

In early 1941 Todd created the Todd-Houston Shipbuilding Corporation to build standardized ships for the Maritime Commission. As at the Higgins yard in New Orleans, Todd-Houston's plant floated on what had previously been a swamp. Todd Corporation created the yard's site by straightening a part of Buffalo Bayou to form a 50-acre island.[48] Construction began with the dredging of one million cubic yards of mud to relocate Buffalo Bayou and by using one half of the dredged material to fill the low-lying areas of the newly formed island. Thousands of steel pilings provided the foundation for the fabricating and machine shop, steel plate shop, main warehouse, and the lumber storage shed. A crust of heavy soil on the surface covered the soft "gumbo"

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[47]Ibid.

[48]Marilyn M. Sibley, The Port of Houston: A History (Austin: University of Texas Press, 1968), p. 190.

mud to an indeterminate depth. Although some of the 60-foot pilings possibly reached a solid bottom on a strata of sand or shell, most of the thirty thousand pilings carried their load by friction alone. All nine shipways, each building, and each machine weighing over one ton required piling support. The shipways and some of the larger buildings even required a reinforced concrete slab over the pilings to tie them together solidily. Eventually one half million pounds of steel went into construction of the yard at an estimated cost of $3 million.[49]

Todd-Houston carefully planned the yard to provide a straight-line production layout from steel plate fabrication to the finished hull. On the first twenty-five ships, Todd-Houston workers riveted frames and gunnel bars while welding the remaining joints. On later vessels the yard gradually reduced riveting to a minimum.[50] Todd-Houston arranged their yard around two slips dredged at a 45-degree angle from the direction of the bayou. One slip measured 2,000 feet long by 100 feet wide; the other slip was 1,500 feet by 210 feet. Platens and shops lined each side of both slips, comprising a total of nine ways from which Todd-Houston launched vessels broadside into the water. Each way

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[49]"Todd South Yards," Manufacturer's Record, November, 1944, p. 50.

[50]Edwin K. Linen, Secretary of Todd Shipyards Corporation to the author, New York, New York, August 23, 1978.

contained a complete fabricating unit. Laborers could move steel plates from storage areas into the layout and welded-assembly shops alongside the ways by means of six miles of standard gauge railroad track, complete with branches, spurs, and cross-overs designed to accommodate the company's diesel locomotives. Todd-Houston also owned seven 25-ton locomotives cranes as well as a fleet of railroad flat cars expressly for the purpose of material manipulation.[51]

In the layout and welded-assembly shops, the welders flame-cut steel plates to size, made joint preparations, positioned work for welding into sections, welded, and then transferred each prefabricated section to the ways for erection at the proper time. Each assembly shop, measuring 400 feet by 100 feet, was open-ended with the sides partially covered to protect the workers from extreme weather conditions. Small trucks brought the smaller steel plates into the shops, and laborers laid them on burning tables for sizing, after which the plates went to welding grids inside the shop for subassembly work. For example, inner bottom sections, measuring the width of the ship and about 22 feet long, took shape on these grids. Larger subassemblies, such as bulkheads and deck houses were assembled on outside welding platens 250 feet long and 60 feet wide. Todd-Houston fashioned their welding platforms from twelve-inch

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[51]"Todd Yards," p. 50.

channel beams or I-beams spaced thirty-six inches apart and supported on timbers eight feet apart.[52] In one respect Todd-Houston differed from the other Gulf coast yards in that it at first did not use welding exclusively in constructing its ships. Todd-Houston increasingly employed welding in constructing its vessels as the war effort developed and as their welders gained experience. Although Todd-Houston's workers riveted selected portions of their first twenty-five ships, the company later utilized portable or semiportable welding equipment exclusively, as Higgins had planned to do in his New Orleans yard. For manual welds Todd-Houston mounted most of the 204 ampere arc welding machines in pairs furnishing current for as many as six welders for each pair of machines. Todd-Houston, as at the other Gulf coast yards, maximized the use of Unionmelt automatic welding machines wherever possible and positioned work so that down-hand manual welding predominated whenever Unionmelt welding could not be used.[53]

At the head of each way, Todd-Houston placed a large platen and a machinery building. These two areas supplied all nine ways with materials that required rolling, forming, or furnace work, as well as small parts which could not be

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[52]Ibid.

[53]G. W. Curry, "How Houston Shipbuilding Corporation Works Arc-Welding Equipment to the Limit," Welding Journal 21(December, 1942): 851-852.

integrated easily into the assembly-line process of the yard. A gantry track ran along the inboard side of the shipways providing crane service to only one side of the ways--a distinct disadvantage of side launching. Todd-Houston offset this problem, however, by placing two cranes by each ship's berth. The cranes could lift sections weighing up to forty tons over the centerline of the ship's hull. In addition, the gantry cranes also lifted prefabricated sections from the transfer tracks to storage alongside the ways, and to some extent they assisted the locomotive cranes in servicing the outside welding platens.[54]

Todd-Houston developed a launching method unique to its yard. While each building berth was level on the inboard side, it sloped toward the water from the ship's centerline outboard at a declination of 1 5/8 inches per foot. As a rule, side launching yards laid wooden launch ways under the ship's hull on ten-foot centers as the vessel neared completion, and the Oregon fir launch ways traditionally extended about 70 feet. The completed operation of constructing this launch way consumed about 3,380 feet of lumber and required 400 man-hours for each individual launch. In 1943, W. B. Kirby, the shipwright leadman for Todd-Houston, perfected a ship-launching device dubbed the "sand jack." It consisted of a steel box filled with dry

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[54]"Todd Yards," p. 51.

sand which supported the cribbing under a vessel during construction. When Todd-Houston prepared to launch a vessel using the "sand jack," laborers slowly removed the sand from the steel boxes through valves attached to the bottoms of the boxes. The hull then came to rest on a permanent launching cradle saving the timber and hundreds of man-hours of time heretofore spent on launching.[55]

The Todd-Houston shipyard did not differ significantly from the other Gulf coast shipyards because the adoption of mass production processes and welding government its growth pattern as well as those of all the Gulf coast yards. To even participate in the nation's shipbuilding effort, Gulf coast yards of necessity relied on such technology in order to produce ships in sufficient numbers for the war effort with the available labor pool. Had Gulf coast shipyards attempted to construct ships in the tradiditonal manner of one at a time relying on skilled craftsmen, they would doubtless have failed regardless of the amount of federal funding. Not only were traditional shipbuilding methods obsolete, but the nation, and the Gulf coast especially, lacked a sufficient number of skilled craftsmen to satisfy the sudden labor demand. In the final analysis, the Gulf coast yards adopted the only construction methods which enabled them to produce a sufficient number of ships with an unskilled labor force.

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[55]New York Times, November 21, 1943, p. 59.

CHAPTER 6

LABOR

World War II imposed changes in Gulf coast labor practices as well as changes in the Gulf coast industrial pattern. As welding and mass production methods introduced a highly technical industry into a basically agrarian economy, the new technology also forced Gulf coast shipbuilders to alter traditional southern labor customs. While older American shipbuilders also had to adopt different labor practices, the greatest changes took place among the newer shipyards. First, American shipyards had to change their construction techniques notably to accommodate the replacement of riveting by welding but also to further incorporate production methods into their plant operations. The older shipyards adapted as best they could, but they could not completely rearrange their plant layout according to the principles of mass production. To achieve optimum manufacturing conditions in mass production, a plant's configuration required a straight-line layout in which the product progressively developed as it moved down the line; consequently, the newest shipyards conformed to mass production fundamentals to a greater degree than the older yards. Gulf coast yards, as new yards, participated fully in this

developmental process and pioneered in the building of standardized cargo ships.

Where mass production techniques were applied to the greatest extent, the most profound changes in shipyard labor customs took place. Before World War II the majority of shipyard employees served an apprenticeship of four years and mastered from forty to seventy skilled operations in a specific craft before receiving recognition as an accomplished craftsman.[1] After shipyards incorporated welding and mass production technology into their systems for World War II, the average shipyard employee needed little previous knowledge or training, except to learn a highly simplified task based on mass production principles. Although welding required a training period, the course seldom lasted longer than four weeks, while an employee could be taught to use a cutting torch in one day. Shipbuilders simplified the welding process even more by using automatic welding machines wherever possible to reduce human error.

This trend toward technology-intensive production concentrated in the Gulf coast shipyards because they built standardized ships almost exclusively and, once in production, with few design alterations. Engineers designed the standardized cargo ships assuming an all-welded construction method in the shipyards which influenced shipyard builders,

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[1]Lane, Ships for Victory, p. 237.

in turn, to adopt the mass production approach in their plant layout. Older, established shipyards could not entirely adopt this mutually supportive type of planning because many of the ships they built remained subject to design experimentation, which required riveting and custom construction methods. Such intensive application of both welding technology and mass production methods caused Gulf coast shipbuilders to take advantage of the shift away from the heretofore fundamental characteristic of shipbuilding, i.e. the skilled labor intensive nature of the industry. Instead of having to find skilled employees to work in a highly technical industry, Gulf coast shipbuilders had only to employ a small nucleus of trained personnel, while the remainder of the work force could be drawn from a large unskilled labor pool.

The development of labor problems by 1940 in the industry necessitated the imposition of nation-wide regulations on Gulf coast shipbuilding labor. Wage-related problems dominated the industry's expansion as the new shipyards competed with the older yards even for unskilled employees, and as the unions joined the struggle pressing for higher wages. Government regulation of labor practices in the shipbuilding industry had originated with the establishment of the Shipbuilding Labor Adjustment Board in August, 1917. During the First World War demands for

increased ship production produced such labor problems as labor pirating, strikes, high labor turnover, and wage disputes. In response to these labor problems, the federal government authorized the Shipbuilding Labor Adjustment Board to settle disputes over wages, hours, and working conditions in shipbuilding construction and to set definite wage scales for the ship construction trades. In addition the Board could provide for the repair of facilities. The agency functioned successfully, moderating labor problems until its termination in 1919.[2]

When shipbuilding labor problems developed during World War II, again because of wartime wage demands, the National Defense Advisory Commission authorized Sidney Hillman, Vice-President of the CIO and Commissioner of the National Defense Advisory Commission's Labor Division, to organize a regulatory labor committee to solve the problems. Hillman's efforts resulted in the formation of the Shipbuilding Stabilization Committee in November, 1940. The Committee consisted of eleven members representing four interested parties: shipyard labor, shipbuilding management, the Navy Department, and the United States Maritime Commission. Originally, the Shipbuilding Stabilization Committee formed a part of the National Defense Advisory Commission, but in

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[2]Leo Pascal, Preliminary Inventory: Records of the Shipbuilding Stabilization Committee (Washington, D.C.: The National Archives, 1959), p. 1.

