NPS Form 10-900
(Oct.1990)

OMB No. 1024-0018

United States Department of the Interior
National Park Service

National Register of Historic Places Registration Form

This form is for use in nominating or requesting determinations for individual properties and districts. See instructions in *How to Complete the National Register of Historic Places Registration Form* (National Register Bulletin 16A). Complete each item by marking "x" in the appropriate box or by entering the information requested. If any item does not apply to the property being documented, enter "N/A" for "not applicable." For functions, architectural classification, materials, and areas of significance, enter only categories and subcategories from the instructions. Place additional entries and narrative items on continuation sheets (NPS Form 10-900a). Use a typewriter, word processor, or computer, to complete all items.

1. Name of Property

historic name Union Iron Works

other names/site number Pier 70, Bethlehem Steel Yard, Potrero Yard, San Francisco Yard

2. Location

street & number South of Illinois Street between 18th and 22nd Streets ☐ not for publication

city or town San Francisco ☐ vicinity

state California code CA county San Francisco code 075 zip code 94107

3. State/Federal Agency Certification

As the designated authority under the National Historic Preservation Act of 1986, as amended, I hereby certify that this ☐ nomination ☐ request for determination of eligibility meets the documentation standards for registering properties in the National Register of Historic Places and meets the procedural and professional requirements set forth in 36 CFR Part 60. In my opinion, the property ☐ meets ☐ does not meet the National Register Criteria. I recommend that this property be considered significant ☐ nationally ☐ statewide ☐ locally. (☐ See continuation sheet for additional comments.)

Signature of certifying official/Title Date

California Office of Historic Preservation
State or Federal agency and bureau

In my opinion, the property ☐ meets ☐ does not meet the National Register criteria. (☐ See continuation sheet for additional comments.)

Signature of commenting or other official Date

State or Federal agency and bureau

4. National Park Service Certification

I hereby certify that this property is: Signature of the Keeper Date of Action

☐ entered in the National Register
☐ See continuation sheet.
☐ determined eligible for the National Register
☐ See continuation sheet.
☐ determined not eligible for the National Register
☐ removed from the National Register
☐ other (explain): ______________

5. Classification

Ownership of Property
(Check as many boxes as apply)

- [x] private
- [x] public-local
- [ ] public-State
- [ ] public-Federal

Category of Property
(Check only one box)

- [ ] building(s)
- [x] district
- [ ] site
- [ ] structure
- [ ] object

Number of Resources within Property
(Do not include previously listed resources in the count.)

Contributing	Noncontributing	
41	4	buildings
		sites
4	15	structures
		objects
45	19	Total

Name of related multiple property listing
(Enter "N/A" if property is not part of a multiple property listing.)

N/A

Number of contributing resources previously listed in the National Register

none

6. Function or Use

Historic Functions
(Enter categories from instructions)

INDUSTRY/manufacturing facility – shipyard/ship repair
DEFENSE/naval facility – shipyard/ship repair
GOVERNMENT/office – Naval office
COMMERCE/professional – shipyard office
INDUSTRY/industrial storage –warehouse

Current Functions
(Enter categories from instructions)

INDUSTRY/manufacturing facility – ship repair
GOVERNMENT/storage - warehouse
COMMERCIAL/storage - warehouse
COMMERCIAL/professional – artist studio
VACANT/NOT IN USE

7. Description

Architectural Classification
(Enter categories from instructions)

OTHER - Industrial
MODERN MOVEMENT - Moderne
LATE 19TH and 20TH CENTURY REVIVALS – Beaux Arts
LATE 19TH and 20TH CENTURY REVIVALS – Classical
LATE VICTORIAN – Renaissance Revival

Materials
(Enter categories from instructions)

foundation concrete
foundation brick
foundation wood
roof metal – iron/steel
roof tar and gravel
roof wood
walls metal – iron/steel
walls brick
walls concrete
walls wood
walls plastic sheeting
other terra cotta

Narrative Description
(Describe the historic and current condition of the property on one or more continuation sheets.)
See continuation sheet

8. Statement of Significance

Applicable National Register Criteria
(Mark "x" in one or more boxes for the criteria qualifying the property for National Register listing)

- [x] A Property is associated with events that have made a significant contribution to the broad patterns of our history.
- [ ] B Property is associated with the lives of persons significant in our past.
- [x] C Property embodies the distinctive characteristics of a type, period, or method of construction or represents the work of a master, or possesses high artistic values, or represents a significant and distinguishable entity whose components lack individual distinction.
- [ ] D Property has yielded, or is likely to yield information important in prehistory or history.

Criteria Considerations
(Mark "X" in all the boxes that apply.)

Property is:

- [ ] A owned by a religious institution or used for religious purposes.
- [ ] B removed from its original location.
- [ ] C a birthplace or a grave.
- [ ] D a cemetery.
- [ ] E a reconstructed building, object, or structure.
- [ ] F a commemorative property.
- [ ] G less than 50 years of age or achieved significance within the past 50 years.

Areas of Significance
(Enter categories from instructions)

Industry - Maritime
Architecture - Industrial

Period of Significance
1884-1945

Significant Dates

Significant Person
(Complete if Criterion B is marked above)

Cultural Affiliation

Architect/Builder
Charles Peter Weeks, Fredrick H. Meyer, George Percy and Frederick Hamilton, Civil Engineer Dr. D. E. Melliss, Bethlehem Steel, U. S. Navy

Narrative Statement of Significance
(Explain the significance of the property on one or more continuation sheets.)

9. Major Bibliographical References

(Cite the books, articles, and other sources used in preparing this form on one or more continuation sheets.)

Previous documentation on file (NPS):

- [ ] preliminary determination of individual listing (36 CFR 67) has been requested.
- [ ] previously listed in the National Register
- [ ] previously determined eligible by the National Register
- [ ] designated a National Historic Landmark
- [ ] recorded by Historic American Buildings Survey # ____________
- [ ] recorded by Historic American Engineering Record # ____________

Primary Location of Additional Data

- [ ] State Historic Preservation Office
- [ ] Other State agency
- [ ] Federal agency
- [x] Local government
- [ ] University
- [ ] Other

Name of repository:
Port of San Francisco

10. Geographical Data

Acreage of Property ______

UTM References
(Place additional UTM references on a continuation sheet)

	Zone	Easting	Northing		Zone	Easting	Northing
1	__	______	______	3	__	______	______
2	__	______	______	4	__	______	______

☐ See continuation sheet.

Verbal Boundary Description
(Describe the boundaries of the property on a continuation sheet.)

Boundary Justification
(Explain why the boundaries were selected on a continuation sheet.)

11. Form Prepared By

name/title ______________________________

organization Carey & Co., Inc. ______________ date ______________

street & number 460 Bush Street ______________ telephone 415 773 0773

city or town San Francisco ______________ state CA zip code 94108

Additional Documentation

Submit the following items with the completed form:

Continuation Sheets

Maps

A **USGS map** (7.5 or 15 minute series) indicating the property's location.

A **Sketch map** for historic districts and properties having large acreage or numerous resources.

Photographs

Representative **black and white photographs** of the property.

Additional items
(Check with the SHPO or FPO for any additional items)

Property Owner

(Complete this item at the request of the SHPO or FPO.)

Name ______________________________

street & number ______________________________ telephone ______________

city or town ______________________________ state ___ zip code ______________

District Description

The Union Iron Works/Bethlehem Steel Shipyard consists of 64 resources, including buildings, piers, slips, cranes, landscape and circulation elements associated with steel shipbuilding, ship repair, and trends in industrial architecture from 1884 to 1945 (Figure 1).[1] This contiguous district was the Union Iron Works/Bethlehem Steel shipyard (UIW).[2] It is primarily composed of industrial buildings representing trends in industrial architecture from the late nineteenth century through WWII, including unreinforced brick masonry shops, concrete shops and warehouses, and steel-frame buildings with corrugated iron or steel cladding. There are also several architect-designed buildings from prominent San Francisco late nineteenth and early twentieth-century architectural firms. Also present are modified waterfront structures inherent to shipbuilding and ship repair, including slipways, wharves, and floating dry docks, which enhance the district's setting and express its historical function.

The Union Iron Works/Bethlehem Steel Shipyard is situated in Potrero Point along San Francisco Bay at the foot of Potrero Hill in the Central Waterfront district of San Francisco, California (Figure 2). The area is primarily industrial, with a power plant and the historic American Can Company building nearby, but is rapidly being transformed to a mixed-use, commercial, light industry, and residential district. The Dogpatch Local Historic District lies several blocks to the west, and this residential area is interspersed with commercial establishments. Third Street is the main thoroughfare linking the site to the rest of the city, and a light rail line extends public transportation to the area.

Roughly two sides of the district border the San Francisco Bay with views of the San Francisco-Oakland Bay Bridge, the East Bay, Treasure and Yerba Buena Islands, and downtown San Francisco. The northern portion of the district remains a working ship repair yard and dry dock run by BAE Systems San Francisco, and an automobile impound lot spreads over the Building 12 (New Yard) Complex in the district's southern portion. A metal salvage company is situated along the southeastern waterfront. Several other buildings are currently used for interim industrial storage or artist studios. The main entrance is at 20th and Illinois Streets, with a secondary entrance at 22nd and Michigan Streets.

Potrero Point

[1] For the preparation of this nomination the Port of San Francisco used the San Francisco Planning Department 2001 *Central Waterfront Cultural Resources Survey*, which was approved by the California Office of Historic Preservation, to guide the definition of the Pier 70 Historic District.

[2] The Union Iron Work moved to Potrero Point in 1884, and the shipyard has taken on many names over the years. In the following pages, for the sake of consistency, the name Union Iron Works/Bethlehem Steel (or UIW) will be used to indicate all incarnations of the shipyards associated with the Pier 70 from 1884 to 1945. See the Ownership Map, Figure 3, which shows the rough boundary of the Union Iron Works Shipyard in 1884 along with the various owners of the southeastern portion of the district prior to the U. S. Navy purchase of the area in 1940 and the construction of the extant Building 12 Complex. Previous owners included the Pacific Rolling Mills (1868-1900), Risdon Iron and Locomotive Works (1900-1912), and U. S. Steel Products Company (1912-1940), who owned the land when the U. S. Destroyer yard was built there and operated by the Union Iron Works Company.

The Union Iron Works/Bethlehem Steel Shipyard was originally a small promontory surrounded by deep waters, called Point San Quentin in the 1850s and later renamed Potrero Point. By the late 1870s, a birds-eye view shows Potrero Point developed with industrial concerns and residential buildings. No filling or grading of the point occurred prior to the construction of Union Iron Works during the early 1880s.[3]

The Union Iron Works Shipyard

In 1884 the Union Iron Works moved from the northwest corner of First and Mission Streets in San Francisco, to the new 22-acre shipyard situated along the shoreline with the steep cliffs of Irish Hill creating a physical boundary to the south, east and west (Figure 4). The Pacific Rolling Mills buildings stood at the end of the point to the east and south of Union Iron Works.

The initial development consisted of six main buildings and a wharf.[4] The machine, erecting, and smith shops and the pattern house stood to the south of 20th Street and roughly followed the general layout of an iron works. Apart from the pattern house, all of these original Union Iron Works buildings were red brick with iron roofs, similar in style to Buildings 113 and 114, designed by Dr. D. E. Melliss in the American round-arched style.[5] Buildings 113 and 114 are the only remaining buildings of this original complex (Figure 5). To the north of 20th Street, along the shoreline, stood the plate shop (sometimes known as the ship shop or machine shop), slip way, wet basin, and wharves. The plate shop was likely wood construction but is not shown on the early yard views. This basic division and the original placement of buildings in the 1880s continued through WWII.

The shipyard was designed with 20th Street as the dividing line between the machine shop and the fabrication yard. The farication portion of the yard dealt with constructing the hull of the vessel. The machine shop portion produced engines, boilers, hardware and all other components necessary for building or repairing a ship.

Ship Construction at the Yard during the 1880s

During the late nineteenth century, UIW was one of the most technologically advanced shipyards, using the new lofting method of shipbuilding instead of the traditional lifting method used for wood and iron ships.[6] Ship hulls were constructed starting with the laying of the keel in the shipways. Workers then riveted steel frames and plates in place to construct the hull. After the completion of the hull, the ship was launched ceremoniously and moved to the wet basins or outfitting docks to be fitted with propulsion systems and outfitted. This process is shown in Figure 6, which indicates the separate and often concurrent processes of hull construction and the fabrication of engine and outfitting components.

[3] San Francisco Planning Department, *Central Waterfront Cultural Resources Survey Summary Report and Draft Context Statement,* 2001, p.16.
[4] Sanborn Insurance Company Map, San Francisco, Vol. 5 (1886), sheet 153.
[5] "Valuable Industries: The New Union Iron Works and the Arctic Oil Works," *San Francisco Call,* January 24, 1884, p.5.
[6] Caspar T. Hopkins, George C. Perkins, Andrew Crawford, Charles L. Taylor and Charles B. Stone, *Report on Shipping and Ship-Building to the Manufacturer's Association, the Board of Trade and the Chamber of Commerce* (San Francisco, 1884/1885), 41.

Hull Construction

UIW erected the ship's hull in one of the slipways at the northern edge of the yard along the waterfront. Instead of tailoring each new hull plate to fill a vacant position on the partly constructed hull, as the lifting method required, hull frames and plates were produced following templates from models. Templates were wood – or sometimes paper patterns – produced by loftsmen. Working in the mold loft, in the second floor of the plate shop standing at the head of the slips, loftsmen produced templates by scaling up from a wood model of the ship. In his discussion of the *Olympia*, historian Robert Stewart describes the process used:

"Loftsmen would produce a table of offsets that gave the ship's scaled-up dimension at 'stations' of location along the length of the hull. This table of offsets determined the contours of full-sized hull lines on the loft floor. Loftsmen then cut wooden shapes or patterns to make full-sized templates. Each template conformed to a frame in the full structure. Skilled workers cut the frames and plates out of steel plate, carefully trimming them to match the template shapes."[7]

Templates were brought downstairs to the plate shop. Steel hull plates, often produced by Pacific Rolling Mills, were stored in a yard to the south of the ship shop and were moved into the plate shop. During the 1880s, unskilled workers or livestock moved plates on carts from the storage area to the plate shop and then to the slips. By the 1890s, several track cranes moved plates around the shipyard.

Workers in the plate shop would bend and shear the plate to match the templates and punch it with rivet holes. The plate shop included a drawing board, bending floor, blacksmith shop, offices, and a second-story molding loft and drawing room. This building is no longer extant but a plate shop has continuously stood in roughly this location. Building 109, a Plate Shop and Mold Loft constructed in 1912, stands there today. Support buildings for the plate shop in the late nineteenth century included a coppersmith shop, blacksmith shops with furnaces, and bending shop, water closets, and rigging storage. None of these early wooden structures remain.

Next, steel hull plates were moved to the slips, where the hull was riveted together by rivet gangs. According to Caspar T. Hopkins et al., writing in 1884, UIW opened with overhead cranes to position plates above the slips (then called ways).[8] Plates did not always fit, and workers used hand-tools or hydraulic shears to custom tailor the plate on the slips. Occasionally they had to scrap plates.[9]

Based on drawings from the late nineteenth century, the shipyard had four slips, the westernmost slips appearing narrower than the eastern (Figure 7). The yard retained slips at this location through WWII, although they were rebuilt several times. After the hull was completed, the ship was launched ceremoniously and moved for outfitting to the ways or wet basins located to the west of the slips, in the approximate location of Pier 68 today. Piers and wet basins at Pier 68 have been rebuilt and extended several times since the 1880s. The current waterfront structures were built after WWII.

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[7] Robert C. Stewart, "Historic American Engineering Record: U. S.S. Olympia," (U. S. Department of the Interior, National Park Service, 1998).
[8] Hopkins et al., *Report on Shipping*, 41.
[9] William H. Thiesen, *Industrializing American Shipbuilding: The Transformation of Ship Design and Construction, 1820-1920* (Gainesville, 2006), 186.

By the late 1880s a hydraulic dry dock was installed along the eastern end of the wharf. The dry dock raised ships out of the water for ship repair. Ship repair often consisted of cleaning and repainting hulls, but also included the replacement of components or entire propulsion systems, which the yard produced in its machine and metal shops.

Engineering and Outfitting
The UIW shipyard was able to fabricate, forge, and machine onsite all metal components necessary for ship construction. This included the smallest bolt to entire engines and boilers. Most of these components were used in building ship propulsion systems – engineering – or for the installation of all non-structural ship components – outfitting. During the nineteenth century this work was done on the south side of 20th Street and this basic arrangement of buildings is visible today, anchored by Building 113.

The process of fabricating equipment often started at the pattern house and pattern shop. Standing to the southeast of Building 113, this building was four stories, with the upper stories for storage, making it the tallest building at the yard during nineteenth century. In the pattern house, workers produced patterns or forms for shaping molds used to produce metal castings for machine parts. [10] Pattern makers utilized motorized tools run by a wire line connected to the boiler house. Materials for the machine shops and foundries were also stored here. The pattern house was demolished after WWII.

After the patterns were made, molds were poured in the foundry. In 1884, the foundry building was the southernmost building at the yard. The western portion of Building 113, divided in the 1880s by Georgia Street, housed the machine and erecting shop where workers constructed marine engines. In the eastern half stood the blacksmith and boiler shop with forges, where the boilers for the ship engines were constructed. Engines, boilers, and other large components constructed in the southern portion of the yard were moved to the wet basins or outfitting piers where the ships were outfitted. To the south of the machine shop stood several smaller buildings, housing a brass foundry and blacksmith shop.

An engine house that stood to the south of Building 113 supplied power for the cranes and motorized tools. During the 1880s, the boilers in the engine house used steam-power to turn a series of cranks, shafts, wires, and belts that ran the motorized tools in the machine shop and tool room. Air compressors located here supplied power to the overhead traveling cranes and to hydraulic pumps for powering hydraulic machinery in the nearby buildings. Dynamos were also housed in the engine room. [11]A 120-foot octagonal brick chimney rose from the engine house and is shown on the 1880s sketch of the yard (Figure 5). When the yard opened, electricity was used only for powering electric lights.

Circulation Systems
Based on an early lithograph, the shoreline ran just north of 20th Street (then Napa Street) with a small inlet extending south of 20th Street into the Union Iron Works site, just west of the machine shop (Building 113). A 20th Street bridge crossed over the inlet and functioned as the main access to the works (Figure 5).

[10] Shipbuilding Division, Bethlehem Steel Co., “An Introduction of Shipbuilding,” (Washington, D. C., 1942), 44.
[11] W. W. Hanscom, "Electricity in the Union Works," *The Journal of Electricity, Power and Gas*, XI (1901), 112.

The city's gridiron street plan was only roughly followed within UIW, and several planned city streets were never opened within the shipyard boundaries. The Board of Supervisors during the mid-1880s closed all planned streets except Napa Street (20th Street) inside the Union Iron Works property.[12] Only one rail line, running between the buildings south of 20th Street and extending to the waterfront north of 20th Street, was installed by the mid-1880s. By the late 1890s, a fence enclosed the shipyard portion of the site with the entrance at the corner of 20th and Georgia Streets, the current entrance to the ship repair yard.

The yard maintained this general process of ship construction well into the twentieth century, and thus retains much of its original design and layout even though most of the earliest buildings have been replaced.

Turn of the Century

In 1896, UIW built an office-specific building (Building 104), and defined office spaces in existing buildings, expanded the rail and crane system, introduced electric-powered tools, expanded its boiler shops, and expanded and upgraded the ship shop, slips, and piers. All of the metal shop buildings constructed in the early 1880s were still in use at this time with little or no modification or changes in function. The yard expanded to cover 28 acres, and included new rail lines between buildings and open truss structures over four slips.

Building and Waterfront Structure Upgrades

In 1896 prominent San Francisco architects George Percy and Frederick Hamilton designed the new UIW office building. Standing on the north side of 20th Street, across from the machine shop, this brick Renaissance Revival style building was the first of several architect-designed buildings to grace the street. The opening of the office building allowed for a new separation of manager and workers, illustrating a transformation in the management style at the yard. The new drafting rooms in this building also allowed for a consolidation of shipyard and engineering plans, signaling an increased reliance on plans and less separation between these two departments.

A larger mold loft was also necessary for the construction of larger ships, as ship size was limited to the size of the mold loft floor. During the 1890s, UIW expanded the plate shop and mold loft, added a bolt and forge shop, planing mill, and a copper smith and tin shop. The large plate shop (also called a machine shop during this period) contained a bending floor, ship blacksmithing shop and iron plate storage area (Figure 8). This building is no longer extant and was replaced by Building 109.

Warships built by UIW during the 1890s also called for larger boilers, and the new boiler shop reflects this upgrade. UIW erected an expanded boiler shop on the north side of 20th Street, closer to the outfitting piers. This brick building, designed to match the original 1880-era buildings, contained a flange shop, boiler shop and coal shed.[13] One wall of this building remains as the southern elevation of Building 105. The Thorneycroft boiler shop and storage buildings were all located to the east along 20th Street. A steel forge stood to the northeast.[14]

[12] Hopkins et al., *Report on Shipping*.
[13] Sanborn Map Company, San Francisco, Vol. 5 (1899), sheet 544.
[14] This building was dedicated to bending, grinding and sawing off Thornycroft boiler tubes and other tubes for ship water boilers. "Union Iron Works, San Francisco," *Marine Review*, February 7, 1901, pp. 6-9.

Expanded facilities at the shipyard allowed for larger hulls and for UIW to construct multiple hulls concurrently. By the turn of the century, the yard contained seven slips fitted with truss structures for overhead cranes (Figure 8). The introduction of cranes at the slips significantly eased the construction of the hull and allowed ship designers to use larger steel plates and frames. Slips 5 and 6 were the largest slips on site at 480-feet long and approximately 80-feet wide. Slips 1 through 4 were approximately 300-feet in length and varied in width.[15] Narrow buildings containing a bolt shed, tool chest shed, and tin shop stood on piers between slips. Directly to the east of the slips was the warship completing berth and three more wet basins.

Ship repair facilities also increased to allow for larger ships and reflected the yard's expanding role as a needed ship repair facility on the West Coast. A hydraulic dry dock, an engineering feat at the time, was located at the northeast end of the yard (approximately at the location of the present-day wharf 3) along with the shipyard's repair shops; none of these remain. Several narrow support buildings (e.g. calkers, tool shop, dry dock storage, rigger, and W.C.) stood near the dry dock on the wharf.[16] A dry dock engine and pump house (in a slightly different location than shown on the 1887 general plan) stood at the head of the dock and supplied the power for the shipyard.[17]

Little construction associated with UIW occurred south of 20th Street during the late nineteenth century. Sheds and outbuildings were added near the Pattern Shop and behind the Machine Shop. To accommodate the introduction of electric-powered tools in the machine shop, the engine house was slightly expanded and reconfigured. During the 1890s, UIW switched to electric cranes, ensuring that it remained a technological leader in the industry.[18] Reliance on cranes thereafter continued to increase at UIW and at shipyards around the country. By 1901, UIW had installed 35 cranes across the site, including cranes in the machine shop, brass foundry, iron foundry, erecting shop, boiler shop, and blacksmith shop.[19] The bridge cranes extant in Building 113 date to this period.

Infrastructural Improvements
A boiler and engine house and coal storage building, no longer extant, were built during this period to provide electricity to the northern portion of the yard.

By the turn of the century UIW installed an expanded rail system with overlapping lines and branches connected most buildings at the yard. A Southern Pacific Rail Road line extended down 20th Street and into the adjacent Risdon Iron and Locomotive Works, located at the former Pacific Rolling Mills site.[20] More than one line ran along Georgia Street, with the rail lines fanning out just north of 20th Street. One line ran northeast, extending onto the wharf between the dry dock and warship berth, and continued to make a circle in front of the slips. Another ran northwest and exited the UIW at the northwest corner to continue along Illinois Street.

[15] Ibid.
[16] Sanborn Insurance Company Map, San Francisco, Vol. 5 (1899), sheet 541.
[17] W. W. Hanscom, "Electricity in the Union Works," *The Journal of Electricity, Power and Gas*, XI (1901), 112.
[18] "Shipbuilding Plant of the Union Iron Works at San Francisco," *Marine Engineering* (1900), 14.
[19] Hanscom, "Electricity," 112.
[20] Sanborn (1899), sheets 541, 543.

A twelve-foot high picket fence surrounded the northern portion of the UIW, separating the shipyard from the saloons and residences at the corners of 20th and Illinois streets. Lumber storage and a corral lay near Illinois Street, marking the northwestern corner of the yard. A small gate house stood at the corner of 20th and Georgia streets. By the turn of the century, Irish Hill continued to be graded toward the south and was used to fill the inlet around 20th Street, replacing the bridge access to the site.

Risdon Iron and Locomotive Works
The Risdon Iron and Locomotive Works erected a shipyard on the Pacific Rolling Mills property to the southwest of UIW in 1901. Risdon removed all of the earlier Pacific Rolling Mills' buildings and replaced them with steel clad structures with monitor roofs. Building 21 was built during this first stage of redevelopment of the southeastern portion of the Union Iron Works/Bethlehem Steel Shipyard and is the only remaining Risdon building.

UIW and Bethlehem Steel before World War I

During the 1910s, the yard continued its expansion. This included the transformation of 20th Street into a grand entrance and the construction of a new administration building in 1917 at the corner of 20th and Illinois Streets. The yard also upgraded and expanded its plate shop, foundries, dry dock facilities, and electrical infrastructure both before and during WWI. Similar to the 1890s upgrades to the site, this wave of new development upgraded or replaced existing facilities and kept the yard competitive for WWI naval contracts, but it did not transform the basic process of steel hull ship construction from the 1880s.

Development along 20th Street
The houses and saloons along Illinois Street near 20th Street were razed and the fence dividing the site from these buildings was removed by 1914. Also, by the start of WWI, the corral and storage area along Illinois Street, north of 20th Street, was no longer in use and this area was mainly vacant. The removal of the corral likely marks the end of animal-powered material movement at the yard.

One of the more noticeable changes during WWI was the construction of a Renaissance Revival style administration building (Building 101), designed by Fredrick H. Meyer in 1917. Dominating the corner of 20th and Illinois streets, this building extended the presence of the yard to 20th and Illinois Streets and created a row of architect-designed buildings along 20th Street, altering the entrance to the yard (Figures 10 and 11). A new fence, which is still extant, was installed in 1917along both 20th and Illinois Streets abutting the new office building and marking the expansion of the northern portion of the yard to the northwest corner of 20th and Illinois streets. Double guardhouses stood on the north side of 20th Street marking the entrance to the northern portion of the shipyard.

In 1912, a new powerhouse (Building 102), fronting on 20th Street, supplied power, including a.c., d.c., hydraulic, and compressed air for pneumatics, to the entire UIW yard.[21] The new powerhouse, with its increased supply of electric power, allowed for widespread use of independent motorized tools, removing the earlier limitations of belt driven tools. The infrastructural upgrades associated with the new powerhouse also resulted in new underground power trenches across the yard that increased power access and reflected the

[21] H. P. Pitts, "Union Iron Works at San Francisco," *Pacific Service Magazine* (June 1916), 2-10.

increased use of mechanization by the yard's laborers. Designed by Charles Peter Weeks, this building also graces 20th Street and contributes to the district's historic core.

Plate Shop and Waterfront Structure Upgrades
The early twentieth century at the yard was marked by further transformation of the waterfront and the area north of 20th Street (Figure 9). Building 109 replaced the earlier plate shop at the head of the slipways. A large crane ran along the south side of Building 109 and the open area surrounding it was used for hull plate storage. Many of the earlier wood buildings adjoining the plate shop, mainly smith shops, were also gone by the mid-1910s. More flange shops were erected while the plate shop bending floor and the plate racks from the turn of the century were also moved and expanded nearby.

The expansion of slips and dry docks to the east into the bay also occurred during the first two decades of the twentieth century (Figure 10). The hydraulic dry dock was badly damaged in the 1906 earthquake and was replaced by two floating dry docks. Bethlehem's Union Iron Works Company installed more wharves, which extended the yard further east into the bay. The northeast slips were rebuilt prior to WWI in 1915. Several small offices dotted the site by 1914.[22] In 1915, a pipe and copper shop replaced the earlier power station near the head of Pier 2. [23]

Piers 1, 4, and 6 were built during WWI and Piers 2 and 3 were rebuilt from the original mid-1880s construction. Two slips with trestles and overhead cranes were added to the yard, running at a diagonal to the slips and piers, in roughly the same location as Slip 4 today, to accommodate longer ships.

Machine and Metal Shop Upgrades
A consolidation of metal shops occurred during this period, as the auxiliary foundries and blacksmith shop that had moved near the waterfront were centralized near 20th Street. A blacksmith shop moved to a rear extension of the boiler and flange shops fronting on 20th Street. The bolt and riveting shop, located near the plate shop and the slipways at the turn of the century, moved to the south side of 20th Street, near the machine shop (Building 113). In 1914 a connector building joined the two halves of Building 113 into a single structure.

During WWI several of the original UIW buildings south of the 20th Street were demolished. A single brass foundry building (Building 115) replaced the smaller buildings, including the earlier brass foundry, an open area between the machine shop and the foundry building. A new foundry building (Building 116) also replaced the earlier 1880s foundry building. Both buildings are still extant and display a strong industrial modernist aesthetic (Buildings 115 and 116). This is one of many cases where similar functions continue in the same location even though a new generation of buildings replaced the original structures. North of 20th Street, UIW constructed a brick warehouse (Building 111) in 1917.

The Risdon Yard
Another wave of development occurred to the east of the UIW. The United States Steel Products Company, who acquired the works, repurposed the 1900-era Risdon Iron and Locomotive Works buildings (following

[22] Sanborn Insurance Company Map, San Francisco, Vol. 6 (1914), sheets 591-592.
[23] Sanborn Insurance Company Map, Vol. 6 (1914), sheets 591-592

that company's shutdown in 1911) as mainly warehouses and storage buildings during the early 1910s (Figure 9). This property also contained a turn of the century machine shop and transformer house (Building 21), which is the only Risdon building in the Union Iron Works/Bethlehem Steel Shipyard. In the line of Maryland Street, the houses of the Irish Hill neighborhood disappeared with the grading of the hill, and rail lines ran where the 75-foot bluff stood 15 years earlier. A small wharf marked the eastern edge of the property.

During WWI, the Union Iron Works Company operated a destroyer plant, known as the Risdon Yard, at the former Risdon Iron and Locomotive Works' site. New building slips were erected at the southeastern edge of this property, and a warehouse was modified to house a new plate shop. The slips for the plant were underneath a single steel-framed roof at the eastern end along the bay (Figure 13). Enclosing the slips was a time-saving technique pioneered at the turn of the century and utilized by the WWI prefabrication yards (see criterion A discussion).

Circulation Systems
By the end of WWI the rail lines at UIW were simplified. Only a single rail line ran through the new connector building of Building 113 (earlier discussed as Georgia Street) and crossed 20th Street. Instead of fanning out into several rail lines, a rail loop is seen north of 20th Street connecting the buildings south of 20th Street with the plate shop and slips. This line also functioned to move goods and materials into the yard and is still visible today. Rail lines also connected the new building slips and plate shop at the destroyer plant with the rest of the yard, and several rail spurs directly connected this new development to the older wharves.

Between the Wars

Little modification occurred to the Union Iron Works/Bethlehem Steel Shipyard between the end of the war and a wave of modernization that started in 1936, as seen on the 1936 Sanborn map (Figure 12). The 1936 modernization included the construction and demolition of several buildings, modernization of the foundries and shops, and upgrades in power and infrastructure.

Building Construction and Upgrades
A new steam powerhouse (Building 103) was built in 1938, which still stands effectively at the end of 20th Street. The word "Bethlehem" was painted on its smoke stack. This building represents a yard-wide infrastructural shift back to internally generated power generation. The most drastic change to the north side of 20th Street was the removal of the four-story boiler shop that fronted 20th Street since the turn of the century and its replacement by a new forge shop (Building 105). The south brick wall fronting on 20th Street still remains from the earlier building. Other construction included new buildings for painters and riggers along the slipways, and worker facilities across the yard. A steel warehouse (Building 117) was built between 1936 and 1938.[24] Irish Hill was further demolished to make way for increased development to the south. Building 117 marked the southwestern edge of the site and extended the rough footprint of the original 1883 UIW site southward for the first time.

Infrastructure Upgrades

[24] Sanborn Insurance Company Map, Vol. 6 (1936), sheet 594; Ibid., 26.

A new utility trench was dug to move fuel, electricity, water, and air to the different buildings, cranes, and slips around the site. Movable steel panels were used to cover the trench, allowing for easy maintenance access.[25] The steel plates and trench are still visible today, particularly near Buildings 21 and 11. Along with this transformation, Bethlehem undertook a general upgrade of the yard's utilities and modernization of shops machinery. New Holophane Prismatic Refractor light fixtures were also installed across the site at this time and still hang in most of the buildings.[26]

World War II

A general expansion of the shipyard occurred during the start of WWII. It included both infill development and further construction and expansion of slips and wet basins along the waterfront (Figure 13). Much of this development was designed, owned, and paid for by the U. S. Navy. The most substantial development was the expansion of the southeastern slips and construction of the New Yard, also known as the Building 12 Complex. The yard also saw increased specialization of buildings during this period, specifically buildings for outfitting and ship repair.

The New Yard

The New Yard consisted of four slipways, a plate shop, machine shop, warehouse, layout yard, welding platforms, and many smaller support buildings (Figure 13). The shift toward welding required welding platforms and layout areas around the slips. The slips for this WWII-era New Yard were completed in 1941, replacing the WWI-era destroyer yard slips and associated plate shop. Building 2 replaced a warehouse dating to the Risdon period.

WWII Changes in Shipbuilding at the New Yard

The New Yard optimized its layout for pre-assembly and for welding, following the "turning flow" design. Since the beginning of steel shipbuilding, the shipyards' goal was to keep parts moving forward, from the arrival of raw materials through the final assembly of vessels. By WWII using a linear or straight flow of materials was optimal and a straight-line flow was a noted accomplishment of the new WWII yards. Shipyards with limited space, however, often implemented the turning flow design. Instead of the optimal strictly linear movement from the storage areas to the slipways, the turning flow design allowed for materials to enter the yard parallel to the shoreline, move through the shops in a straight line, and then turn to be assembled on the shipways (Figure 14).

At the New Yard the working plans for a ship were drafted in the administration office (Building 101) or the naval office (Building 104). Plans were laid down in the mold loft and templates were made and moved downstairs to the plate shop. Following the typical turning flow process, raw steel entered by rail at the top end of the yard and was held in storage yards to the west of the plate shop (Building 12) until needed. The steel was then formed in the plate shop and, when required, joined into sub-assemblies. Cranes carried the sub-assemblies to the welding platforms where the parts were joined into even larger sections, such as deck

[25] "Bethlehem Reconditions Potrero Works of Union Plant," *Pacific Marine Review*, Vol. 35 (1938), 23.
[26] Ibid., 24.

houses, and bow and stern assemblies.[27] Completed subassemblies were then moved by cranes to the slipways. At the New Yard, preassembly was also completed on welding platforms adjacent to the slips. When the hull was complete it was launched and moved to outfitting piers.

During WWII, specialized engineering and outfitting buildings were constructed or repurposed between the New Yard and the outfitting wharves. These buildings corresponded with specific outfitting and engineering divisions, including pipe, rigging, electrical, carpenters and joiners, sheet metal and paint shops. The majority of engine and boiler work remained at Buildings 113-116 and Building 105. Material was moved by rail and cranes from these buildings to the outfitting wharves and installed in the hulls.

Building Construction at UIW
Building 6, the approximately 500-foot long light warehouse, was erected along the shoreline during WWII expansion. Its angled placement is a defining feature of the yard's layout (Figure 15). New bay fill between Building 6 and the New Yard supported the expansion of the wharves and wet basins.

Construction also occurred along the waterfront in the northern portion of the yard. Slip 4 was built at a diagonal allowing for expanded length and width. Wet basins 6 and 7, along with wharves 7 and 8, were added to the yard, and basins 4 and 5, along with wharves 4, 5, and 6, were altered and expanded from their WWI-era construction and configuration.

To increase the flexibility of power distribution, the yard management constructed substation buildings, and existing buildings were modified to house substations, as occurred at Building 11. Support buildings and workers' facilities increased across the yard during WWII, including locker rooms, kitchens, and washrooms. Many of these small buildings stood on or near the newly erected piers.

Circulation Developments
During WWII, two separately owned, and possibly separately operated, rail lines existed at the shipyard: the Bethlehem Steel line and the U. S. Navy line. A Southern Pacific rail line ran along the site on Illinois Street and entered the yard along 20th Street. The U. S. Navy rail line, based on a 1945 plan, connected the Building 12 Complex to the newer slips and wet basins.[28] This rail system also connected the new wet basins and slips to the large light warehouse (Building 6) and other newly constructed warehouses and shops at the eastern edge of the site. The Bethlehem rail line, still following the general loop around the site established by the end of WWI, extended down each of the northern wharves. Several rail spurs surrounded Slip 4.

Current Conditions and Character-Defining Features

World War II represented the maximum build-out of the district. Since 1945, few new buildings have been added to the yard and primary buildings from all periods of growth and modernization remain. Two areas in the Union Iron Works/Bethlehem Steel Shipyard contain the majority of modification since 1945: the waterfront features and the removal of a row of buildings near Building 6 (Figure 16).

[27] Carey & Co., "Seawall Lot 349 at Pier 70, Building 12 Complex San Francisco Electrical Reliability Power Project Setting Analysis," (2003), 9.
[28] Plans of The San Francisco Yard, Bethlehem Steel Company, Shipbuilding Division 1944-1945, Sheet 1.

Continued use of the Pier 68 area as a dry dock and ship repair facility has resulted in the rebuilding or decay of the wharves from 1945 or earlier. The piers, wharves, and wet basins of both Piers 68 and 70 have also seen extensive modification since 1945. Pier 68 has been reconfigured and the majority of Pier 70 is collapsing into the bay. The continual rebuilding and rearranging of wharves and wet basins also resulted in the loss of earlier support structures on or near the waterfront. Remaining auxiliary buildings include Building 64 and Buildings 68 and 137 on Pier 68. During rebuilding, wharves often needed to remain in use, so new structures were built alongside the existing ones.

Both the New Yard slips and the northern slips, except for Slip No. 4, were filled in and paved over after 1945; however, the slips' ends are still visible along the northern and eastern shoreline, indicating that subsurface portions may also be intact. Besides the cranes at Slip No. 4, all of the auxiliary structures and cranes associated with the slips have either been destroyed or moved. While these features have lost their integrity of design, materials, workmanship, and feeling, they are also essential components that contribute to the integrity of setting and design of the district. They may also (see Section 8, Integrity section).

After the end of the WWII a strip of land between Building 6 and the Building 12 complex was impacted by the loss of resources. These resources included buildings that supported ship outfitting at Piers 6 through 8. The following buildings were removed from this area after the period of significance; all but the first two date to the WWII expansion:[29]

- Building 4 – Sheet metal shop (built in 1900 with WWI and WWII additions)
- Building 5 – Copper Shop (built in 1900 with WWI and WWII additions)
- Building 7 – light warehouse
- Building 8 – Riggers, carp, and painters shop,
- Building 9 – Pipe Shop No. 2,
- Building 10 – Pipe Rack and Locker Room
- Building 22 – washroom
- Building 56 – Sheet Metal Shop,
- Building 57 – Central Kitchen,
- Building 61 – scale house

The buildings along 20th Street and south of Building 113/114 all date to the period of significance and form the historic core of the district. The buildings (Buildings 113, 101, 102, 103, 104, and wall of 105) along 20th Street functioned to create a promenade and entrance to the yard and, as a group, defined its character. The fencing installed during WWI along Illinois and 20th Streets is still mainly intact and the entrance to the shipyard has remained at the same location since the 1890s.The buildings of the New Yard, also known as the Building 12 Complex, are largely intact and exhibit little modification. The buildings north of 20th Street, associated with ship building and ship repair at Slips 1-4 and Pier 68, have also seen little modification since WWII. The most notable modification is the removal of the large gantry cranes associated with Building 12 and Building 109.

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[29] This list is based on a comparison between the Bethlehem Steel Co. Plan 1945 and a current aerial photo. Building numbers and uses are also based on that plan. See Figure 16 for a map of demolished and extant buildings.

The density of this urban industrial center and the variation in materials, styles, rooflines, cranes, chimneys, and waterfront features convey the historic evolution of the yard and distinguish it from other shipyard and industrial sites built or heavily remodeled during a single period. The district currently contains unreinforced masonry, wood, concrete, and sheet metal clad buildings that are a record of the evolution of UIW. While several of the multi-story buildings erected within the district during the period of the significance are no longer extant, Building 2 and Building 111, both over 60-feet tall, convey the variation in building height seen at the yard since its inception. The use of multi-lite windows is another character-defining feature of the district and the prevalence of bands of windows, often with central or asymmetrical ventilators laid out in distinct patterns, is a feature of the post-1936 buildings.

Other character-defining features are buildings that create visual landmarks by their prominence and size. Since the 1930s, Building 103 and its large smokestack have dominated the view of the site from its entrance at 20th Street and have defined the end of 20th Street. The 512-foot long Building 6, set at an angle diagonal to the waterfront, counters the otherwise rectilinear district plan, expresses the scale of the materials used at the yard, demonstrates the historic interaction between materials and the water, and distinguishes this yard from others by its angled placement.

The curved pathways conforming to the turning radius of trains, the lack of a gridiron street plan, and the absence of landscaping or prominent curbs and gutters are all character-defining aspects of the Union Iron Works/Bethlehem Steel Shipyard that convey its history as a ship yard and its industrial nature. The use of trains and cranes to move materials was essential to the shipbuilding process and played a significant role in defining the design and layout of the site. The visibility of rail lines and the persistence of historic open areas that contained rail junctions, construction and storage yards, or gantry cranes help to convey the historical use of the Union Iron Works/Bethlehem Steel Shipyard. The car storage lot to the west of Building 12 was a plate storage yard during WWII and open areas to the east of the Building 12 complex were welding platforms and slipways. Similarly, open spaces around Building 109 were plate storage yards, to the south, and slipways, to the north, since the late nineteenth century.

Regardless of the changes at the yard, the Union Iron Works/Bethlehem Steel Shipyard contains 45 contributing buildings, structures and objects (Figure 17). The district includes examples from all periods of construction and expansion from the opening of the yard in the early 1880s to the end of WWII. Furthermore, the buildings that remain are those central and integral to the shipbuilding process, particularly the plate shops and mold lofts, Buildings 12 and 109.

Resource Descriptions

All resources within the Union Iron Works/Bethlehem Steel Shipyard District are described in the following section. Resources are organized first by contributing and non-contributing status, and then by resource type, starting with buildings. The buildings are organized by Bethlehem's building number system, in place by WWII, and adhered to by all previous surveys of the district. The building number is followed by the resource's name during WWII in parenthesis and a figure number reference (see the "Figures" section).

Building number references are those which appear in the Bethlehem Steel Company General Plan of 1944. In some cases, additions to existing buildings are given separate building numbers. This is especially true where the addition has a distinct use.

Contributing Resources

Building 2 (Warehouse No. 2)
Figure 18

Physical Description

Building 2 stands east of the complex created by Buildings 113/114, 115/116 and 117, and, together with Building 14, forms a courtyard. This complex stands on the site formerly occupied by a portion of Irish Hill. The architect and builder of this industrial-vernacular building are unknown, but it was likely designed and built by government personnel as part of the joint WWII effort.

This six-story, board-formed concrete warehouse, constructed in 1941 and 1944, is rectangular in plan with a flat roof. The building measures 256' long, 76'-9" wide and 79'-6" high. It contains a total of 98,804 square-feet and is one of the tallest extant buildings at the site. It runs north-south, with one loading door at the north façade and three at the north end of the west façade. Also on the north façade is a personnel entrance protected by a flat awning and accessed by three stairs. The windows are steel, multi-pane fixed sash and most contain operable, four-lite, central vent sashes. The top floor, dating to 1944, has wood sash windows, otherwise matching the design of the steel sash on the lower floors. An elevator and stair tower projects slightly from the west façade. Painted signage on the building's north end designates this as "Warehouse 2." Other signs have been added as the function has evolved. Some original light fixtures remain on the west façade, above the paired loading dock doors.

On the interior, as on the exterior, concrete is the primary building material. The walls and ceiling of each floor are of board formed concrete and the floor is exposed concrete slab, except for the sixth floor, which has wood boards over the original concrete roof slab. Columns on a 20' grid divide the interior into bays; those on floors one through four are round with flared capitals, while those on floors five and six are square. Except for the columns, each level consists primarily of open space for storage. The large freight elevator and stairwell stand along the west wall, near the north end.

Historic/Current Use

Building 2, constructed for WWII, originally functioned as a warehouse to support hull construction at the Building 12 Complex and outfitting. The sixth floor contained a drafting room, and offices were located on the first and second floors. A bridge connects the fourth floor to the mold loft in Building 12, to the south.

This building is currently used for commercial storage. Building 2 is one of two multi-story warehouses extant on the site, along with Building 111.

Integrity
Building 2 has experienced few alterations since its construction, except for the addition of the sixth floor in 1944, within the period of significance for the district. Therefore, the building retains a high degree of integrity, and is a contributing resource because of its associations with World War II shipbuilding. Also, it is one of the few concrete buildings from the WWII period and adds to the diversity of materials used at the district.

Building 6 (Light Warehouse No. 6)
Figure 19

Physical Description
Light Warehouse No. 6 stands at an angle along the waterfront between Pier 70 and Pier 60. Built on vacant land and tidal flats, it was associated with several smaller and now demolished sheds. A BAE Systems materials layout and storage yard now surrounds the building to the east and south. Built in 1941, the architect/engineer and builder are unknown, but this structure was likely designed and built by government personnel as part of the WWII effort.

This is a 512' long, 72' wide, 52' tall, industrial-vernacular, pile-supported rectangular steel warehouse which occupies 37,128 square-feet. It has corrugated metal siding and a gable roof. The axis is generally north-south with a large rolling metal door on both north and south elevations. A continuous band of steel sash windows glaze the north and south elevations; most lites are broken. A loading dock covered by a corrugated metal awning spans the entire western façade; metal loading doors have 16-lite steel sash windows. A band of 25-lite continuous, fixed steel sash windows with operable central ventilators runs above the awning. Located below the eaves is a second band of 15-lite fixed, steel sash windows also with operable ventilators. The eastern elevation has similar glazing, but the lack of loading doors allows for the lower band to consist of larger 30-lite windows. A metal ladder ascends to a roof-level platform at the southwest corner of the building.

The interior is an immense and completely open long rectangular space. The gable roof is supported by Fink trusses with king posts on exposed steel I-beams. East and west walls show steel cross and diagonal bracing. The openness of the space is accentuated by the lack of interior support columns. Crane tracks extend along both the east and west sides but the bridge cranes are missing. The ceiling and walls consist of the inside surfaces of the exterior cladding. The floor is concrete. The west elevation has 17 bays with hanging metal freight doors leading to the exterior concrete loading platform. The north and south ends have vehicular metal roll-up doors and interior loading docks. A rail spur ends at the northern loading dock. A small wood platform stands in the northwest corner. Graffiti covers much of the interior. Empty electrical panels hang on the western wall. Several pendant light fixtures and reflectors remain.

Historic/Current Use
This building originally functioned as a warehouse for storing outfitting materials used to outfit ships in the outfitting docks off of both Pier 68 and Pier 70. Building 6 is currently vacant.

Integrity
The building retains a high degree of integrity as it is has experienced few alterations It is a contributor historic district for its association with WWII steel shipbuilding. It is also a representative example of industrial architecture from WWII. The massing and angled footprint of Building 6 is also a character-defining feature of the overall yard design.

Building 11 (Tool Room and Office/Noonan Building)
Figure 20

Physical Description
Building 11 stands just east of Building 21and west of a paved parking lot, accessed by a road to the north. The infilled Slips 5-8 are to the southeast, and the Building 12 complex is to the southwest. Located on the site of the Pacific Rolling Mills sheet and tin plate warehouse, Building 11 was built in 1941 by the Navy as part of the New Yard to aid in production related to World War II.[30]

This three-story, rectangular wood frame structure is 156' long by 72' wide by 38' high, and contains a total of 32,664 square-feet. It has a flat tar and gravel roof, and is clad with horizontal wood siding. Two stair towers project one story above the roof. Windows are wood double-hung with simple wood surrounds, and are often paired. Exterior open staircases at the west and north elevations lead to small landings and doors at the second-story. Doors include single metal units at each elevation, a wood freight door centered in the east elevation, and a sliding metal door at the north.

The interior currently includes artist studios and office space. First floor spaces open directly to the exterior, without internal circulation. Exterior stairs access the second floor double-loaded corridor, while interior winding stairs connect the second and third floors. Corridors feature resilient sheet flooring, plaster walls, glue-up acoustical tile ceilings, simple wood door and window trim, and wood baseboards. Office doors at the second level are glazed, with a central, large rectangular lite. Third floor corridors are similar to the second, but walls are finished with vertical tongue and groove wood paneling and topped with a grid-like transom. Wood paneled office doors at this level are glazed with frosted glass. At least one space retains original light fixtures, and a large safe with a hand-painted door is located on the third level as well.

Historic/Current Use
Building 11 provided support for hull construction at the Building 12 Complex. The first floor originally contained a tool room, temporary lights department, and burner department, as well as three small offices. The two upper floors were devoted to office space.[31] Interior signage indicates that the offices were used by

[30] Tim Kelley, "Building, Structure, and Object Record," Central Waterfront Survey Advisory Committee, 2001.
[31] Bethlehem Steel Co. Plan 1945, Sheet 23.

the Navy. The building contained a cafeteria as well.[32] Currently, artist studios and offices occupy the building.

Integrity
While the building has sustained minor alterations, mostly on the interior related to change of use, it maintains a high degree of integrity of location, setting, feeling and association; and a good degree of integrity of design, materials and workmanship. Therefore, it is a contributing resource for its association with WWII.

Building 12 (Plate Shop No. 2)
Figure 21

Physical Description
Building 12 stands at the south end of the site, part of a complex of related buildings. The Building 12 Complex, comprising Buildings 12, 15, 16, 25, 32, and 66, was constructed mainly in 1941 as the central building of the New Yard. The building was designed and built by government (Navy) personnel as part of the joint WWII public-private shipbuilding effort.

Building 12 measures 248’-2” x 242’-2” in plan by 59’-6” tall, and contains a total of 118,890 square-feet spread across two floors. Construction is steel and wood with corrugated steel cladding. The roofline is an Aiken configuration, with five raised, glazed monitors running east-west for the width of the building. Clerestory multi-lite steel sash awning windows extend the length of the monitors on the north and south sides. The central monitor measures twice the width of the others. Twelve vertical bays divide the east and west elevations into 24’ sections. Three bands of multi-lite steel sash awning windows, with a double-height bottom band, line the north and east elevations. Below the topmost band of windows, the south elevation directly connects to Building 15. Four bands of multi-lite steel sash awning windows run the length of the east elevation and the top band on all four sides provides light into the Mold Loft. A shallow ridge runs north-south along the center of the building, over the monitors, and the roof gently slopes at ¼” per foot to the east and west.[33] The west elevation has three vehicle roll-up doors, while the north has two.

On the ground floor two rows of columns running north-south divide the interior into three bays. Exposed square Howe trusses support the second floor 38’ 4” above the ground. Lighting consists of standard factory lights with glass reflectors. On the north end of the building two steel staircases with concrete treads provide access to the upper level. Asphalt paves the ground floor.

The 360 degree band of windows and the clerestory monitor windows give the second story Mold Loft superlative light qualities. The Mold Loft has a wood plank floor, and wood cladding lines the walls up to window height. The ground floor columns penetrate through the Mold Loft floor to divide the space into three separate bays, with 9’ 7” ceilings that rise to 17’ 4”’ in the monitors. Industrial light fixtures similar to those on the first floor provide additional illumination. Two personnel doors open onto the roof of Building 15 on

[32] Kelley, “Building, Structure and Object Record.”
[33] Bethlehem Steel Co. Plan 1945, Sheet 54.

the south elevation, and on the north elevation an enclosed walkway connects to Building 2. A dumbwaiter shaft opens near the walkway. In the northeast corner, partitions enclose an office, game room, and bathroom.

Historic/Current Use
Building 12 housed the plate shop and mold loft for the Building 12 Complex and was central to hull construction at Slips 5-8, see statement of significance Section 8. The building was constructed on newly leveled ground where Irish Hill once stood. It was one of a number of structures constructed for the large enterprise of ship building specifically for World War II. In the process of producing a ship from blueprint to hull, the construction plans were first transferred to a life-size model in the Mold Loft. This pattern was then taken to the mold makers who made a template out of wood, used for the guidance of marking the steel plates. Steel plates were stored in the adjacent yard to the west. The marked plates were then cut and shaped into the desired hull shapes. The finished plates were then transferred to the adjacent Layout Yard (Building 15) where the plates were checked against the molds and plans before welding.[34] The plates were moved from the yard to Building 12 and from Building 15 to the welding platforms and slips via U. S. Navy-owned rail lines. A rail line connecting Building 12 to the rest of the shipyard also ran next to Building 2. Building 12 stood adjacent to Machine Shop 2 (now demolished) and Layout Yard (Building 15) as the center of this WWII-era complex. Welding platforms adjoined these buildings to the south linking the complex with Slips 5 through 8. The building is currently used for impounded vehicle storage by Auto Return, the City's towing contractor.

Integrity
Building 12, Plate Shop No. 2, has experienced few alterations and retains integrity of location, design, setting, materials, workmanship, feeling, and association. The main alteration to the building is the removal of machinery and equipment from the first floor. Building 12 contributes to the Union Iron Works/Bethlehem Steel Shipyard because of its association with the WWII shipbuilding historic context. It is also a representative example of industrial architecture from WWII. It forms the core of the Building 12 Complex, which also includes Buildings 15, 16, 25, 32, and 66.

Building 14 (Heavy Warehouse)
Figure 22

Physical Description
Building 14, the Heavy Warehouse, stands east of the complex created by Buildings 113/114, 115/116 and 117, and together with Building 2, forms a courtyard. The architect/engineer and builder of this 1941 industrial-vernacular building are unknown, but it was likely designed and built by government personnel as part of the joint WWII effort.

Building 14 is a double-gable metal structure measuring 140' x 116'-6" in plan by 66" tall, containing 15,969 square-feet. Corrugated galvanized iron siding clads the structure. Two tiers of ribbon windows punctuate both the north and south facades; the west façade has one window in each bay. One window remains in the east facade (north bay); modifications to the south bay resulted in the removal of the other window. A large, rolling metal door and adjacent personnel entrance penetrate the south elevation, near a faded "Warehouse

[34] San Francisco Planning Department, 2001.

14" sign painted on the exterior. Two additional loading doors are on the east façade, one in each gabled section.

The interior forms a single space. Walls are corrugated metal, and the floor is asphalt. A central row of steel I-shaped columns supports the double gable roof. Modified Pratt trusses form the roof structure. A 20-ton crane with cab runs along the south side. Eight wall-mounted heaters attach to the walls on the interior, four on the south wall and four on the north.

Historic/Current Use
Building 14 historically functioned as a Heavy Warehouse where equipment was stored for work on heavy machinery in Machine Shop 1 and for outfitting ships with mechanical and propulsion systems. A U. S. Navy-owned rail line transported materials from the warehouse to Slips 5-8. The building is currently used for storage by the Port's maintenance division.

Integrity
The building retains a high degree of integrity as has experienced few alterations. Building 14 is district contributor for its association with the WWII shipbuilding context.

Building 15 (Layout Yard)
Figure 23

Physical Description
Building 15 stands at the south end of the site and is part of the Building 12 Complex. The group, including Buildings 12, 15, 16, 25, 32, and 66, was constructed in 1941 – 1944 specifically for WWII. The architect/engineer and builder are unknown, but the building was likely designed and built by government personnel as part of the joint WWII effort.

This east-west oriented warehouse stands immediately adjacent to Building 12 and measures approximately 242' 8" x 71' 7", with an interior area of 17,134 square-feet. A fink truss with a kingpost supports the gabled roof, with the peak approximately 53' off the ground. Nine columns along the interior walls subdivide the space into eight distinct bays. The gabled roof covers the seven eastern bays; a flat roof of wood joists and decking covers the eighth, westernmost bay. A steel staircase on the south exterior wall leads to the flat roof, and a personnel platform on the roof rises slightly above the steel parapet.

Part of the Building 12 Complex constructed specifically for WWII, Building 15 attaches to four other buildings, three to the south (Buildings 32, 25, and 16) and one to the north (Building 12), leaving only the eastern and western ends exposed. On the interior, no significant walls or partitions separate Building 15 from Buildings 12 or 32, creating a unified interior space between the three buildings, although at the northeast corner of Building 15 a corrugated steel wall with multi-lite steel sash windows partially divides the easternmost bay from Building 12. The southern interior wall features a cut-out through the corrugated steel that reveals the exterior north elevation of Building 25. Short wood planking serves as a roof over the approximately one foot gap between the two buildings. Two wood personnel doors on either side of the Building 25 cut-out provided access between the two buildings. Where Building 16 and Building 15 meet, newer corrugated steel covers the wall and non-corrugated steel panels cover the wall at ground level. Standard industrial light fixtures, apparently original, remain.

On the exterior, the upper portion of the western façade features a corrugated steel parapet above a continuous band of multi-lite, steel sash pivot windows spanning the entire façade width. A similar band of windows glazes the ground level, interrupted by a large vehicle door in the central bay. Most of the southern elevation attaches to smaller buildings, but the western end of this elevation features a band of multi-lite windows above a vehicle door large enough for rail cars. The eastern elevation includes a band of multi-lite steel sash pivot windows at the upper level, and a roll-up steel door at the ground level. All of the northern façade attaches to Building 12.

Historic/Current Use
The Layout Yard served as an intermediate staging area for the steel plates of a vessel's hull used for hull construction in Slips 5-8. As the plates left the Plate Shop (Building 12) adjacent to the north, they were arranged, numbered, and checked against the molds and plans. This process assured that the welders had the correct panels lined up for welding. This occurred on either one of the welding platforms, if preassembled, or directly on the hull of the ship in one of the slips adjacent to the east. U. S. Navy-owned rail lines transported the steel plates to the welding platforms and slipways of the New Yard.

The personnel platform and stairs leading up to the flat roof on the western edge of the building indicate a potential use as a viewing platform to oversee activities in the plate storage yard to the west. The lots, now used by the Auto Return Company as a vehicle impound yard and storage area for hundreds of cars, sit on the eastern side of the Irish Hill remains. Today, the building is largely unused, with the exception of limited industrial storage.

Integrity
Building 15 contributes to the Union Iron Works/Bethlehem Steel Shipyard because of its association with the WWII steel shipbuilding effort undertaken at the New Yard. Building 15, the Layout Yard, has experienced few alterations and retains integrity of location, design, setting, materials, workmanship, feeling, and association.

Building 16 (Stress Relieving Building)
Figure 24

Physical Description
Building 16, located at the south end of the site, is part of the Building 12 complex, comprised of Buildings 12, 15, 16, 25, 32, and 66. It was constructed in 1941 specifically for the WWII effort. The architect and builder are unknown, but it was designed and built by government personnel as part of the joint WWII effort.

This two-story gabled warehouse measures 50'-10" by 152'-2" in plan and 45'7" in height. It contains a total of 7,588 square-feet, and corrugated steel panels cover the steel frame. Five prominent vents run along the gable ridge. The upper portion of all exposed facades features a band of multi-lite, steel sash awning windows with operable vents near the top of the building. The eastern façade (which currently faces an Auto-Return parking lot) has five bays and two roll-up steel doors that interrupt a lower band of windows. The southern façade, divided into three bays, is almost entirely covered with steel sash windows, and has a single steel personnel door. The western façade, visible from a courtyard formed by neighboring Buildings 15 and 32, reveals more multi-lite, steel sash windows and two metal personnel doors with windows.

The interior consists of one open bay, with a concrete foundation and a double-height ceiling approximately 33’ 7” from the ground. An exposed steel compound Fink truss with a kingpost top forms the gable, which rises an additional 12’. The former entrance from Building 16 into Building 15 now appears covered with metal panels. Some standard factory light fixtures remain.

Along the western façade a large industrial furnace with a gable roof approximately 20’ tall attaches to Building 16. The furnace features steel-framed doors at the east and west elevations, with the eastern door opening directly into Building 16. The doors slide vertically into a protected compartment, and fire brick appears through holes in the doors. Four hydraulic actuators to tightly seal the furnace wrap around the door’s perimeter. A chimney stands along the southern side, and numerous exposed mechanical systems envelop the north and south elevations of the furnace.

Historic/Current Use
The Stress Relieving Building was used for hull construction at the Building 12 Complex. Related to quality control, pre-assembled welded components for ship hulls assembled in Slips 5, 6, 7, or 8 would have joints relieved of the stress inherent in the bond from imperfect welds. Stress relieving involved re-heating the bond juncture, burning the ridge and inserting a splint or “strong back” mechanically and re-welding the joint in a controlled environment. The building is currently used for storage by Auto Return.

Integrity
Building 16, the Stress Relieving Building, has experienced few alterations and retains integrity of location, design, setting, materials, workmanship, feeling, and association. Building 16 contributes historic district for its association with the WWII steel shipbuilding effort at the New Yard. The industrial furnace connected to this building is also a character-defining feature and is the only example of this type of furnace at the site.

Building 19 (Garage #1)
Figure 25

Physical Description
Building 19, just south of Building 108, is surrounded by open space on the east, west and south elevations. This building stands at the end of 20th Street, which was closed during WWII. Built in 1941, the architect and builder of this simple, industrial structure are unknown.

This is a one-story, rectangular-plan gable-roofed warehouse with corrugated, galvanized steel roofing and cladding. It measures 50’-8” x 24’-6” in plan and 31’-6” tall, and contains a total of 6,152 square-feet.

Windows are fixed, multi-lite steel sash with central ventilators; many lites are boarded or painted over. Rolling metal doors appear on the west, east and south elevations. The north elevation is board-formed concrete and stands higher than the adjacent east and west. A small metal shed attaches to the west elevation.

The interior is a single open space. Walls are corrugated metal, except for the concrete north wall. Modified Howe trusses form the roof structure and the floor is concrete slab. Freestanding machinery includes a sifter/conveyor, and the building stores sandblast grit, used to sandblast ships prior to painting.

Historic/Current Use
Listed as Garage No. 1 and owned by the Government on the Bethlehem 1945 plan, this building was used as a garage and housed a small office during WWII. It adjoins Building 108, a planing mill and joiner shop. Building 19 is currently used by BAE Systems for storage of sandblasting grit.[35]

Integrity
Despite minor alterations, such as the attached metal shed at the west elevation, the building retains a high degree of integrity and therefore is a contributing resource historic district. Building 19 is a contributor for its association with the World War II shipbuilding effort at the yard.

Building 21 (Substation No. 5)
Figure 26

Physical Description
Building 21 stands just west of the Noonan Building (Building 11), surrounded by two paved roads, to the north and west, and a paved lot to the south and southeast, the site of infilled Slips 5-8. The architect/engineer and builder of this industrial-vernacular building, constructed c. 1900, are unknown.

This two-story building is rectangular in plan and measures 101’-2” long by 75’-6” wide by 44’ high, and contains 10,172 square-feet. It is steel frame, with corrugated metal cladding. The roof, also corrugated metal-clad, is double gable, and each gable has a wide roof monitor. The glazing consists primarily of multi-lite, double hung wood or horizontal steel sash windows, many with an operable vent sash. Many windows are covered with plywood or metal security grates; the monitor windows have been covered with corrugated metal.

The primary elevation is north; the west half features two sets of personnel doors. Two glazed metal doors at the center of the elevation lead to the Port’s electrical storage area, and a pair of metal doors east of center lead to the radio tower control room. The east half of the north elevation features two pairs of steel freight loading doors, glazed with twelve lites per door. Two additional personnel doors open at the second level, the easternmost accessed by a metal stairway.

The south elevation has two freight doors; each centered on the east and west half of the wall. A shed-roofed utility building attaches to this elevation at the southeast corner. The west elevation features a set of five hanging steel freight doors, now soldered shut. Each door is glazed with twenty-four lites.

[35] Bethlehem Steel Co. Plan 1945, Sheet 1.

Subdividing the building interior is a board-formed concrete wall running north-south. An east-west trending concrete wall divides the west interior portion into two sections. The east interior portion is two stories; steel I-beams support the second story.