January, 1941, it became part of the Office of Production Management. The Committee's function remained the same under each agency, however,[3]

To stabilize shipyard labor conditions, the Shipbuilding Stabilization Committee periodically sponsored zone conferences in each of the country's four major shipbuilding areas--the Atlantic coast, the Pacific coast, the Gulf coast, and the Great Lakes. At these conferences, employers, union representatives, and federal officials fashioned two-year Zone Standards Agreements intended to establish uniform labor standards for each area. Seven topics appeared on the agenda of each zone conference: (1) basic wage rates for skilled mechanics, (2) overtime provisions, (3) shift premiums, (4) no-strike and no-lockout clauses, (5) provisions against limitations on production, (6) grievance and arbitration clauses, and (7) provisions for periodic wage adjustments.[4]

The first zone conference for the Gulf coast met at the Roosevelt Hotel in New Orleans from May 13 through May 18, 1941. Both the AFL and the CIO represented much of Gulf coast shipbuilding labor at the conference. The AFL spoke for workers at Ingalls Shipbuilding Corporation, Tampa Shipbuilding and Engineering Company, Pennsylvania Shipbuilding

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[3]Ibid.

[4]Lane, Ships for Victory, p. 239.

Incorporated, Todd-Galveston Drydocks Incorporated, and Lykes Brothers. The CIO represented workers at Alabama Drydock and Shipbuilding Company and Todd-Johnson Drydocks Incorporated of New Orleans.[5]

The Gulf coast zone agreement did not differ greatly from the other zone agreements except on the matter of wages. In all the zone agreements workers received time-and-a-half for all work performed over eight hours a day or over forty hours a week, and for working on Saturdays. Sunday work earned double time. Discussions in the Gulf coast zone conference focused on wages, with the unions pushing for nationwide equality, while the federal government and industry stressed wage sacrifices for the duration of the war. Controversy concerning wages marked the opening of the Gulf coast conference when the AFL and CIO representatives, J. W. Atkins and Jasper Davis respectively, insisted on double time pay for all overtime repair work. Captain John Fisher (USN), representing the federal government's interests, offered time-and-a-half as fair wages for overtime repair work pointing out that all navy shipyards followed such a policy for this type of work. Monroe B. Lanier, vice-president of Ingalls Shipbuilding Corporation and the principal industry representative at the conference, added that industry could not pay double time for repair

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[5]Ibid., pp. 285-286.

work unless the federal government subsidized the difference.[6]

The application of mass production techniques as well as southern sensitiveness to wage differenctials prompted this difference of opinion concerning overtime pay for repair work, which required skilled labor exclusively, while "new" construction using standardized construction methods needed only a minimum of skilled labor. If shipyard workers received the same overtime pay for repair or "new" work, they naturally preferred "new" work, which was both easier and cleaner. Historically, the unions had precedent on their side. Gulf coast shipyards had paid double time for overtime repair work for twenty years to avoid labor pirating or scamping by other shipyards. Furthermore, the Merchant Marine Act of 1936 gave Pacific coast labor a 6 percent wage differential over the Atlantic coast to avoid scamping when that act passed.[7]

Without agreement on the overtime wages for repair work, the conference topic drifted to the subject of shift premiums. On this point the unions asked for a ten cents per hour premium for the second shift and fifteen cents per

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[6]"Gulf Shipbuilding and Repair Zone Agreement, June 13, 1941," Record Group 254, Records of the Shipbuilding Stabilization Committee, National Archives; Lane, Ships for Victory, p. 286. (References to the Records of the Shipbuilding Stabilization Committee hereafter cited as Shipbuilding Stabilization Records).

[7]Merchant Marine Act, 46 U.S. Code 703(c) (1936).

hour for a third shift, if it developed. Both the industry and federal government representatives opposed such increases. Some Gulf coast yards paid shift premiums and some did not. While Ingalls, Tampa, and Pennsylvania had never paid a premium, Todd and Alabama Drydock paid five cents an hour more for second shift work.[8] Again the various representatives debated the topic without reaching agreement, which led to a heated discussion of the third and most fundamental wage decision: the basic wage for skilled mechanics.

Prior to the conference, Gulf coast shipyard workers received less than their brethern on either the Atlantic or Pacific coasts. In June, 1940, a skilled mechanic earned $.88 per hour in Gulf coast yards, while Atlantic coast mechanics received $.99 per hour and Pacific coast mechanics $.95 per hour.[9] (See Table XVII in the Appendix for selected average hourly earnings by regions, 1943-1944). Most Gulf coast employees received raises to $.93 per hour in November, 1940, and $.90 per hour in February, 1941, but these increases stayed proportionately behind the Atlantic and Pacific coasts. Mechanics at the Tampa yard got only $.90

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[8]"Proceedings of the Gulf Coast Shipbuilding Zone Conference, May 26, 1941," Record Group 254, Shipbuilding Stabilization Records.

[9]Fischer, A Statistical Summary of Shipbuilding During World War II, p. 136.

per hour, and Pennsylvania Shipbuilding mechanics got $.95 per hour in the February, 1941, wage adjustments.[10]

When the conference chairman, Father Peter Wynhoven, raised the question of setting a basic wage for skilled mechanics on May 26, 1941, representatives of industry, the federal government, and both unions differed widely. Jasper Davis (AFL) proposed $1.37½ per hour; Monroe Lanier (industry) suggested $.97 per hour; Captain John Fisher (Navy) recommended $1.05; and J. W. Atkins (CIO) demanded $1.12 per hour to match the Pacific coast agreement. The deadlock continued until Captain Fisher and Daniel S. Ring, Director of the Maritime Commission's Division of Shipyard Labor Relations, made it clear that the federal government would support labor's position no more than $1.05 per hour, including a shift premium.[11]

When the Atlantic coast conference set the basic skilled mechanic's rate at $1.12 per hour, the action weakened the federal government's position. As a result, the Gulf conference hiked the basic skilled mechanic's rate from $1.05 to $1.07 per hour as the conference came to a close. On the issue of shift premiums, the Gulf coast received least consideration. The agreements awarded Pacific coast

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[10]"Proceedings of the Gulf Coast Shipbuilding Zone Conference, May 26, 1941," Record Group 254, Shipbuilding Stabilization Records.

[11]Ibid.

workers 10 percent for the second shift and 15 percent for the third, while Atlantic coast workers gained 7 percent for workers 10 percent for the second shift and 15 percent for the third, while Atlantic coast workers gained 7 percent for both shifts; Gulf coast employees secured only 6 percent.[12] The question of overtime pay for repair work persisted until the June 5, 1941, session of the conference, in which the federal government compromised its position to accommodate Gulf coast custom. The government agreed to pay double time on all government repair work provided that the direct labor cost did not exceed a total of $112,500 on any individual job.[13]

Despite the fact that Gulf coast shipbuilding labor suffered in comparison with that of other zone wage agreements, the agreement resulted in approximately an initial 25 percent pay increase for Gulf coast labor. All the zone agreements contained escalator clauses providing for wage increases corresponding to rises in the cost of living. On this point the Gulf coast received equal treatment. The zone standards allowed wage adjustments if the cost of living in a zone exceeded 5 percent in one year. In the Gulf coast area the agreement relied on surveys taken by

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[12]Lane, Ships for Victory, p. 286.

[13]"Proceedings of the Gulf Coast Shipbuilding Zone Conference, June 5, 1941," Record Group 254, Shipbuilding Stabilization Records.

the Bureau of Labor Statistics in ten cities to determine the cost of living: Jacksonville and Tampa, Florida: Mobile, Alabama; Pascagoula, Mississippi; New Orleans, Louisiana, and Orange, Galveston, Beaumont, Port Arthur, and Houston, Texas.[14]

The zone standards agreements contributed a partial but temporary stability to the shipbuilding labor situation until mid-1942. While the zone agreements had provided a measure of stability, they failed to restrain wages, which posed an inflation problem for the industry by 1942. In an attempt to moderate labor's expected wage demands, the Shipbuilding Stabilization Committee called for a meeting at Chicago, in April, 1942. The escalator clause in each zone agreement required that the cost of living be stabilized at the March 15, 1942, level which meant that Pacific coast wages should rise 13 percent, Gulf coast wages should rise 12 percent, and Atlantic coast and Great Lakes wages would not rise at all. President Roosevelt set the tone of the Chicago meeting in a message he sent to the conference calling for labor to help restrain the inflationary characteristic of the escalator clauses:

> The situation that now confronts you is that the full percentage wage increase for which your contracts call and to which, by the letter of the law, you are entitled is irreconcilable with the national policy to control the cost of living. Under these circumstances...try to work out a

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[14]Ibid., May 28, 1941.

> plan by which...the living standards of all persons of modest income may be preserved against an inflationary rise in the cost of living.[15]

When the conference reached agreement, all shipyard workers received a minimum increase of eight cents per hour, raising the basic skilled mechanic's rate to $1.20 per hour. Gulf coast labor, which obtained the full advantage of this nationwide agreement, enjoyed wage increases from nine to thirteen cents per hour.[16] (See Table XVIII in the Appendix for the average base rates for selected occupations in the shipyards by regions in June, 1943).

After the Chicago conference, labor wage complaints came under the jurisdiction of the National War Labor Board created by Executive Order 9017 on January, 12, 1942, which replaced the National Defense Mediation Board. In handling wage disputes the National War Labor Board followed a policy of restraining wage increases in order to combat inflation. By its involvement in the steel dispute case of July, 1942, the Board imposed its "Little Steel Formula" which limited the general wage increases that could be granted employees to compensate for increases in the cost of living. With passage of the Stabilization Act of October 2, 1942, Congress granted President Roosevelt the authority to impose

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[15]President Roosevelt to Paul Porter, chairman of the Shipbuilding Stabilization Committee, May 2, 1942, Washington, D.C., Record Group 254, Shipbuilding Stabilization Records.

[16]Lane, Ships for Victory, p. 309.

wartime control of wages and salaries, directing the President to issue a general order freezing prices, wages, and salaries at September 15, 1942, levels.[17] Furthermore, Section One of the Chicago Amendments to the zone agreements eliminated automatic cost of living increases for shipyard workers.[18]

After 1941 labor difficulties on the Gulf coast centered around local differences which developed following acceptance of the agreement. The broadly-stated zone agreements left many details to local collective bargaining, resulting in some confusion and disagreement concerning which authority could determine certain policies. Only on the Pacific coast did management and labor negotiate a coast-wide master agreement covering the items not included by their zone policy. In the other zones collective bargaining between labor and the individual shipyards supplemented the general agreements.[19]

The attempt by Gulf coast labor to gain further concessions created labor unrest and led to another Gulf coast zone conference, held at New Orleans, August 9, 1943. At

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[17]Estelle Rebec, Preliminary Inventory: Records of the National War Labor Board (Washington, D.C.: The National Archives, 1955), p. 6.

[18]B. A. McMillan, Deputy Chairman of the Shipbuilding Stabilization Committee, to Senator W. Lee O'Daniel, June 26, 1942, Washington, D.C., Record Group 254, Shipbuilding Stabilization Records.

[19]Lane, Ships for Victory, p. 282.

that conference labor representatives presented a proposed agenda of seventeen items not contained in the Gulf coast standard agreement of 1941 but which were scattered throughout twenty-eight individual collective bargaining contracts with Gulf coast shipyards. The representatives failed to reach a procedural agreement during the three week meeting. Management's representatives objected to consideration of any items not already included in the zone standards, while labor's representatives refused to discuss any amendments to the zone standards without consideration of the seventeen points labor wanted included on the conference agenda. This impasse led Paul R. Porter, Chairman of the Shipbuilding Stabilization Committee, to adjourn the conference without any agreement on November 29, 1943.[20]

Gulf coast shipyards could also resort to the War Manpower Commission as an agent for solution of their labor problems. Established by executive order in April, 1942, as an agency within the Office for Emergency Management, the Commission's mandate included formulating plans and programs to establish national policies for the most effective mobilization and maximum utilization of the nation's manpower. As originally established, the Federal Security Administrator,

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[20]Paul Porter to Howard Higman, December 5, 1943, Washington, D.C.: Porter to John Steelman, January 4, 1944, Washington, D.C.: and R. J. Manguno to Porter, December 10, 1943, New Orleans, Louisiana, Record Group 254, Shipbuilding Stabilization Records.

who chaired the Commission, presided over representatives from the departments of War, Navy, Agriculture, and Labor, as well as the War Production Board, the Labor Production Division of the War Production Board, the Selective System, and the United States Civil Service Commission. Of special importance to the Gulf coast, the Committee on Fair Employement Practices came under the authority of the War Manpower Commission on July 30, 1942.[21]

During its three and one-half years of existence, the War Manpower Commission had four major goals: to recruit labor for placement in civilian industries essential to war production, to provide training to insure a market of qualified labor, to analyze manpower utilization practices in an effort to increase production efficiency, and to compile information and statistics on the national labor market.[22] The War Manpower Commission confronted a number of war-related problems, such as housing and transportation shortages, absenteeism and scamping among shipyards, but the problem of segregation remained the most significant unsolved problem the War Manpower Commission faced on the Gulf coast.

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[21]Central file, Record Group 211, Records of the War Manpower Commission, Region VII, Federal Records Center, East Point, Georgia.

[22]Ibid.

Absenteeism and turnover rates among shipyard workers gave some indication of the stabilizing effect of the War Manpower Commission not only among shipyards but also among war-related industries adjacent to the yards. For 1943 and 1944 absenteeism averaged about 10 percent for the same time periods, but absenteeism rates did not always accurately reflect true conditions in the shipyards.[23] (See Table XIX in the Appendix for a comparison of absenteeism rates in the shipyards by regions from 1943 through 1945). The published figures included not only those who missed work for valid reasons but also those who did not. The statistics also recorded workers who maintained a farm while working in the shipyards; seasonal absenteeism by these workers represented time spent planting their crops.[24]

The turnover rates probably gave a better measure of labor stabilization. By comparing the total number employed each month with the total number of separations for each month, labor turnover among the Gulf coast shipyards averaged about 10 percent. (See Table XX and Table XXI in the Appendix for employement and separation statistics for selected Gulf coast shipyards). This figure equaled the

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[23]Fischer, A Statistical Summary of Shipbuilding During World War II, p. 140.

[24]Lane, Ships for Victory, p. 413.

the national average for shipbuilding, the leader among major war industry in labor turnover.[25]

Reasons for the high turnover rates ranged from hunting for better positions or higher pay to escaping from poor housing, transportation, or community services. The lack of uniformity of wages and conditions among the shipyards aggravated the turnover problem, and the proliferation of other war-related industries along the Gulf coast enticed shipyard labor to seek employment in other industries. In an effort to stop the migration of shipyard workers to competing shipyards or to other industries, in 1942 the War Manpower Commission sanctioned local War Manpower Committees to issue certificates of availability for terminated employees. No employer in any industry could hire an individual unless he or she could produce a certificate of availability proving that they had a justifiable reason for changing jobs. Since neither local committees nor individual employers established standard rules by which to judge such cases, workmen could be denied certificates of availability for such varied reasons as loafing, violating safety rules, or faking an illness.[26]

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[25]Fischer, A Statistical Summary of Shipbuilding During World War II, p. 147.

[26]Central file, Record Group 211, Records of the War Manpower Commission, Region VII, Federal Records Center, East Point, Georgia.

Each shipyard in the area furnished the other local shipyards and unions with a list of its employees along with a list of those workers given certificates of availability to seek work elsewhere. For Region X (Texas and Louisiana) in 1942, the War Manpower Commission received four hundred requests for certificates of availability. Two hundred eighty-one (88%) of the four hundred requests came from a total of 29,000 shipyard workers. Seven reasons accounted for 70.4 percent of all these requests.

TABLE VIII

REASONS FOR AVAILABILITY REQUESTS*

Reason	Number	Percent
Worker's health	66	16.5
Family's health	46	11.5
Housing	45	11.2
Wages	45	11.2
Transportation	30	7.6
Another Job	28	7.1
Skill under-utilized	21	5.3
Totals	281	70.5

*Source: Minutes of the Meeting of the Beaumont Area War Manpower Committee, November 10, 1942, Record Group 211, Records of the War Manpower Commission, Region X, Federal Records Center, Fort Worth, Texas.

Other industries in the area presented no great problem in this regard. The petroleum refining industry with an

employment of 11,250 workers received only four requests for certificates of availability during the same time period, and the construction industry with an employment of approximately 15,500 workers received fifteen such requests.[27]

Of all the changes in southern labor customs imposed or encouraged by the war conditions, none had more significance than the potential for change among women and blacks. Female labor in the South had been traditionally confined to the farm or factory. The advance of technology into the shipbuilding and other industries and the war's demands for civilian workers created opportunities for women to escape their time-honored role. In June, 1942, women composed less than 0.4 percent of the wage earners in private shipyards, yet by December, 1942, this proportion had increased to an average 3.4 percent. The Pacific coast led in hiring women, with almost 6 percent, followed by the Gulf coast with 4 percent. Along the Atlantic coast and in the Great Lakes region women represented less than 2 percent of the work force.[28] The following table shows that women continued to make gains in the Gulf coast shipyards.

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[27]Ibid.

[28]E. A. McMillan to Gustav Peck, February 22, 1943, Washington, D.C., Record Group 254, Shipbuilding Stabilization Records.

TABLE IX

EMPLOYMENT OF WOMEN IN GULF COAST SHIPYARDS AT SIX MONTH INTERVALS, JULY 1942-JULY 1945*
(Percent of total wage earners)

Shipyard	1943 Jan.	1943 July	1944 Jan.	1944 July	1945 Jan.	1945 July
Alabama	6.4	9.7	7.7	9.4	9.8	10.6
Ingalls	7.0	7.4	6.7	9.7	10.0	7.8
Pennsylvania	1.0	5.2	5.9	7.7	7.8	5.2
Todd-Houston	4.5	5.1	5.9	6.5	6.8	3.4

*Source: 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 D.C.: Government Print Office, 1942), p. 129.

Women formed the largest and most available pool of labor as World War II progressed, especially for the newest shipyards using mass production techniques. The majority of women in shipbuilding worked as welders, operators of various types of machines, and as helpers to shipfitters and loftsmen. The assembly-line method of construction put a premium on these unskilled jobs thereby making the employment of women in the new Gulf coast shipyards relatively easy, although women had not worked in the industry before the war's demands altered southern labor customs. (See Table XIX in the Appendix for the distribution of private shipyard by region and occupation in June, 1943).

As all Gulf coast industries competed for the limited white labor supply, by 1942 the shipbuilders yielded to

necessity and began employing more blacks. Previously, blacks had worked in the nation's shipyards only as unskilled or semi-skilled labor in an industry that traditionally required about 70 percent skilled labor. According to the census of 1910, which listed 67,066 workers in the industry, blacks had numbered 4,347 or 6.5 percent.[29] Expansion of the shipbuilding industry during World War I had raised the number of shipyard workers by 1919 to approximately 381,500 of which blacks constituted 38,723 or 10 percent.[30]

The decline of prosperity for the industry during the 1920's brought a corresponding decline in black employment. The census of 1930 registered 93,437 workers employed in shipbuilding with only 7,628 or 8 percent of them black. The census also listed 60 percent of the black shipyard workers as unskilled, 25 percent as semi-skilled, and only 15 percent as skilled.[31] Not only did the southern black experience job discrimination in the industry at that time, he also received less wages than did his white counterpart.

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[29]U.S. Department of Commerce, Bureau of the Census, Population, vol. IV of Thirteenth Census of the United States (Washington, D.C.: Government Printing Office, 1914), pp. 344-45.

[30]George E. Haynes, The Negro at Work During the World War and Reconstruction (Washington, D.C.: United States Department of Labor, 1921), pp. 58-61.

[31]U.S. Department of Commerce, Bureau of the Census, Population, vol. V of Fifteenth Census of the United States (Washington, D.C.: Government Printing Office, 1933), pp. 476-77.

The Shipbuilding Labor Adjustment Board, which set the wages in the industry for World War I, fixed rates for southern shipyards "in comformity with established local custom:" for white "laborers" ten cents an hour higher than for black "common laborers" despite the fact that both performed the same work.[32] Most of the Gulf coast's serious labor difficulties related to interracial conflicts between Negroes and whites, especially in the shipyards.[33]

The federal government tried to eliminate discrimination in defense industries through the creation of the Fair Employment Practices Committee (FEPC) in June, 1941. The FEPC could investigate complaints of discrimination and recommend to other government agencies ways to enforce integration, but it had no power to force compliance in any industry. In June 1942, the FEPC held hearings on Gulf coast shipyard discrimination at Birmingham, Alabama. Testimony at the Birmingham hearings revealed widespread racial discrimination practices among the Gulf coast shipbuilders, only one of whom, Andrew J. Higgins of New Orleans, complied with FEPC recommendations.[34]

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[32]U.S., Department of Labor, Bureau of Labor Statistics, History of the Shipbuilding Adjustment Board, 1917-1919, prepared by W. E. Hotchkiss and H. R. Seager, Bureau of Labor Statistics Bulletin no. 283(Washington, 1921), pp. 35-36.

[33]Merl E. Reed, "The FEPC, the Black Worker, and the Southern Shipyards," South Atlantic Quarterly 74(Autumn, 1975): 446.

[34]Ibid., p. 447.

Pennsylvania Shipyard, Alabama Shipbuilding and Drydock Company, and Higgins Shipbuilding Company experienced the greatest racial problems among Gulf coast shipyards. The only strike during the war at Pennsylvania Shipyard of Beaumont, Texas, erupted on June 15, 1943, as a result of an interracial conflict. Pennsylvania Shipyard employed blacks mainly for unskilled jobs such as clean-up and maintenance worker, riggers, plate-hangers, and drivers. At Pennsylvania blacks drove all company vehicles, including the official Pennsylvania Shipyard and United States Maritime Commission cars used for company business inside the yard. Blacks also drove the yard's shuttle busses for employees as well as the shipyard's mail truck. On occasion the company hired these same blacks as stewards on sea trials and for special shipyard parties, since many had generally worked as domestic servants in private homes before World War II.[35]

Tension between blacks and white residents of Beaumont increased after June 5, 1943, when Curtis Thomas, a twenty-four-year-old black ex-convict, abducted a nineteen-year-old white telephone operator, whom he raped three times after stabbing and beating her when she resisted his advances.[36]

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[35]PennShip Log, February 15, 1943, p. 8. PennShip Log was the weekly newspaper published by Pennsylvania Shipbuilding Company during World War II.