Historic/Current Use

This building dates to the Risdon Iron Works period and is the only building left from that iron works. Since the functional history of Building 21 is linked to its ownership history, it is useful to recount some key transitions in land use and ownership of Risdon Iron and Locomotive Works. In 1911, the Risdon yard shut down and a subsidiary of the U. S. Steel Corporation purchased the yard. During World War I, the Union Iron Works Company built and operated, for the Emergency Fleet Corporation (EFC), a United States destroyer plant on the site of the former Risdon yard. The destroyer plant was commonly known as the Risdon Plant. [36] In 1940, during the build-up to World War II, the Navy built an entirely new shipyard on the site of the old Risdon Yard. According to *The Argonaut*, the Navy purchased the Risdon Yard in 1940. "This was operated by Bethlehem, and it was at this 'New Yard,' as it came to be known during World War II, that four high-speed anti-aircraft cruisers were built"[37].

While the construction date of this building has been identified as 1900, the documentary record suggests some possible contradictions. A 1905 Sanborn Map of the portion of the Risdon Iron Works east of the machine shop, appears to show a power house in the approximate location of Building 21. Although the map is an update and somewhat difficult to decipher, the Risdon Iron Works power house shown on the 1905 map appears to have similar dimensions but a different configuration from that of Building 21 as it appears on the 1945 Bethlehem Steel General Plan and the 1936 Sanborn Map of Union Iron Works. Furthermore, a 1902 *Marine Engineering* article on Risdon Iron Works describes a new powerhouse in the center of Risdon Iron Works as a one-story steel structure 100 feet by 150 feet, whereas Building 21 is 101 feet long by 75 feet wide. The *Marine Engineering* article provides dimensions of all the main buildings at Risdon Iron Works in 1902 and many of the minor buildings including warehouses and a stable; none of the buildings described in the article matches the dimensions of Building 21 in 1945. However, a turn of the century photograph shows a Risdon building similar to Building 21 indicating that this structure was built in 1900.[38]

Both the 1914 and 1936 Sanborn Maps show Building 21 to be a machine shop and transformer house. A 1945 Bethlehem Steel Company plan in 1945 describes Building 21 as sub-station no. 5 and electric shop no. 2. It is described as a government owned building; the owner prior to 1941 is shown as Columbia Steel Co. (U. S. Steel Corp.)[39]

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[36] "History of Bethlehem's San Francisco Yard," *Pacific Marine Review,* XLVI (October 1949), 31; "1849-1949, A Century of Progress," Bethlehem Steel Company Shipbuilding Division, San Francisco, 15-16; "History of the San Francisco Yard, Bethlehem Steel Company, Shipbuilding Division," *The Argonaut*, Vol. CXXVI (August 29, 1947), 11.
[37] "History of the San Francisco Yard," 11.
[38] Sanborn Map Company, San Francisco, Vol. 5 (1905), sheet 544; Sanborn Insurance Company Map, Vol. 6 (1936), sheet 594; Sanborn Map Company (1914), sheet 594; "Risdon Iron Works, San Francisco," *Marine Engineering*, 7 (February 1902), 50; 1897 to 1904 Risdon Catalog, San Francisco Maritime National Historical Park, San Francisco.
[39] Sanborn Insurance Company Map, Vol. 6 (1914), sheet 594 and (1936), sheet 594; Bethlehem Steel Co. Plan 1945, Sheet 34.

In 1945, the first floor had a compressor room in the northwest corner, with air compressors from 1942, and a small electric parts room east of the compressor room. Adjoining the compressor room and electrical parts room to the south was an area used for housing large equipment, including transformers. Most of eastern portion of the first floor was used as an electrical shop, with a small office in the northeast part of the floor. The second floor housed a shop in the north portion and a store room in the south.[40]

Building 21 now functions as a substation for the Pier 70 site and for storage. The roof was replaced in kind in 2008.

Integrity
The building retains its integrity, although a portion of the roof recently flew off. Building 21 is a district contributor because of its association with the development and expansion of power distribution at the yard, a key component in the advancement of shipbuilding processes during the late nineteenth and early twentieth centuries. Building 21 is also the earliest example of steel clad construction at the Union Iron Works/Bethlehem Steel Shipyard and is the only extant example of the turn of the century buildings constructed by Risdon.

**Building 24 (Bethlehem Steel Co. Washroom and Locker Room)
Figure 27**

Physical Description
Building 24 stands at the east end of Building 113 and shares its western wall with Building 23.[41] It is one of three small structures at the east end of Building 113 – the other two, Buildings 23 and 118, abut 113. While the buildings attach to 113, they have separate numbers and distinct uses. Since they were given separate numbers historically, all will be considered separate resources in this document.

This one-story, exposed concrete building measures 38’-8” long by 15’-6” wide by11’-6” tall, and contains 519 square-feet. Eight square windows penetrate the long eastern elevation, with two similar openings on the southern elevation. Rainwater leaders extend from the low-pitched roof. Most of the window openings have been secured with plywood. The building is purely utilitarian and lacks ornamentation. The architect and builder are unknown.

Historic/Current Use
This building originally functioned as a washroom and locker room for the Machine Shop.[42] It was first installed in 1914 and upgraded in 1936 and 1941. It is one of the seven washroom and locker room facilities constructed or upgraded in 1941 to meet the need of a rapidly expanding workforce. Of the four extant facilities it is the only concrete structure, the rest are steel. This building is currently unused.

Integrity

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[40] Bethlehem Steel Co. Plan 1945, Sheet 34.
[41] Building 23 is a corrugated sheet metal-clad shed addition to Building 113.
[42] Bethlehem Steel Co. Plan 1945, Sheet 1.

While some windows are missing, this building reveals few alterations or additions. Given its association with the upgrade of worker facilities at the shipyard, this building is a district contributor.

Building 25 (Washroom and Locker Room)
Figure 28

Physical Description
This single-story, steel-frame, gable-roofed industrial building with corrugated metal-clad walls measures 51'-6" long by 29' wide by 19' tall, and contains 1,407 square-feet. Built in 1941, it stands in a courtyard created by four other buildings (15, 16, 31, and a mechanical building). The northern end attaches to Building 15. A band of multi-lite, steel sash pivot and awning windows runs continuously on three exposed elevations, approximately 8' from the ground. Metal double doors with four-lite glazed upper panels open on the western façade. The steel Howe truss supports the gable roof.

No alterations to the plan or external materials are evident. The toilets, sinks, and urinals still line the walls, although none of them has plumbing fixtures. Most stall partitions have been removed, as have the shower stalls near the center of the room. Prominent anti-Lyndon Johnson and anti-NAACP graffiti remains over one of the urinals.

Historic/Current Use
This building contains shower, bathroom, and locker facilities for the workers who labored in the adjacent buildings. Building 25 is one of the seven washroom and locker room facilities installed in 1941. It is the only example of a corrugated metal clad washroom from that period, but is similar in style to the two washrooms (Buildings 110 and 119) constructed during the late 1930s. Washrooms, lockers and lunch rooms were scattered throughout the Yard as a means of providing needed amenities to the workers where they worked, a more efficient means of running a business with hundreds of workers.[43]

Integrity
Building 25, the Washroom and Locker Room, has experienced few alterations and retains integrity of location, design, setting, materials, workmanship, feeling, and association. Building 25is a district contributor for its association with the improvement of worker amenities during WWII.

Building 30 (Template Warehouse)
Figure 29

Physical Description

[43] San Francisco Planning Department, 2001.

Building 30, just south of Building 49, stands in the northwest quadrant of the Union Iron Works/Bethlehem Steel Shipyard. It runs in northeast-southwest direction parallel and adjacent to Slip 4 and in 1945 adjoined a welding platform. A crane stands to the east of this building, along Slip 4. Constructed in 1941, the architect and builder are unknown.

This is a tall, single story, rectangular warehouse that measures 61’ long by 18’ wide by 25’6” high, and contains 991 square-feet. It has a flat roof and corrugated metal-clad walls. The northwestern elevation features three bays of windows covered with plastic sheeting. The northeastern elevation has a large, rectangular ground-level opening. A shed extension with a personnel door and several windows attaches to the southwestern elevation. Three large openings covered with metal panels comprise most of the southeastern elevation. The building is purely utilitarian and lacks ornamentation.

The main interior space is a single-story with elevated wooden walkways supported by metal straps hanging from the ceiling. Corrugated metal and plastic sheeting clad the wood frame, with wood panels along the southwestern wall of the attached shed. The floor and foundation are concrete. Wooden access ladders to the elevated wooden walkways mount to the southern corner and along the southeast wall. The wooden shed extension, one step lower than the main space, contains two rectangular office spaces.

Historic/Current Use
The Template Warehouse, Building 30, stored wooden templates used to mark the steel hull plates at Building 109. It is one of two extant template warehouses in the district. Used in the production of multiple hulls of the same design, the templates could be reused several times. Building 30 is currently unused.

Integrity
Alterations include a shed addition to the south elevation, and the replacement of some windows with plastic sheeting. These changes do not significantly compromise the integrity of the building; therefore, Building 30 contributes to the district for its association with the WWII shipbuilding effort at the site.

Building 32 (Template Warehouse, 1941)
Figure 30

Physical Description
Building 32 stands at the south end of the site and is part of the Building 12 Complex (Buildings 12, 15, 16, 25, 32, and 66). The complex was constructed from 1941 – 1944, specifically for WWII, as part of the New Yard. This building stands on the former location of Irish Hill. The architect and builder of this 1941structure are unknown, but it was likely designed and built by government personnel as part of the joint WWII effort.

This single-story, semi-attached, rectangular warehouse with a gable roof is of steel frame construction with corrugated metal-clad walls. It measures 100’ long by 50’ wide by 32’ high, and contains 4,900 square-feet. Its northern end attaches to Building 15. Exposed steel compound Fink trusses with a king post form the gable and create a clear interior space with no support columns. The western façade features two rows of four, evenly space rectangular multi-lite steel sash awning windows with steel sills. The southern façade contains vents and a metal personnel door with four window panes. Multi-lite steel sash windows can be seen on the eastern façade from the courtyard formed by neighboring Buildings 15 and 16. Wood planking, exposed on the interior and covered with roll roofing at the exterior, clads the roof. Two prominent vents sit on the gable ridge.

The interior ground floor has been repaved with asphalt and any mechanical and/or template storage racks have been removed. Many small standard factory light fixtures remain intact.

Architectural plans illustrate a mezzanine that wrapped around the entire second story, with offices in the northeast and northwest corners. The mezzanine rose 10’ from the floor and sat 11’ from the bottom of the trusses. Little evidence of the mezzanine or offices remains, except for a belt of steel beams that runs around the interior perimeter at approximately 10’ from the floor.

Historic/Current Use
The Template Warehouse, Building 32, stored wooden templates used in shaping steel hull plates at the Building 12 Complex. It is one of two extant template warehouses at the yard. Used in the production of multiple hulls of the same design, the templates could be reused several times. Auto-Return company, San Francisco’s towing contractor currently, leases the site for the storage of cars and motorcycles.

Integrity
Building 32, the Template Warehouse, has experienced few alterations and retains integrity of location, design, setting, materials, workmanship, feeling, and association. Building 32 contributes to the historic district for its association with the WWII shipbuilding effort at the New Yard.

Building 36 (Welding Shop)
Figure 31

Physical Description
Building 36, the Welding Shop, is located between Buildings 104 and 52/109. Open, paved areas used for parking and storage surround the building on all sides. Built in 1941, the architect and builder are unknown.

This rectangular metal industrial structure measures 200’ long by 60’-9” wide and 47’ high. It has an east-west axis and contains 12,050 square-feet. Both the walls and the gable roof are clad in corrugated, galvanized iron. A 17’-9” high shed extension runs along the entire south elevation. Windows are multi-lite steel sash, with operable central ventilators, and consist of 16- or 20-lite panels arranged in rows of three or four. At the shed extension, windows are tall, 28-lite units in groups of three. Some windows at the north elevation are now covered with metal sheeting, and others, at the shed-roofed extension, have been altered as doorways.

The interior consists of an open area with a row of steel columns that separate the shorter, southern shed extension from the main space. Walls consist of the exposed steel structure, with the exterior corrugated steel cladding behind. The main roof structure is a series of compound fan trusses overlaid with corrugated metal cladding. Simple triangular trusses support the shed-roof over the southern extension. The floor is concrete and in good condition. Four swing-out, one-ton cranes extend from the north wall, and two mount to the south. Double tracks for working 10-ton cranes run along both the east and west ends. Sliding metal freight doors in the east wall and double metal doors in south extension access the space. A personnel door and a soldered shut freight door penetrate the west wall. An office occupies the southeast corner.

Historic/Current Use
As part of the hull construction process during WWII, this building was originally used for welding preassemblies that were then moved to the slipways, Slips 1-4, using Bethlehem Steel-owned rail lines. Building 36 is currently in use as a machine shop by BAE Systems after the ship repair company moved out of Building 113.

Integrity
Building 36, the Welding Shop, has experienced few alterations and retains integrity of location, design, setting, materials, workmanship, feeling, and association. Building 36 contributes to the historic district for its association with shipbuilding during WWII.

Building 38 (Pipe and Electric Shop)
Figure 32

Physical Description
Building 38 stands northeast of Building 105, with an open area to the east between Building 105 and 109. Building 111, a substation and warehouse, is directly to the west, and Building 119 is directly to the south. The building is adjacent to the wharves of Pier 68, currently used by BAE Systems. This building dates from 1915 and was altered in 1941; the architect and builder are unknown.

This two-story rectangular plan, reinforced concrete structure measures 138’ long by 124’ high by 36’-6” high and contains 30,519 square-feet. A shaped parapet on the north and south elevations conceals the double gable roof. The walls are board-formed concrete. A projecting belt course separates the first floor from the second. Each elevation contains a variety of openings on both floors, showing many modifications.

The primary elevation is east. The first floor features two damaged metal roll up doors, two wood personnel doors, and one double-hung and one fixed wood sash, multi-lite window. The primary glazing on the second level is 20-lite, fixed wood sash; four of twelve are boarded or replaced with four-lite fixed sashes.

A one-story metal, gable-roofed shed addition with five damaged metal rolling doors opening to the north covers most of the north façade. A kiln stands along this elevation adjacent to the shed projection. Primary glazing on the north elevation is eight-over-eight, double hung wood sash, mostly on the second floor.

The west façade contains five, 24-lite windows on the ground level and three, 8-lite fixed wood sash windows over three personnel doors. Two metal rolling doors also penetrate this elevation. On the second level are two personnel doors with transoms opening onto cantilevered wooden decks. Multi-lite double-hung and awning wood sash windows glaze the second-story.

The south elevation, like the north, features a shaped double parapet. The concrete wall surface is spalling and failing over approximately 50 percent of the elevation, exposing rebar on the southeastern side. Windows along this elevation are fixed, wood sash, multi-lite.

The first floor divides into two unconnected bays with a northern shed addition. The west bay is an open shop area with a chain link partitioned storage enclosure in the southern half. Typical first floor construction includes board-formed concrete walls, steel columns, and steel beams that carry the second floor wood joists. The walls are of board-formed concrete and the exposed steel frame supports the roof structure. The floor is covered with wood planks. At the first floor, the ceiling consists of wood joists supporting the exposed diagonal floorboards from above. Double crane rails hang in the northern half.

Within the projection on the north side, the former exterior wall now functions as an interior wall that divides the main space from the shed addition. This wall displays multi-lite wood sash windows and wood industrial doors with diagonal beadboard. The east bay contains two spaces, accessible from the exterior or from a second-floor staircase along the south wall; doorways from the west bay are blocked.

The second floor divides into several rooms with a locker room and electrician's shop occupying most of the floor. Offices, a men's room and lunchrooms, along with several narrow hallways fill the rest of this level. Floors are battleship linoleum with wood planking in storage areas. Walls are concrete with plywood and fiberboard finishes. Open storage areas expose the steel roof structure, consisting of flat Pratt and Fink trusses supporting corrugated metal roofing.

Historic/Current Use

Erected in 1915, the shops in Building 38 produced components for a ship's mechanical and propulsion systems during the outfitting phases of shipbuilding. The 1936 Sanborn map shows a building plan with several functional areas, including a copper and pipe shop, with smaller rooms shown as electrical shop, furnaces, brazing room, and tool room. Most of the western portion of the building served as a pipe shop; the northwest corner had furnaces, and the southwest corner housed a marine electrical shop. The eastern half of the building divided into a marine machinery tool room in the northeast corner, a brazing room south of the tool room, and a copper shop in the southeast corner.[44]

In 1945 the building was called "Pipe and Electric Shop No. 1," with the pipe shop taking up most of the first floor and the electrical shop on the second floor. The first floor plan, labeled "Pipe Shop No.1," shows the west half of the floor as a pipe shop, with a pipe bending area and small soldering room at the northwest. Other spaces are as follows: a hanger shop and small office at the southeast corner, the "Vanstone" department (perhaps named for the "Vanstone" machine centered in the room) at the center east portion, and

[44] Sanborn Insurance Company Map, Vol. 6 (1936), sheet 592.

the sandblast room and government-owned dust collector at the floorplate's northeast corner.[45] "Vanstone" or "Van Stone" is a type of flanged pipe fitting.[46]

The second floor, in 1945, contained "Electric Shop No. 1," with the electric shop in the west and north portions of the floor, an electric storage and supply area in the center west portion, offices in the northeast corner and center of the building, a smaller office in the electric storage and supply area, and a locker room with fountains in the southeast corner of the second floor.[47]

Building 38 currently houses storage, offices, and an electrician's shop for BAE Systems.

Integrity
While the building has condition issues (spalling concrete on the south elevation), it retains sufficient integrity to be considered a contributor to the Union Iron Works/Bethlehem Steel Shipyard district for its association with shipbuilding and ship repair during WWI and WWII.

Building 40 (Employment Office)
Figure 33

Physical Description
Building 40 is located on Illinois Street, behind Building 101, the Main Office. This is a Moderne-style, three-story rectangular structure with a flat roof and two-story, glazed entry feature. It measures 95'-9" long, by 41'-9" wide, by 34'-6" tall and contains 8,259 square-feet. The building stands adjacent to a retaining wall at Illinois Avenue, with two stories above street level and the main entry at the third floor.

A bridge flanked by plain, six-foot high stucco walls provides access to the building entry from Illinois Avenue. The door surround is faceted, with a simple, projecting overhang above. A glazed, two-story, beveled-corner stairhall stands behind the entry door, dominating the façade. Horizontal-paned, vertical wood window sash form the cladding of this stairhall. The body of the building, extending north from the entry, is a simple, stucco-clad, rectangular block. The double hung windows are arranged in groups of two or three, with simple, horizontal bands of scored stucco relief. The interior was inaccessible for survey.

Historic/Current Use
This building was an employment office annex used for interviewing and processing the paperwork of the thousands of employees during WWII. On the March 1945 site plan, this building is labeled "Steel Office." Building 40 is currently vacant.

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[45] Bethlehem Steel Co. Plan 1945, Sheet 39.
[46] "The process of manufacturing a pipe spool with both flanges rotating without the use of conventionally welded or screw threaded collars is known as the "Conrac" or more properly the "Van Stone" system. The process essentially forms a lap collar by spinning over the parent tube at right angles to the original tube axis." From "What is Van Stone?" http://www.crp.co.uk/technical.aspx?page=263, accessed May 5, 2010.
[47] Bethlehem Steel Co. Plan 1945, Sheet 40.

Integrity
This building is a district contributor for its association with the increase of facilities necessary for managing the vast influx of WWII workers at the yard. The exterior of the building retains sufficient integrity to be included as a district contributor. The interior was inaccessible because of condition-related safety concerns.

Building 49 (Galvanizing Warehouse)
Figure 34

Physical Description
Constructed c.1940, this simple industrial building stands in the northwest corner of the yard, just west of Slip No. 4. The architect and builder are unknown.

This 152' long, 52' wide, and 46' tall rectangular steel frame warehouse contains 8,039 square-feet. It has corrugated metal clad walls and a concrete foundation. The gable roof features a monitor extending almost the entire length. Crane rails run the length of the building, and two of the original three, six-ton cranes remain. The roof is wood-sheathed under asphalt shingles. There are no openings on the south or east elevations. The west elevation, which features two large, vehicular doors, each inset with personnel doors, is the primary façade. The northernmost freight door is only partially intact; the top portion is infilled with plastic sheeting. Corrugated plastic sheathing also covers the west window openings. The south elevation features a shed addition clad in corrugated sheet metal. A single metal personnel door stands next to this addition. At the south end of this elevation is a small freestanding shed. A rail spur runs along the north elevation of the building.

The interior is an open, double-height, single-bay space. Compound king post, Fink steel trusses that extend the width of the structure support the ceiling's exposed wood-sheathing. The floor is concrete and walls display the exterior corrugated metal siding and structural steel columns. A six-ton crane hangs between the two longer east-west walls. A green tarp divides the space, concealing the northern third of the warehouse. There are no openings along the east wall, and plywood panels lean against much of its base. The south end has two covered plastic openings and a metal personnel door that accesses the small shed storage area. The west wall has several variously-sized openings, three of which have been covered with plastic.

Alterations include shed additions along the south elevation, and the removal windows and doors in the west elevation.

Historic/Current Use
Constructed as a galvanizing plant in 1941, steel hull plates and metal components of ships were galvanized in this building. Galvanization, the coating of steel with zinc, was used to reduce corrosion. Building 49 contained a zinc storage area at the southwest corner of the building, and wood-lined concrete tanks containing lye, sulphuric acid, and muriatic acid.[48] The toxicity of this process resulted in the placement of the building at the edge of the property. During WWII, rail lines connected the Welding Shed (Building 36) and Slips 1-3 with the galvanizing warehouse. Building 49 is currently unused.

[48] Plans of the San Francisco Yard, Bethlehem Steel Company, Shipbuilding Division 1944-1945, Sheet 56,

Integrity
The building retains sufficient integrity to be considered a district contributor for its association with the shipbuilding and ship repair processes during WWII.

Building 50 (Pier 68 Substation #2)
Figure 35

Physical Description
Building 50 is a single story, steel frame building standing to the north of Building 110, near Slip No. 4. It is 30’ long, 25’ wide, and 23’ tall with a square floor plan encompassing 678 square feet. Similar to Buildings 103 and 110, this building has a high brick base below a band of multi-lite, steel sash windows with operable awning ventilators, and corrugated galvanized iron cladding. Metal railing runs along the flat roof, surrounding roof-mounted electrical equipment. This area was originally enclosed with wire.

Historic/Current Use
Building 50 was erected by the government in 1941 when the yard was expanding in response to WWII. It is one of three extant substations built by the government on the site during WWII. It provided electrical power to Slip No. 4, nearby support buildings, and the welding shed. This building is currently vacant.

Integrity
Building 50 is a contributing building to the district for its association with the expansion of electrical distribution in response to the WWII build-out of the shipyard. Specifically, Building 50 allowed for welding facilities to be installed at Slip No. 4. It retains its integrity of location, design, materials, setting, workmanship, feeling, and association.

Building 58 (Pier 68 Substation #4)
Figure 36

Physical Description
Building 58 stands on Pier 68, south of Dry Dock 1. Built in 1943, the architect and builder are unknown. This rectangular-plan substation measures 40’ long, 26’ 2” wide, and 21’ tall, and contains 939 square-feet. It rests on chamfered square pylons and extends over the bay. Its gable roof with monitor runs east to west and is clad with corrugated metal. Walls are concrete at the base with corrugated metal cladding above. Windows are multi-lite, fixed steel sash, with operable center ventilators. At the primary, south elevation are double steel personnel doors with glazed upper panels; one pane has been removed to allow electrical feeder cable to pass. A double sliding metal loading door with low vents occupies the eastern half of the elevation.

Turbines and other equipment fill the open interior. Floor paving is of 6” by 6” red terra cotta tile. Like the exterior, walls are concrete at the base with the inside face of the corrugated metal cladding set above and exposed steel structure. The ceiling consists of exposed steel trusses supporting the corrugated roof cladding.

Historic/Current Use
Building 58 is labeled Substation No. 4 on the March 1945 plan. It provided easily accessible a.c. and d.c. power to Pier 68 and the dry docks. The building is still in use as a substation for the dry dock facilities.

Integrity
The building retains a high degree of integrity, and therefore appears eligible as a district contributor for its association with the expansion of electrical distribution essential to welding and the WWII ship repair effort at the site.

Building 64 (Substation No.6)
Figure 37

Physical Description
Building 64, built in 1945, stands on Pier 70 near Pier 8, situated between the now- collapsed Piers 7 and 8, along Wet Basin 7. This is a single story, steel frame building with corrugated steel siding and a corrugated steel roof. It measures 52’-4” long, by 41’-4” wide, by 25’-3” tall, and contains 2,070 square-feet. The western elevation includes three has bays of industrial steel sash windows, while the northern elevation has a sliding steel door. The architect and builder are unknown.

Historic/Current Use
Like Building 58, Building 64 was a substation installed on the piers to meet power demands for outfitting activities on ships in the outfitting docks. This installation was one of many upgrades to UIW’s infrastructure to increase efficiency during WWII.

Integrity
This building displays little or no alteration, and appears eligible for listing as a district contributor for its association with WWII ship repair. This building, however, is at risk of collapsing into the bay as Pier 70 continues to fail.

Building 66 (Welding Shed, c. 1945)
Figure 38

Physical Description
Placed to the northeast of Building 12, Building 66 marks the northern end of the Building 12 Complex, a series of five buildings constructed specifically for the WWII effort (Buildings 12, 15, 16, 25, 32, and 66). The Bethlehem Steel Company’s 1944 architectural plans indicate that the federal government erected a welding platform on the site in 1941, but the plans do not show a shed. The shed first appears in a 1945 aerial photo. Its architect and builder are unknown.

This large, rectangular plan, two-story, steel frame shed with corrugated metal siding measures approximately 220' long by 105' wide and covers 23,100 square-feet. It is almost completely open on the north and south ends, providing an unobstructed north/south view through the building. Columns divide the space into eleven vertical bays, and Pratt trusses support the roof gable.

Along the west elevation, an attached men's locker room, measuring approximately 15' x 60', sits outside the main bay of Building 66. At some point (after the period of significance), the locker room's north end sustained significant damage, with the roof torn off and the interior exposed to the elements. Two personnel doors from the locker room opened to the west and one opened to the east, into the main Welding Shed bay. Almost all interior fixtures have disappeared, but a few toilets, urinals, and a prominent "Men Only" sign stenciled on a western door remain in place. Large, angled support columns for Building 66 penetrate the locker room, dividing the space into distinct bays. The locker room roof, approximately 15' high along the western wall, slopes down eastward at an approximately 15˚ angle. Translucent roof panels provided interior lighting.

At the east corner of the northern elevation, a sliding vehicle door on an overhead track remains standing, supported by horizontal beams. No other steel panels surround the door, although a personnel door opens through the vehicle door.

Note that this Building 66, as described here, differs from the Building 66 as described on the 1945 Bethlehem Steel map.

Historic/Current Use
Building 66 was used for welding preassemblies and other hull components during hull construction at the Building 12 Complex and Slips 5-8. When Building 66 was constructed in 1945 on land that was formerly part of the Pacific Rolling Mills lands, most of the yard was used for the production of war vessels. This open building sheltered outdoor activities so that the welding work would not have to depend on good weather.[49] This structure is currently used for vehicle storage by Auto Return, the city's towing contractor.

Integrity
Despite some interior modifications, Building 66, the Welding Shed, has experienced few major alterations and retains its original spatial qualities. Therefore, it retains integrity of location, design, setting, materials, workmanship, feeling, and association, and contributes to the historic district for its association with the WWII shipbuilding effort at the New Yard.

Building 101 (Main Office/Administration Building)
Figure 39

Physical Description
Building 101 stands at the corner of 20th and Illinois Streets, marking the corner and the entry to the shipyard. An iron perimeter fence frames the entrance to this building and originally extended down both 20th and

[49] Tim Kelley, "Building, Structure and Object Record," 2001.

Illinois Streets; this fence is still partially intact and described as a separate resource. Designed by preeminent San Francisco architect Fredrick H. Meyer and built in 1917, the building is Classical Revival in style.

This Classically detailed, three-story-with-basement concrete and brick building is “L” shaped in plan with a wide bevel at the outside corner of the “L”. It measures 140’-6” long, by 51’-10” wide, by 72’-0” high, and contains 56,268 square-feet. Stucco clads the exterior, and is rusticated at the first floor. The roof is flat. At the beveled corner, granite steps lead to an elaborate, recessed entry. A keystone with egg and dart molding, and an oval cartouche caps the entry arch. The primary window type on all elevations is one-over-one, double-hung, wood sash with lamb’s tongue details and operable transoms. Windows on the first floor are paired. A wide string course encircles the building between the first and second floors, with projecting balustraded window sills over the entry and at both end bays of the street-facing façades. These window sills are concrete and are supported by curved brackets with acanthus leaf ornamentation. Two-story fluted Doric pilasters ascend from the stringcourse, dividing the primary façades into bays. Set within each bay on the second and third floors, windows are in threes, with ornamental spandrel panels between the second and third floors. As seen on the west façade, these spandrel panels originally were ornamented with low relief floral patterns, though all of these have been lost on the south façade. A wide, simple entablature tops the building, with a projecting cornice band and solid parapet.

This building has three approximately 11,000 square-foot primary floors over a basement and sub-basement, with a partial 1,512 square-foot fourth floor and penthouse. Double-loaded corridors access offices at the three primary floors and the basement.

The octagonal main lobby features cast stone walls over pink marble wainscoting and a pink marble floor. Centered on the coffered ornamental plaster ceiling is an octagonal bronze and glass pendant light fixture. The elevator, with Art Deco doors and a pink marble door surround, is along the south wall.

The lobby leads to the circular main stairhall. Extending to the third floor, it has marble steps and landings and an ornamental metal railing. The walls above the third floor level are ornamental plaster; those below are ashlar-patterned granite. Low marble walls divide the stairhall from the lobbies at each floor. An ornamental plaster ceiling tops the space.

The first floor corridor has a marble floor and marble wall cladding, which extends up from the ground approximately seven feet. The marble cladding is topped with oak picture rails. Above the oak railing are wood and glass clerestories and plaster wall finish. Cove moldings ring the plaster ceilings. Executive offices are located at the first floor. Rooms 116 and 117, exhibit herringbone-patterned wood flooring and floor-to-ceiling wood paneled walls with dentiled cornices.

Like the first floor corridors, the second and third floor corridors feature clerestories over wood moldings. Third floor corridor walls have c.1950 blond wood paneling, patterned vinyl asbestos tile (VAT) flooring, and glue-up acoustical tile ceilings. Two types of staff offices occur at the second and third floors. Second floor staff offices include resilient sheet flooring, plaster walls and ceiling, wood wainscot, profiled wood door and window trim, and heavy wood crown molding at the ceiling. The flooring is generally in poor condition, and walls and ceiling are in fair condition. Third floor staff offices include plastered ceilings covered by glue-up acoustical tiles, resilient sheet flooring, gypsum board walls, wood baseboards and chair rails, and simple wood door and window trim.

A small theater at the fourth floor features wavy wall cladding. At the ceiling, an enclosed former skylight is now surrounded by wavy paneling and a series of wavy glass panels interrupt its reveal.

Vandals have stripped the vacant building of the ornamental metal railing from the first floor stairs and most of its door hardware and light fixtures. Water damage has occurred in several of the offices on the second and third floors.

Historic/Current Use
Building 101 was designed as a new main office building in 1917, to accommodate the "enormously increased business of the Potrero plant and its branch across the bay," in Alameda, according to the *San Francisco Chronicle*. Architect Frederick H. Meyer told the *San Francisco Chronicle* in January 1917 that the building, then under construction, would be the largest and best equipped private office building in the West, accommodating 350 clerical, professional and executive staff:

> The Union Iron Works company is constructing an office building at its plant in the Potrero, this city, at a cost of $250,000....Work on the building is to be rushed in order that the various departments to occupy it may have the space already needed....The present brick building at the entrance to the Potrero works, large as it is, does not accommodate the office forces which are scattered through the works in other buildings, and when the new structure is occupied the present one may be demolished to make room for the shipyards.[50]

> Meyer's building plan, described in the *Chronicle*, had executive offices on the first floor, clerical departments on the second floor, drafting and naval architects on the third floor, a basement floor with blue printing rooms and laboratories, and a sub-basement for storage and a service plant:

> Strictly Class A
> The big structure will stand at the corner of Twentieth and Illinois streets, on both of which streets it will have a frontage of 140 feet with a depth of fifty feet for each wing. It will be of class A type, which calls for steel frame with concrete walls, floors and roof, and it will have three stories, a basement and sub-basement.

> Brick and stone will be used in the exterior finish, and the interior will be done in hardwoods and marble, after the style of first-class office buildings. Special attention has been given the finish of the executive offices, which will be on the first floor. Specially designed rooms are provided for the president, general manager, vice-president, secretary, treasurer and cashier on this floor.

> Entrance to Be Imposing
> The second story will be laid out for various clerical departments, purchasing agents, estimating, etc., and also for a private dining-room, with kitchen, for the officers and department heads. The third

[50] *San Francisco Chronicle,* January 27, 1917, p. 11/3.

> floor will be used by the drafting forces and naval architects, with accommodations for 150 men. In the basement will be testing rooms, laboratories, and blue printing rooms, while the sub-basement will be used for storage and service plant. Approximately 350 persons will be housed in the building, including officials, clerical forces and drafting and scientific staff.
>
> An imposing entrance and vestibule are designed in relation to the general interior plan. With maximum window space on fronts and backs of the building, the offices and other rooms will be flooded with light while careful provision has been made for ideal ventilation and heating, with efficiency the uppermost idea in the planning.[51]

In the mid-1930s much of the office equipment was replaced during a site wide upgrade; some interior modification may have been made at this time.[52] In 1945 Building 101 was still the shipyard's main office building and still had executive offices on the first floor. One striking difference in 1945 was the expansion of vital functions into the basement and sub-basement floors, including a cafeteria and Navy dining room in the sub-basement:

> In addition to the cafeteria and Navy dining room the sub-basement had a vault, boiler room, kitchen, storage, printing shop, janitor's quarters, file room, a small office, and a storage area.
>
> The basement floor contained the office of the plant engineer, file room, cashier, purchasing department, blueprinting department, dark room, photostat room, dumb waiter, and women's and men's restrooms.
>
> The first floor featured offices and a vault, the second had offices and restrooms, the third had a drafting room, offices, a vault, dumb waiter, and supply room. The penthouse had a drafting room a PBX room and a rest room. PBX stands for "private branch exchange," and refers to a telephone service for in-house use.[53]

The building is currently vacant.

Integrity
Building 101 defines the entrances to the shipyard and conveys the prominence and success of the yard during WWI. It is a character-defining feature of the district that functions as the cornerstone to the promenade along 20th Street. The building expresses the growing role of management and administration in the shipbuilding process during WWI and WWII. Despite interior modifications on the upper levels and vandalism that resulted in the removal of character-defining light fixtures and hardware, Building 101 maintains a high degree of integrity and is therefore a district contributor.

[51] *San Francisco Chronicle*, January 27, 1917, p. 11/3
[52] Plans of The San Francisco Yard, Bethlehem Steel Company, Shipbuilding Division 1944-1945, Sheets 16-17.
[53] Plans of The San Francisco Yard, Bethlehem Steel Company, Shipbuilding Division 1944-1945, Sheets 16-17.

Building 102 (Powerhouse)
Figure 40

Physical Description
Building 102 fronts 20th Street. Along with Building 101 to the west and Building 104 to the east, it creates a strip of architect-designed buildings at the entrance to the shipyard. It was designed by San Francisco architect Charles Peter Weeks and built in 1912.[54]

This tall, rectangular concrete building has a hipped roof clad with straight mission tiles. It measures 128'-6" long, by 42'-4" wide, by 48' tall, and contains 8,428 square-feet over the first floor and basement. The front (south) and rear (north) façades are each five bays wide. A large, arched, multi-lite wood window occupies both the east and west ends. Five arched window openings dominate the primary façade. The center, cartouche-topped arch contains galvanized metal-clad paneled entry doors. Each of the doors is glazed with a vertical strip of wood framed square lites. The remaining arched openings on the front façade, and all five at the rear, enclose multi-lite wood windows with operable transoms, and are topped with a decorative scrolled keystone. The entablature is notable for its terra cotta shell motif frieze and copper modillioned cornice. The ground level on the north elevation also has three sets of paired, two-over-two, double hung windows with lamb's tongue details, as well as two personnel doors. Each entry consists of paired, wood paneled six-lite doors. All doors and windows on this ground level have transom openings secured with metal grates.

The interior of Building 102 consists of a main floor over basement. The main floor is a single, large space with partial-height wood-and-glass partitions forming three rooms at the west end. Four turbines occupy the main floor, with newer electrical racks at the east end. The floor, of hexagonal tile with Greek key borders, is in good condition. Walls are of plaster at the upper portions, with white Carrara glass wainscoting, broken in a few places. Windows are trimmed in wood. The gabled ceiling is wood with exposed steel trusses. Crane equipment spans the ceiling north-south, and crane tracks run east-west. Offices at the west end feature linoleum floors, plastered walls with partial-height wood and glass partitions, and Carrara glass wainscoting. Plasterboard ceiling panels over the offices are framed in wood.

The basement has a concrete floor, poured-in-place-concrete walls with visible horizontal form-board delineations, and a concrete ceiling. Electrical equipment fills the room.

Historic/Current Use
Before construction of the new powerhouse in 1912, the entire Union Iron Works was operated from two isolated steam-driven power stations. Direct current energy was chiefly used to drive the machinery in the plate shop, the woodworking shop, boiler shop, machine shop, and foundry, while steam-driven compressors were operated for the air tools and all other pneumatic tools.[55]

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[54] Charles Peter Weeks (1870-19280 was a significant San Francisco-based architect, responsible for such structures as the Mark Hopkins (1926), Huntington (1922), and Sir Francis Drake (1928) Hotels, and the Shriner's Hospital (1923) in San Francisco. He also designed the State Library and Courts Building in Sacramento (1924-1926).
[55] *Journal of Electricity Power and Gas*, XXXI, November 15, 1913; *Pacific Service Magazine*, VIII, June 1916, p. 3.

For the new powerhouse, shipyard management decided to purchase power from a power company – both for maximum consistency and affordability. The contract was awarded to the Pacific Gas and Electric Company. "Continuity of service was paramount and it was felt that the company's big station at Humboldt and Georgia streets offered maximum security against interruptions."[56] Contract bids for construction of a new powerhouse opened in early October 1912. The powerhouse was built for $145,000.[57]

The shipyard used many different kinds of power, including compressed air for pneumatic tools; low pressure air for forges and oil burners; hydraulic power for presses and lifts; direct electrical current for general purposes as well as electric welding; alternating current for lighting, for starting air compressors, and for running rotary converters; and salt water power for fire protection and sprinkling.[58] Due to the different types of power used at the site, the power house functioned both as a generator of power for non-electrical equipment and as an electrical substation that transformed and distributed electrical power from the Pacific Gas and Electric Company.

According to the *Journal of Electricity, Power, and Gas*, the heaviest load on the power plant when it opened in 1912 was the compressed air service, at 100 lb. per square inch, for operation of all the pneumatic equipment, including drills, chipping and caulking hammers. Compressed air was also used for many other purposes, "such as blowing out motors and machinery and operating small steam engines and hoists on ships laid up for repairs." Four large electrically operated air compressors furnished power for the pneumatic tools. They are "of the Franklin type manufactured by the Chicago Pneumatic Tool Company and are two-stage machines 28 in. and 17 in. diameter by 26 inch stroke, each having a capacity of 2,500 cubic feet of free air per minute."[59]

For general power distribution, the power plant had two rotary converters. "Direct current for general power distribution at 230 volts was furnished by two 3-phase, 60 cycle, 1,200 r.p.m. shunt-wound, rotary converters rated 200 kilowatts at unity power factor, and operated in parallel on the direct current end."[60] The switchboard in the power house gave the operator complete control of all the electrical power circuits in the various shops.[61]

The power house design and equipment were proudly described in PG&E's *Pacific Service Magazine* in June, 1916:

> Under the roof of this building, which is a beautiful piece of architecture of the Spanish Renaissance type, built of reinforced concrete, in dimensions 126 feet by 40 feet, are housed the four large Chicago Pneumatic Tool Company air compressors for supplying air for pneumatic hammers, each compressor being direct-connected to a 450-horsepower General Electric synchronous motor. Located here are also two rotary converters of a capacity of 200 k.w. each, which are used for supplying all

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[56] *Journal of Electricity Power and Gas*, XXXI, November 15, 1913, p. 436.
[57] *San Francisco Call*, October 5, 1912, p. 12/2; *Pacific Service Magazine*, VIII (June 1916), 4-5.
[58] *Journal of Electricity, Power, and Gas*, XXXI, November 15, 1913, p. 436.
[59] *Journal of Electricity, Power, and Gas*, XXXI, November 15, 1913, p. 438.
[60] *Journal of Electricity, Power, and Gas,* XXXI, November 15, 1913, p. 438.
[61] "Modern Facilities for Building Modern Liners," *Pacific Marine Review*, XXV, August 1928, p. 359.

> direct current required for cranes, special machinery, etc., in the shops…[next to the converters is the switchboard]. The 18-panel switchboard located at one end of the building behind which are located three 500-k.v.a., 11,000/480-volt transformers, the three 50-k.v.a., 11,000/120-volt transformers and the two 225-k.v.a. transformers. Above all of this machinery may be seen the large 10-ton electrically-driven traveling crane which spans the entire width of the building. Beneath the switchboard, and on a lower floor, are the 11,000-volt switch compartments which receive the incoming cables that enter the building through underground ducts, the works being fed by two distinct circuits, one of which is direct from the Pacific Gas and Electric Company's main generating station at the Potrero. By this means there is a surety of service which is unexcelled. On this floor also is located the electric department, where all new and repair work is done.[62]

The *Pacific Service Magazine* described in 1916 how the new powerhouse affected "nearly every other feature of the works," permitting direct connections of all machine tools to individual motors:

> With the coming of central station energy came also numerous alterations and improvements of the departments; main line shafts and countershafts were eliminated, doing away with the use of belting, and all machine tools were direct connected to individual motors, which, besides making a great savings in power, made the shops light and much more inviting to the workmen.[63]

The electric distribution system was all underground. "There are twelve main feeders leaving the power house consisting of four direct current and six alternating current power feeders and two alternating current lighting feeders, all of which were from 400 to 600 amp capacity."[64]

Notably, the division between the north and south sides of 20th Street, which had long been considered the north and south districts of the shipyard, also comprised distinct electrical districts when the power house opened:

> The works were divided by 20th Street into north and south districts and as far as possible this natural boundary line has been followed in the separation of the alternating and direct current distributions. The south works consists mainly of machine shops and forms the direct current district while the north works is principally devoted to plate work and forms the alternating current district. There is however a certain amount of unavoidable overlap which is taken care of by one feeder running to each works and looped through all departments to provide for portable tools, etc.[65]

The Bethlehem Steel Co.'s General Plan from 1945 identifies Building 102 as Powerhouse No.1 Electric. The main floor contained offices, four air compressors for pneumatic power (dating from 1913-1914), three rotary converters dating from 1913, a switchboard, a traveling crane beam, and five transformers, also dating from

[62] *Pacific Service Magazine,* VIII (June1916), 4-5.
[63] *Pacific Service Magazine,* VIII (June1916), 4-6.
[64] *Journal of Electricity, Power, and Gas,* XXXI, November 15, 1913, p. 439.
[65] *Journal of Electricity, Power, and Gas*, XXXI, November 15, 1913, p. 439.

1913. The basement held paper storage, a chain hoist, a monorail, and vault, switch cells and other electrical equipment.[66] This building continues to serve some of the electrical needs of BAE Systems.

Integrity

Building 102 is a contributing resource because of its high architectural value and its place in the architect-designed group of buildings along 20th Street. This group functions as the main entrance to the yard and is a character-defining feature of the district. Building 102, particularly with its intact pre-WWI pneumatic and electrical equipment, is associated with ongoing upgrades to the power distribution at the yard, which allowed the yard to remain a top tier shipbuilding facility during the early twentieth century. The building retains a high degree of integrity, as it has experienced few alterations. One of the exterior light fixtures framing the main entrance was stolen.

[66] Plans of The San Francisco Yard, Bethlehem Steel Company, Shipbuilding Division 1944-1945, Sheet 38.

Building 103 (Steam Powerhouse No. 2)
Figure 41

Physical Description
Building 103 stands at the end of 20th Street. Its tall smokestack is a character-defining feature, creating a visual anchor from the district entry at 20th and Illinois Streets. Built in 1937, the architect and builder are unknown.

This is a tall, one-story rectangular steel-frame powerhouse, with a gabled monitor roof. It measures 62'-8" long, by 38'-2" wide, by 45'-6" tall, and contains 2,258 square-feet. This structure has a brick-clad base over a concrete foundation, and corrugated steel cladding and roofing. It is glazed with two rows of multi-lite steel sash windows on all but the east elevation, giving an appearance of a two-story structure. A black-painted steel smokestack ascends from the southeast corner with "BETHLEHEM" still barely visible on the west elevation. A large, sheet-metal funnel-shaped chimney, likely associated with the boilers, stands adjacent to the east wall; metal ducting emerges from it and runs eastward, above Building 107. Sliding double metal doors, with square panels, penetrate the north elevation. The bottom row of windows, consisting of two, triple 30-lite units, has an irregular pattern of operable ventilators. Similar glazing occurs along the south elevation, giving the building a sense of translucence. Four, fixed multi-lite steel sash windows glaze the west façade. There are no openings along the east elevation.

The interior is a single space filled with steam generating equipment, including a control panel at its center. Two rectangular boilers dominate the eastern mass. Constructed from brick masonry and steel, they tower almost to the ceiling. Metal walkways wrap the boilers at the upper window level, reached by stairs along the north wall. Flooring is checkered steel and walls are corrugated metal over brick masonry. Fink trusses support the corrugated metal roofing. Ducts, entering the structure from the west wall, run along the entire northern length of the structure to the boilers.

Historic/Current Use
Construction of Building 103 in 1937 was part of a sweeping program of shipyard modernization that took place in the late 1930s. A photograph and description of the building appeared in a 1938 edition of *Pacific Marine Review*:

> In order to make this yard independent a complete steam power plant has been installed in a separate power house. Two water tube boilers are used, each having a rated capacity of 350 horsepower and each being capable of continuous operation under a load of 700 horsepower. These boilers are equipped with Bethlehem-Dahl combination gas and oil burners fitted with automatic firing control. Normally the burners use natural gas. If for any reason natural gas supply fails, the burners can be changed over to oil fuel in a few minutes.[67]

Three air compressors with a combined capacity of 1700 cubic feet of free air per minute are installed in this new power house. In order to facilitate connection, inspection, maintenance, and repairs, a pipe trench of reinforced concrete was installed in a loop encircling the entire yard. The various pipelines, including fresh

[67] "Bethlehem Reconditions Potrero Works," *Pacific Marine Review*, 35 (October 1938), 23.

and salt water, hydraulic service pneumatic service, natural gas and fuel oil services, are carried on hangers on each side of this trench. This trench gives ample room for a man to pass between the pipes. It is covered at the top with checkered iron plates. Passing under railroad tracks it connects through 42-inch diameter corrugated steel culverts.[68]

A Bethlehem Steel Company floor plan of the building dated October 1944 shows the two water tube boilers and three air compressors described in the 1937 *Pacific Marine Review* article. The compressors are in the west portion and the boilers in the east portion of the building.[69]

Building 103 continues to serve its historic function as a steam powerhouse, now for BAE.

Integrity
The building retains a high degree of integrity as it is has experienced few alterations. Building 103 is a contributing resource because of its associations with the World War II building campaign. Building 103 and its prominent smokestack also function visually to mark the end of 20th Street and have defined the view down 20th Street from the entrance of the yard since the 1930s; therefore, this building is also a character-defining feature of the district.

Building 104 (UIW Office Building/Industrial Relations Building)
Figure 42

Physical Description
Designed by prominent San Francisco architects George Percy and Frederick Hamilton, this red-brick Renaissance Revival style building is two stories high with a full basement and attic. It fronts 20th Street and is the third in the line of architect-designed buildings along this street. Built in 1896, it is the earliest of architect-designed buildings.

It has a hipped, clay tile roof and wood, one-over-one, double-hung windows. It measures 150'-6" long, by 49'-6" wide, by 60' tall, and contains 37,641 square-feet. Originally "T"-shaped, with the primary rectangular mass on 20th Street and a projecting center bay at the rear, the rear void areas have been infilled to create a rectangular footprint. The primary (south) façade features two-story brick arches, each containing paired, first- and second-story windows, which dominate the front (20th Street) and two side façades. These arches are set above a rock-faced, rusticated, concrete base, dressed to imitate sandstone. Actual sandstone accents the building as quoins, water table, keystones, windowsills, lintels and an upper-level string course. A sandstone string course separates the second floor from the attic. Deeply set, paired, rectangular windows with shouldered molded brick and terra cotta surrounds punctuate this level. A copper modillioned cornice, in poor condition, tops the building.

A finely-detailed sandstone Renaissance-style portico at the front entrance features banded rustication, engaged Ionic columns, and a projecting cornice over the arched opening. The entry recess includes a

[68] "Bethlehem Reconditions Potrero Works," *Pacific Marine Review*, 35 (October 1938), 23-24.
[69] Bethlehem Steel Co. Shipbuilding Division 1944, Sheet 38.

coffered, barrel-vaulted ceiling and polished marble walls. The arched sandstone door surround with voussiors frames the wood-paneled, glazed front doors with transom and sidelites. The original door hardware has been removed.

The original rear (north) projection is flanked on either side by infill additions constructed in 1941. A band of multi-lite steel sash windows with central ventilator sash are located at both the second and third stories. The original (1896) central portion features seven wood sash windows of different types and one personnel door at the ground level. The east addition also has personnel entrance doors at the ground level. Both additions have one-over-one, double hung wood windows at the ground level, and are covered with metal cladding, pressed to imitate brick on the upper two levels, and wood lap siding at the ground level. A metal fire escape attaches to the east end of the addition.

The interior of Building 104 includes three floors over a basement. The first level has linoleum floors, plaster walls and ceilings, and wood window trim. At the east end is an open office area with columns and some partial-height wood and glass partitions. The lobby at the main entrance exhibits World War II-era alterations including vinyl asbestos tile (VAT) flooring, wood paneling at the walls, and streamlined horizontal steel railing at the lobby stair hall. Similar-vintage alterations are found at the west end of the first floor including wood-paneled walls and built-in wood counters.

The second floor is a single column-free space with (non-contributing) carpeted floors, plaster walls, and a plaster ceiling. There are three private offices at the east end with mid-twentieth-century (possibly WWII) alterations, including wall trim, flush doors, and blond-wood wainscoting. Wood and glass partitions are also located at the east end. Stairhall features at the second floor include glass dividers and a safe with the words "National Safe & Lock Co., Cleveland, O." The second floor also features a WWII-era photo mural of shipbuilding and ship yard workers.

The third floor contains a single large room with partial-height wood-and-glass partitions along the east, west, and south sides. The linoleum flooring is in poor condition. Walls are of painted brick, and the ceiling is constructed of wood with wood cross trusses in both the north-south and east-west directions. The ceiling has a total of 17 skylights.

Historic/Current Use
From the mid 1880s until 1896 the Union Iron Works executive offices were located in a corner of the western portion of the machine shop, Building 113; offices for bookkeepers, draftsman, and clerks were located in the basement of the boiler house, in the eastern portion of Building 113. The firm also had administrative offices in downtown San Francisco; in 1895, these downtown offices were located at 222 Market Street.[70]

In 1896, the company constructed a new office building to achieve many goals: to house its offices in one place, including an "elegant suite" for the executives; to consolidate the shipyard's two drafting rooms (shipyard and engineering) into one efficient system; and to relieve bookkeepers, draftsman, and clerks, who

[70] "Industry 1895," in Ruth Teiser Manuscript Collection, Series 6, Subseries 3, Box 146, File 10, Folder 10, J. Porter Shaw Library, San Francisco Maritime Historical Park; *San Francisco Call*, July 26, 1896, p. 10/2.

had been toiling in the dark basement of the boiler house, where, according to the *San Francisco Call*, "they were compelled to work by gaslight during the daytime."[71]

A notable functional feature of Building 104 at the turn of the twentieth century was an iron bridge spanning 20th Street, creating "ready access" between Building 104 and the machine shop in Building 113.[72] However, no physical evidence of this bridge could be found at either building.

Storage rooms occupied the basement. The ground floor had a furnace, chemical laboratory, check house, and storeroom. The first floor contained offices. To the west of the entrance hallway were the offices of the shipyard manager, secretary, and cashier. To the east were offices for Navy inspectors. The first floor also had a central telephone station with 32 circuits to various parts of the plant, and to the downtown offices of Union Iron Works.[73]

The most noteworthy feature of the four-story office building was the new drafting (or draughting) department, occupying the entire second floor. The drafting system was considered so exemplary at the time that *Engineering Record* devoted an entire article to it in March 1900. The UIW drafting department shared the second floor with U. S. Navy constructors' drafters, who had separate drafting rooms in the western portion. The UIW drafting room contained three departments: Shipbuilding, Engineering, and Electrical.[74]

Before construction of Building 104, drawings in both the shipyard and engineering departments had been stored in chests of drawers, and by 1895 there were about 60,000 drawings in a "deplorable state of preservation." Two women employees – Miss Turrell and Mrs. Davidson – spent two years indexing about 25,000 of the drawings, storing them in paper cylinders in custom-built galvanized steel racks, and developing a bookkeeping system for keeping track of them as they circulated throughout the shipyard.[75]

Tracings were stored on the third level of a three-story fire-proof vault. On the ground floor the vault served as a safe for the chemical laboratory. On the first story it was the cashier's safe. At the drafting-room floor it held all the tracings.[76] The third floor housed the blue printing and photography departments, a laying-out floor space for the shipyard department, several offices, and a room for the electrical draftsmen. Most of the drawings were circulated in blue-print form, but photography was used to reduce drawings to a small size for mailing.[77]

In 1917 a new Main Office building (Building 101) was built at the corner of 20th and Illinois Streets. By 1938 (and perhaps earlier) Building 104 was referred to as the Navy Office building.[78]

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[71] *San Francisco Call*, July 26, 1896, p. 10/2.
[72] *The Engineering Record*, Vol. 41, March 10, 1900, p. 227.
[73] *The Engineering Record*, Vol. 41, March 10, 1900, pp. 226-228; Sanborn Map Company, Vol. 6, Sheet 591.
[74] *Marine Engineering* (January 1900), 16; *The Engineering Record*, Vol. 41, March 10, 1900, pp. 226-228; Sanborn Map Company, Vol. 5 (1899), sheet 541.
[75] *The Engineering Record*, Vol. 41, March 10, 1900, 227.
[76] "Draughting Department, Union Iron Works," *The Engineering Record*, Vol. 41, March 10, 1900, p. 227.
[77] "Draughting Department, Union Iron Works," 227-228; Sanborn Map Company, Vol. 5 (1899), sheet 541.
[78] *Pacific Marine Revie*, 35 (October 1938), p. 26.

In 1941, the rear, north elevation was infilled from the central staircase to the east and west corners. The 1945 Bethlehem Steel Co. General Plan, calls the building “Navy Office-Hospital.” The hospital most likely was introduced in 1941 at the time of the addition. The 1945 Plan shows a sub-basement with storage spaces and vaults, as well as unexcavated spaces. The basement floor contained an office for Navy Inspectors at the southwest corner; hospital emergency rooms, a doctor’s office and waiting room at the northeast corner; and additional offices, a dark room, and lockers. The first and second floor held offices, while the third floor had a duty officer’s room, women’s lounge, supply room, locker room, and storage room. The three story vault is shown extending from the sub-basement through the second floor.[79]

The building is currently vacant.

Integrity
The building retains a high degree of integrity. Interior alterations appear to date to the period of significance. The exterior retains a high degree of integrity, with no major alterations since 1941. Building 104 is a contributing resource because of its associations with the early Union Iron Works period through WWII, and for its high architectural value.

Building 105 (Forge Shop)
Figure 43

Physical Description
Building 105 stands along 20th Street and is the last of the line of buildings along this side of the street. It was constructed in 1937, incorporating one wall of an earlier late nineteenth-century structure. The architect/engineer and builder are unknown.

This 223’ long, 93’ wide, and 63’ tall, rectangular building contains 20,111 square feet. It has a gabled, monitor roof with ventilation grilles. A one-story, shed-roofed projection, with its own roof monitor, runs along the south, 20th Street side. This steel-framed building has corrugated metal cladding and steel sash windows along three sides. The south elevation, along 20th Street, incorporates an earlier one-story brick wall with twelve bays of wood 15-lite hopper windows separated by projecting brick piers, probably dating to the nineteenth century (the 1899 Sanborn map shows a flinch shop and boiler shop in this location). The building steps back above this elevation to reveal a high ribbon of steel sash windows set in corrugated metal cladding. The remaining elevations rest on a five-foot high brick base. The north and west elevations have two levels of steel sash ribbon windows: an upper level, four lites high, and a lower level of continuous two-tier multi-lite steel sash units. A crane platform mounts over the first level of windows on the north façade and a crane extends northward. The east elevation is almost completely open, with crane rails projecting out into the yard. Rolling metal doors penetrate the north and east elevations.

The interior consists of a 20,739 square-foot, two-bay open shop space with crane rails and a working crane running the entire east-west length of the northern bay. The ceiling consists of exposed steel Belgian trusses

[79] Bethlehem Steel Co. Shipbuilding Division, San Francisco Yard Calif., 1945, Sheet 20.

with sub-diagonals below corrugated metal roof cladding. The south wall is brick, while remaining walls are exposed steel frame with corrugated metal sheeting over a brick base. An office booth clad with sheet metal and steel sash windows stands at the west end. The floor is concrete with steel panels.

Historic/Current Use
The building originally constructed at the yard appears as a flange shop, boiler shop, and sheet metal shop in the 1899 Sanborn map (it does not appear on the 1886 map). The 1914 Sanborn map shows this L-shaped building infilled to form a square; the c. 1914 portion housed a blacksmith shop. The brick wall fronting 20th Street remains from the pre-1899 structure. The March 1945 site plan labels Building 105 as a “Forge Shop.”

The original part of Building 105 (represented by the south wall of the existing building) was built circa 1899, and was described as a new building housing a boiler shop and flanging shop in a January 1900 article in *Marine Engineering*:

The boiler shop is a new building, 90 ft. by 200 ft., with a flanging shop 60 ft. by 100 ft. attached. The frame is of steel, the walls of brick, and the interior is particularly well arranged and equipped. It contains some large tools, among which might be mentioned the large hydraulic riveter, with 12 ft. gap; the vertical bending rolls, that can roll I 3-4 in. plate 10 ft. wide; the horizontal rolls, that can bend I 1-4 in. plate 18 ft. wide; and the guillotine shears, that can shear 88 in. of I in. plate at one cut. There is also a new boiler shell drilling machine, in which a 16 ft. boiler can be set up on end and five drilling heads, each head operating three drills, can be worked simultaneously upon it. Flanging is done with a large Tweddell hydraulic flanging machine, circular flanges are beveled on a large milling machine made for the purpose, and manholes in heavy plate are cut with an elliptical boring machine or man-hole cutter. There is a fine assortment of punches, shears, gang drills, etc., and plenty of hydraulic jib cranes for handling the light work. Two 50 ton, overhead electric cranes, traveling on the same track, do the handling in the main shop, and the two large riveters have overhead traveling cranes of their own. All the large shears, punches, rolls, etc. are driven by independent motors.[80]

The 1899 and 1905 Sanborn Maps show the original part of Building 105 divided into three functional areas: a boiler shop in the east portion of the building, a sheet iron works in the west portion, and a flange shop in the western portion of the building that forms the short wing of the “L”. A coal shed attaches to the northeast corner. The yard south of the coal shed and east of the building is labeled “scattered lumber.”[81]

The 1913 Sanborn Map shows this L-shaped building infilled to form a square; the new northeast portion housed a blacksmith shop. A new copper and tin shop occupied the center of the building, where the sheet iron works had been located in 1899 and 1905. The coal shed and lumber yard area east of the original building were also filled in by 1913, forming a rectangular extension along the whole east side, labeled “lumber storage area.”[82]

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[80] “Shipbuilding Plant of the Union Iron Works at San Francisco,” *Marine Engineering* (January 1900), 16.
[81] Sanborn Map Company, Vol. 5 (1899), sheet 541; Sanborn Map Company, Vol. 5 (1905), sheet 541.
[82] Sanborn Map Company, Vol. 6 (1913), sheet 591.

In 1937, the building was entirely rebuilt, retaining only the south wall of the earlier structure. The new building retained not only the masonry wall, but also a function and layout similar to that shown on the 1913 Sanborn Map. The Bethlehem Steel Company plan of the building in 1944 labels the building as a forge shop. The plan shows that all the building's cranes date to 1937, and all other equipment and tools including forges, furnaces, hammers, blowers, pumps, and tanks, date to either 1937 or 1941.[83]

The building still functions as a shop for BAE.

Integrity
The building retains a high degree of integrity, as it is has experienced few alterations since its construction in 1937. Building 105 is a contributing resource because of its associations with the build-up prior to WWII as well as for its earlier associations with Union Iron Works.

Building 107 (Lumber Storage)
Figure 44

Dating to 1937 and standing just north of Building 19, Building 107 is a 3,461 square-foot rectangular plan, narrow steel frame shed measuring 124' long, 33' wide, and 20' 8" tall. It is clad and roofed with corrugated sheet metal, and has a 4' tall brick base at the western and southern elevations. [84] The eastern portion attaches to Building 108 and infills the southwest corner of Building 108's rectangular floor plan. Approximately 50 feet of Building 107 extends westward from Building 108 toward Building 103. Portions of the north elevation are open. Metal ducting runs east-west on triangular truss supports approximately 8 feet above the roof. Most of the southern elevation is concealed by Building 19.

A compressor room lies near the western end of the building; it is enclosed by corrugated sheet metal and has a metal door facing north. Building 107 shares its northern wall with Building 108, and multi-lite windows and doorways currently connect the two buildings. Building 107 also includes a gate that provides access between the east and west portions of the yard.

Historic/Current Uses
Built in 1937 by Bethlehem Steel, this building was used for lumber and tube storage for work occurring in Building 108. It is part of the late 1930s upgrades to the yard that increased storage space and organization of materials. Building 107 is currently used by BAE Systems mainly for storage.

Integrity
This simple industrial shed has seen little alteration and retains its integrity. Building 107 is a district contributor for its association with the late 1930s site-wide upgrades that positioned the yard for WWII government contracts.

[83] Bethlehem Steel Company Shipbuilding Division 1944, Sheet 43.
[84] Brick bases were common to the buildings constructed during the late 1930s.

Building 108 (Planing Mill and Joinery Shop)
Figure 45

Physical Description
Building 108 stands within a cluster of buildings including Building 111 (the former Main Office, Warehouse and Substation No. 3), Building 38 (the former Boiler Shop) and smaller storage sheds (Buildings 107 and 120). Built in 1911 and expanded in 1913, the architect and builder are unknown.

This two-story industrial building measures 155' long, 149' wide, and 50' tall, and contains 40,846 square-feet. The building incorporates two distinct masses, each under its own north-south oriented gable roof. The western half was constructed in 1911 and the eastern half was constructed two years later. A monitor sits along the western gable; skylights also penetrate the slopes of both gables. Corrugated steel sheathes the walls and roofs. Each mass has distinct openings – the eastern mass features eight-over-eight wood double-hung windows, while continuous bands of multi-lite steel sash stretch across the north, west, and south elevations of the western mass. At the eastern mass, wood rafter tails extend at the gable-ends; they do not at the western mass. Doors include rolling metal loading doors at the north and west elevations, and two personnel doors at the north end of the west elevation.

The 20,423 square-foot first floor contains a shop, a bathroom/locker room, and a storage area. Many large shelves and cabinets break up the otherwise uninterrupted space. Atop the concrete foundation, the floor is wood tongue and groove, worn and covered with plywood and steel plates in some areas. Walls are corrugated metal with exposed steel framing. The exposed ceiling structure consists of wood joists and cross-bracing supporting narrow tongue and groove wood sheathing. Riveted steel I-beams support the joists at regular intervals. The second floor boasts the same square footage and contains an open shop space with two small, narrow rooms at the north and south ends. The floor is wood, and walls are corrugated metal over exposed steel framing. Steel trusses support the roof at both gables. Skylights on the west face are exposed and those on the east have been covered.