[36]James A. Burran, "Racial Violence in the South During World War II" (Ph.D. diss., University of Tennessee, 1977), p. 170.

After the assault Thomas fell asleep, allowing the woman to escape and call the police. As two police cars approached the scene, Thomas awoke and attempted to escape through a dead-end alley. Police shot him four times. Critically wounded, Thomas was taken to the "Negro ward" of Hotel Dieu Hospital.[37] On June 6, a mob of about 150 men collected outside the hospital and threatened to lynch Thomas. Chief of Police Ross Dickey secretly transferred Thomas to the city jail under guard while Dickey convinced the mob to disperse. Although Thomas died on June 8, interracial feeling continued to run high after the incident.[38]

On June 15, 1943, racial tension again rose when a young white female employed by Pennsylvania Shipyard accused a black shipyard employee of raping her. Tension mounted among the shipyard workers throughout the day and continued to affect workers on the evening shift. During that shift workers dropped their tools and marched to the city jail in search of the alleged rapist. As the crowd approached the jail, it had increased to about three thousand members, including the victim of the alleged attack as well as one thousand white residents of Beaumont who had heard about the

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[37]Beaumont Journal, June 5, 1943, p. 1; Beaumont Enterprise, June 6, 1943, p. 1.

[38]Beaumont Enterprise, June 7, 1943, p. 1; Beaumont Journal, June 7, 1943, p. 1; Beaumont Journal, June 8, 1943, p. 1.

incident.[39] Taken by surprise, police chief Dickey allowed the woman to inspect the prisoners in the jail, aware that she would not find the assailant there. He feared the mob would ransack the jail if he failed to cooperate. When the woman could not identify her attacker, the mob dispersed, but reappeared about midnight and attacked black residential areas in west and south Beaumont. Despite the fact that Pennsylvania Shipyard security guards escorted black employees to their homes that night, angry whites beat one Negro employee just outside the shipyard gates. Blacks struck back, resulting in the death from a fractured skull of a white carpenter as well as thousands of dollars in property damage.[40] One white resident, Gil Rector, of Beaumont remembered watching his father sit by a window of his house all night with a shotgun on his lap waiting for angry blacks to invade the neighborhood.[41]

On the following day, June 16, at the request of Beaumont Mayor George Gary, Acting Governor A. M. Aikin, Jr., declared martial law in Beaumont. Approximately 2,400 state guardsmen, Texas Rangers, and city police patrolled the streets and arrested those suspected of looting businesses the night before. No further violence occurred in Beaumont;

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[39] Beaumont Enterprise, June 16, 1943, p. 1.

[40] Burran, "Racial Violence in the South," p. 174.

[41] Gil Rector, personal interview, Beaumont, Texas, June 11, 1969.

work resumed at the Pennsylvania Shipyard on June 19. Significant in quieting white emotions after this disturbance was a physician's examination of the assault victim, which showed no evidence of rape. According to Sheriff W. W. "Bill" Richardson, the woman had made the allegation of rape in an attempt to incite a racial dispute, never giving any reason for starting the riot other than her prejudice against blacks.[42] For the Negroes at Pennsylvania Shipyard the Beaumont racial clash erased any chance for approximate economic equality at the shipyard. As before the riot, blacks employed at the Beaumont shipyard remained in menial jobs throughout the rest of the war effort. This incident did end racial violence in Beaumont during World War II.

Blacks faired somewhat better at Alabama Drydock and Shipbuilding Company in Mobile. On November 19, 1942, the Fair Employment Practices Committee (FEPC) ordered the company to train and upgrade its employees without regard to race. At that time the company employed thirty thousand workers including four thousand blacks as laborers and helpers. The yards had increased its proportion of blacks to 23 percent of its total work force by March, 1943, while promoting some blacks from laborers to shippers and caulkers.[43]

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[42]Beaumont Enterprise, June 19, 1943, p. 1; W. W. Richardson, personal interview, Beaumont, Texas, June 16, 1969.

[43]Herbert R. Northrup, "Negroes in a War Industry: The Case of Shipbuilding," Journal of Business 16(July, 1943): 168; Reed, "FEPC, Black Worker, Southern Shipyards," p. 454.

The FEPC, the Maritime Commission, the War Manpower Commission, and the local leaders of the International Union of Marine and Shipbuilding Workers of America--CIO continued to urge the Alabama Drydock officials to upgrade black workers, as manpower shortages, caused partially by under-utilization of black labor, retarded ship production in 1943. On May 3, 1943, Burton R. Morley, area director for the War Manpower Commission, sent a letter to John Griser, general manager of Alabama Drydock, recommending that two shipways at the Alabama shipyard be manned exclusively by Negroes, including the skilled positions. The shipyard officials rejected the proposal, claiming that not enough black labor was available to provide the 2,500 men required on each shipway. Instead, the company attempted immediately to integrate the welding force on four different ways without forewarning the unions or the workers. Morley responded by stating that the War Manpower Commission would not be responsible if trouble ensued.[44]

When on May 24, twelve black welders joined the white workers on the night shift, between five hundred and one thousand white workers on the following day shift attacked black workers in the shipyard. Limited access to the island site of the shipyard, served only by a drawbridge, tunnel, or ferryboat, prevented many blacks from fleeing the white

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[44]Reed, "FEPC, Black Worker, Southern Shipyards," p. 455.

workers wrath. Although no blacks died in the rioting, the mob injured eight people, including those whites who attempted to rescue blacks being attacked. After four hundred law enforcement officers occupied the shipyard rioting had ceased by noon of the same day.[45]

In the days following the incident all those involved in the controversy sought a peaceful solution. The shipyard continued operation at a reduced scale as black workers boycotted. The local office of the War Manpower Commission received approximately a thousand requests from black employees seeking release from their jobs or transfers to other locations.[46] Representatives of Alabama Drydock, the Maritime Commission, the War Manpower Commission, the FEPC, and the Industrial Union of Marine and Shipbuilding Workers of America agreed to a plan in which blacks exclusively manned four ways located at the north end of the yard, where they could participate in all crafts involved in the hull construction. Although this arrangement left Alabama Drydock segregated, the FEPC accepted the plan on June 8, ending the immediate crisis and allowing the shipyard's work to resume at full capacity.[47]

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[45]Ibid., pp. 457-58.

[46]Burran, "Racial Violence in the South," p. 116.

[47]Ibid., p. 120.

This proposal not only limited the number of skilled positions for blacks to approximately two hundred but also limited the types of skilled occupations available to blacks as well. Only bare hull construction took place on the all-black shipways leaving the interior and superstructure construction work for whites. Black employees could not find employment as machinists, pipefitters, or electricians.[48] After the riot, blacks at Alabama Drydock did make some progress toward economic equality. Instead of receiving sixty-three cents per hour as common laborers, some blacks earned higher wages as they advanced into more skilled jobs, such as rigging at $.90 and welding at $1.20 per hour.

Higgins Shipyard presented blacks with their greatest opportunity for advancement on the Gulf coast during World War II; however, the potential failed to materialize when Higgins lost government support late in the war effort. Their first opportunity developed at Higgins' yard in March, 1942, when the company's shipyard won a Maritime Commission contract to build two hundred "Liberty" cargo ships. The company had successfully constructed smaller boats on an assembly-line basis, but, being the last builder to enter the industry had forced Higgins to consider using black labor extensively. Recognizing that he would not be able to find sufficient white craftsmen to meet his labor needs,

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[48]Reed, "FEPC, Black Worker, Southern Shipyards," p. 457; Burran, "Racial Violence in the South," p. 124.

Higgins gained support from local New Orleans labor leaders for his plans to use considerable black labor, so long as he did not hire blacks as foremen or supervisors. Higgins planned to construct two major assembly lines separated by a large machine and fabricating shop. One of these assembly lines would be manned by an all-white labor force; blacks would man the other one under the direction of white foremen and supervisors. The possibility that twenty thousand members of their race would be trained and hired in the areas shipbuilding trades greatly encouraged New Orleans blacks. Claiming that the country had sufficient ship-building capacity, the Maritime Commission cancelled Higgins' contract on July 18, 1942.[49]

Black hopes rose again on October 30, 1942, when Higgins obtained an Army Air Corps contract totaling $212,000,000 to build 1,200 plywood cargo planes using an assembly-line operation. The contract allowed Higgins to spend $30,000,000 of the contract funds to redesign the unfinished shipbuildig facility as an aircraft factory.[50] Higgins then reaffirmed his intent to employ blacks, indicating he would hire them on an equal basis with whites.[51] This opportunity also failed to materialize for Higgins and the black workers of

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[49]Strahan, "Higgins," pp. 75-77.

[50]Ibid., p. 87.

[51]New York Times, October 30, 1942, p. 1.

New Orleans. On August 3, 1943, the War Department renegotiated the agreement and instead of C-76 plywood planes the contract required Higgins to build metal C-46 cargo planes. Although Higgins had completed building the plant, few skilled metal aircraft workers lived in the New Orleans area. Higgins consequently launched an intensive training program in an attempt to meet the labor needs demanded by the contract, but before Higgins could make the required transition, the War Department cancelled its contract for the C-46 cargo planes in early 1944. For a third time black expectations had been dashed.[52]

Other Gulf coast shipyards successfully avoided hiring blacks in large numbers or to skilled positions. Todd-Houston Shipbuilding Company trained over 4,100 welders to work in the Houston yard, yet labor shortages occurred throughout the war. Claiming to fear labor violence, Todd-Houston refused to hire even trained black welders. To no avail the FEPC attempted to persuade Todd-Houston to adopt the Mobile plan of segregated shipways.[53] Using the same line of reasoning as Todd-Houston, Ingalls Shipbuilding Corporation of Pascagoula, Mississippi, employed blacks as laborers and helpers but resisted the integration efforts of federal agencies. At Pascagoula, The Brotherhood of

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[52]Strahan, "Higgins," pp. 87-88; Northrup, "Negroes in a War Industry," p. 165.

[53]Reed, "FEPC, Black Workers, Southern Shipyards," p. 462.

Boilermakers, Iron Shipbuilders and Helpers of America, an AFL union, controlled most of the skilled positions in the yard, keeping blacks confined to unskilled jobs.[54]

By the end of World War II, white male shipyard employees in the Gulf coast shipyards had profited most from the application of welding and mass-production techniques to shipbuilding. White women profited to a lesser extent than white males among shipyard workers, followed by the blacks who advanced least. White males benefited in two important ways from these technical innovations. The application of welding and assembly-line methods to shipbuilding introduced an industry with high wages to a region of the country historically underpaid. Since white males represented a large majority of shipyard workers, they reaped most of the financial rewards. In a second important and permanent way white males also benefited; they acquired welding skills which provided them with valuable training, applicable to other industries after the war's end. Since, with the development of welding, riveting had become an obsolete and inferior means of joining metal; therefore, practically all metal construction work after the war required welding skills. The progress made by white women and all the black workers engaged in Gulf coast shipbuilding during World War II was primarily symbolic and represented little material

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[54]Burran, "Racial Violence in the South," p. 155.

advancement for either group. Although white women formed only a small percentage of the total Gulf coast shipbuilding force, they successfully broke away from the southern white woman's traditional role, which had confined them to menial labor on either the farm or to low-paying factory positions. On the other hand, blacks made only token advances in the skilled shipbuilding crafts as the southern patterns of racial discrimination generally survived the war intact. Blacks incidentally received pay increases as the wage scales were raised by the zone standards, but, with a few exceptions, blacks generally remained at the bottom of the shipbuilding trades in the common labor pool and worked at menial jobs.

CHAPTER 7

CONCLUSION

World War II had compelled the United States to construct enough ships to support a truly world-wide war. While World War I had required the United States to provide only a 3,000-mile supply line to France, from 1914 through 1920, American shipyards produced 1,911 merchant vessels totaling 13,332,785 deadweight tons. For the period from 1939 through 1943, World War II maritime demands drove American shipbuilders to build 2,486 merchant ships amounting to 25,136,769 deadweight tons.[1]

Shipyard facility expansion and labor employment figures reflected the same upward trend during the Second World War as did the production records. From a post-World War I low in 1936 of ten shipyards with forty-six ways, the industry had grown to over sixty yards with more than 300 ways by 1942, an increase of over 500 percent. Shipyard employment rose from less than 65,000 to 1,750,000 during the same period. Closely-related contributory industries, dependent on the growth and maintenance of the maritime shipbuilding

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[1]Unpublished report titled "Post-War Prospects for the Shipbuilding Industries" prepared by Lawrence Oosterhous and Leon Epstein of the Industrial Section of the National Resources Planning Board, September, 1942, pp. 1-2, Record Group 187, Records of the National Resources Planning Board, National Archives.

industry, also developed at inland locations to supply many of the smaller parts, such as generators and valves, for construction of the standardized ships.[2]

By 1942 the condition of the nation's maritime shipbuilding industry had become a major concern of the National Resources Planning Board. The National Resources Planning Board recognized that a substantial curtailment of shipbuilding after World War II would create a significant threat to the entire industry. By exploring possible options in 1942, the Board sought to avert a collapse of the American shipbuilding and shipping industry after World War II similar to that which had occurred after World War I. Its 1942 report drew pessimistic conclusions concerning the future of the shipbuilding industry. Assuming that the build-up of a merchant fleet during World War II would drastically reduce the need for merchant marine construction after the war, the Board's prediction forecast a need for repair facilities.[3]

The June, 1945, report of the National Resources Planning Board, which speculated about the future of the American shipbuilding industry concluded more optimistically. Pointing out that the severe damage sustained by foreign fleets and foreign shipyards in World War II would delay the

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[2]Ibid., p. 3.

[3]Ibid., p. 7.

revival of foreign merchant marine competition for several years after the war's conclusion, the Board reasoned that the United States would have an excellent opportunity to establish a dominant peacetime trade position while helping to rebuild the countries devastated by the war. Not only would the United States be called upon to provide substantial quantities of food, materials, machinery, and equipment, but the Board also recognized that the United States might have to import some natural resources depleted by the war effort.[4] All these activities could encourage use of the American merchant marine.

Although the wartime ship construction program of the Maritime Commission produced a fleet of standardized cargo ships, wartime demands for ships in great numbers forced the shipbuilders to eliminate some of the more desirable characteristics of commercial cargo ships. For example, it became necessary to equip many of the cargo ships with slow reciprocating engines because of the shortage of faster turbines and diesel propulsion machinery. Even though satisfactory for emergency war purposes, these slower reciprocating engines could not be commercially competitive after the war. The Board reasoned that the American shipbuilding industry

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[4]Unpublished report titled "Post-War Problems of the Shipbuilding Industry" prepared by Lawrence Oosterhous of the Industrial Section of the National Resources Planning Board, June, 1945, pp. 24-25, Record Group 187, Records of the National Resources Planning Board, National Archives.

would be kept active building a modern fast fleet as the United States dominated the trade routes during the post-World War II era. Board members also favored selling the slow emergency vessels to American allies, a convenient way to dispose of a large obsolete merchant marine fleet and a good way to retard competition.[5]

The Board realized that the shipbuilding industry could neither continue to produce ships in such large numbers as during the war nor could it return to the traditional customized method of shipbuilding practiced before the war. An adjustment to a peacetime economy would likely bring a closing of some shipyards and a corresponding conversion of others to the manufacture of other products. During the adjustment period the Maritime Commission proposed to oversee the transition to ensure an orderly and smooth shift to peacetime conditions and at the same time try to help the industry retain as many as possible of the technological advances made during the war. The Maritime Commission also hoped to avoid extensive government subsidization, while protecting the industry from foreign builders who received financial support from their respective governments.[6]

Supervision of the transition process required the Maritime Commission to preserve the concept of standardized

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[5]Ibid., pp. 25-27.

[6]Ibid., p. 28.

shipbuilding in particular. A return to the shipbuilding methods used before World War II would encourage an undesirable reverse trend toward both labor specialization and customized ship construction, both of which could increase shipbuilding costs and, more importantly, lead to a renewal of substantial government subsidies, a development the government wanted especially to avoid. The Maritime Commission encouraged all American shipbuilders to agree on some standardized specifications for construction of merchant marine cargo ships. A single standard design might result in enough orders to permit a continuation among shipbuilders of practices of synchronized flow of materials, centralized procurement, and extensive prefabrication of ships' sections. The National Resources Planning Board believed the shipbuilding industry should refine its mass production techniques as the automobile industry had already done so successfully.[7]

The Board anticipated that certain war-built shipyards would either convert their plants to the production of other products or discontinue operation. Some yards, with minor alterations to their plants, could construct related products, such as flying boats, experimental cargo ships, or pleasure craft. Other yards with more major alterations could manufacture structural members for buildings, bridges,

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[7]Ibid., p. 30.

or prefabricated housing. A few shipyards would simply have to cease operation. Within the Board's projected outlook, the Gulf coast and the Atlantic coast appeared to hold the most promise for American shipbuilding because of their proximity to the steel industry. In its 1945 report the National Resources Planning Board reflected a greater optimism concerning the future of the American shipbuilding industry than it had in its 1942 report.[8]

With one exception all the Gulf coast shipyards continued to operate after World War II, surviving the transition to a peacetime economy by manufacturing items related to maritime industries, such as oil well drilling platforms. As happened after World War I, the American merchant fleet, and subsequently the shipbuilding industry, steadily declined. At the end of World War II, the American merchant marine carried 57.6 percent of American foreign trade;[9] yet, by 1949 it handled only 45 percent and by 1969 a mere 6 percent.[10] The shipbuilding businesses accordingly employed 1,397,000 workers in ninety-seven yards in 1944 but only 30,000 in 1947.[11] The industry's decline began almost immediately after the war's end, and the government failed

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[8]Ibid., p. 33.

[9]New York Times, October 24, 1969, p. 2.

[10]Albert R. Karr, "Nixon Readies Merchant Shipbuilding Plan," Wall Street Journal, October 13, 1969, p. 4.

[11]Newsweek 30(November 17, 1947): 71.

to respond effectively to the situation. As the decline became evident President Truman created the President's Advisory Committee on the Merchant Marine, chaired by Kaufman T. Keller, President of Chrysler Corporation, to devise a "stable, long-range program for strengthening our merchant marine."[12] The Keller Committee favored a privately-owned and privately-operated merchant marine but recommended a construction differential subsidy of 50 percent under the Merchant Marine Act of 1936. The recommendations were not accepted by the President because they were considered too dependent on government aid, and the merchant marine industry declined even more rapidly.[13]

Of the Gulf coast shipyards, Ingalls adjusted more successfully to post-war conditions, winning, almost before the war ended, a contract to build the first post-war luxury liner in the United States. In January, 1946, the Del Norte slid down the ways at Pascagoula to begin the first of the 1,300-mile round trip cruises between Knoxville, Tennessee, and Paducah, Kentucky, for which it had been designed. The ship, designed to carry three hundred passengers and their cars on the Tennessee River, represented an attempt to capitalize on those tourists traveling to Florida in the summertime. In nation-wide competition Ingalls yard

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[12] New York Times, January 18, 1947, p. 7.

[13] Ibid., November 16, 1947, p. 2.

continued to win contracts and eventually built twenty of the thirty-five merchant ships constructed in the United States between 1946 and 1948.[14]

By specializing in the construction of naval vessels and oilfield equipment, the Ingalls company managed successfully to change its shipbuilding markets as the American merchant marine continued to decline after the war. In September, 1951, Ingalls Shipbuilding received a $25,600,000 naval contract for the construction of five landing ship tank (LST) amphibious vessels. The yard obtained another important contract in August, 1955, to build the navy's last conventionally-powered diesel-electric submarine. The awarding of this contract assured Ingalls' survival after the war. Submarine construction demanded absolute precision because of the close mechanical tolerances required in construction, and to be awarded submarine contracts signified a virtual guarantee of future naval contracts. With the successful completion of this diesel-electric submarine in January, 1957, the navy awarded Ingalls Shipbuilding a contract for construction of two nuclear-powered submarines.[15]

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[14]William L. Zigler, "Shipbuilding on the Pascagoula River," Journal of Mississippi History 36(February, 1974): 11.

[15]Robert F. Couch, "The Ingalls Story in Mississippi, 1938-1958," Journal of Mississippi History 26(February, 1964): 203-204.

After Litton Industries purchased the company in December, 1961, Ingalls Shipbuilding continued to build nuclear submarines at its Pascagoula yard, and it pioneered the development of a fast deployment logistic ship (FDL) designed to carry military cargo at high speeds for long distances without refueling. In conjunction with its role as a naval shipyard, Litton-Ingalls began construction of a new shipyard on the west bank of the Pascagoula River in 1968. Costing a total of $130,000,000 the new yard advanced mass production techniques in shipbuilding by eliminating the stationary shipway. Litton-Ingalls prefabricated each section of a ship to such an extent that when a particular ship's section reached the final assembly point, very little work remained to be done on the ship. Since this new method allowed continuous work on each section, the ships reached the launching platform 90 percent complete rather than 68 percent complete as with the old method.[16]

Alabama Drydock and Shipbuilding Company, Pennsylvania Shipbuilding Company, and Todd-Houston Shipbuilding Company survived World War II by combining ship repair or conversion work with the construction of oil well drilling platforms. Reducing the size of their shipbuilding operations as government subsidies ceased and the merchant marine declined, these three yards switched to construction of deep-sea

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[16]Zigler, "Shipbuilding on the Pascagoula," p. 14.

platforms for the expanding petro-chemical industries of the Gulf coast which soon became their major supporters. An important factor in the transition process of these yards was their ability to incorporate mass-production techniques into the fabrication of the platforms and to use welding exclusively for joining the platform sections.[17]

Higgins Industries, Incorporated, failed to survive the war. Reeling from the cancellation of the government contracts during the war, the company did not make a successful transition into the post-war economy. For a short time, Higgins Industries manufactured the bonded plywood used for pleasure boat construction in one end of the defunct aircraft plant, while at the other end, the company experimented with building an amphibious jeep for the army. Neither venture prospered. Starting in 1945 Higgins Industries began experiencing serious labor problems marked by jurisdictional union disputes, strikes, and labor violence. Deciding to close his plants in 1946, Higgins maintained only a small boat construction business until his death in 1952.[18]

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[17]Radcliff Maumanee, President of Alabama Drydock and Shipbuilding Company, to the author, Mobile, Alabama, April 2, 1977; J. O. Crooke, General Manager of Bethlehem Shipyard (formerly Pennsylvania Shipyard), personal interview, Beaumont, Texas, July 1, 1969; Edwin K. Linen, Secretary of Todd Shipyards Corporation, to the author, New York, New York, August 23, 1978.