Historic/Current Use
The shops of Building 108 worked to outfit the ships in the outfitting docks. The 1914 and 1936 Sanborn Maps call Building 108 a saw mill and joiner shops building. A joiner department builds the living quarters on a ship, such as lounges, recreational rooms, and crew space. Joiners produced "fancy woodwork, trimmings, and wood railings" – finish carpentry – in contrast to a carpenters department that typically built staging areas, launch ways, shoring, and supports for a ship under construction. Both joiners and carpenters historically were part of the outfitting division of a shipyard, along with the electrical department, sheet metal department, and paint department.[85]

The1914 Sanborn Map shows a car shop adjoining the southwest portion of the saw mill and joiner shops building. There are only two notable alterations shown on the 1936 Sanborn map: an extension and partition in the southeast corner of the building labeled "varnishing room," and a lumber shed in place of the car shop that appeared in 1914, Building 107.

[85] Bethlehem Steel Co. Shipbuilding Division, "An Introduction to Shipbuilding," (1942), 46-49.

In 1945, Building 108 functioned similarly to before, as a Planing Mill-Joiner Shop. The planing mill occupied almost the entire first floor at this time, with a small office at the northwest corner. Tools in the planing mill dated from 1911 to 1942, and included planers, saws, grinders, knives, drills, surfacers, jointers, and borers.[86]

A joiners shop occupied most of the second floor in 1945, except for, again, a small office in the northwest corner, and a varnishing room and polishing room in the southeast corner. Tools installed at the shop dated from 1911 to 1942 and included drills, chisels, saws, grinders, sanders, lathes, clamps, and a hoist.[87]

The building is currently used for storage by BAE, and retains wood shop equipment at the second level.

Integrity
The building retains a high degree of integrity, as it is has experienced few alterations. Building 108 is a contributing resource because of its associations with pre-World War I Bethlehem Steel site development.

Building 109 (Plate Shop No. 1)
Figure 46

Physical description
Building 109 stands near the site's northern edge, beside Slips 1, 2 and, 3. Building 109 was mostly constructed in 1912 as a Plate Shop and Mold Loft, although the eastern-most section was added in 1936 as a Tool Room. The architect and builder of this industrial-vernacular building are unknown.

Building 109 measures 483'-6" east-west, by 152' north-south, and 37' at the peak of the mold loft. It contains 82,099 square-feet of floor space. Corrugated steel clads the riveted steel frame. The plan forms a truncated "L" shape, with the short arm of the "L" facing south. Semi-exposed machine shops occupy the western part of the plan, while enclosed machine shops and the second-story Mold Loft occupy the eastern section.

Sixteen bays measuring approximately 20' wide run the length of the eastern arm of the building, beneath the mold loft. The 1945 Bethlehem Steel architectural plans indicate that the two easternmost bays were added on to the rest of the structure in 1936 for use as a tool shop. A series of five glazed monitors, each two bays wide, forms an uneven roofline along the north and south elevations, with a low-slope gable roof made of Howe trusses. The clerestory windows allowed maximum light into the mold loft, although most of the windows have been covered over with corrugated steel or fiberglass panels.

Diverse window and door openings appear on the elevations around the mold loft, reflecting the building's expansions and alterations. A continuous band of wood framed multi-lite windows runs the length of the second story of the eastern elevation and wraps around the corner of the north elevation. Some of the windows are operable. The ground level of the east elevation features two bands of multi-lite windows,

[86] Bethlehem Steel Co. Shipbuilding Division 1945, Sheet 64.
[87] Bethlehem Steel Co. Shipbuilding Division 1945, Sheet 65.

interrupted by multiple personnel doors and a vehicle door. The north elevation of the mold loft features an overhanging bay that projects approximately 12' beyond the footprint of the building and houses offices, bathrooms, and crane rooms for moving material to and from the ground level. A diverse series of steel sash windows, personnel doors, and vehicle doors line the north elevation beneath the projecting bay of the Mold Loft. The south elevation of the Mold Loft is currently unfenestrated, although cuts and infill in the metal cladding relate to prior window openings. A post-era-of-significance warehouse sits at the southeastern corner of the building, partially obscuring the south elevation. Inside the Mold Loft, a collection of wood templates used in the shipbuilding process, possibly from the era of significance, stands in racks against the west wall. Along the east end, a series of numbers indicating the grid used to lay out templates is painted on the floor.

The western part of Building 109 features a saw-tooth roof with a shed roof over the "L" extension and multiple ventilators and monitors penetrating the roof. Open to the north and south, the steeply pitched roof forms abut the monitors of the Mold Loft to the east. A line of continuous steel frame multi-lite windows runs the length of the first floor of the west elevation, with corrugated steel panels above and below.

Building 52, added to Building 109 in 1941, consisted of a lean-to shed housing a craneway along the short "L" portion of the southern façade. It measured 16' wide by 16' high, and 181' long in the east-west direction. This building is no longer extant.

Historic/Current Use
Building 109 housed a mold loft and plate shop where essential steps in hull construction took place. In the process of producing a ship from blueprint to hull, the construction plans were first transferred to a life-size model in the mold loft. This pattern was then taken to the mold makers who made a template out of wood, used for the guidance of marking the steel plates. The marked plates were then cut and shaped into the desired hull shapes in the plate shop. The finished plates were then transferred to the adjacent layout yard east of Building 109, where the plates were checked against the molds and plans before final assembly.[88] Building 109 stands next to Slips 1, 2, and 3, which facilitated the easy transfer of steel plates from the plate shop to the awaiting ships. The slips were infilled between 1959 and 1964. The plate shop served a critical role in the construction of a ship, and the multiple railways and craneways that served Building 109 underscore this role.

The Sanborn map from 1886 shows a machine shop and mold loft on piers in tidewater flats, at roughly the location of Building 109. The 1914 Sanborn map shows an expanded machine shop in the same location, with the tidewaters flats infilled, and the 1945 Bethlehem Steel plans indicate that most of Building 109 was erected in 1912.[89]

Currently, BAE Systems uses the exposed, western part of Building 109 for tool and equipment storage. The mold loft serves primarily as storage, although BAE Systems uses the central section for repair of sandblasting curtains. Multiple machine shops and painting sheds subdivide the area beneath the mold loft.

Integrity

[88] San Francisco Planning Department, 2001.
[89] Sanborn Map Company, Vol. 5 (1886), sheet 153; Sanborn Map Company, Vol.6 (1914), sheet 591.

Despite changes to doors and windows, as discussed above, and damage to some windows and corrugated steel panels, Building 109 retains integrity of location, design, materials, workmanship, feeling, and association. Building 109 is a district contributor because it was a central feature of the steel shipbuilding process occurring at the site from the early 1910s through WWII, as discussed in the national steel shipbuilding context, Criterion A.

Building 110 (Yard Washroom and Locker Room)
Figure 47

Physical Description
Building 110 stands to the west of Slip 4 and to the north of Building 109 in the northwestern potion of the shipyard. It forms a complex with Building 50, which stands immediately to the north. It is one of two extant washroom and locker room facilities installed during the late 1930s. Built in 1936, the architect and builder are unknown. This is a rectangular, 85'-4" long, 46' wide, 24' tall metal building that contains 1,356 square-feet. It has a gable monitor roof and corrugated metal siding and roofing, set above five-foot high brick walls. The horizontal strip windows are steel sash with operable awning panels.

Historic/Current Use
Building 110 was part of the yard's 1930s modernization effort, which included new worker facilities near the slipways. A 1938 article in the *Pacific Marine Review* described in glowing terms the "reconditioning" of the venerable Union Iron Works shipyard, "recently…rejuvenated and transformed into a modern shipbuilding establishment."[90]

Singled out for special praise was the upgrading of amenities for workers, including washrooms like Buildings 110 and 119, both built in 1936:

> The most spectacular betterment in this program of progress is the modern sanitary provision for the comfort of the employees. For every man employed there is provided a large steel locker, and adjacent to these lockers is installed ample provision in lavatories and toilets. These are all kept in sanitary condition by an ample corps of janitors. Mastic tile is used on all floors.[91]

The Bethlehem Steel Co. plan for Building 109 of January 1945 also shows Building 110, labeled "wash room erected 1936," but does not include a floor plan.[92]

Building 110 is currently vacant.

Integrity
Building 110 shows few alterations and therefore retains integrity of location, design, materials, workmanship, feeling, and association. It contributes to the historic district because of its association with the

[90] "Bethlehem Reconditions Potrero Works," *Pacific Marine Review*, 35 (October 1938), 22.
[91] "Bethlehem Reconditions Potrero Works," 25-26.
[92] Bethlehem Steel Co. Shipbuilding Division 1945, Sheet 49.

late 1930s upgrade of the site to increase worker facilities. Building 110 is also a representative example of the architectural style and materials used at the site during the late 1930s. .

Building 111 (Main Office/Warehouse and Substation No. 3)
Figure 48

Physical Description
Building 111 is part of a group of buildings that include Building 38 (1915) and Building 108 (1911). This industrial/Renaissance revival-style building dates from 1917. The architect/engineer and builder are unknown.

This four-story, rectangular, and finely-detailed brick building has a flat roof and extensive glazing. It measures 212' long, 50' wide and 65' tall, and contains 46,272 square-feet. The first floor is high, and topped by a wide, cast belt course. Openings on this floor have arched heads, with terra cotta keystones and impost blocks. At the northern end, a mezzanine creates a second story. This area contains office space, with wood, two-over-two double-hung windows and paneled spandrels between the two levels. The second bay has a personnel door in a profiled surround. An open, north-south loading bay runs through the building west to east. The seventh bay of the west elevation has a metal rolling door. At the southern end, the arched window openings contain steel sash panels with some operable awning sash. The three floors above are uniform, with wide rectangular steel sash windows. Windows on the second and third floors along the north elevation have been replaced with aluminum units. A machicolated cornice tops the building.

The brick masonry is of a very high quality. In addition to the cornice detailing, header courses run vertically up both sides of each pier. Rowlock courses run at the top of each window. Diagonally placed bricks form diamonds, centered in each spandrel panel at the third and fourth floor levels.

The approximately 40,000 square-foot interior consists primarily of open storage space, with some offices and partitions on each floor. The open warehouse space has board-formed square concrete columns with angled tops. Floors and ceilings are painted concrete and exterior walls are painted brick. Interior partitions on some floors include drywall and hollow clay tile. Board formed poured concrete walls form the elevator shaft. Poured concrete stairs are surrounded by concrete walls, with metal pipe handrails at the upper floors. Plaster and marble wainscoting clad the stairwell between the first and second floors, along with decorative cast iron and wood handrail assemblies. Notable features include a counter-weighted metal fire door at the south end and original wood shelves and work benches.

The northern end of the first floor and the mezzanine that sits half a floor above it contain finely-detailed, richly-finished offices. Walls are painted plaster and brick. Marble wainscoting lines the foyer and oak trim includes door-height picture moldings. Doors are paneled wood, with wire-glazed upper panels and original hardware. Above the wood picture moldings are oak-trimmed clerestory windows.

Historic/Current Use

Building 111 was built to be multifunctional, and principally provided support for outfitting activities at Pier 68. Within its walls were offices, warehouse space, and power generation facilities. It is currently used for inactive storage by BAE Systems.

Integrity
Despite window replacements at the north end and some non-contributing interior finishes, Building 111 retains a good degree of integrity, especially at the exterior. The west, primary elevation exhibits few modifications. Building 111 is therefore a contributing resource because of its associations with WWI and its high artistic merit.

Building 113/114
Figures 49, 50, 51, and 52

Physical Description
Building 113/114 stands on the south side of 20th Street. The earliest remaining structure on site, it was designed by Civil Engineer Dr. D. E. Melliss.[93] The eastern portion was completed in 1885, and the western, in 1886.[94] The two structures were joined by a connector in 1914.

This two-block long industrial structure consists of the two original unreinforced brick buildings, and the central reinforced concrete connector. Building 113/114 measures 492' long by 175'-6" wide by 62' tall, and contains 89,686 square-feet of floor space. Both brick structures have high gable roofs with monitors, projecting piers, arched windows and simple corbelled cornices. A lower, double gable section extends the western portion south creating an "L." While the two sides of the building are similar in form, scale, and materials, they differ in terms of fenestration, bay width, and rooflines.

Building 113 includes all of the 81,964 square-foot area beneath the high, single gable as well as the northern portion of the double gable structure (including an 8,800 square-foot mezzanine); Building 114 comprises only the 7,722 square-foot area beneath the southern gable of the double gable portion.

The eastern portion originally housed the blacksmith and boiler shop. It stands under a single gable roof with an original central, venting monitor and two, slightly later strip skylights along the northern and southern roof slopes (these show up in the 1899 but not the 1886 Sanborns). The long, north and south elevations are eleven bays wide. Each bay contains a single arched wood multi-lite window. The short, east elevation is seven bays wide, with a corrugated metal-clad shed addition, built in 1941, abutting the southern end (Building 23).[95] Like the long elevation, each bay has one arch-topped, multi-lite wood window. In addition, a high, arch-topped window penetrates each of the three central bays.

[93] Machine Shop, Union Iron Works Original Drawings 1882-1884, Tube #900, J. Porter Shaw Library; "*San Francisco Call*, January 24, 1884, p. 5/7.
[94] Bethlehem Steel General Plan, 1945.
[95] This shed addition is Building 23. "Testing and Boiler House."

The connecting structure is similar in style to the roughly contemporaneous steam power house across the street (Building 102). It is classically detailed, with a large, arched central opening and flanking steel sash windows. Cast cartouche ornaments top each of the four piers and a dentiled cornice completes the wall.

The western portion, which originally housed the machine shop, sits beneath a high and broad, nine-bay wide single gable, and two lower and smaller three-bay gables. The primary (north) elevation has eleven bays. Most bays feature three arched window openings at both the first and second story; however, the central bay has five arched windows at each level, and an infilled brick arch between the first and second levels, indicating that this may have once been the primary entry for his building. The arched windows are multi-lite wood sash.

The west elevation is fifteen bays wide. A corbelled band continues across this elevation at the same level of the north-elevation's cornice, visually dividing the elevation into two stories. Beneath the larger, nine-bay gable, the three northern-most bays feature paired, arched windows similar to those at the north elevation. The three central bays have a single larger arched window in each bay, with four arched windows at the second level. The last three bays beneath the wide gable, as well as the six bays under the lower, double gabled portion, each have a single multi-lite arched window, narrower than those in the central bays.

The east elevation of the double-gabled portion features three arches. A single monumental arch stands beneath the northern gable; its lower portion has been infilled, while the upper retains multi-lite wood window sash. A central pilaster divides the southern gable façade into two bays; each of these has a single, arched multi-lite wood window, extending only halfway down the wall. At the lower portion, a loading door accesses the building, centered beneath the pilaster. Smaller, 12-lite wood windows flank the loading door.

The interior beneath the main, high-gabled portion of Building 113 is a clear span space with machinery and free-standing office enclosures at the connector. A railroad track bisects the space transversely. Attached to the exposed steel truss ceiling are two 30-ton bridge cranes marked either with the numbers "7" or "8," which appear to date to 1896. Two 5-ton bridge cranes span the south bay of the eastern portion and may also date to the late 1890s. Two 20-ton bridge cranes span the south bay of the western portion and may also date to 1896.[96] Jib cranes are attached to the steel columns in the central bay and project from the north and south walls in the eastern half. Several pieces of large equipment remain; footprints of additional removed machinery are also visible. A concrete pit with a maze-like layout of concrete walls slices through the eastern end of Building 113; it allowed workers access to the underside of equipment. This pit was likely added after the period of significance, as it does not appear on the 1945 Plan or any of the earlier Sanborn maps.

End-grain wood blocks, roughly six inches square and covered with asphalt, pave the floor. The building's walls are unreinforced brick, with one concrete section. A mezzanine hangs over the north side of the western half. It is accessed at the east end by an iron staircase and on the west by an iron spiral staircase. Small wood-framed, free-standing, one-and-two story single-room office enclosures stand within and adjacent to the connector. These sheds have varying ceiling heights and multi-lite steel sash windows. A sign on one of these enclosures reads: "Notice to Employees: Machine Shop No. 1 & No. 2. All employees must return all tools to

[96] Plans of The San Francisco Yard, Bethlehem Steel Company, Shipbuilding Division 1944-1945, Sheets 45 and 46.

the tool crib when finished with job…only the tools that were originally issued with tool boxes are to be kept out." Another sign reads: "The Machine Department has worked____ days without a disabling injury."

The interior of Building 114 is separated from that of 113 by a brick masonry fenestrated wall. Building 114 measures 200' long by 40'-6" wide and contains approximately 8000 square-feet of floor space. The floor is asphalt-paved, and walls are unreinforced brick, except for the south wall, which is board-formed concrete (probably dating from 1917 when the adjacent Building 115 was constructed). The ceiling is an exposed steel structure, which in this case includes five, four-sided caged trusses. A skylight sits over the western end. Rail lines run across the center of the building transversely, connecting to both Buildings 113 and 115. There are also 10 ton cranes, and several curbs and platforms that once held ovens, furnaces, and other foundry-related equipment.

Historic/Current Use

Building 113 changed functions and floor plans several times between its construction in mid-1880s and WWII. The western portion of Building 113 originally housed the Machine Shop, while the eastern portion contained the Blacksmith and Boiler Shops. By 1945, the entire Building 113 served as a Machine Shop, with Building 114 serving as the Foundry Furnace Building. The buildings are not currently in use.

Machine shops have historically been considered part of a shipyard Engineering Department, along with the Blacksmith Shop, Pipe Shop, Boiler Shop, Foundry, and Pattern Shop. According to a Bethlehem Steel Co. manual, produced for new employees in World War II, shipyard engineering work included a ship's propulsion and auxiliary machinery, steering apparatus, and all piping.[97]

Building 113 was designed as a multi-purpose building, with a functional division between the eastern and western portions. In the late 1880s most of the western portion was devoted to the Machine and Erecting Shop, with car tracks crossing the floor. The eastern portion had a Blacksmith Shop in the north half and a Boiler Shop in the southern portion. There was also a small, two-story management office and drawing room in the northeast corner of the western (machine shop) portion of the building. That was the main shipyard office until 1896. Other shipyard offices were located in the basement of the Boiler Shop in the eastern portion. The southwest corner of the Machine Shop had a brass foundry, copper shop, and tool room. An engine room was at the southeast corner of the machine shop.[98]

A simple description of the function of the Union Iron Works' Machine Shop appears in an 1885 report on shipping and ship building in San Francisco. It offers an invaluable description of the shipyard in its first years of operation: In this shop engines, large or small, can be put together complete, then picked up by an overhead traveling crane, placed upon a car, and taken to the wharf, where a set of steam shears, with a capacity of 100 tons in a single piece, again picks it up and puts it in a vessel in the position required.[99]

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[97] Bethlehem Steel Co. Shipbuilding Division (1942), 16, 43-44.
[98] Sanborn Map Company, Vol. 5 (1886), sheet 153; General Plan: Machine Shop, Union Iron Works Original Drawings 1882-1884 Tube #900, J. Porter Shaw Library; Hopkins 1885, pp. 35-37; *San Francisco Call*, July 26, 1896, p. 10/2.
[99] This 1885 report was prepared by three prominent San Francisco business groups: The Manufacturers' Association, the Board of Trade, and the Chamber of Commerce. Lead author was Caspar Hopkins. Hopkins 1885, p. 36.

The western portion of Building 113 was divided by four rows of cast-iron columns into five bays: four of them were 40' by 200', and one was 55' by 200'. In the 1880s the erecting shop used two bays, each equipped with overhead hydraulic traveling cranes. Three of the bays contained operating machinery.[100]

According to the Hopkins' report, the machine shop equipment was considered state-of-the-art in 1885. The shop had a planer that could "plane a surface twelve feet wide and twenty-six feet long, fitted with six cutting tools, suited for planing and cutting any type of machinery." The lathe department had a lathe that could "turn a shaft 49 feet long, or a crank shaft, such as is used in compound marine engines… the most complete tool of its class in the United States." The shop's largest boring mill could "turn thirty feet in diameter and ten foot face, or it will plane a surface thirty feet long by ten feet wide. The machine will also perform boring, planing, slotting, drilling and key-seating…It combines all the modern tool improvements known up to 1884, and is said not to be excelled by any similar machine in the world." The machine shop also had "one of the largest hydraulic presses in the world, for pressing in crank pins and pressing on crank plates."[101]

Engine House/Boiler Room (western portion of Building 113)
A 40' by 80' engine house and boiler room (no longer extant), with a 120-foot high octagonal chimney, was adjacent to the southeast end of the machine shop. It was described in detail by a reporter for the *San Francisco Call,* who visited the shipyard in January 1884:

> In the [engine house] will be a condensing horizontal engine…. There are also a separate engine for the electric light machines, an air compressor, and pumps for the accumulator for supplying hydraulic power throughout the establishment. In the boiler room there are two boilers of the Dickie patent... The chimney is a handsome octagonal structure, 120 feet high and 6 feet internal diameter. The roof of the engine building is an iron tank two feet in depth, in which will be cooled the water from the condensers of the main engine, thereby saving considerable expense, as by this method only about 800 gallons of water per day will be required.[102]

The reporter further noted that "Those living in the neighborhood of the works will be pleased to hear that the furnaces are claimed to be absolute smoke-consumers."

Tool Room/Blacksmith Shop (western portion of Building 113)
The 1884 *San Francisco Call* article and the 1885 Hopkins report both describe a small tool room adjacent to the southwest end of the machine shop; however, the 1886 Sanborn Map shows a small blacksmith shop in this location[103]

Brass and Copper Shops (western portion of Building 113)
Adjoining the south end of the tool room/blacksmith shop was the brass foundry and copper shop. The brass foundry was described in 1900 as a very busy shop; Union Iron Works made a great deal of brass work, such as valves and marine fittings that most shipyards bought from special manufacturers. In 1900 it had an

[100] Hopkins 1885, p. 35; *San Francisco Call,* January 24,1884, p. 5/7.
[101] Hopkins 1885, pp. 35-36.
[102] *San Francisco Call,* January 24, 1884, p. 5/7.
[103] Hopkins 1885, p. 37; Sanborn Map Company, Vol. 5 (1886), sheet 153.

overhead electric crane of 12 tons capacity, as well as hardening furnaces, tempering and babbitting furnaces, and hydraulic cranes.[104]

The 1914 Sanborn Map shows an enlarged and reconfigured Brass Foundry in the southwest corner of Building 113. A 1916 article in *International Marine Engineering* cites a new brass foundry among the many improvements at the shipyard under new Bethlehem Steel management.[105]

Offices in the Machine Shop (western portion of Building 113)
The offices of Irving M. Scott and his brother, Henry T. Scott, general manager and president, respectively, of Union Iron Works, were described in the *San Francisco Call* newspaper in 1892:

> Blue prints and lithographs hang on the walls and are standing in rolls in nearly [every shelf] of the office of Irving M. Scott, the president of the Union Iron Works… Mr. Scott's office has three sections, one an outer room for his employees, one for himself and his brother, Henry T. Scott, and another adjoining the latter one, containing a long table and cases full of drawings. The last-mentioned room is for consultations of a mechanical nature, and the long table is for the purpose of spreading out the drawings. The desk of Mr. Scott is a double flat one, and is occupied by the two brothers, one on each side. Between them is the paraphernalia necessary to complete the furniture of a writing-desk, and most days a lot of letters, pamphlets, price lists or circulars.[106]

Other shipyard offices occupied the basement of the boiler shop before the mid-1890s. By 1896 these machine shop offices were described as "inconvenient and in such a scattered location that bookkeepers, draughtsmen and clerks were compelled to work by gaslight during the daytime."[107]

Most of the shipyard offices were relocated to a new office building (Building 104) in 1896. The 1899 Sanborn Map shows that the old two-story machine shop offices in the northeast corner of Building 113 were converted to a tool room and electrical department, with a small office space remaining in the northeast corner.[108]

By 1914 the offices in the northeast corner of Building 113 had apparently been removed; the Sanborn Map of that year shows no demarcation of space in the northeast corner. This map does show a new mezzanine at the north side of the building's western half.[109]

The Boiler House (eastern portion of Building 113 in 1885)
The boiler shop, in the southern half of the buildings eastern section, was used for construction of ship's steam boilers. According to the *San Francisco Call*, the building's eastern half, housing the boiler shop and

[104] *Marine Engineering* (January 1900), 14; Hopkins 1885, p. 37.
[105] Sanborn Map Company, Vol. 6 (1913), sheet 593; *Marine Engineering* (March 1916). Pam File, Union Iron Works, J. Porter Shaw Library, no page number.
[106] *San Francisco Call*, November 25, 1892, p. 6/1.
[107] *San Francisco Call*, July 26, 1896, p. 10/2.
[108] Sanborn Map Company, Vol. 5 (1899), sheet 543.
[109] Sanborn Map Company, Vol. 6 (1913), Sheet 593.

blacksmith shop, was the first completed building at the Union Iron Works shipyard. It was described on January 24, 1884, as "ready for occupancy, and the machinery is being placed in position with all possible haste, the probability being that in about two weeks the shop will be in running order."[110]

The boiler shop had hydraulic machines for riveting, planing, and shearing; bending machines for shaping or bending iron, rollers for rolling iron or steel boiler plates, and heating furnaces for plates. It also had smaller equipment such as angle iron shears and punches. A railroad connected to an overhead hydraulic traveling crane which moved through the entire length of the building, for efficient and cost-effective movement of work and materials.[111]

The Blacksmith Shop (eastern portion of Building 113 in 1885)
The Blacksmith Shop, in the north half of the building's eastern section, had three steam hammers as well as other tools for forging work, and a system of hydraulic cranes. In 1900 the blacksmith shop had 24 fires, and hydraulic jib cranes for handling heavy work under the hammers.[112]

Alterations to the Plan of Building 113
By 1899 the building's internal functions and plan had changed. The Erecting Shop had been moved from the western (Machine Shop) portion to the south half of the eastern portion, taking the place of the Boiler Shop. In 1899 the eastern portion was shared by the Forge Shop in the north wing and erecting shop in the south. The Boiler House was moved from the east wing to the southeast corner of the western half of the Machine Shop, where the Engine House had been located in 1886. The offices in both halves of the building were relocated to the newly erected Building 104, constructed in 1896. This arrangement also appears on the 1905 Sanborn Map update.[113]

In 1914, a connector building joined the eastern and western halves of Building 113. By 1914, the Boiler House and Forge were no longer part of the Machine Shop complex. A new Bolt and Rivet Shop was located in the north half of the building's eastern portion, where the Forge Shop stood in 1899 and 1905. The Erecting Shop remained in the south part of the eastern portion.[114] The 1936 Sanborn map shows the same basic layout as the 1914 Sanborn Map.

The Foundry Building, Building 114
Foundry workers made metal castings of tools or machinery based on drawings produced by shipyard draftsmen, and machine part forms produced by the pattern shop. In the foundry, molders worked with several large cranes and cupolas (round furnaces) capable of melting tons of iron, large core ovens, and pits for

[110] *San Francisco Call*, January 24, 1884, p. 5/7.
[111] Hopkins 1885, pp. 38-39; *San Francisco Call*, January 24, 1884, p. 5/7.
[112] Hopkins 1885, p. 40; *Marine Engineering* (January 1900), 15.
[113] Sanborn Map Company, Vol. 5 (1899), sheet 543; Sanborn Map Company, Vol. 5 (1905), sheet 543.
[114] Sanborn Map Company, Vol. 6 (1913), sheet 593.

making castings of molten iron or steel in almost any size and shape. In the late nineteenth century, the molds were mostly constructed of sand, although some loam was used.[115]

The 1886 Sanborn Map shows that the south end of the foundry had several functional features: a core room with core ovens at the southwest corner, three cupolas (round furnaces) on an iron floor in the center of the south end, and a coke shed at the southeast corner. The coke shed does not appear on the 1899 Sanborn Map.[116]

There are no signs of shipyard development south of Building 114 on the 1886 Sanborn Map. From 1899-1905, however, the open space south of the foundry had a rail line, a Flask Storage Yard behind the Foundry's western portion, and a scrap iron yard behind its eastern portion.[117]

Foundry Molding Pit and Core Ovens
The main molding pit for making the largest metal castings was 14 feet in diameter and 14 feet deep. A second pit was 9 feet in diameter and 10 feet deep. The foundry had four core ovens for drying cores from a few ounces to 20 tons, and an overhead traveling crane covering the whole space of the foundry floor "so that a casting may be run from or to any part of it."[118]

Foundry Cupolas
Hopkins describes the three foundry cupolas as capable of making castings weighing 60 tons in three hours. The cupolas had a hydraulic lift to carry up iron, coal, and coke.[119]

Hopkins admired the shipyard's system of car tracks that facilitated movement of materials within buildings. In the foundry, "the car track delivers the iron, coal, or coke, or takes the material from the cupolas without any additional cost for handling or transportation, and also enters the foundry at two points convenient to the overhead cranes."[120]

Building 113/114 was used by BAE Systems for ship repair work until 2001 when it was abandoned because of structural problems. Building113/114 is currently not in use.

Integrity
This building retains a very high level of integrity. It is a contributor to the historic district because of its associations with the earliest Union Iron Works period through World War II. Building 113/114 was one of the original buildings constructed on the site and is a necessary element in understanding the layout of the site. It is the only extant example of the American Round-arched style, used for the original construction of

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[115] Blum 1989, pp. 98, 110.
[116] Sanborn Map Company, Vol. 5 (1886), sheet 153; Sanborn Map Company, Vol. 5 (1899), sheet 543; Hopkins 1885, p. 37.
[117] Sanborn Map Company, Vol. 5 (1886), sheet 153; Sanborn Map Company, Vol. 5 (1899), sheet 543; Sanborn Map Company, Vol. 5 (1905), sheet 543.
[118] Hopkins 1885, p. 37.
[119] Hopkins 1885, p. 37.
[120] Hopkins 1885, p. 38.

the yard and is an essential component of the district's ability to represent industrial architecture from the 1880s through 1945.

Building 115/116 (Concrete Warehouses)
Figure 53

Physical Description
These buildings stand along the western edge of the district, between Buildings 114 and 117. Built in 1916/1917, the architect/engineer and builder are not known. [121]

This three-bay reinforced concrete structure has a strong, industrial modernist aesthetic, characterized by expressed structure with expansive, multi-lite wood sash windows. Altogether the three sections measure 218' long, by 174' wide, by 57'-2" tall at the highest gable, and contain 33,858 square-feet of floor space. Constructed as a single building with three similar gable bays, a board formed, poured-in-place concrete wall divides Building 115 (northernmost bay) from the double gable Building 116. The southern bay of 116 is higher than the two northern bays of the group. The gable roofs have squared parapets at the gable tops. Beneath the two gables of Building 116 are ventilation grilles; plywood infills the vent opening on Building 115. The words "Pacific Coast Steel Corporation" appear on the center gable of the west façade.[122] A corrugated metal shed-roofed addition abuts the south end on the west side.

Building 115 is one story tall and measures approximately 60' wide by 200' long. The primary entry is through the east end. The roof assembly consists of steel decking over steel framing with Belgian trusses spanning the full width of the building. The east and west walls are primarily solid, board formed concrete. The north perimeter wall is contiguous with Building 114, has a clerestory of steel sash windows in the upper portion, and a center opening connecting to Building 114. The south wall is a partition shared with Building 116. A central opening provides access between the two buildings. A heavy, rigid conduit rises from a box mounted at the north end and runs along the west wall. Pipes run along the north, south, and west walls, with a caged stairway at the northeast corner. One large 20-ton crane on heavy steel tracks mounts on the walls. Three, two-ton jib cranes attach to the south wall, and a one-ton jib crane swings out from the west wall. The asphalt floor is in good condition.

Building 116 is a double-bay building measuring 120' by 200'. A row of columns runs between the two bays. Interior floor, wall, and ceiling finishes are similar to those in Building 115. The east and west walls of the north bay are primarily glazed. In the south bay, high wood sash windows run the length of the building, with two tiers of steel sash, five bays each, at the east end. Openings at the concrete west end, infilled with boards, opened to the adjacent Building 117. Two, one ton, swing-out cranes mount to the center columns. Vertical pipes attach to a central column, one for acetylene gas and the other for oxygen; each has six spigots. A wood

[121] Bethlehem Steel's plans for the yard lists 1917 as the construction date. A January 1916 newspaper article, however, discusses the building. Most likely, the buildings were constructed in 1916 and completed later that year or in early 1917. Plans of the San Francisco Yard, Bethlehem Steel Company, Shipbuilding Division 1944-1945, Sheet 62.
[122] Pacific Coast Steel was a subsidiary of Bethlehem Steel acquired in 1929. *Time*, December 16, 1929.

plank wall runs along the center west portion at the south side of the columns. A one-story CMU shed stands along the west wall in the south bay.

Historic/Current Use
Buildings 115 and 116 were used for fabricating and erecting components for a ship's mechanical and propulsion systems, as well as producing a wide range of metal components for shipbuilding, ship repair, and the ship yard.

Building 115
Building 115 was constructed as a new foundry, adjacent to the original shipyard foundry, Building 114. A contract for building the new, one-story reinforced concrete and steel foundry was awarded in January, 1916. According to PG&E's *Pacific Service Magazine*, the new foundry, was under construction by June 1916.[123] The *San Francisco Examiner* described Building 115 as "the first building included in the many improvements to be made at the plant of the Union Iron Works," to meet a growing demand for ships. The building contract was for almost $100,000; neither the contractor nor the designer was mentioned in the *Examiner* article.[124]

The *Bethlehem Star*, a journal published by the Bethlehem Shipbuilding Corporation in 1918-1919 for the employees of the Union Iron Works shipyard, described the iron foundry, under the leadership of R. Schilling, as one that "turns out more iron per man than any other foundry on the Pacific Coast."[125] By 1919, the *Bethlehem Star* reported that the new foundry was producing over a million pounds of castings a month for the machine shop. "Last January the foundry management promised J. J. Tynan [Joseph J. Tynan, General Manager] to turn over to the machine shop a million pounds of good clean castings each month. We have made good, J. J., and have over a million pounds to spare."[126]

Building 115 is identified on the 1945 Bethlehem Steel General Plan as a foundry mold room building, in contrast to Building 114, which is identified as a foundry furnace building. A double rail track connected Buildings 114, 115, and 116.

Building 116
1n 1945 Building 116 served a dual function: an ordnance repair shop in the northern half and a warehouse in the southern half.[127] The ordnance repair function was a World War II development; a plan of the shipyard published by *Pacific Marine Review* in 1938 identifies Building 116 simply as "Steel Warehouse." [128] In 1945 the western half of the Ordnance Repair Shop was divided by a wood partition, 8' high, with an office beneath

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[123] *Pacific Service Magazine*, VIII (June 1916), 6.
[124] "Iron Works Is To Build An Addition," *San Francisco Examiner*, January 16, 1916, p. 45, Real Estate & Finance Section; *San Francisco Examiner*, January 26, 1916, p. 3/1.
[125] An intriguing note was included about R. Schilling as a "politician [who] used to rule Scotch Hill," known later as Irish Hill. *Bethlehem Star*, I (June 1918), 9.
[126] "Foundry Smoke," *Bethlehem Star*, I (April 1919).
[127] Plans of the San Francisco Yard, Bethlehem Steel Company, Shipbuilding Division 1944-1945, Sheet 62.
[128] *Pacific Marine Review*, 35 (October 1938), 26.

the southwest corner. A second small office stood at the building's southeast corner, in the warehouse section.[129]

Tools and Equipment in the Ordnance Repair Shop section of Building 116 during WWII were as follows: Radial Drill (1942, owned by the Government); Bench Drill #16, "Buffalo" (1942, Government); Contour Saw (1942, Government); 2 Grinders (1942, Government); Core Oven UIW (1917, owned by Bethlehem); Babbit Pot 2 Holer B. S. Co. (1937, Bethlehem); 15 foot 1 ton Jib Crane Yale (1918, Bethlehem); Shop Car UIW (1917, Bethlehem); Bending Slab on Legs (1943, Bethlehem). Tools and Equipment in the warehouse portion of Building 116 that Bethlehem owned included generators under the platform at the western section: one generator, 25 kw "Allis Chalmers" (1937); one 40 H.P. Motor (1937); a thirty-ton Crane "Cyclops" (1937); and a Pitchometer (1919). Government owned equipment in the warehouse included a Power Hack Saw from 1943. [130]

Currently both buildings are used for Port maintenance.

Integrity
The buildings retain a high degree of integrity, experiencing few alterations since 1917. These buildings contribute to the historic district because of their association with both World Wars. They are also important to the district's expression of the development of industrial architecture. Buildings 115/116 are either a precursor to or a very early example of Modern Movement principles applied to industrial architecture and contribute to the shipyard's embodiment of significant twentieth-century trends in industrial architecture.

Building 117 (SF Shipyard Training Center – Warehouse No. 9)
Figure 54

Physical Description
Building 117 stands south of the complex created by Buildings 113/114, 115/116 and 102. Together with Building 14, forms a large courtyard space (see accompanying site map). Constructed in 1937/41, Building 117 is a wide, one-story warehouse structure located between the remnants of Irish Hill to the south and Building 116 to the north. It measures 240' long, by 131' wide, by 45'-6" high at the gable, and contains 30,940 square-feet of floor space. The architect and builder are unknown.

Corrugated, galvanized iron siding clads both the exterior walls and roof of the building. A shed addition attaches to the south elevation. Continuous bands of multi-lite steel sash windows stretch across each elevation, some with operable central vent sash. A personnel door opens at the north corner of the east elevation, and a large roll-up metal door on the east corner of the north elevation allows freight to be transferred to the warehouse interior. Painted signage underneath the east gable reads, "San Francisco Shipyards Training Center." This signage dates from the 1990s.

[129] Plans of the San Francisco Yard, Bethlehem Steel Company, Shipbuilding Division 1944-1945, Sheet 62.
[130] Plans of the San Francisco Yard, Bethlehem Steel Company, Shipbuilding Division 1944-1945, Sheet 62.

The roof consists of steel decking over steel roof rafters, spanning modified Pratt trusses. The trusses are supported by a central row of steel I-section columns. Industrial incandescent light fixtures and corrugated plastic skylights light the interior. The slab-on-grade floor is covered with asphalt. The floor inclines to the south and the entire south bay is elevated approximately eighteen inches. Railroad rails run from the loading door at the northeast corner to the raised area at the southeast corner. Crane tracks attach to the roof, running east to west for the length of the building. The west wall has concrete infill spanning between steel columns. The north wall is contiguous with Building 116 and is composed primarily of concrete infill; wood infill at the west end indicates a blocked access door to the adjacent building.

Historic/Current Use
Building 117 is listed in the 1945 Site Plan as a "Warehouse." It still serves as a storage building.

Integrity
The building retains integrity, having experienced few alterations. Building 117 contributes to the historic district for its relationship with sweeping site upgrades prior to WWII and its association with the influx of new workers during WWII that necessitated a training center.

Building 119 (Yard Washroom)
Figure 55

Physical Description
Building 119, constructed in 1936, stands immediately south of Building 38. Its architect/engineer and builder are unknown. It is one of two washrooms added during the late 1930s and one of four WWII-era washrooms extant at the site.

This one-story rectangular metal building is 60' long, by 24' wide, by 19' high, and contains 3,925 square-feet of floor space. It has a corrugated metal, gabled, truss-supported roof with monitor. Cladding is corrugated steel over five-foot high brick walls, typical of the late 1930s construction style at the site. Windows are steel sash with pivot ventilators and ventilation grilles in the raised monitor. Glazed metal entry doors, each with a three-lite transom, are at both the east and west ends.

The 1,400 square-foot interior is mostly open, with metal stalls along the south wall. A row of five circular concrete washbasins dominates the remaining area. The ceiling consists of Fink trusses supporting corrugated metal roofing. The walls are corrugated metal and painted brick with exposed steel structure.

Historic/Current Use
This building, although currently unoccupied because of structural damage, has always served as a wash room. It was part of the pre-World War II construction campaign.

Integrity

The building retains a high degree of integrity. This is a contributing resource because of its associations with the construction of worker facilities prior to WWII.

Building 120 (Pipe Rack and Women's washroom and locker room)
Figure 56

Physical Description
Building 120 is an open shed located between Buildings 108 and 111. A simple utilitarian structure, this single story, steel frame shed was constructed in 1936 and expanded in 1942. The structure measures 71' long, by 22' wide, by 20' 8" high, and contains 1,392 square feet. The cladding is corrugated metal set above a brick base. Five open bays on the west elevation reveal an interior brick cross-wall between the first and second bays and a metal cross-wall between the second and third bays. A metal ramp ascends to the northern-most bay, while a fence encloses the three southern bays and the adjacent paved area to the west.

Historic/Current Use
This building served as a "Pipe Rack," an ancillary building to the adjacent Planing Mill (Building 108). The northern end was constructed in 1942 to provide a women's washroom and lockers. During WWII separate women's facilities were added to existing buildings (Buildings 11, 12, 14, 39, 54 101, 104, 110, and 113 all have clearly marked women's facilities), and several separate facilities, no longer extant, were erected on the wharfs. [131] This structure is currently used for storage.

Integrity
This building retains sufficient integrity for inclusion in the historic district because of its association with pre-WWII upgrades to the site aiming to increase material storage and handling and to improve worker facilities during WWII. The expansion of Building 120 catered to the growing female labor population at the yard during WWII.

Building 121 (Drydock Office)
Figure 57

Physical Description
This building stands in an open area north of Building 105. Originally constructed in 1941, it was moved before 1975 from its original location near Building 6, where it was designed to fit between two structures so as not to impede traffic on the dock.

This single-story, freestanding, flat-roofed wood frame office building is clad in shiplap siding and has an irregularly shaped six-sided footprint that contains 584 square feet. The building has a variety of opening types. Doors are wood; they are found at the east, the short north wall, and the west elevations. Windows along the east and northeast elevations are continuous bands of multi-lite wood sash, while the western façade features three high, four-lite wood sash.

[131] Plans of the San Francisco Yard, Bethlehem Steel Company, Shipbuilding Division 1944-1945, Sheet 64.

The interior of this small two-room structure has lost integrity due to extensive interior modifications.

Historic/Current Use
Building 121 originally served as a Timekeeper's Office. It remains in use as a field office by BAE Systems.

Integrity
Despite a move that postdates the period of significance, the building retains integrity of design, materials, workmanship, feeling, and association. While it retains an industrial context, its move to an open site, rather than a constrained one, renders the building's odd shape meaningless. This building retains sufficient integrity for inclusion in the historic district, relating to the increased need of management oversight at the wharves during WWII.

Building 122 (Check House No.1)
Figure 58

Physical Description
Located between Buildings 102 and 104, this small Spanish Eclectic structure was constructed in 1937.[132] It is one of two extant check houses on the site. The architect and builder are unknown. One-story high, the concrete, stucco-clad building measures 30'long, 25' 6" wide, and 16' 8" high, and contains 714 square feet. Its hipped roof is clad in straight mission tiles. Three bays, marked by simple pilasters, enclose three pairs of wood-paneled, multi-lite glazed doors. Exterior decorative elements consist of basic details such as the simple, moulded cornice and blank frieze panel above the projecting stringcourse. Metal partitions divide the interior into six lanes, which the workers passed through twice daily when they entered and exited the site.[133]

Six original doors on the south elevation have been replaced with glazed plywood panels. The original light fixtures are still extant.

Historic/Current Use
In 1938, Building 122 was described as a "new checking house" providing "comforts for workmen." The article appeared in the *Pacific Marine Review*, which also featured a photograph of the building, offered the following description of Building 122: "Another provision which aids in morale of employees is the new checking house with its six check lanes eliminating all delays in the check in and check out lines. This house, located between the main office building and the Navy office building, adds a very pleasing architectural effect."[134] Building 122 is currently used for storage.

[132] Bethlehem Steel Company Shipbuilding Division, October 1944-1945, Sheet 25.
[133] The six check lanes in the 765 square-foot building are shown on the Bethlehem Steel 1944 floor plan of Building 122. Plans of the San Francisco Yard, Bethlehem Steel Company, Shipbuilding Division 1944-1945, Sheet 25.
[134] "Bethlehem Reconditions Potrero Works," *Pacific Marine Review*, 35 (October 1938), 26.

Integrity
Building 122 is a contributor to the historic district for its association with the influx of workers, the management of the labor force, and efficiency of operations during WWII. The building retains a high level of integrity of location, design, materials, workmanship and association. Temporary fencing installed to protect this building and the adjacent buildings has impacted the setting and feeling of this structure but could easily be removed.

Building 123 (Check House No. 2)
Figure 59

Physical Description
Building 123 abuts Building 104 at the southeast corner and is one of two extant check houses on the site. The architect and builder of this small, Spanish Eclectic style structure, built in 1914 and altered in 1941, are unknown.[135]

This single-story, concrete, stucco-clad building measures 25’ long, 16’ wide, and 14’ tall, and contains 384 square feet. It has a hipped roof clad in straight mission tiles. The front (south) elevation has two bays, one covered by a sliding metal door. A projecting flat awning protects the opening from weather. The building has a simple, moulded cornice and blank frieze panel above the projecting stringcourse. Window sashes have been removed from the two window openings on the east elevation. Metal partitions divide the 584 square-foot interior space into six lanes, which the workers passed through to enter and exit the site twice daily.

Historic/Current Use
The 1936 Sanborn Map shows the original 1914 building on the southeast corner of Building 104, described as one of a pair of small “gatesmen’s houses” on 20th Street; the other small gatesmen’s house (Building 124 on the 1944 plan) adjoined the southwest corner of Building 105 and is no longer extant.[136]

The Bethlehem Steel Co. 1944 plan shows that like Building 122, Building 123 had six check lanes. However, at approximately 400 square-feet, it was about half the size of the more commodious Checkhouse No. 1.[137]

Integrity
The building retains a high level of integrity of location, design, materials, workmanship, setting, association, and feeling. Building 123 is a contributor to the historic district for its association with the influx of workers, the management of the labor force, and efficiency of operations during WWII.

Irish Hill Remnant
Figure 60

[135] Plans of the San Francisco Yard, Bethlehem Steel Company, Shipbuilding Division 1944-1945, Sheet 25.
[136] .Sanborn Map Company, Vol. 6 (1936), sheet 591.
[137] Plans of The San Francisco Yard, Bethlehem Steel Company, Shipbuilding Division 1944-1945, Sheet 25.

Physical Description
Irish Hill is an approximate 24' tall, rocky promontory standing in the undeveloped southwestern portion of the district and is the remains of the originally 70 to 100-foot tall geological land form that dominated the southern portion of the yard. The remnant of this land form stands near the corner of Illinois and 22nd Streets, it was once a point of land that extended from the San Francisco Bay to Potrero Hill. During the late nineteenth century the hill towered over the shipyard, visually separating it from the adjacent Pacific Rolling Mills to the east (Figure 4). To the west, a small enclave that housed the unskilled labor force of Union Iron Works and other factories balanced on its slope. Around 1917, much of the hill was flattened and dumped into the bay as landfill. All that remains is a serpentine outcropping with a small stand of trees on its eastern embankment.

Historic/Current Use
By the 1880s, Irish Hill, originally Scottish Hill, was a compact neighborhood of mostly lodging houses, restaurants, and saloons. The majority of residents were Scottish or Irish immigrant industrial workers who, despite the noise and pollution of the factories nearby, were drawn to the area because of its proximity to their places of work. Irish Hill remained a favored residential enclave for Irish immigrants until the early twentieth century, when the majority of the hill was flattened and used as landfill to make way for shipyard expansion.

Integrity
The remaining peak east of Illinois and 22nd Streets and south of Building 117 represents the original topography of what once was Irish Hill. The topography of Irish Hill was modified during the district's Period of Significance and expresses the struggle between lower income, worker communities and the shipyard's desire to expand and promote itself. Because the remaining portion of Irish Hill is the last vestige of a residential enclave that served early Irish immigrant workers who were mostly employed by waterfront industry, Irish Hill qualifies as contributing to the historic district. Irish Hill, in its modified form, qualifies as a contributing landscape feature that resulting from the WWI expansion of Union Iron Works, retaining all seven aspects of integrity (location, design, materials, workmanship, setting, association, and feeling).

Slip No. 4 and Cranes 14 and 30
Figure 61

Physical Description
Slip No. 4 was built by the government in the northeast corner of the yard in 1941.

The slipway is 550-feet long and is concrete-lined with timber piles at the northeast end at the waterline. It is oriented on an axis running roughly northeast–southwest. Steel service columns supporting utility pipes flank the slipway and are badly bent along a portion of the eastern edge. Portions of the wood runway structure used to support and launch the hull, including remnants of the wood foundations for the keel blocks and the timber ground ways and sliding ways. The runway extends to the edge of the slip and into the launching basin where it is still supported on piles visible in the shallow waters of the bay. Railroad spurs run parallel to the slip. A light pole, also installed during WWII, still stands to the southwest of the slipways.

The cranes, numbers 14 and 30, stand on either side of the slipway. Crane 14 is an American Hoist & Derrick Co. 50-ton crane, erected by the government in 1941. Crane 30 is an American Hoist & Derrick Co. 30-ton crane, originally erected by the government in 1943, and moved to Slip No. 4 after 1944.[138]

Historic and Current Use
The slip or slipway is where the ship's hull is constructed and launched. A slipway was first constructed in this area during the 1890s and has been rebuilt several times in association with yard modernization programs and war efforts. Slip No. 4 was constructed in 1941 to facilitate the WWII increase in shipbuilding at the yard. During WWII, three cranes were installed at this slip: Crane 14 on the northeast track (still extant) and Cranes 9 and 12 on the southwest track. This slip is not currently in use and is non-functional.

Integrity
Slip No. 4 is associated with WWII shipbuilding at the site. Besides the removal of some of the above ground features, this slip appears to have undergone little modification since 1945 and retains its integrity of location, design, materials, workmanship, setting, association, and feeling. Slip No. 4 is one of five slips constructed at the yard during WWII and is the most intact example of a slipway in the district. Slip No 4, the steel service columns, and its associated cranes all contributing structures to the district. The steel service columns provided the necessary infrastructure to allow hull construction at the yard, specifically, the electricity required for welding.

Crane 14, on Slip No. 4, has remained in its current location since the government erected it in 1941 and retains a high degree of integrity. Crane 30 currently sits on the east side of Slip No. 4; however, the 1944 Bethlehem Steel plans indicate that the government originally installed Crane 30 on Pier 10 in 1943.[139] Despite the fact that Crane 30 was moved from its original location, most likely after the period of significance, it retains its integrity because it was relocated to a location within the historic district compatible with its original setting.

Whirley Crane 27
Figure 62

Physical Description
One of the nine whirley cranes within the district appears to be eligible as a contributing resource: Crane 27 on Wharf 3 at Pier 68. The two cranes associated with Slip No. 4 are included as contributing elements to that resource and are included in the Slip No. 4 description and evaluation. The other cranes within the district were installed at the yard after the period of significance.

The whirley cranes all feature a revolving crane on top of a steel tower base. The cranes have steel latticed booms, with steel cable guy lines and hoist rope. Their size and location mark them as important parts of the Pier 70 skyline.

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[138] Plans of the San Francisco Yard, Bethlehem Steel Company, Shipbuilding Division 1944-1945, Sheets 8 and 10.
[139] Pier 10 was part of the WWII submarine repair base owned by the U. S. Navy and operated by Bethlehem, located several block to the north, off of 16th Street. Only fragments of the wharf structure associated with this base remain.

Crane 27 is an American Hoist & Derrick Co. 30-ton, model R-20, originally erected by the government in 1942.[140] The other cranes, while similar to those used at the yard during WWII, were not identified, based on model and number, with cranes shown in the 1945 Bethlehem Plan.

Historic/ Current Use
Whirley cranes first came to American Shipyards in the 1920s and became an omnipresent feature of WWII shipyards. They evolved from gantry cranes, which are cranes that travel on the ground and are mounted on tall legs. By adding a revolving mechanism on the platform at the top of the legs, the whirley crane was born. The flexibility and high lifting capacity of the cranes made them popular in shipyards. Two or more cranes could do a joint-lift for objects too heavy for a single crane.[141]

Although a wide variety of crane makes and models existed, the typical whirley crane at UIW stood approximately 60’ tall at the operator’s level, ran on tracks from 24’ to 32’ wide, and they had 100’ boom.[142] The height of the crane’s legs allowed a truss design that permitted vehicles and material to pass beneath them, ensuring the free-flow of traffic on the wharfs and docks. Electric motors fed by a third rail powered the cranes.

Whirley cranes form the final step of the materials handling system of a shipyard. Rail carts move parts fabricated in the machine shop or plate shop to staging areas around the cranes. Welding platforms around the shipyard occupied space within the reach of one or more whirly cranes. The cranes moved the finished part to its assembly point on the ship under construction. Previous to WWII, a slip or wet basin did not always have cranes operating on either side of it. The tight time schedules and heavy lifting requirements of wartime production demands mandated an expanded use of cranes, frequently with two cranes on either side of a slip or wet basin.[143] Two cranes per side also permitted the occasional four crane joint-lift of extremely heavy parts. The increased lifting ability allowed for the movement of prefabricated ship components and of hull sections from the welding platforms to slip and wet basins. This ability transformed the movement of materials and changed the layout of shipyard complexes during WWII. Crane 27 still operates at the south end of Wharf 3.

Integrity
Cranes were an integral part of the hull construction process and allowed for the use of prefabricated components that changed the layout and design of shipyard complexes during WWII. Crane 27 currently stands on the south end of Wharf 3. The 1944 Bethlehem Steel plans indicate that the government originally installed Crane 27 on pier 7 in 1942. Its overall integrity remains high. Although Crane 27 was moved from its original wharf, most likely after the period of significance, it has retained its integrity of setting and association. Crane 27 has also retained its integrity of materials, workmanship, design, and feeling and is a contributor to the district.

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[140] Plans of the San Francisco Yard, Bethlehem Steel Company, Shipbuilding Division 1944-1945, Sheet 1.
[141] Richmond Shipyard #3 HAER documentation, 130.
[142] *Build Ships*, 63.
[143] Richmond Shipyard #3 HAER, 142-143.

**Fence on 20th and Illinois Streets
Figure 63**

Physical Description
A decorative iron fence surrounds the western end of the shipyard extending from Building 104 on 20th Street westward, and northward along Illinois Street to yard's north gate near Building 49. The fence abuts the façade of Building 101, creating a grand entrance to this office building also unifying the site visually along the 20th and Illinois Street frontages. The fence consists of pointed iron spikes, joined by double horizontal rails at top and bottom. Within the double rails are circular motifs. Finial-capped cast iron newel posts ornament and support the fence at approximately every six feet. The fence is imbedded in a concrete curb.

Eastward, the iron fence appears to terminate just before Building 104, although a portion of the fence near Building 101 was removed by the SF Port several years ago. At this point the perimeter fence begins to show a slight difference in design. Although the circle and spike motifs remain, here each spike terminates in a cast finial.

Historic/ Current Use
The fence was erected in 1917, when the shipyard underwent a significant phase of modernization and expansion, as Union Iron Works became centerpiece to Bethlehem's Pacific Coast shipbuilding complex. Historic photos provide no indication that the fence extended beyond its current length. The fence still provides security to the northern section of the district.

Integrity
The iron fencing at the corner of 20th and Illinois Streets was built during WWI and retains integrity of location, association, setting, materials, workmanship, and feeling. This qualifies it as contributing resource for its association with the WWI-era plan to create a grand entrance to the shipyard, Bethlehem Steel's West Coast shipbuilding center.

Non-Contributing Resources

**Building 41 (Fire Station)
Figure 64**

Physical Description
Partially submerged in the San Francisco Bay south of Warehouse 6, Building 41 is a single story, steel frame building with a corrugated steel-clad gable roof. Most of the siding and any windows that may have been present are now missing. The pier on which it was constructed collapsed and the structure settled into the bay. The architect and builder are unknown.

Historic/Current Use
This building functioned as fire station, located on a pier leading to the dry docks and wet basins, and was one of the safety features added during WWII. It is currently underwater.

Integrity
Most of the building is underwater and the visible portion of the roof is a remnant. The building therefore does not retain sufficient integrity for listing as a contributing resource.

**Building 68 (Dry Dock Office/Substation 7)
Figure 65**

Physical Description
This small, brick-clad structure stands along the wharf near the dry docks. It appears to post-date 1945, as it does not show up on either the site plan or aerial photo from that date.

This one-story, rectangular plan, flat-roofed office and substation is of brick masonry construction. The parapet topping the brick, running bond walls has a terra cotta coping. Windows are aluminum sash, four-lite, with some fixed and awning sash. Angled courses form sills under windows. The foundation is poured concrete. A corrugated single-story metal shed addition runs along the west side.

Historic/Current Use
This building currently serves as a powerhouse (east side) and office (west side) for BAE Systems and is part of the functioning wharf operation.

Integrity
The building post-dates the Union Iron Works/Bethlehem Steel Shipyard's period of significance; therefore, it is a non-contributing resource.

**Building 127 (Pier 68 Production Offices)
Figure 66**

Physical description
Building 127, a two story, wood framed building with a shallow gable roof, sits on Pier 68 near Building 58 (Pier 68 Substation #4). It measures 24' by 44', oriented east-west, rises to 22' at the ridgeline, and contains 1,056 square-feet.[144] An exterior stair on the east elevation provides access to the second story. The building was constructed of wood and corrugated galvanized iron, with "bitumuls" flooring and composite roofing..[145]

After the period of significance, the building underwent major alteration. Vinyl siding replaced the original corrugated galvanized iron cladding. The building also now has aluminum double-hung windows, vinyl composite flooring, hollow metal doors and door frames, and gypsum board interior partitions.

Historic/Current Use
Bethlehem Steel erected the building in 1944 to house offices on the second floor, and storage rooms and lockers on the first. BAE Systems continues to use the building as offices.

Integrity
Because of extensive modifications, Building 127 lacks integrity of design, materials, workmanship, and feeling. The building therefore does not retain sufficient integrity for listing as a contributing resource.

Building 141 (Pier 68 Break room/Washroom/Restroom)
Figure 67

Physical Description
Building 141 is a rectangular-plan steel frame restroom structure with steel siding and a flat roof. It stands on Pier 68 near Building 127, and has a projecting canopy that shelters tables. This building is not shown on the 1945 Bethlehem Steel Plan.

Historic/Current Use
Not shown on the 1945 Bethlehem Steel Plan, this building was added to the yard after the period of significance. It appears to retain its original function as a restroom and break area.

Integrity
This building was constructed after the period of significance and is not historically significant. It is not a contributor.

Pier 68 and Wharves 1, 3 and 4
Figure 68

Physical Description

[144] Plans of the San Francisco Yard, Bethlehem Steel Company, Shipbuilding Division 1944-1945, Sheet 35.
[145] Plans of the San Francisco Yard, Bethlehem Steel Company, Shipbuilding Division 1944-1945, Sheet 35.

From the northeast corner of the site, Pier 68 juts approximately 950 feet east into the San Francisco Bay and measures approximately 70 feet wide for most of its length. Wharves 3 and 4, built after WWII, extend north into the bay approximately 650 feet each. The remains of Wharf 1 extend northwards approximately 360 feet, marking the western boarder of the wet basins and the eastern boundary of Slips 1-3. Constructed in 1915, Wharf 1 consists of wood decking (now collapsing) over concrete piles. The pier and wharves feature concrete decking. The existing wharves and Dry Dock 2, discussed below, enclose three wet basins.

Pier 68 links the wharves to the rest of the shipyard and serves as a road to transport materials, services and people to the moored ships and dry docks. It also supports multiple buildings that facilitate the process of ship repair, including Building 127 (offices), Building 58 (electrical substation), a locker room/washroom and additional offices. A boiler called a “steam donkey,” used to generate steam for servicing the ships, also sits on Pier 68. Large steel cargo containers used for storage line most of the southern side of the pier.

Wharves 3 and 4 include all the necessary infrastructure to service large, modern, oceangoing vessels. Distribution centers with attachments for compressed air, fresh water, salt water, oxygen, electricity, steam, and several other services sit at regular intervals along the wharf. The pipes that carry the services appear on the side of the wharf, beneath the wharf decking. Each wharf also has two 35-ton whirley cranes with the rails embedded in the deck approximately 24 feet apart. Wood timbers, treated against decay, line the edges of the wharves. Massive steel mooring bits, spaced approximately 50 feet apart, line the sides of the wharf and serve as anchor points to lash the ships to the wharf.

Historic/Current Use

Union Iron Works established the first wharves in 1883 when it began its initial shipbuilding operations. UIW used the wharves to finish outfitting the ships and make straightforward repairs. The shipyard has changed the position of the docks numerous times over the course of its history, as each advance in ship design required different infrastructure to service those ships. A major upgrade occurred in 1915 when the slips, wharves and wet basins associated with Pier 68 were all rebuilt. Piles associated with these earlier wharves are likely mixed in with the piles from the existing wharves and Pier 68.

The most recent round of changes to the wharves’ positions occurred sometime after 1945 with the goal of providing larger wet basins for larger modern ships. It involved the destruction of Wharf 2, and the shifting of Wharf 3 to the north in 1967. Wharf 4 was rebuilt in 1957 but remained in approximately the same location. Wharf 5 was demolished by the Port in 2001 because of impending collapse and because it was a navigational hazard.

The wet basins consist of the parts of the bay enclosed by the wharves. Originally, the wet basins served as the final stop in the shipbuilding process. After the shipyard launched the ship down the slip, the fitting out tasks, including final electrical installation, fine woodworking, appliance installation, etc. took place at the fitting-out wharves while the ship sat in the wet basin. Only after the fitting-out process was the ship actually “finished.” The wet basins also served as the holding area for the ship while undergoing repairs. Together, the wharves and wet basins make up the interface point between land and sea. They constitute the place where finished goods produced in land-based factories become ocean-going vessels.

Integrity

Wharves 3 and 4 were rebuilt after the period of significance and hence lack integrity of materials, design, workmanship, and feeling, and are not recognized as contributing resources to the district. Because the wharves define the physical boundaries of the wet basins, the wet basins also lack integrity and do not contribute to the district. Wharf 1 is collapsing into the bay and has lost integrity of materials, design, and workmanship. Its setting has been impacted by the filling in of Slips 1-3. Since the wharves represent a continual process of rebuilding, they may contain fragments of earlier wharves.

However, the piers, wharves, and wet basins form an integral part of the historic shipyard and illustrate critical steps in the shipbuilding and repair process. These features play an integral role in the setting and design of the district and help to express the district's historic function.

Pier 68 Dry Docks
Figures 69, 70

Physical Description
Three floating dry docks are currently moored at Pier 68. These dry docks are all steel vessels with a U-shaped cross-section. The bottom and sides contain flotation tanks used to submerge or float the dock. It is 654 feet long by 128 feet wide by 54 feet high and is moored to the east of Wharf 4 near the eastern edge of Pier 68. Dry Dock 2, approximately 900 feet long, has a permanent mooring point at the eastern tip of Pier 68 (Figure 69). Dry Dock 2 dates to the 1960s and has a control room. Dry Dock Eureka (Figure 70), a WWII vintage dry dock, was brought to the site by BAE Systems in the 1990s and is moored to the west of Wharf 3. Dry Dock 2 and Eureka are in use at the ship repair yard and, unlike Dry Dock 1, retain working cranes.

Historic/Current Uses
Dry docks are essential components of ship repair work that allow vessels to be removed from the water for repairs. Floating dry docks are submerged, the ship is maneuvered into the dock and the dock is then re-floated and the ship raised out of the water. The floating dry dock provides a stable surface for ship repair work. During WWII, the U. S. Navy had a standard design for floating dry docks that resulted in both Dry Dock 1 and Dry Dock Eureka. Standard Navy dry docks included repair facilities and crew quarters, allowing the docks to be moved, unless they were built for civilian yards, where such services were unnecessary.

The former Dry Dock 1, since moved to Pier 80, was added to the yard by the Navy during WWII to replace the yard's earlier wooden dry docks.[146] Unlike standard Navy dock designs, Dry Dock 1 did not include crew quarters or repair facilities. This dock is currently not in use. Dry Dock Eureka and Dry Dock 2 are in use for ship repair.

Integrity
Dry Dock Eureka was moved to the site after the period of significance. The historic significance of the dry docks at the site is evaluated under Criterion A, the yard's role in the birth and expansion of the United States steel hull shipbuilding and ship repair industry. The Dry Dock Eureka is not significant under this criterion, nor is it significant under Criterion C. Dry Dock 2 was built 25 years after the period of significance. Therefore, none of the dry docks is a contributing resource to the district. The dry docks do, however,

[146] Workplace History Organization, 2.

contribute to the design and setting of the district and the removal of all dry docks from the district would impact the ability of the district to convey its historic function as a ship repair facility.

Pier 70 and Wharfs 6, 7, and 8
Figure 71

Physical Description
Pier 70 extends eastward into the bay near Building 6 and directly north of Slips 5-8. The pier consists mainly of wood decking over wood piles, and the decking has collapsed or is collapsing in many areas. Wharves 6, 7, and 8 project northward off the pier, creating Wet Basins 6 and 7. Wharves 6 and 7 are constructed of wood piles supporting wood decking and are missing most of the wood decking and large portions of their wood piles. Viewed from above, a rough outline of the wharves is still visible, but from many perspectives at the site even the rough footprint of these two wharves is no longer discernable. Wharf 8 was rebuilt with wood decking, concrete, and steel after 1980 as a fuel dock, but is currently in poor condition.