[18]Jack B. McGuire, "Andrew Higgins Plays Presidential Politics," Journal of the Louisiana Historical Association

In retrospect, the development of the shipbuilding industry along the Gulf coast during World War II did introduce and accelerate some significant changes in the region despite the fact that the industry declined in the post-war period. Gulf coast shipbuilding had helped eliminate an invisible industrial barrier that had previously limited southern industrial development to extractive or agrarian enterprises characterized by low wages, poor working conditions, and a chronic lack of capital. After World War II new wealthy industries in defense, electronics, aerospace, agribusiness, and petro-chemicals evolved in the South and Southwest characterized by the antithesis of the pre-war industries--high wages, better working conditions, and adequate sums of capital. The dominant geographical position of northern industries, which had led to charges of economic colonialism by southerners before World War II, changed significantly during and after the war as industry developed in the milder southern and southwestern climates.[19]

The trend toward industrialization of the South during and after World War II has been recognized by historians and need not be repeated in this study. The significant point

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15(Summer, 1974): 284; C. T. Post, "A. J. Higgins Planning National Transport Systems," Iron Age 154(December 7, 1944): 111; Times Picayune, September 4, 1952, p. 3.

[19]Kirkpatrick Sale, Power Shift: The Rise of the Southern Rim and Its Challenge to the Eastern Establishment (New York: Vintage Books, 1975), p. 6.

that historians have overlooked in the South's industrial development is the role of technology in providing the South with an opportunity to alter its economic base and escape economic stagnation. The Gulf coast yards developed a small nucleus of shipbuilding skill despite the decline of the shipbuilding industry following World War I and the shortage of capital funds. These shipyards profited greatly from the experience gained in the shipbuilding efforts of 1917-1919. The area's greatest advance in shipyard development, however, came from the intensive application of welding and mass-production techniques to shipbuilding during World War II. A generous portion of government subsidies, such as those provided under the Merchant Marine Act of 1936, allowed the Gulf coast yards to take advantage of the new technology.

The key to the shipbuilding contribution by the Gulf coast was the successful application of technology to this industry. Although the Gulf coast yards did develop a labor force with some shipbuilding skill and although the Merchant Marine Act of 1936 provided the capital for expansion, the war demanded a volume of ships far beyond the ability of traditional shipbuilding methods made possible the attainment of World War II production demands.

If mass-production techniques made possible the production of the volume of ships needed, the development of welding made possible the construction of stronger, faster ships. As experience accumulated in the use of welding for

shipbuilding, riveting became increasingly obsolete. Not only were welded joints stronger than riveted ones, welding produced large weight and friction reductions, especially in outer-hull construction. The fact that welders could be trained quickly provided Gulf coast shipbuilders with access to a large labor pool of both men and women. Since many Gulf coast shipyards were newly constructed, they enjoyed an additional advantage over the older established shipyards: they could incorporate assembly-line methods and other technological advances into their shipbuilding processes, while older yards had to adapt their existing plants as best they could. As a result Gulf coast shipyards produced inherently stronger and faster welded cargo ships.

Technology also benefitted the unskilled Gulf coast laborer. The adoption of mass-production methods to shipbuilding afforded a new, high-wage opportunity for the southerner without the necessity of long training programs. The unskilled southern laborer could become productive almost immediately upon employment. Not only could he (or she) learn to weld quickly, but welding skills also prepared the worker for the post-war economy as well. Since welding became the preferred method for joining metals, the decline of the shipbuilding industry after the war did not generally affect welders. They could use their skill in many other high-wage jobs. Although in the South white males generally profited most from these technological

advances, white women also succeeded in breaking from their traditional roles by working in the new industries. The black worker probably gained least from southern industrial growth during World War II. Southern racial prejudice remained strong throughout the war, thus preventing the black from receiving his fair share of this new prosperity.

While the shipbuilding industry did not prosper either in the nation generally or the South particularly after the war, it was representative of the changes that occurred in the southern United States as a result of the war, changes reflected in other southern industries but changes on different scales. Shipbuilding, along with aircraft manufacturing, was one of the largest wartime industries in the South, but hundreds of smaller plants which produced standardized parts for the larger industries undoubtedly played an unrecognized but important role in advancing the southern industrial cause. From 1940 to 1945 the use of new technological developments had made Gulf coast shipyards a new and vital force operating on the American economy. By dramatically accelerating and magnifying the impact of this new technology, World War II played an all important role in the development of Gulf coast shipbuilding. Although nation-wide in their impact, these technological changes had a profound and lasting effect on southern industry.

APPENDIX

TABLE X

YEARS IN WHICH PRIVATE GULF COAST SHIPYARDS
WERE IN OPERATION*

NAME	LOCATION	YEARS OF OPERATION
Alabama Drydock & Shipbuilding Co.	Mobile, AL	1918-1944
Beaumont Shipbuilding & Drydock Co.	Beaumont, TX	1918-1920
Brown Shipbuilding Co.	Houston, TX	1942-1944
Chickasaw Shipbuilding & Car Co.	Chickasaw, AL	1920-1921
Consolidated Steel Corporation	Orange, TX	1940-1944
Daniels, Oscar, & Co.	Tampa, FL	1919-1921
Delta Shipbuilding Co.	New Orleans, LA	1941-1944
Dierks-Blodgett Shipbuilding Co.	Pascagoula, MS	1918-1919
Doullut & Williams Shipbuilding Co.	New Orleans, LA	1920-1921
Gulf Shipbuilding Co.	Mobile, AL	1940-1944
Hodge Ship Co.	Moss Point, MS	1918-1919
Houston Shipbuilding Corporation	Houston, TX	1941-1944
Ingalls Shipbuilding Co.	Pascagoula, MS	1939-1944
International Shipbuilding Co.	Pascagoula, MS	1919-1920
International Shipbuilding Co.	Orange, TX	1918-1919
Jahncke Shipbuilding Co.	Madisonville, LA	1918-1919
Jones, J. A., Construction Co.	Panama City, FL	1940-1944
Levingston Shipbuilding Co.	Orange, TX	1918
Lone Star Shipbuilding Co.	Beaumont, TX	1918-1931
Ley, Fred T. & Co.	Mobile, AL	1919
Louisiana Shipbuilding Corporation	Slidell, LA	1919
Magnolia Petroleum Co.	Harrisburg, TX	1919
McBride & Law Co.	Beaumont, TX	1918
Midland Bridge Co.	Houston, TX	1918-1919
Mobile Shipbuilding Co.	Mobile, AL	1918-1920

TABLE X--Continued

NAME	LOCATION	YEARS OF OPERATION
Murran Shipbuilding Corporation	Mobile, AL	1920-1922
National Shipbuilding Co.	Orange, TX	1918-1920
Pensacola Shipbuilding Co.	Pensacola, FL	1919-1922
Pennsylvania Shipyards, Inc.	Beaumont, TX	1939-1944
Southern Dry Dock & Shipbuilding Co.	Orange, TX	1918-1919
Tampa Dock Co.	Tampa, FL	1918-1919
Tampa Shipbuilding Co.	Tampa, FL	1938-1944
Tampa Shipbuilding & Engineering Co.	Tampa, FL	1917-1919
Union Bridge & Construction Co.	Morgan City, LA	1918-1919
Universal Shipbuilding Co.	Houston, TX	1918-1919
Weaver Shipbuilding Co.	Orange, TX	1899

*Source: Merchant Vessels of the U.S. - 1945
Shipbuilders Council of America Files, 1900-1944

TABLE XI

MEMBERSHIP
NATIONAL COUNCIL OF AMERICAN SHIPBUILDERS*
MARCH 31, 1935

Individual Members

Name of Company	Delegate Representing Company
Alabama Drydock & Shipbuilding Co.	David R. Dunlap
American Shipbuilding Co.	W. H. Garhauser
Cleveland, Ohio	
Lorain, Ohio	
Bath Iron Works Corporation	W. S. Newell
Bethlehem Shipbuilding Corporation, Ltd.	S. W. Wakeman
Boston, Mass.	
Quincy, Mass.	
Baltimore, Md.	
Sparrows Point, Md.	
San Francisco, Cal.	
San Pedro, Cal.	
Electric Boat Company	L. Y. Spear
Federal Shipbuilding & Drydock Company	L. H. Kornokiff
Johnson Iron Works Drydock & Shipbuilding Company	Warren Johnson
Kensington Shipyard & Drydock Corp.	John Watt
The Maryland Drydock Company	H. F. Brown
Merrill Stevens Drydock & Repair Company	J. C. Merrill
Newport News Shipbuilding & Drydock Co.	H. L. Ferguson
New York Shipbuilding Corporation	J. F. Metten
Norfolk Shipbuilding & Drydock Co.	G. W. Roper
The Pusey & Jones Corporation	C. Stewart Lee
Sun Shipbuilding & Drydock Co.	Robert Haig
Todd Shipyards Corporation	John D. Reilly
Robins Drydock & Repair Co. Brooklyn, N. Y.	
Tietjen & Lang Drydock Co. Hoboken, N. J.	
Todd Mobile Drydocks Inc. Mobile, Ala.	
Todd New Orleans Drydocks Inc. New Orleans, La.	
Todd Galveston Drydocks Inc. Galveston, Texas	
Todd Seattle Drydocks Inc. Seattle, Wash.	