Historic/ Current Uses
Since the late nineteenth century, piers and wharves have been erected and replaced in the vicinity of Pier 70. The first pier was constructed by the Pacific Rolling Mills in the late nineteenth century. Risdon Iron Works appears to have expanded this pier during the early twentieth century. Piles associated with these piers are likely mixed in with the piles from Wharf 6 or Pier 70. The western end of Pier 70 appears to date to WWI; however, portions of the turn-of-the-twentieth-century Risdon pier may have been incorporated. The 1936 Sanborn map shows little change to the pier from the 1914 Sanborn. The wharf was extended and Wharves 6, 7, and 8 were added during WWII. Therefore, most of the extant wharves and wet basins of Pier 70 date to WWII and were owned and built by the U. S. Navy.

The pier was strengthened in 1941and widened in 1942 and 1944.

Wharf 6 originally extended northward off the eastern edge of Pier 68 in 1920. It was extended southward to join with Pier 70 in 1941, creating Wet Basin 6. This wharf was widened, toward the west, in 1943 and 1945. A rail line on Wharf 6 connected Pier 68 and Pier 70, and crane rails also extended down the wharf. Wharf 7 was 1,674 feet long with a rail and crane track to move materials onto and along the wharf. Wharf 8 was originally constructed in 1944 and consists of wood decking over a structural steel frame on steel cylinders filled with concrete. As noted above, it was rebuilt in the 1980s.

These waterfront features are no longer in use.

Integrity
Pier 70, Wharves 6 and 7, and Wet Basins 6 and 7 are associated with the expansion of the yard during WWII. Wharves 6 and 7 are currently collapsing into the bay and have lost their integrity of design, workmanship, materials, and feeling. Due to the loss of these wharves, the associated wet basins are no longer discernable and have also lost their integrity. Wharf 8 was rebuilt outside of the period of significance. None of these waterfront structures is a contributing resource. The removal of the buildings between the Building

12 Complex and Building 6, which provided support for workers, has also impacted the setting of these piers and wharves.

Slips 1 -3
Figure 72

Physical Description
Slips 1, 2, and 3 are situated next to Wharf 1 and directly north of the Plate Shop No. 1 (Building 109). Slip 1, 2, and 3 were built in 1915. They are approximately 70 feet wide and 325 feet long, running north-south, and were infilled between 1959 and 1964. Subsurface portions, including the timber pilings, caps, and stringers; the concrete slab and posts of Slip 1; the crushed rock fill of Slip 2; and the crane runway supports, are assumed to be preserved beneath the infill and asphalt paving. Portions of the crane runway supports and the ends of Slips 1 and 2 are visible.

Historic and Current Use
These slips at Pier 68 are the earliest remaining at the yard, earlier than the WWII Slips 5-8 at the New Yard, and were used to construct smaller ships. In 1886 a slip was constructed in the vicinity of Slip 1, and two slips were built in the vicinity of Slips 2 and 3 in 1900. All three slips were rebuilt in 1915. Steel hulls were constructed in the slipways on keel blocks and heavy wooden posts. Layers of timber, called ground ways and sliding ways, were placed on top of the keel blocks to form runways beneath the ship.[147] Prior to WWII steel plates were cut to size, bent, punched for rivet holes, and transported to the slipways where they were fitted into place on the hull and riveted. By WWII the yard had moved to welding and welding platforms were installed at the head of the ways. Crane tracks constructed on truss towers measuring approximately 70-feet tall flanked the slips, and two cranes were installed on each track in order to move plates and pre-assemblies into place. When the hull was complete it was launched and moved to the nearby wet basins where it was outfitted.

A small portion of the infilled Slips 1-3 is currently used for storage and is fenced; the rest of the slips are vacant.

Integrity
Slips 1-3 are associated with both WWI and WWII shipbuilding efforts at the yard. Due to the dismantling of the 70-foot crane runway towers, removal of the cranes, and infill of the slips, these features have lost their integrity of design, workmanship, materials, and feeling. This loss of integrity renders the resources non-contributing. However, they are important to the setting and design of Building 109 and help it to convey its relationship to the bay and to express its historic function. Further, they may, if disturbed, yield information important to the history of the site. They should therefore be evaluated as potential archeological resources when and if disturbed.

[147] *An Introduction to Shipbuilding*, Shipbuilding Division, Bethlehem Steel Co., (Washington, D.C., 1942), 41.

Slips 5-8
Figure 73

Physical Description
Slips 5, 6, 7, and 8 were built in 1941 as part of the New Yard (or Building 12 Complex)' designed and built by the U. S. Navy. Slips 5 and 8 were 400-feet long and Slips 6 and 7 were 660-feet long descending from the shoreline into San Francisco Bay. All are oriented east-west, and are longer than the Pier 68 slips, allowing for the construction of larger ships. All slips were infilled after 1964 and the associated platforms and cranes were removed. It is assumed that the subsurface portions of the ways are preserved under an asphalt parking lot. The crane ways and the edge of the ways are visible along the shoreline.

Historic/Current Uses
Slips 5-8 were installed in 1941 when the U. S. Navy constructed the Building 12 Complex. The hulls were constructed in the ways before they were launched and moved over to the adjacent wet basins for outfitting. These slips were designed to accommodate one, 6,000-ton cruiser or two, 2,100-ton destroyers.[148] Welding and prefabrication were the primary methods of steel hull construction during WWII. Welding platforms were placed on all available sides of the slips, include a larger platform at the head of Slip 8. Two head house buildings, Buildings 34 and 35, no longer extant, sat at the head of the longer slips, Slips 6 and 7. Instead of the 70-foot crane track towers found at Slips 1-3, single Colby cranes ran on crane tracks only slightly raised above the slip ways. Rail lines and a semi-gantry crane moved plates and materials from the Building 12 Complex to the slips.

This area is currently used as vehicle storage for Auto Return, the city's towing company.

Integrity
Slips 5-8 were integral to the WWII shipbuilding process at the New Yard and are a defining feature of the layout of the Building 12 complex. These slips were infilled and paved over during the 1960s and have lost their integrity of design, materials, workmanship, and feeling. Because of this loss of integrity they are non-contributing resources. However, they are important to the setting and design of the Building 12 Complex and help the district to convey its relationship to the bay and to express its historic function. Further, they may, if disturbed, yield information important to the history of the site. They should therefore be evaluated as potential archeological resources when and if disturbed.

Paving Stones
Figure 75
Physical Description
The basalt paving blocks along 20th Street are a testament to early paving in San Francisco. The approximately 5" by 10" blocks are laid between granite or concrete curbs that extend along the street

[148] Plans of The San Francisco Yard, Bethlehem Steel Company, Shipbuilding Division 1944-1945, Sheet 11.

between Illinois and Louisiana Streets. Asphalt now covers the majority of the historic paving; however, the paving is visible along the curb on both sides of 20th Street and in several potholes in the center of the street.

Historic/Current Use
According to the Board of Supervisors report, the blocks date from 1893-1895. Historically the roads of the shipyard and the majority of roads in San Francisco were paved with basalt blocks. The blocks are still found, beneath several later layers of asphalt, at currently-functioning roads.

Integrity
These paving stones are the same paving material used historically for most roads in San Francisco. The basalt paving stones thus represent a barely remaining vestige of San Francisco's original paving material, and the paved roads played an integral role in the early development of the shipyard. The paving stones retain integrity of location, setting, association, and materials. However, because the stones are currently covered with asphalt it is unclear if the paving extends across the entire street, therefore, the paving stones are a non-contributing element to the district but do add to the district's setting and design.

Rail Lines
Figure 76

Physical Description
Currently, there are two visible rail spurs at the Pier 70 site that connected with rail lines on Illinois Street. Several visible rail lines once used to move materials around the site are also extant within or adjacent to buildings. These tracks are part of a complex and interconnected system of rail lines that was essential to the ship building and ship repair activities occurring at the site from the 1880s until 1945. The extant lines at the shipyard are visible through several layers of asphalt that had once covered them but has since failed. Additional rail lines may be buried beneath still sound asphalt. The locations of the known rail spurs are as follows:

> A rail spur enters the site off of Illinois Street which was associated with both the Santa Fe and Atchison Topeka Rail Road and the Southern Pacific Rail companies. This line begins at the corner of 20th and Illinois Streets, branches near the eastern edge of Building 101, and heads toward Building 113, where it turns and runs along the eastern edge of Buildings 115 to Building 117. The other branch runs down 20th Street where, during WWII, it met with a U. S. Navy-owned line near Building 103. The portion of the track from its point of entry to the site boundaries until the point where it joined the government-owned line remains intact.
>
> An exposed rail spur enters the site at the northwestern gate near Building 49 and Slip 4. This line runs south past Building 30 toward Building 101. It curves near Building 101 and runs east, ending near Building 36. Based on the 1945 Plan this line was owned by Bethlehem Steel and the majority of this spur is visible.

A rail line runs to the west of Slips 1-3 and to the east of Buildings 110 and 50. Owned by Bethlehem Steel during WWII, this line connected Building 109, the Plate Shop, with the welding platform at Slips 1-3.

A rail line remnant is visible in front of the main entrance to Building 113; another visible line connects Buildings 113, 114, and 115, and a line runs into Building 117.

Historic/Current Use
In 1886, the first rail line at the shipyard site was located along Georgia Street between 21st and 20th Streets, running between the two halves of Building 113. Sanborn maps indicate that by 1899 at least fifteen more rails were added to the site. By 1914, the number of rail lines had almost doubled, and more were added until the late 1930s. Historically, these lines made it possible for the movement of materials and supplies to, from, and within the site. The rail lines played a significant role in the development and success of Union Iron Works.

Currently the rails are no longer in use and have all been covered with multiple layers of asphalt. Industry once relied heavily upon rail line transportation for the locomotion of supplies, but advancements in technology ushered in their replacement with internal combustion vehicles. This transformation is evident at the shipyard site in the overlay of asphalt on partially exposed rail lines

Integrity
The extant rail lines date from the period of significance and played a significant role in the production and development of the shipyard. Rail lines were essential to the movement of materials around the shipyard as well as for importing raw materials for shipbuilding. The extension of private rail lines into the yard allowed for steel plates and other materials to be delivered directly to the areas where they were needed, streamlining the shipbuilding process. While these rail lines retain some integrity they do not appear to form a complete transportation network and therefore are not a contributor to the district.

Removal of the asphalt overlay may reveal a more complete surviving rail system. The integrity of the rail system should thus be reassessed when and if the asphalt covering is removed.

Summary Statement of Significance

The Pier 70 Historic District is a maritime industrial yard eligible for the National Register of Historic Places under criteria A and C. The California Office of Historic Preservation determined that the shipyard was eligible for the National Register of Historic Places in 2001. It is significant at the national level under criterion A in the area of "Industry" for the period 1884 – 1945, from the initial construction of the Union Iron Works (UIW) yard through the close of World War II.[1] The "Industry" area of significance relates to the "technology and process of managing materials, labor and equipment to produce goods and services."[2] The Union Iron Works/Bethlehem Steel Shipyard is significant for its pioneering technological developments in shipbuilding, labor relations, government and private industry relationships, and the production of significant wartime vessels. The district is also eligible at the national level under criterion C in the area of Architecture for the same period of 1884 to 1945. The Pier 70 historic district is a physical record of the trends in industrial architecture from the late nineteenth century through WWII.

General History of the Union Iron Works/Bethlehem Steel Shipyard

The Pier 70 historic district tells the story of the American steel hull shipbuilding industry from the late nineteenth century through World War II. As California's pioneering iron works, the Union Iron Works' early history coincides with the shift from wood to iron shipbuilding. By opening the first steel shipyard on the West Coast in 1884, the Union Iron Work established a national steel hull shipbuilding industry. Over the next three decades, the shipyard at the Pier 70 historic district played an integral role in the United States government's efforts to increase naval resources and bolster the nation's image as an international military power. By World War I, the yard stood at the center of the shipbuilding industry on the West Coast. A crew of mostly skilled laborers produced dozens of warships and submarines that resulted in the United States overwhelming success in World War I. The combination of a skilled labor force and the yard's ability to build or repair all ships afloat kept the yard open during the lean interwar years. As World War II approached, the yard participated in the unprecedented military build-up occurring across the country. The WWII build-out at the yard resulted in an increase in unskilled workers and mass production . At the same time, ship repair and naval contracts completed by the yard's skilled laborers made a significant contribution to the war, and by maintaining many of the older buildings, produced the Union Iron Works/Bethlehem Steel Shipyard's unique collection of buildings from all period of the United State's steel shipbuilding industry.

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[1] The Union Iron Work moved to Potrero Point in 1884, and the shipyard has taken on many names over the years. In the following pages, for the sake of consistency, the name Union Iron Works (or UIW) will be used to indicate all incarnations of the shipyards associated with the Union Iron Works/Bethlehem Steel Shipyard from 1884 to 1945. See the Ownership Map, Figure 3, which shows the rough boundary of the Union Iron Works Shipyard in 1884 along with the various owners of the southeastern portion of the district prior to the U. S. Navy purchase of the area in 1940 and the construction of the extant Building 12 Complex. Previous owners included the Pacific Rolling Mills (1868-1900), Risdon Iron and Locomotive Works (1900-1912), and U. S. Steel Products Company (1912-1940), who owned the land when the U. S. Destroyer yard was built there and operated by the Union Iron Works Company.

[2] Linda F. McClelland, *National Register Bulletin: How to Complete the National Register Registration Form*, (Washington, D.C.: National Parks Service, 1997), 40.

The Pier 70 Historic District can trace its origins to California's first iron works, opened by Peter and James Donahue at Jackson and Montgomery Streets in San Francisco during the Gold Rush. In the early 1850s, the works moved to First and Mission Streets and in 1853 was renamed the Union Iron Works. The works constructed engines and boilers for iron ships, locomotive equipment for California's first trains, and the majority of mining equipment used in the Comstock silver mines. Irving M. Scott managed the works starting in 1865, after Donahue retired, and was responsible for transforming the works into one of the country's leading steel hull shipbuilding and repair yards.

The deep waters around Potrero Point facilitated easy loading and unloading of cargo, making it an excellent location for the new shipyard. Located in the outskirts of the city, the point also made an ideal manufacturing area for hazardous materials. The E. I. du Pont de Nemours Company was one of the first manufacturers to exploit this region in 1854 to manufacture black powder. Over the following decades the Tubbs Cordage Company/ San Francisco Cordage Manufactory, the Pacific Rolling Mills, and City Gas Company Works moved to the area. The Pacific Rolling Mills, whose property would eventually be managed by Bethlehem's Union Iron Works Company, was the first manufacturer of steel on the West Coast, starting in the 1860s.

By the early 1860s the city's early wood ship builders abandoned the crowded shoreline along Steamboat Point in San Francisco's South of Market district for the deep waters and vacant lands around Potrero Point. John North was the first shipbuilder to relocate in 1862, followed by Henry Owens, William E. Collye, and Patrick Tiernan.[3] The 1867 completion of the Long Bridge from the South of Market district over the waters of Mission Bay and the extension of Third Street improved access and eased transportation to this developing manufacturing center in the Potrero district. The Irish Hill and Dogpatch neighborhoods emerged during this period as workers moved to the area. The Irish Hill Neighborhood consisted of two settlements of cottages, lodging houses, and saloons clinging to the hillside north of the Pacific Rolling Mills and around the intersection of 20th and Illinois streets.[4]

The Union Iron Works shipyard opened at Potrero Point in 1884 with a machine shop (Building 113), plate shop, pattern shop, foundry, smith shops, and slipways. The next year the yard launched the *Argo*, the first steel hull ship produced by UIW and launched on the West Coast, and one of the first steel hull ships completed in the country. In 1885, after the yard's success with the *Argo*, Scott and the Union Iron Works secured naval contracts, initiating a relationship between the U. S. Navy and the yard that lasted through WWII. During the late nineteenth century, the shipyard completed some of the most famous warships of the Spanish-American War, including the *Oregon* (Figure 77) and the *Olympia* (Figure 78)(see Appendix A, List of Vessels).

A new era in the history of the Pier 70 historic district began with the turn of the new century. In 1902 the United States Shipbuilding Company (USSC) acquired the Union Iron Works shipyard along with other yards and steel mills across the country. Two years later USSC collapsed, allowing Charles Schwab to purchase the shipyard in 1905 on behalf of the Bethlehem Steel Corporation, the second largest steel manufacturer in the country. In the spring of 1908, Schwab personally oversaw upgrades to the yard's repair facilities, which

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[3] Roger Olmstead, Nancy Olmstead, David Fredrickson, and Vance Bente, *San Francisco Bayside Historical Cultural Resource Survey, San Francisco Clean Water Program*, 1982, p.191.
[4] San Francisco Planning Department, *Central Waterfront Cultural Resources Survey Summary Report and Draft Context Statement,* 2001, p.16.

allowed the yard to repair the Great White Fleet, the naval fleet that President Theodore Roosevelt famously ordered to sail around the world between 1907 and 1910 as a brazen display of the country's growing military power.

By WWI the shipyard served as the headquarters of a West Coast shipbuilding complex, which included the Hunter's Point Dry Dock, the Alameda Yard, and the U. S. Navy Destroyer Plant. Fredrick H. Meyer and Charles Peter Weeks, two renowned San Francisco architects, designed buildings along 20th Street, which created a grand entrance to the yard. The shipyard expanded and modernized during the 1910s, including expansion of the yard's infrastructure, a new plate shop (Building 109), and new foundries (Building 115 and 116). The destroyer plant run by the Union Iron Works used some of the new prefabrication methods of the period to produce three destroyers per month. The Navy prioritized submarine destroyers as the primary fleet defense against torpedo attacks from submarines and the 66 destroyers produced by the yard made a substantial contribution to the WWI naval effort. The yard survived the lean years after WWI on commercial ship construction and ship repair contracts.

United States Maritime Commission contracts, starting in 1936, resulted in a new wave of modernization at the yard. Upgrades included a new boiler house (Building 103) and a yard-wide transformation from riveting to welding, which helped the yard adapt to standardized mass production that typified WWII ship production. During the war, the yard was primarily under naval managemen. The New Yard shipbuilding facility (the Building 12 Complex), built by the Navy, stands on the former destroyer plant. The yard also significantly contributed to WWIIin the repair of 2,500 ships.

Labor played an integral role throughout the history of the Pier 70 historic district. From the earliest days as one the first steel hull shipbuilders, the yard employed highly skilled laborers, who could adapt to new technologies and modes of production. While most shipyards closed during the interwar period, the skilled workers and the flexibility of the yard's facilities kept UIW open. Since WWII, the yard has not led innovations in shipbuilding technology or production. Instead the skilled labor force has enabled the district to become the longest continually operating shipyard in the nation.

After WWII, the yard continued to build government and commercial ships into the 1970s. In the early 1980s, the Bethlehem Steel Company went bankrupt and sold the shipyard for one dollar to the Port of San Francisco. Todd Shipyards purchased much of the machinery and leased portions of the yard for ship repair. Today, BAE Systems San Francisco Repair leases portions of the yard from the Port of San Francisco and continues to operate a repair facility onsite, making the yard the longest operating steel hull ship repair yard in the country.

Chronology of the Union Iron Works/Bethlehem Steel Shipyard

The following chronology outlines significant events associated with the Union Iron Works/Bethlehem Steel Shipyard including the history of Union Iron Works, Bethlehem Steel, Pacific Rolling Mills, Risdon Iron and Locomotive Works, U. S. Steel Corp., and U. S. Navy, all land owners in the district during the period of significance. This chronology also includes significant events that shaped the United States steel hull shipbuilding industry.

1849	Donahue brothers open California's first iron foundry during the height of the California Gold Rush
1853	Peter Donahue becomes the sole-owner and renames the works the Union Iron Works
1857	Bethlehem Steel Company starts as an iron works in Bethlehem, Pennsylvania
c.1860	Wooden shipbuilders John North and Henry Owen move to Potrero Point
1861-1865	Civil War
1865	Irving M. Scott becomes a partner and Peter Donahue retires
1868	Pacific Rolling Mills opens on Potrero Point as the first steel mill on West Coast
c.1870s	Irish Hill neighborhood established
	Union Iron Works purchases Henry Owen's shipyard
1884	The Union Iron Works shipyard opens
1885	First U. S. Naval contract for steel hull ship given to John Roach's Delaware River Iron Shipbuilding and Engine Works shipyard ("ABCD ships", or *Atlanta, Boston, Chicago,* and *Dolphin*)
	San Francisco iron workers' strike successfully for higher wages, reviving labor movement in San Francisco, leading to leading to formation of the first iron trades council in the United States (Federated Iron Trades Council), and creating model of labor organization across the country
1886	Newport News Shipbuilding and Dry Dock Company opens in Virginia
	UIW builds the Blacksmith Shop and Machine Shop, the brick masonry sections of what is now Building 113 and Building 114
	UIW secures first Naval Contract to build the steel steamer *General McDowell*
	UIW builds world's first hydraulic dry dock
1896	UIW builds Building 104, its first dedicated office building
1898	Spanish American War; UIW's *Olympia* serves as Admiral George Dewey's flagship during is successful defeat of the Spanish fleet at Manila Bay
	UIW's battleship *Oregon* completes high-profile, 15,000-mile trip around tip of South America to confront four cruisers of the Spanish fleet in Cuba
1900	Risdon Iron and Locomotive Works purchased the Pacific Rolling Mills, demos all the mill buildings and establishes a shipyard
1901-1903	San Francisco machinists, in association with International Association of Machinists, launch successful two-year strike for nine-hour day
1902	Union Iron Works acquired by United States Shipbuilding Company

1905	Union Iron Works Company incorporated in New Jersey on January 1
	Bethlehem Steel Corporation purchases the Union Iron Works Company. The yard takes on several names, including the Union Plant, Union Yard and Potrero Yard.
1908	Hunter's Point Dry Dock acquired by Union Iron Works Dry Dock Company, and Union Iron Works Company subsidiary
1912	U. S. Steel Products Company formed as a subsidiary of U. S. Steel
	Bethlehem Steel Corporation constructs Building 102, Powerhouse No. 1
1914	WWI breaks out in Europe
	United States Shipping Board (USSB) established to direct national shipbuilding program
	Sanborn map shows U. S. Steel Products Company owning the Risdon Iron and Locomotive Works
1916	UIW Company purchases the Alameda shipyard of the United Engineering Co.
	UIW runs U. S. Naval Destroyer Plant on US Steel Products Co. property
	Bethlehem Steel Corporation constructs Buildings 116 and 117, two concrete warehouses
1917	United States officially enters World War I
	Bethlehem Steel Corporation constructs Building 101, the Bethlehem Steel Administration Building
	Emergency Fleet Corporation (EFC) incorporated to distribute funds to national shipbuilding program
	Bethlehem Shipbuilding Corporation, Ltd. incorporated in October and leases the Alameda and Potrero Plants from the UIW Company
	Shipbuilding Labor Adjustment Board established to broker regional wartime agreements on hours, wages, working conditions, and union powers
	Pacific Coast Strike over wage demands in San Francisco, Seattle, and Portland
1918	World War I ends
1924	Bethlehem Shipbuilding Corp., Ltd., buys UIW, Alameda, and San Pedro plants
1927	American Bureau of Shipping approves welded hulls
1929	Stock Market Crash
	U. S. Steel Corp. absorbs Columbia Steel Corp., Los Angeles; uses former destroyer plant
	Bethlehem acquires Pacific Coast Steel Company in Seattle and its subsidiary, Southern California Iron & Steel Co.
1932	Franklin Delano Roosevelt elected President
1934	General Strike in San Francisco
1936	Merchant Marine Act passed and United States Maritime Commission established to direct national shipbuilding program (replaces United States Shipbuilding Board)
	UIW receives contracts from Navy for two 1500-ton destroyers, first of 70+ ships to be built at UIW during WWII era; major modernization program at Pier 70 begins
1938	Bethlehem Shipbuilding Corp., Ltd. becomes the Bethlehem Steel Company, Shipbuilding Division and the UIW yard is renamed the San Francisco Yard

1939	Germany invades Poland, WWII begins
1940	U. S. Navy purchases the Risdon Plant from Columbia Steel of San Francisco, a U. S. Steel subsidiary, and constructs the Building 12 Complex, also known as the New Yard
	National Defense Appropriation Act passed
	U. S. Navy purchases Hunter's Point
	Henry J. Kaiser opens first of eventual four shipyards in Richmond
1941	Japan attacks Pearl Harbor; U. S. enters WWII
	President Roosevelt signs Executive Order 8802, creating a Fair Employment Practices Committee and paving way for African Americans to work at shipyards
1942	W. A. Bechtel Co. opens Marinship in Sausalito
1945	WWII ends
	Marinship in Sausalito and Kaiser shipyards in Richmond close
1982	Bethlehem sells UIW to the Port of San Francisco

Criterion A: The Steel Hull Shipbuilding Industry

The Pier 70 Historic District is significant for its substantial role in the birth and development of the national steel hull shipbuilding industry from 1884 through 1945. Union Iron Works shipyard (UIW) was one of the nation's leading shipyards and is the oldest continuously operating steel ship repair yard in the country. UIW maintained the ability to fabricate on site all the components necessary for building or repairing a ship. This flexibility and a skilled labor force allowed the yard successfully to produce a wide variety of government and commercial ships, including several of the most famous naval warships of the Spanish-American War. UIW also played a significant role in both WWI and WWII naval mobilization efforts. By WWI, UIW was the centerpiece of Bethlehem's West Coast shipbuilding complex. The yard was a technical pioneer during the late nineteenth century and continued to expand and modernize its facilities through WWII. During WWII, it matured into the best equipped repair yard on the West Coast. The Union Iron Works/Bethlehem Steel Shipyard reflects the major trends in the American steel shipbuilding and ship repair industries from 1884 to 1945, including the interdependence of private shipyard development and naval expansion programs; the national evolution of shipbuilding methods in pursuit of greater efficiency and mechanization; the relationship between technological advances, the rise of scientific management, and labor; and the blending of shipbuilding and metalworking industries.

Union Iron Works

James and Peter Donahue founded California's first iron works in a tent at the corner of Jackson and Montgomery Streets in 1849 at the height of the Gold Rush.[5] The following year, the newly named Union Iron and Brass Foundry moved to the South of Market District, establishing a foundry district near the waterfront. Peter Donahue became the sole owner in 1853 and renamed the firm the Union Iron Works. By the end of the decade, UIW employed over 120 men and contained more than $150,000 worth of equipment.[6] While Donahue continued to own the works until 1865, it was Irving M. Scott who managed and directed the factory from the early 1860s through the turn of the century.[7] During this period, Scott's vision and leadership turned the works into one of the most successful shipyards in the country.

UIW established itself as vital to steel shipbuilding on the West Coast and nationally from the earliest days of the industry. Like other iron works that moved into shipbuilding during the late nineteenth century, Union Iron Works built engines and produced other metal parts for wooden ships.[8] Starting in the 1850s, Naval historian Hugo P. Frear writes that Union Iron Works' iron casting for the shaft of the steamer *John S. McKim*

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[5] Gray Brechin, *Imperial San Francisco: Urban Power, Earthly Ruin* (Berkeley: University of California Press, 1999), 127.
[6] California State Agricultural Society, "Report of the Visiting Committee of the State Agricultural Society," (Wilmington, Del.: Hagley Museum and Library, 1859).
[7] Scott was hired by Donahue in 1860 as a draftsman and by 1865, as Donahue retired, became a full partner. By the 1890s, Scott was a nationally known Figure and a potential Vice President nominee for President McKinley in 1900. "Talk of Western Candidates" *New York Times*, June 14, 1900.
[8] Besides fabricating ship parts, UIW was famous for building over 90 percent of the machinery for Nevada's Comstock mines, and also produced railroad locomotives and agricultural equipment.

was the first iron casting in the state of California.[9] Union Iron Works continued ship-related manufacturing with the production of steam engines, specifically an engine for the U. S. sloop *Saginaw*, the first government vessel completed on the West Coast. Union Iron Works, in concert with the Secor Brothers in Jersey City, New Jersey, constructed the *USS Camanche*, an iron monitor, in 1864, possibly the only iron hull ship constructed on this coast.[10]

Scott was the master-mind behind UIW's transition from an iron works to a shipyard. Scott ran the works with Henry J. Booth and G. W. Prescott for the next decade until 1875. Familiar with the inefficiencies of separate machine works and shipyards and aware of the increasing demand for metal hull ships, the three men planned a shipyard in early 1870s and secured land in the Potrero Point district of San Francisco. Specifically, they bought the Owen's shipyard, one of the first wooden shipyards to move to the Point. [11] Union Iron Works, however, stayed at their south of Market location for another decade.

Scott decided to open the steel shipbuilding yard during a round-the-world trip with millionaire and miner James G. Fair in 1880. Scott, famously, was inspired to follow his plans of the previous decade and open the UIW yard after visiting the steel shipyards of Europe.[12] Fair subsequently became a U. S. Senator in 1881, creating direct connections for Scott to Washington, and likely, knowledge of the lucrative naval shipbuilding contracts that Congress would soon authorize and the lack of domestic shipyards able to build the modern steel hull warships that the Navy desired. By 1883 Scott purchased adjacent parcels at Potrero Point, amounting to some twenty-five acres and began construction of the Union Iron Works shipyard.

The UIW Shipyard and Shipbuilding at UIW

The new UIW yard, which opened in 1884, was a pioneering facility that used the latest technological innovations and steel shipbuilding methods. Designed as an integrated yard, UIW could produce all ship components onsite, allowing for the greatest flexibility in the type of ships that could be built or repaired there. The plate shop and shipways utilized the new lofting method of shipbuilding, rather than the earlier lifting method, and the machine and metal shops were an upgrade from the already renowned south of Market Street works.

The yard's original layout captures the scale of Scott's lofty ambitions and his business acumen. UIW consisted of five machine shop buildings on the south side of 20th Street and the plate shop and a wharf across the street along the waterfront (Figure 5). It was designed with machine shops (West portion of Building 113), smith shops (East Portion of Building 113), foundries for producing metal components, along with all the necessary shipyard facilities for hull construction and outfitting. As geographer William Walters points outs, such yards were known as integrated yards because they built engines as well as ships and did not

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[9] Hugo P. Frear, "History of Bethlehem's San Francisco Yard: Formerly the Union Iron Works," Society of Naval Architects and Marine Engineers Historical Transactions, 1893-1943 (New York: The Society of Naval Architects and Marine Engineers, 1945), 238.
[10] "Launch of the Camanche," *San Francisco Evening Bulletin*, November 10, 1864.
[11] Irving M. Scott Interview, San Francisco, April 7, 1891, original typescript in Biographical Materials Relating to Irving Murray Scott, Hubert Howe Bancroft Collection, Bancroft Library, University of California Berkeley, Berkeley, 7.
[12] Hubert H. Bancroft, *Chronicles of the Builders of the Commonwealth*, Vol. I (San Francisco, 1891), 461.

need to subcontract with other companies for components.[13] The late nineteenth-century integrated yards built the largest and heaviest mercantile and naval ships, and by the turn of the century these yards were generally considered the premier steel shipyards in the country. The yard's metal working and machining capabilities continued over the years, and proved crucial not only to the yard's lasting success, but also to the endurance of the Union Iron Works/Bethlehem Steel Shipyard's early layout and design. Scott's decision to build an integrated yard allowed UIW to remain competitive in both government and private shipbuilding through WWII and to remain a successful ship repair facility today.