*Source: National Council of American Shipbuilders

TABLE XII

COMPARATIVE SUMMARY STATEMENT OF SHIPBUILDING
IN PRIVATE SHIPYARDS OF THE UNITED STATES
DURING 1933 and 1934*

(Steel Seagoing Vessels: 1,000 Gross Tons or Over)

	1933		1934	
	Number	Tons**	Number	Tons**
Under Construction Jan. 1				
Privately-Owned	5	13,265	4	53,652
Government-Owned	27	134,300	6	37,900
Contracted During Year				
Privately-Owned	3	19,211	5	13,265
Government-Owned	11	33,600	22	106,400
Launched During Year				
Privately-Owned	6	14,476	-	-------
Government-Owned	2	3,000	3	24,900
Delivered During Year				
Privately-Owned	6	14,476	4	53,652
Government-Owned	5	27,900	1	10,000
Under Construction Dec. 31				
Privately-Owned	2	18,000	5	13,265
Government-Owned	33	140,000	27	134,300

*Source: National Council of American Shipbuilders
**Gross Tons for privately-owned vessels
Displacement Tons for Government-owned vessels

TABLE XIII

NUMBER AND TYPES OF SHIPS CONTEMPLATED
BY THE MARITIME COMMISSION*

No. of Vessels	Speed (Knots)	Type	Tons
		ATLANTIC COAST	
3	24	Passenger and express	34000-26000 gross
3	22	Combination	12000-14000 gross
3	20	Combination	12000 gross
4	18	Combination	12000 gross
4	18	Combination	10000-12000 gross
24	16-18	Combination	8000-10000 gross
3	16	Combination	8000-9000 gross
2	16	Combination	7000-8000 gross
10	16	Combination	12000 gross
4	16	Cargo	9000 D. W.
10	16	Cargo	9000 D. W.
8	16	Cargo	9000-10000 D. W.
6	16	Cargo	9000-10000 D. W.
7	15	Cargo (12 passengers)	9000 D. W.
12	15	Cargo	9000 D. W.
10	15	Cargo (12 passengers)	9000-10000 D. W.
7	15	Cargo	9000 D. W.
4	15	Cargo (12 passengers)	9000-10000 D. W.
5	15	Cargo	8000-9000 D. W.
6	14	Cargo (12 passengers)	8000-9000 gross
8	14	Cargo	8000-9000 gross
3	14	Cargo	8000-9000 gross
		GULF COAST	
15	15	Cargo	8000-9000 D. W.
3	15	Cargo	8000-9000 D. W.
7	15	Cargo (12 passengers)	8000-9000 D. W.
4	15	Cargo (12 passengers)	12000 D. W.
3	14	Cargo (12 passengers)	8000-9000 D. W.

TABLE XIII--Continued

No. of Vessels	Speed (Knots)	Type	Tons
		PACIFIC COAST	
3	22	Passenger and express	22000 gross
4	22	Passenger and express	22000 gross
3	20	Combination	16000 gross
4	18	Combination	12000 gross
10	18	Combination	12000 gross
6	18	50 percent refrigerated space	8000-9000 D. W.
8	16	Cargo	9000 D. W.
10	16	Cargo	8000-9000 D. W.
15	15	Cargo	8000-9000 D. W.
6	13	Cargo	8000-9000 D. W.
10	13	Cargo	8000-9000 D. W.
4	13	Cargo (12 passengers)	9000 D. W.
		COAST WISE AND INTERCOASTAL	
30	18	Combination	5000-12000 gross
6	16	Combination	8000-10000 gross
25	13	Cargo	4000-6000 D. W.
20	13	Cargo	2500-4000 D. W.
40	13	Cargo	5000-7000 D. W.
25	13	Cargo	5000-7000 D. W.
3	20	Combination	10000-12000 gross
100	14-16	Cargo	8000-9000 D. W.

*Source: Emory S. Land, "Some Policies of the United States Maritime Commission," Transactions of the Society of Naval Architects and Marine Engineers 48 (1940): 265.

TABLE XIV

NUMBER AND TONNAGE OF VESSELS DELIVERED AND PRODUCED BY ALABAMA DRYDOCK AND SHIPBUILDING COMPANY, 1941-1945*

Types	Number Delivered	Deadweight Tons Delivered (000)	Gross Tons Delivered (000)	Shipsworth Produced
All Types-Total	124	1951	1196	122.4
1941	2	26	15	2.8
1942	18	194	129	24.2
1943	26	423	258	25.8
1944	44	738	448	43.2
1945	34	570	346	26.4
EC2-S-C1-Total	20	216	143	20.0
1941	-	-	-	2.4
1942	18	194	129	17.3
1943	2	22	14	0.3
T2-SE-A1-Total	102	1709	1038	102.0
1942	-	-	-	6.9
1943	24	401	244	25.5
1944	44	738	448	43.2
1945	34	570	346	26.4
Private Tankers-Total				
1941	2	26	15	0.4

*Source: 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, D.C.: Government Printing Office, 1949), p. 58.

TABLE XV

NUMBER AND TONNAGE OF VESSELS DELIVERED AND PRODUCED
BY INGALLS SHIPBUILDING CORPORATION (PASCAGOULA), 1939-1945*

Types	Number Delivered	Deadweight Tons Delivered (000)	Gross Tons Delivered (000)	Shipsworth Produced
All Types-Total	70	781	575	69.7
1939	-	-	-	N.A.
1940	2	25	16	N.A.
1941	3	35	26	5.3
1942	5	37	50	8.6
1943	20	218	168	19.1
1944	15	171	118	20.4
1945	25	295	197	16.3
C3-Cargo-Total	4	50	32	-
1939	-	-	-	N.A.
1940	2	25	16	N.A.
1941	2	25	16	-
C3-S-A2-Total	41	513	322	39.1
1942	-	-	-	4.4
1943	14	175	109	13.1
1944	7	88	55	12.7
1945	20	250	158	8.9

TABLE XV--Continued

Types	Number Delivered	Deadweight Tons Delivered (000)	Gross Tons Delivered (000)	Shipsworth Produced
C3-P-Pass. & Cargo-Total	2	20	22	0.7
1939	-	-	-	N.A.
1940	-	-	-	N.A.
1941	1	10	10	0.7
1942	1	10	12	-
C3-S-A2 (APA)-Total	7	63	55	6.7
1943	-	-	-	0.2
1944	2	18	16	6.5
1945	5	45	39	-

*Source: 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, D.C.: Government Printing office, 1949), p. 120.

TABLE XVI

FACILITY CONTRACT ESTIMATES (PENNSYLVANIA)*

Equipment	Original Estimate	New Estimate
3 - Building Ways - C-1	$ 330,000	$ 380,831
3 - 45-ton Gantry Cranes	140,000	150,600
3 - 30-ton Gantry Cranes	70,000	265,200
3 - 25-ton Gantry Cranes	90,000	
Building Racks	35,000	60,000
Building Racks	6,000	
Plant Piping	30,000	115,000
Plant Piping	5,000	
Plant Lighting & Power	15,000	160,000
Plant Lighting & Power	3,000	
Locker Buildings	20,000	42,000
Tracks	25,000	101,208
Tracks	6,000	
Rack Building	20,000	50,000
Machine Shop Additions	25,000	41,050
Structural Shop Additions	25,000	40,000
Furnace & Blacksmith Shop	15,000	4,500
Pipe Shop & Machinery	35,000	38,250
Sheet Metal Shop	15,000	15,000
3 - 400' Outfitting Wharfs	105,000	241,881
Welding Machines	60,000	276,000
Barges for Welding Machines	20,000	
Cables & Equipment	15,000	105,156
4 - 220' Ways	130,000	
Dredging	10,000	33,550
Office Building		135,000
Garages		2,000
Parking Lot - Island		10,000
Parking Lot - Main Land		5,000
Cyclone Fence		3,001
Pontoon Foot Bridge		22,500
New Wagon Bridge		35,000
Dredge Cutoff		34,000
Carpenter Shop		20,000
2 - Locomotive Cranes		12,000
Warehouses		107,500
First Aid Stations		25,000
Re-surface Road		9,500
Plant Protection		25,000
Miscellaneous Items		24,100
TOTALS	$1,250,000	$2,589,927

*Source: "Minutes of the U.S. Maritime Commission, July 22, 1941," pp. 18163-18164, Record Group 178, Records of the U.S. Maritime Commission, National Archives.

TABLE XVII

AVERAGE HOURLY EARNINGS IN PRIVATE SHIPYARDS BY REGION*

January 1943 to December 1944

Year/Month	Atlantic	Gulf	Pacific
1943			
January	$1.23	$1.13	$1.35
February	1.26	1.12	1.35
March	1.23	1.16	1.35
April	1.24	1.13	1.37
May	1.25	1.17	1.38
June	1.24	1.16	1.37
July	1.29	1.17	1.40
August	1.28	1.18	1.38
September	1.33	1.26	1.42
October	1.34	1.21	1.40
November	1.38	1.27	1.49
December	1.34	1.24	1.42
1944			
January	1.29	1.21	1.43
February	1.31	1.22	1.42
March	1.31	1.21	1.42
April	1.32	1.21	1.42
May	1.33	1.23	1.42
June	1.33	1.23	1.42
July	1.31	1.22	1.42
August	1.33	1.22	1.43
September	1.38	1.23	1.48
October	1.40	1.26	1.48
November	1.44	1.26	1.51
December	1.42	1.27	1.47

*Source: Wartime Employment, Production, and Conditions of Work in Shipyards, p. 17, Record Group 254, Records of the Shipbuilding Stabilization Committee, National Archives.

TABLE XVIII

AVERAGE BASE RATES PER HOUR FOR SPECIFIED OCCUPATIONS*
IN SHIPYARDS BY REGION, JUNE 1943

Occupation	Atlantic	Gulf	Pacific
Anglesmiths	$1.08	$1.18	$1.19
Blacksmiths	1.08	1.07	1.20
Boilermakers	1.05	1.13	1.20
Burners	1.09	1.10	1.18
Carpenters	1.09	1.10	1.18
Chippers	1.07	1.13	1.16
Coppersmiths	1.13	1.05	1.16
Crane Operators	1.11	1.09	1.22
Electricians	1.06	1.10	1.18
Foremen	1.58	1.30	1.50
Joiners	1.13	1.18	1.19
Laborers	.75	.63	.88
Layer-out-men	1.12	1.09	1.32
Loftsmen	1.16	1.21	1.32
Machinists	1.08	1.10	1.20
Painters	1.07	1.17	1.20
Patternmakers	1.33	1.20	1.55
Pipe Coverers	1.06	1.07	1.09
Pipefitters	1.07	1.10	1.19
Riggers	1.05	1.12	1.16
Riveters	1.14	1.17	1.20
Sheetmetal men	1.07	1.10	1.17
Shipfitters	1.05	1.10	1.18
Tool Makers	1.06	1.08	1.34
Welders	1.07	1.09	1.16
Welders Helpers	.80	.71	.95

*Source: Wartime Employment, Production, and Conditions of Work in Shipyards, p. 28, Record Group 254, Records of the Shipbuilding Stabilization Committee, National Archives.

TABLE XIX

COMPARISON OF ABSENTEEISM RATES IN SHIPYARDS BY REGIONS*
January 1943 - February 1945 (Percent)

Year/Month	All Regions	Atlantic	Gulf	Pacific
1943				
January	10.2	10.9	9.7	9.8
February	11.4	13.1	10.7	10.6
March	10.7	13.6	8.0	9.9
April	9.0	11.1	7.0	8.4
May	9.7	12.2	7.7	8.9
June	9.7	12.7	8.8	8.0
July	11.0	13.7	9.4	9.8
August	10.8	14.0	8.9	9.4
September	10.1	12.7	7.7	9.4
October	10.2	13.2	7.2	9.5
November	9.4	11.2	7.1	9.2
December	11.5	13.3	8.2	11.6
1944				
January	11.1	14.1	11.1	9.3
February	10.3	13.4	8.9	8.8
March	10.8	13.5	10.4	9.2
April	10.9	13.6	9.8	9.4
May	9.6	11.3	8.7	8.9
June	9.7	10.8	9.1	9.4
July	10.3	11.4	9.7	10.0
August	10.0	11.0	9.5	9.7
September	12.0	14.5	13.6	10.1
October	9.9	10.6	8.9	10.0
November	10.2	10.7	8.4	10.8
December	9.7	9.7	8.0	10.6
1945				
January	8.6	9.9	5.9	8.8
February	8.9	11.8	5.9	8.4

*Source: Gerald J. Fischer, A Statistical Summary of Shipbuilding Under the U.S. Maritime Commission During War II. Historical Reports of War Administration, U.S. Maritime Commission, No. 2 (Washington, D.C.: Government Printing Office, 1949), p. 140.

TABLE XX

NUMBER OF PERSONS EMPLOYED IN GULF COAST SHIPYARDS*
1941-1945 (Hundreds)

Year/Month	Alabama	Ingalls	Pennsylvania	Todd-Houston
1941				
January	6	18	3	0
February	5	19	3	0
March	5	19	4	0
April	6	19	6	0
May	5	21	7	0
June	3	22	10	0
July	2	23	11	2
August	4	23	8	6
September	7	24	9	9
October	11	26	18	10
November	16	26	22	21
December	26	28	26	32
1942				
January	28	27	26	49
February	32	27	28	64
March	43	28	31	78
April	54	30	34	111
May	81	34	35	134
June	98	41	40	148
July	132	43	43	194
August	126	51	44	189
September	117	54	49	196
October	135	56	51	213
November	199	62	53	214
December	172	68	56	216
1943				
January	169	67	53	214
February	185	66	55	220
March	185	71	54	218
April	193	71	54	219
May	210	72	53	228
June	270	68	50	221
July	249	65	50	222
August	249	64	52	223
September	239	64	47	223
October	135	56	51	219
November	199	62	53	212
December	172	68	56	205

TABLE XX--Continued

Year/Month	Alabama	Ingalls	Pennsylvania	Todd-Houston
1944				
January	230	65	55	191
February	229	66	54	188
March	223	76	53	187
April	218	88	52	187
May	218	93	54	182
June	215	96	54	185
July	216	96	54	187
August	220	93	55	185
September	215	91	55	176
October	211	93	54	172
November	214	92	56	174
December	216	86	58	162
1945				
January	221	82	58	141
February	176	77	58	125
March	146	73	54	93
April	130	69	52	54
May	120	65	50	47
June	101	64	48	45
July	90	64	47	39
August	71	65	37	30
September	41	67	28	25
October	0	71	21	29
November	0	62	12	20
December	0	60	0	0

*Source: 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, D.C.: Government Print Office, 1949), p. 127.

TABLE XXI

RATES OF TOTAL SEPARATIONS IN GULF COAST SHIPYARDS*
July 1941 - December 1945 (Percent)

Year/Month	Alabama	Ingalls	Pennsylvania	Todd-Houston
1941				
July	N.A.	5.8	N.A.	3.5
August	N.A.	5.9	N.A.	7.9
September	N.A.	5.3	N.A.	6.7
October	N.A.	6.9	N.A.	8.3
November	N.A.	6.2	N.A.	5.9
December	N.A.	7.4	N.A.	5.9
1942				
January	N.A.	16.4	4.1	6.5
February	N.A.	13.6	4.0	8.1
March	N.A.	8.9	4.3	9.0
April	N.A.	8.9	8.6	8.0
May	N.A.	10.6	4.4	8.2
June	N.A.	11.8	9.2	7.6
July	N.A.	10.8	8.8	10.4
August	N.A.	13.1	7.3	11.0
September	N.A.	15.1	7.6	8.9
October	N.A.	15.8	7.4	11.5
November	9.3	16.0	7.3	7.3
December	5.1	15.5	7.2	7.4
1943				
January	6.7	17.6	7.1	10.5
February	10.7	19.1	7.9	8.8
March	11.4	16.2	7.8	12.6
April	8.1	14.1	7.1	10.6
May	8.8	15.7	7.0	10.0
June	10.6	15.2	8.3	14.0
July	13.0	17.9	9.8	12.5
August	12.3	21.9	8.8	15.4
September	15.9	17.7	7.1	13.8
October	8.0	18.1	7.3	10.5
November	6.3	14.9	6.2	9.7
December	15.9	17.3	5.8	9.0

TABLE XXI--Continued

Year/Month	Alabama	Ingalls	Pennsylvania	Todd-Houston
1944				
January	4.9	13.8	6.0	11.0
February	6.9	12.9	6.1	9.6
March	9.4	17.0	6.0	9.9
April	7.7	11.2	6.1	9.1
May	9.2	13.8	7.7	12.2
June	9.1	19.4	8.5	10.3
July	8.1	14.2	6.2	9.9
August	9.6	15.9	6.6	11.3
September	10.3	18.1	6.1	12.2
October	8.6	16.3	6.0	10.6
November	6.9	12.0	8.7	7.6
December	7.7	21.0	7.0	9.0
1945				
January	10.1	7.3	7.9	16.3
February	24.8	10.2	9.8	15.3
March	21.9	9.9	9.1	31.9
April	14.4	11.3	10.5	55.0
May	10.7	10.4	13.5	19.4
June	19.4	10.5	17.4	14.0
July	14.2	8.5	19.9	20.8
August	26.8	12.2	45.0	31.2
September	54.8	18.7	53.0	25.0
October	91.0	9.5	N.A.	19.2
November	55.1	8.9	25.6	35.0
December	22.7	7.8	35.9	N.A.

*Source: 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, D.C.: Government Printing Office, 1949), p. 143.

TABLE XXII

PERCENTAGE DISTRIBUTION OF PRIVATE SHIPYARD WORKERS*
BY REGION AND OCCUPATION, JUNE 1943

Occupation	Atlantic	Gulf	Pacific
Anglesmiths	0.2	0.4	0.5
Blacksmiths	0.5	0.3	0.2
Boilermakers	1.6	3.5	2.8
Burners	3.4	4.6	4.3
Carpenters	5.2	6.2	7.4
Chippers	2.5	2.3	3.3
Coppersmiths	0.5	0.5	0.6
Crane Operators	0.7	0.4	0.6
Electricians	6.2	6.3	7.3
Furnacemen	0.2	0.08	0.08
Joiners	1.0	0.2	0.6
Laborers	5.7	9.8	3.5
Layer-out men	0.4	1.1	0.3
Loftsmen	0.3	0.3	0.5
Machinists	9.0	7.8	7.1
Molders	0.1	0.07	0.07
Painters	3.0	2.9	3.0
Patternmakers	0.1	0.07	0.08
Pipe Covers	0.5	0.3	0.09
Pipefitters	7.1	8.1	7.2
Riggers	3.3	2.3	2.9
Riveters	0.6	0.1	0.3
Sheetmetal men	3.3	3.0	3.1
Shipfitters	9.0	13.1	12.7
Toolmakers	0.1	0.09	0.08
Welders	12.6	16.4	17.5
All others	22.5	9.4	13.7

Source: Wartime Employment, Production, and Conditions of Work in Shipyards, p. 17, Record Group 254, Records of the Shipbuilding Stabilization Committee, National Archives.

GLOSSARY

Aft - At, in, or toward the stern.

Amidships - In or toward the middle of a ship, or the part midway between the stem and stern.

Barkentine - A five-masted sailing ship with the foremast and square-rigged and other masts rigged fore-and-aft.

Bilge - The relatively flat under portion of a ship's hull.

Bilge end plates - The curved shell plates at the end of the bilge.

Bottom shell - The outside covering of plating or planking forming the bottom of a vessel's hull.

Bow - The front or forward end of a ship or boat.

Brigantine - A two-masted sailing vessel, square-rigged on her foremost with a fore-and-aft rigged mainmast.

Deadweight - The total weight a vessel carries when immersed to her authorized load draft, including cargo, fuel, and crew.

Declivity of ways - The slope or downward inclination of the launching ways.

Dogging - Any of various simple mechanical devices for clamping down or otherwise securing some object.

Double bottom - The space between the inner and outer bottoms divided into a number of small compartments.

Fan Tail - The fan-shaped plate of the ship on the overhanging stern.

Fayed - Two metal or wood surfaces closely fitted together.

Fidley top - A trunkway above and opening into the boiler room housing fire-room ventilators, escape ladders, and usually uptakes to the smoke stack.

Fixture - A device for holding the work in a machine tool, especially where the machining is to be done on straight surfaces, as in a planer or a milling machine.

Forward - At, in, or toward the front.

Frame Line - The line formed by the intersection of a vertical transverse plane with the hull's molded surface at a specific position along the fore-and-aft line.

Full-Scantling - A vessel built to the highest standard of structural strength from the hull up to her uppermost continuous deck.

Gantry - An overhead structure on which a traveling crane is mounted.

Girder - Any supporting member in a vessel's structure serving to supply longitudinal strength or stiffness. Often loosely termed a stringer.

Gunnel bars - An angle bar that connects the deck stringer plate and shell plates at the weather deck.

Hatch coaming - The raised wood or iron around a hatchway or other deck opening for strengthening a deck to protect against the ingress of water.

Inner bottom - Plating forming the top of the double bottom. Also called tank top.

Intercostal - Any girder or other structural unit composed of short members running between and secured to continuous members.

Jig - A device for holding the work in a machine tool, especially one for accurately guiding a drill or group of drills so as to insure uniformity in successively machined pieces.

Laps - A joint in which one part overlaps the other.

Longitudinal - Of, or pertaining to, longitude, length, or the lengthwise dimension.

Margin plates - Any one of the outer row of plates of the inner bottom, connecting with the shell plating at the bilge.

Mold loft - A building with a large smooth floor for laying down the lines of a vessel to actual size on templates.

Platens - Skids plated over, on which structural welded parts are assembled.

Rib band - Any long metal strip secured along the frames to keep frame members in proper positions during construction.

Scarfing - A connection of two ends of timber or metal by overlapping so that the material forms a continuous piece of the same cross-section.

Schooner - Originally, a two-masted sailing vessel characterized by the fore-and-aft rig of her principal sails.

Scow - A flat-bottomed boat used in sheltered waters for freighting or lighterage purposes. The craft has many names according to the locality in which it is employed; as, bateau, flatboat, punt, or square-ender.

Sea chest - A casing fitted to the shell of a vessel for the purpose of supplying water from the sea to the condenser and pumps.

Settling tank - In vessels using oil fuel, tank in which oil is heated preparatory to use and let stand for a time until any water content settles to the bottom.

Shaft alley - The watertight passage housing the propeller shaft throughout the shaft's length from engine room to the stern tube.

Side shells - The outside covering of plating or planking forming the side of a vessel's hull.

Smack - A small decked sailing vessel of any fore-and-aft rig engaged in trawling or in the coasting trade.

Stem - The forward part of a ship or boat.

Stern - The rear part of a ship or boat.

Stiffener - A girder fastened to a surface, as a plated bulkhead, for increasing rigidity.

Strongback - A hatch beam or any portable timber or metal beam supporting the hatch covers.

Transverse - Lying at right angles to the centerline.

Trawler - A ketch-rigged vessel of 50-75 ft. in length.

Tree nail - A wooden bolt, two to four feet long and about one inch in diameter used in wooden shipbuilding in place of metal nails.

Way or shipway - The inclined tracks on which the ship slides during launching.

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