Like most of the nation's leading integrated shipyards, UIW's layout consisted of a basic division between shipyard and machine shop, which reflected the origins of steel hull shipbuilding in the melding of the wood shipbuilding and metal working industries. Ironclad and iron hull shipbuilding during the Civil War first witnessed the amalgamation of these two industries. Only in the 1880s, however, did UIW and other shipyards, pioneer a national shipbuilding industry that grew out of established iron machine shops and wooden shipyards and improved many of the characteristics and techniques of each. Iron works that moved into shipbuilding, in particular, drew from the knowledge and expertise of existing wooden shipbuilding firms and their workers, see the Labor History Section, pages 45-46[14]

Shipbuilder Charles Cramp, in Philadelphia, describes the conversion of shipyards during the shift from wood to metal hull vessels during the nineteenth century. A similar transformation occurred when the Union Iron Works shipyard replaced the 1860s wood shipyards at Potrero Point:

> The old shipbuilding district …has changed in appearance; where piles of planking, ship timber and lumber, etc., occupied the principal space in the shipyard, will be found great buildings filled with machinery, and where hundreds of men were formerly seen plying the axe, adze, maul, etc., will be found railway tracks occupied by yard locomotives, overhead traveling cranes and piles of plates, angle bars and beams. The buildings are devoted to machinery and tools for working the plates, etc. These will be found besides, power plants, steam, electric, pneumatic, hydraulic, and other machinery.[15]

The Union Iron Works/Bethlehem Steel Shipyard illustrates early efforts to combine the shipbuilding and metal working industries. Specifically, it retains a division between the shipyard and machine shop, even as they are located on the same site. This arrangement dates to the yard's 1884 opening. The logic behind it originates more generally when metal working shops custom crafted ship components and then transported them to the shipyard.[16] The need to optimize this relationship between the machine shop and the shipyard was one factor driving shipyards to combine with iron works. The layout of early steel hull shipyards often retained a separation of the two departments while attempting to ease the movement of parts and materials around the shipyard and, ideally, limiting any backward movement of rejected parts.[17]

Lifting and Lofting Methods of Shipbuilding

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[13] William D. Walters, "American Naval Shipbuilding: 1890-1989," *Geographical Review*, 90 (2000), 419.
[14] William H. Thiesen, *Industrializing American Shipbuilding. The Transformation of Ship Design and Construction, 1820- 1920* (Gainesville: University Press of Florida, 2006), 80.
[15] David B. Tyler, *The American Clyde: A History of Iron and Steel Shipbuilding on the Delaware from 1840 to World War I* (New York: University of Delaware Press, 1958), 73-74.
[16] Ibid., 88.
[17] J. Mitchell, *Shipbuilding and the Shipbuilding Industry* (London: Sir Isaac Pitman & Sons, Ltd., 1926), 34-35.

The Union Iron Works shipyard was designed to utilize the most advance methods of shipbuilding. Scott's experience with the early days of iron shipbuilding and the inefficiencies of the lifting method compelled him to design UIW according to the new lofting method. For the lifting method, shipbuilders created new templates by "lifting" their outlines from the hull itself while it was being built, rather than from plans or drawings. William H. Thiesen, a maritime historian, writes of the process, "Rather than prefitting and prefabricating iron parts for assembly at the shipways, each piece had to be fabricated and attached to the hull in sequences as the hull grew from the keel up."[18] In other words, for each new piece to be fit, a template was tailored to its vacant position on the partly constructed hull. Using this template, the plate shop would bend and shear a plate to match and punch it with rivet holes. This custom method proved inefficient, not only because parts were unique, but also because it required many rounds of communication between the slipways and the shops.

The "lofting" method superseded the lifting method. Using the new method, templates were produced in "mold lofts" based on models and plans.[19] As the lofting method grew popular, the mold loft became an essential component of the shipyard, and the locations of hull plate storage and metal shops changed to suit the new workflow. Ships engineered by this method were known as fabricated ships.[20] Prefabrication and further standardization in shipbuilding and ship design was introduced at the turn of the century, which led to government sponsored prefabrication yards by WWI.

The Union Iron Works shipyard opened in the 1880s with a template shop and a fully equipped and modern mold loft.[21] The yard also boasted drafting rooms and an entire floor for drawing and copying blueprints.[22] The mold loft was used to lay down the lines of the hull by scaling up designs from wood models. This method produced accurate templates for the hull frames but still required skilled workers to reproduce the curves and angles on the hull plates and to punch precise rivet holes, ensuring that hull plates aligned properly. At the turn of the century, the lofting method was streamlined by standardization of ship design and an increased reliance on drawings and templates.

When the UIW shipyard opened it utilized the most efficient methods of shipbuilding then available (Figure 6). The yard's lasting design and layout was solidified during the late nineteenth century, as shipbuilding processes continued at their original locations, though the buildings and structures that housed them were replaced and upgraded. Particularly, Buildings 113 and 114, commonly referred to as the machine shop, anchored the yard's plan.

The New Navy and the Birth of America's Steel Ship Industry

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[18] Thiesen, *Industrializing American Shipbuilding,* 100.
[19] Robert C. Stewart, "Historic American Engineering Record: U.S.S. Olympia," U. S. Department of the Interior, National Park Service, 1998, p. 10.
[20] Fredric L. Quivik, "Historic American Engineering Record: Kaiser's Richmond Shipyards," National Park Service, 2004, p. 132.
[21] Caspar T. Hopkins, George C. Perkins, Andrew Crawford, Charles L. Taylor and Charles B. Stone, *Report on Shipping and Ship-Building to the Manufacturer's Association, the Board of Trade and the Chamber of Commerce* (San Francisco: Joint Committee of the three Associations, 1884/1885), 41-42.
[22] Ibid., 42.

At the end of the Civil War, the country focused on domestic rebuilding efforts, and few resources were devoted to maintaining the naval fleet. By the 1880s, most of the Civil War ironclads had deteriorated and were sold for scrap, leaving the U.S. Navy with a fleet of mainly wooden ships, which was considered an outmoded "laughing-stock for the nations of the earth" compared to powerful European steel navies.[23] This perception resulted in a growing public and Congressional conviction that development of a new, stronger Navy was needed to protect trade interests and to recover the nation's naval prestige.[24] A nationwide steel shipbuilding industry soon developed.

On March 3, 1883, Congress authorized $1.3 million for the construction of the first steel warships and thus initiated the steel hull ship industry in the country. UIW, along with the major private East Coast shipyards, pursued these naval contracts. As the iron shipbuilding industry had been created for the military during the Civil War, the mid-1880s push for the New Navy directly resulted in the birth of the United States steel ship industry. To create its steel fleets, the government turned to commercial yards, as it would continue to do for every war effort through WWII. This cycle of government contracts for steel ships established at the industry's founding determined the industry's trajectory for the next sixty years, through WWII.

The U.S. Navy and Private Shipyards
The government chose to encourage private shipyards and steel mills to expand their facilities to build the New Navy rather than rely on international yards or on government naval yards. The Navy offered contracts in batches large enough to incentivize domestic companies to build the necessary facilities, an approach that continued through WWII. Leading Civil War-era shipyards on the East Coast, such as Pusey and Jones, Harlan and Hollingsworth, John Roach (earlier Reaney, Son, and Archbold), and William Cramp and Sons, were all contenders for the initial naval contracts.[25] The latter two yards, along with the Union Iron Works and the Newport News Shipbuilding and Dry Dock Company of Virginia, which opened in 1886, became the major players in the creation of the steel shipbuilding industry.

The government rarely allocated funds, even during wartime development, for the construction or improvement of shipbuilding facilities at government yards. Instead, contracts went to private yards for building steel ships to naval specifications. Governmental shipyards were mainly responsible for ship repair during the late nineteenth and early twentieth centuries.[26] There were fewer than ten naval yards prior to WWII, and these yards built only a handful of ships from the end of the Civil War until the early twentieth century.[27] Shipbuilding was not common at naval yards until WWII, which saw a nationwide increase in government naval shipbuilding yards. On the West Coast, only two naval yards pre-dated the twentieth century: Mare Island, which opened in 1854, and a yard at Bremerton, Washington, which did not open until 1891.

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[23] Ruth Teiser, "The Charleston: An Industrial Milestone," *California Historical Society Quarterly* 25 (March 1946), 39.
[24] Andrew Gran, *Bethlehem Steel* (New York, 1999), 14.
[25] Leonard Alexander Swann, *John Roach, Maritime Entrepreneur* (New York, 1980), 51; Thiesen, *Industrializing American Shipbuilding*, 123; E. F. Kenny, "The Development and Use of Steel in Shipbuilding," in *Historical Transactions, 1893-1943* (Westport, Conn., 1945), 445.
[26] Frank A. Beard and Robert L. Bradley, "Portsmouth Naval Shipyard National Register Nomination," U. S. Department of the Interior, National Park Service, 1977, Section 8, p.4.
[27] Douglas C. McVarish, "Philadelphia Naval Shipyard Historic District, National Register Nomination," U.S. Department of the Interior, National Park Service, 1999, Section 8.

During most of the nineteenth century, the Navy depended on the private sector not only for its shipyards but also for its engineering and design expertise. Naval facilities for training engineers did not open until the 1870s. Naval oversight of military shipbuilding, which included assuming greater responsibility for specifications, generally increased during the late nineteenth and early twentieth centuries. Thus, the steel hull shipbuilding industry gradually underwent a transition away from the loose technical organization of its early days—when specifications tended toward generality, fostering free experimentation by commercial yards—toward a regime of more strictly detailed designs and guidelines.

In 1885, John Roach's Delaware River Iron Shipbuilding and Engine Works won the contract to build the first American steel warships, the so-called ABCD ships.[28] While Roach was going bankrupt attempting to fulfill these initial contracts, UIW successfully launched its first steel-hull ship, the *Arago*, which was a commercial ship.[29] The hull plates were manufactured by the Pacific Rolling Mills, a pioneering industry at Potrero Point. Most other parts were manufactured onsite at UIW. The *Arago* was one of the first steel hull ships built in the United States, helping to establish the capabilities of the national shipbuilding industry. She was the first steel hull ship built on the West Coast, establishing UIW as a capable shipyard, as worthy as any established East Coast yard for lucrative naval contracts.

Naval Contracts at UIW

After launching the *Argo*, Irving Scott and the Union Iron Works landed their first naval shipbuilding contracts, inaugurating a lasting relationship between the government and this West Coast yard. UIW soon emerged as a national leader in steel shipbuilding, successfully competing with the top tier yards on the East Coast. During the 1890s, UIW continued to upgrade its facilities. It remained an industry leader, along with a handful of East Coast steel shipyards, through the turn of the century.

UIW quickly established its prominence in the steel hull shipbuilding industry. In 1886 UIW built the steel steamer *General McDowell* for the Navy and received the contract for a protected cruiser, the *Charleston*, the first built in the country.[30] In 1888, the yard started on *San Francisco* and *Cruiser No. 5*.[31] These ships were followed by contracts for the *Monterey*, a coast defense ship, and the *Olympia*, a cruiser, in 1888. Today, the *Olympia* is the world's oldest extant steel hull warship.[32] Richard Stewart writes that the ship's design was "the realization of a generation of improved steel ship designs... [the] design achieved a successful balance of armament, protection, speed and endurance."[33]

In 1890 Congress approved funds for three *Indiana* Class sea-going coastal battleships, the *Indiana*, *Massachusetts*, and *Oregon.* According to Frank Marion Bennett, writing in 1900, these ships were built exclusively from American designs and pioneered the "distinctively American battleship."[34] Cramp's shipyard received the contract for the first two ships. UIW won the contract for the battle ship *Oregon* in

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[28] Stewart, "HAER: *U.S.S. Olympia*," 5-6.
[29] "Shipbuilding Plant of the Union Iron Works at San Francisco," *Marine Engineering* (1900), 14.
[30] "Our State. Retrospect of the Twelve Months of Prosperity," *San Francisco Call*, January 1, 1887, p. 2.
[31] "Our Shipyards. A Year of Prosperity for Builders," *San Francisco Chronicle*, January 1, 1889, p. 5; Naval Historical Center and the Ships History Branch, "Dictionary of American Naval Fighting Ships," Naval Warfare Division, ed. (Department of the Navy, 1991).
[32] Stewart, "HAER: U.S.S. Olympia," 1.
[33] Ibid., 19.
[34] Frank Marion Bennett, *The Monitor and the Navy under Steam* (Boston and New York, 1900), 258-260.

1891.[35] The 11,688-ton *Oregon* was the largest ship built at the yard during the nineteenth century and was one of the first battleships constructed in the country. The *Oregon* was also celebrated as one of the fastest battleships in the world and catapulted UIW's reputation in shipbuilding even before the *Oregon's* famed role in the Spanish American War. UIW captured international attention by designing the Imperial Japanese cruiser *Chitose,* which at the turn of the century was the fastest cruiser built to date in the United States.[36]

While UIW fulfilled government contracts, it continued to undertake a variety of private shipbuilding contracts and ship repairs. It constructed commercial vessels throughout its history—mainly barges during the late nineteenth century, but also steamers, tug boats, oil tankers and passenger freighters. As the original ironworks had done, the shipyard produced parts for other shipyards as well. In 1885, for instance, UIW constructed parts for the Mare Island dry dock, the first of its kind built on the West Coast, and installed new boilers on the *State of California*.[37] UIW also continued building mining equipment during the 1880s. These activities illustrate the continuing influence of UIW's beginnings as an iron works, and, more importantly, the yard's versatility.

Late Nineteenth Century Developments in Power Distribution and Materials Management at UIW

During the late nineteenth century, UIW was at the cutting edge in mechanization, power distribution, and materials management. UIW was an innovator in hydraulic power and an early adopter of electric power. The yard's hydraulic dry dock was known across the country. During this time, the yard was a model for a modern shipyard; it pioneered many new shipbuilding methods, especially applications of emerging technologies to shipbuilding. The placement of the plate shop and the mold loft near the slipways and the cranes, as well as the rail lines, installed by the turn of the century, exhibit the period's best efforts to optimize the shipbuilding process (Figure 7).

The Hydraulic Dry Dock

One of UIW's famed technological innovations during the late nineteenth century was a hydraulic dry dock, known as the most advanced in the country.[38] A dry dock is a necessary component in a shipyard for ship repair. A significant portion of ship repair consists of cleaning and painting the hull. These tasks require a quick turnaround, making it necessary to limit the time required to move ships in and out of the dry dock. During the mid-1880s, the UIW management considered a graven or sunken dry dock, common at the time, but quickly determined that cleaning the mud out of the dock would take more time than the ship work itself.[39] UIW chief engineer George W. Dickie came up with an innovative solution: a lift dock.

Dickie designed a hydraulically powered dry dock. Hydraulic power utilizes "fluid pressurized in a cylinder forcing a piston to transmit energy in a steadier, more efficient way than force applied directly from a steam engine."[40] The new dry dock was capable of lifting 600 tons to a height of 32 feet. It consisted of a platform measuring 62 feet wide and 435 feet long,[41] and "hydraulic rams on each side" performed the lifting.[42] All the

[35] "The Pride of the Coast," *New York Times*, August 16, 1891, p. 9.
[36] Frear, "History of Bethlehem," 239.
[37] *Mining and Scientific Press*, January 10, 1885.
[38] "Far Ahead of America," *New York Times*, August 30, 1891.
[39] "Hydraulic Lifting Dry Dock at Union Iron Works, San Francisco," *Marine Engineering* 4 (1899), 189.
[40] Thiesen, *Industrializing American Shipbuilding*, 175.
[41] "Hydraulic Lifting Dry Dock at Union Iron Works, San Francisco," 189.

components of the dry dock were constructed on site at UIW. *Marine Engineering* and *Scientific American* hailed the dock as a feat of engineering, and it performed without mishap for almost twenty years, when the 1906 earthquake destroyed it.[43] The dry dock allowed the yard to shorten the total turnaround time required for ship repair as well as to service the largest ships on the West Coast.

Shipyard Infrastructure

Two technological developments—new sources of power and new methods of transmitting power—had the greatest impact on the United States shipbuilding industry and shipyard design near the end of the nineteenth century. The development of hydraulic, pneumatic, and electric power changed how materials were moved around the site. Thiesen writes that "[n]ew and powerful machines for materials handling made obsolete the need for manpower and animal power to lift and transport items within the shipyard."[44] These developments also eliminated earlier restrictions imposed by the steam-powered tools and equipment on the layout of building interiors and the shipyards as a whole.

When UIW adopted hydraulic power in the 1880s, it was seen at the time as the most efficient and advanced means of powering heavy machinery. UIW used hydraulic power in the 1880s and 1890s to operate nearly all heavy machinery, including stationary riveters, bending presses, plate planers, and steel plate shears. The assortment of hydraulic tools at UIW drew great praise from the industry, as hydraulic power provided more powerful tools than belt-run steam-powered tools, which was the other option prior to the commercialization of electric motors. Local writers claimed that the machine shop housed the "latest and best- improved machinery and appliances in use for erecting the largest iron and steel merchant ships and war vessels."[45] Hydraulic cranes were employed in the machine shop, and the traveling cranes over the slipways were likewise hydraulic. When C. P. Huntington's Newport News Shipbuilding Company was built several years later in Virginia, it followed UIW's example by installing its own hydraulic shop and hydraulically-powered overhead cranes.[46]

UIW led the United States in riveting technology as well. Hydraulic riveters were commonly employed at British shipyards during the 1870s. They allowed for the four-man riveting gang to complete riveting in one-third the time, half the cost than hand riveting, and with better quality.[47] R. H. Tweddell designed a stationary hydraulic riveting machine for shipyards in 1865 in England and Fielding and Platt introduced a first portable version in 1871.[48] These riveters were either stationary (often used in the shops), or were moved with cranes or on tracks either in shops or along the slips.[49] UIW installed hydraulic bull riveting machines in its shops around the mid-1880s.[50]

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[42] Waldon Fawcett, "The Ship-Building Yards of the United States," *Engineering Magazine* (1900), 502.
[43] "Hydraulic Lifting Dry Dock at Union Iron Works, San Francisco," 189; "Great Pacific Coast Shipbuilding Plant," *Scientific American*, July 2, 1892, p. 1.
[44] Thiesen, *Industrializing American Shipbuilding* 169.
[45] *The Bay of San Francisco*, vol. 1 (San Francisco, 1892).
[46] Thiesen, *Industrializing American Shipbuilding* 176.
[47] David H. Pollock, *Modern Shipbuilding and the Men Engaged in It.* (London: E. & F. N. Spon, 1884), 139.
[48] John Wilton Cuninghame Haldane, *Steamships and Their Machinery from First to Last.* (London: E. & F. N. Spon, 1893), 136.
[49] Pollock, *Modern Shipbuilding and the Men Engaged in It.*, 140.
[50] "A Great Industry." *San Francisco Newsletter and California Advertiser* (1886).

Pneumatic riveters proved to be more versatile than the hydraulic versions and gained popularity at U. S. shipyards during the 1890s.[51] In the United States, Roach's shipyard first used Allen pneumatic riveters in the early 1880s, which were then introduced to other shipyards during the late nineteenth-century.[52] Too heavy for a single man to carry, late nineteenth century pneumatic riveters were not useful as portable riveters and remained mainly in the shops. By the turn of the century, lighter and portable pneumatic tools were in use at Newport News, Cramp's shipyard and New York Ship. These tools, however, only reduced the traditional riveting gang by one man and the rivet gang would continue until welding replaced riveting after World War I (see the Labor History Section for a detailed discussion on mechanization and skilled labor in regard to riveting, pages 49-50).[53] Both pneumatic and hydraulic riveters increased the rate of production and "the elaboration and enhanced refinement of detail demanded by the much more exacting standard of modern times."[54] UIW installed both hydraulic and pneumatic hand tools in its shops and along the slips by 1900.[55]

Shipyards started to electrify across the country during the late 1880s and 1890s. During the nineteenth century, electricity proved most useful for its portability and flexibility, particularly because it could be used for work aboard ships. With electric tools, the layouts of the yard and shop were no longer constrained by the reach of steam-powered shafts, belts, or pullies.[56] Electricity also enabled shipyards to expand, and as yards increased in size during the early twentieth century, electricity became the dominant power source.
UIW demonstrates the impact of electricity on shipbuilding and on shipyard design. UIW introduced electricity during the 1880s. UIW started with electric lighting, followed by a few electric tools that often replaced hand tools.[57] By 1895, UIW had 400 horsepower of generating capacity. The engine house, which stood behind Building 113 during the 1890s, contained a compound engine and air compressor for overhead traveling cranes as well as hydraulic pumps for supplying hydraulic power throughout the works.[58] When a new powerhouse was built in 1912, it also functioned as a central location to supply these various types of power.

Materials Movement

Union Iron Works and the Newport New Shipbuilding Yard pioneered the use of overhead crane systems in the United States. Prior to these developments, man- and animal-power, with occasional and selective aid from steam power, were the principal power sources for manufacturing and for transporting materials around the shipyard. The type and size of ships that a yard produced or repaired depended partly on its ability to transport materials around the shipyard. The speed and expense of shipbuilding was likewise tied to the movement of materials. Cranes and rail lines proved essential for quickly relocating massive ship components, particularly hull plates.[59] Thus, steel shipyards generally were one of the first industries to rely upon cranes in the United States.[60]

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[51] Thiesen, *Industrializing American Shipbuilding*, 177.
[52] Ibid., 179.
[53] Ibid., 181.
[54] Pollock, *Modern Shipbuilding*, 129.
[55] "Shipbuilding Plant of the Union Iron Works at San Francisco," *Marine Engineering* (1900), 16.
[56] Thiesen, *Industrializing American Shipbuilding*, 182.
[57] W. W. Hanscom, "Electricity in the Union Works," *Journal of Electricity, Power and Gas,* XI (1901), 111.
[58] Hanscom, "Electricity," 112
[59] Thiesen, *Industrializing American Shipbuilding*,186
[60] Quivik, "HAER: Kaiser's Richmond Shipyards," 111.

When the yard opened, UIW had a single rail line as well as bridge and jib cranes in several buildings, a gantry crane near the plate shop, overhead traveling cranes at the slipways, and a 100-ton, steam powered lifting shears at the outfitting wharf. By the late 1880s, UIW increased its use of rail and cranes. Overhead hydraulic cranes were used during ship construction, and cars and tracks moved heavy equipment around the yard.[61] These helped build the *Charleston*, the *San Francisco*, and the *Monterey*.[62] Each slip was covered with skeleton framing for supporting two cranes.[63] During the 1890s, UIW switched to electric cranes, ensuring it remained a technological leader in the industry.[64] Reliance on cranes thereafter continued to increase at UIW and at shipyards around the country. By 1901, UIW had installed 35 cranes across the site, including in the machine shop (West portion of Building 113), brass foundry, iron foundry, erecting shop, boiler shop, and blacksmith shop (East portion of Building 113).[65] Overhead electric bridge cranes from the 1890s are still suspended from the ceiling in Building 113, and remnants of rail spurs are visible throughout the district, reminders of these major technological developments in the movements of materials at the Union Iron Works/Bethlehem Steel Shipyard.

UIW maintained its status as a leading steel shipyard thanks to Scott's original plan for the yard as well as the continual improvements made there. During the late nineteenth century the United States shipbuilding industry developed more effective means to distribute power within shipyards. UIW was a national leader in the advancement of power and materials distribution; it was a leader in the use of hydraulics as well as an early adopter of electrical power. Its innovative design and construction of a hydraulic dry dock was unique in American yards. By the 1890s, UIW had even installed a crane and rail system that extended across the yard. Although this system did not fully implement the principles of efficiency experts and scientific management that were pioneered at the turn of the century and popularized during WWI, it was a technological innovation at the time. During the late nineteenth century, according to the yard's own literature, the UIW's design embodied the best and most progressive ideas for shipyard layout.[66]

The Spanish-American War

The Spanish-American War of 1898 provided the United States with an opportunity to showcase its military prowess and modern Naval Fleet. As one of the most modern yards of its time, UIW built some of the largest and now best known ships of the Spanish-American War. The influence of the national United States steel shipbuilding industry and UIW's central role in the industry became clear with the naval victories of the Spanish-American War.

President Benjamin Harrison called for a naval fleet that could offer defensive and commercial protection but could also serve as an offensive force. In June of 1890, Congress answered this call by authorizing the construction of three battleships, *Indiana*, *Massachusetts*, and the *Oregon*. The last of these was famously built at UIW. [67] Along with the *Iowa*, these ships formed the core of the new United States fleet. In 1897, prior to the declaration of war, the Navy underwent a phase of growth and reform. The U. S. Navy released a

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[61] "A Great Industry," *San Francisco Newsletter and California Advertiser* (1886).
[62] *The Bay of San Francisco*.
[63] Hanscom, "Electricity," 113.
[64] "Shipbuilding Plant of the Union Iron Works at San Francisco," 14.
[65] Hanscom, "Electricity," 112.
[66] "Union Iron Works," c.1900, document on file at the San Francisco Maritime Museum.
[67] Michael J Crawford, Mark L. Hayes, Michael D. Sessions, "The Spanish American War Historical Overview and Select Bibliography," in *Naval History Bibliography* (1998).

new wave of contracts in 1896 and UIW received contracts for the gunboats *Wheeling* and *Marietta*, plus *Farragut*, a torpedo boat, and *Wisconsin*, another battleship.

The Spanish-American War started in Cuba with the destruction of the battleship *Maine* in Havana's harbor on February 15, 1898. Although the explosion is now known to have been an accident, 266 Americans lost their lives. The event made potent propaganda for the pro-war contingent in this country and the United State's declared war in March. Spain's Pacific territories created a second front and it was the battle of Manila Bay in May of 1898 that reshaped the world's opinion of the U.S. Navy and sealed the success of the nation's steel ship makers, including UIW. Admiral George Dewey was charged to attack and blockade the Spanish fleet and, if possible, to capture Manila Bay. UIW's *Olympia* was Dewey's flagship, of which he assumed command on January 3, 1898. Dewey destroyed the Spanish fleet in a sunrise attack that lasted for only several hours. Not a single American sailor was lost, but the Spanish lost seven major ships, with 381 men killed and 1,800 wounded.[68]

The UIW's Battleship *Oregon* likewise captured national attention in July of 1898 when she raced around the tip of South America to engage Admiral Cevera's four cruisers of the Spanish fleet in Cuba. Secretary Long ordered the *USS Oregon* to depart from Bremerton, Washington on March 7. The *Oregon* concluded its 15,000-mile trip less than three months later, arriving at Key West in full working order and ready to take on the Spanish fleet. Her feat demonstrated the viability of the new steel navy and UIW's high quality of work.

During the war, new naval contracts were awarded to all the major yards, including UIW. In 1899 the works built the battleship *Ohio,* monitor *Wyoming*, and several destroyers. The yard also started to build submarines at the turn of the century. Although most of these ships were not finished until after the war, the contracts occupied the yard into the twentieth century, until it was sold to the United States Shipbuilding Company.

The new steel fleet's success in the Spanish-American War was hailed as a triumph of the domestic steel shipbuilding industry. In less than two decades, the new shipbuilding industry had grown to maturity. UIW and the leading East Coast yards—William Cramp and Sons of Philadelphia, Newport News Shipbuilding and Dry Dock Company of Virginia, and the new New York Shipbuilding Company in New Jersey—proved that world-class ships could be built in this country. The New Navy helped the United States emerge as a world power in the twentieth century.

The Growth of the United States Steel Ship Industry

With the New Navy's success came the vision materialized of a national shipbuilding corporation that could fulfill naval and commercial needs across the country. With the turn of the century, and the formation of the United States Shipbuilding Company (USSC), the steel shipbuilding industry entered into a new phase of industry consolidation. This development fostered new methods in ship design and management, with an ongoing emphasis on efficiency and standardization. To remain competitive before and during WWI, the dominant late nineteenth-century yards like UIW required further expansion and modernization.

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[68] Stewart, "HAER: U.S.S. Olympia,"30.

John W. Young formed the USSC in 1901 to create a national steel shipbuilding company. Young recruited as his partner Lewis Nixon, the naval designer responsible for the *Oregon* and other battleships.[69] In August of 1902, USSC purchased eight shipbuilding companies: Union Iron Works, Bath Iron Works (a shipyard in Bath, Maine), the Hyde Windlass Company (a deck machinery works also in Bath, Maine), the Crescent Shipyard Company (of Elizabeth, New Jersey), the Samuel L. Moore & Sons Company (also of Elizabeth, New Jersey), the Eastern Shipbuilding Company (of New London, Connecticut), the Harlan & Hollingsworth Company (of Wilmington, Delaware), and the Canda Manufacturing Company (of New York). Young also purchased the capital stock of the Bethlehem Steel Company (of Pennsylvania). The sale of UIW occurred less than a year before Irving Scott, the long-time manager of UIW, died in 1903.[70]

By 1905 the USSC had failed, and its properties were handed over to a reorganization committee. The failure resulted in a shift of ownership and a rearrangement of the dominant players in the shipbuilding industry. By the end of 1905, Charles Schwab and Bethlehem Steel controlled UIW as well as several other East Coast shipyards.[71] The Union Iron Works Company was incorporated in New Jersey in 1905 as a subsidiary of the Bethlehem Steel holding company. After the acquisition, Bethlehem Steel replaced all yard managers, and used corporate funds to expand and modernize several of the shipyards, including UIW. Schwab planned this modernization and expansion effort after touring European shipbuilding and` ship repair yards; however, these plans were not implemented at UIW for several years.

The Modernization and Expansion of UIW (1908 – WWI)

Under Schwab's management Bethlehem Steel quickly became the largest shipbuilder in the country and the second largest steel producer. Of the five main steel shipbuilding companies, Bethlehem Steel owned two of the five largest steel hull shipyards in the country: Union Iron Works in San Francisco and Fore River Yard in

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[69] L. Walter Sammis, "The Relation of Trust Companies to Industrial Combinations, as Illustrated by the United States Shipbuilding Company," *Annals of the American Academy of Political and Social Science* (1904), 242-243.
[70] Ibid., 242.
[71] To understand how this transformation occurred and to understand its future impact on UIW and the shipbuilding industry as a whole requires some background on Bethlehem and Schwab. Bethlehem Steel Company started as an iron works in Bethlehem, Pennsylvania in 1857. By 1885, the works was producing heavy forgings and castings using open-hearth steel techniques and the next year signed the first contract in the United States to provide steel armor plates for the U.S. Navy. Charles Schwab, while president of J. P. Morgan's United States Steel Corporation, acquired a controlling interest in Bethlehem in 1901. Schwab started in the steel industry as a worker at the Carnegie Steel Company. Following a similar trajectory to Irving Scott, Schwab rose to president of the company by 1897 at the age of 35. Several years later, Morgan and Co. appointed Schwab president of U.S. Steel Corporation, the country's largest steel trust. In order to retain his position at U.S. Steel, Schwab sold Morgan his recently acquired Bethlehem Steel Company. In June of 1902, Morgan authorized the sale of Bethlehem to USSC, and Schwab offered his own funds to insure the transfer. Of the properties controlled by USSC, only Bethlehem Steel was profitable, and the USSC teetered on the verge of collapse. In order to prop up the parent shipbuilding corporation, Schwab released funds from Bethlehem to USSC in exchange for a primary lien on the USSC properties. Schwab's gamble paid off. The USSC failed and Schwab gained control of Bethlehem Steel and eventually UIW. In response to this move, amidst charges of fraud and extortion, Schwab was forced out of U. S. Steel. By 1905, all of USSC's property was transferred to a Reorganization Committee. Later that year, Bethlehem Steel incorporated in New Jersey as a holding company and took control of the former USSC shipyards, including the Union Iron Works. Schwab thus became the president and the major owner of the new Bethlehem Steel. Robert Hessen, "The Transformation of Bethlehem Steel, 1904-1909," *The Business History Review* 46, no. 3 (1972), 344-46.

Massachusetts.[72] In 1910 UIW was the largest private shipyard on the coast and was the core of an expanding West Coast shipbuilding industry.[73] Three main national trends in the shipbuilding industry directly impacted UIW between 1908 and WWI: the new principles of scientific management spurred a wave of modernization at the yard; the country's expanding role as a global power fostered expansion of the UIW facilities; and the opening of the Panama Canal increased shipping demands. The results of these trends on steel hull shipyards are still visible at the Union Iron Works/Bethlehem Steel Shipyard.

The Expansion of UIW

In the winter of 1907, after the end of the Russo-Japanese War, President Roosevelt ordered the Navy's Great White Fleet on a worldwide cruise. Roosevelt, in a characteristic display of a big stick, used the fleet to exhibit America's military power and to install a naval presence on the West Coast. The fleet was scheduled to arrive in San Francisco after many months of travel in the spring of 1908 and would require repairs. UIW was the only yard on the Coast capable of repairing the naval fleet and Roosevelt persuaded Schwab, who was currently dismantling UIW,[74] to prepare the yard for the fleet's arrival.[75] Encouraged by the government's need for a large, private ship yard on the West Coast, Schwab personally oversaw the initial rehabilitation of the yard. During the next decade, Schwab upgraded and modernized UIW's facilities, which prepared the yard for WWI naval contracts. By the start of WWI, UIW was the center of shipbuilding on the Pacific Coast.

Starting in 1908 with the purchase of the San Francisco Dry Dock Company, UIW expanded by purchasing other facilities around San Francisco Bay. During the 1906 Earthquake, the passenger vessel *Columbia* crashed into the water, destroying UIW's famed hydraulic dry dock.[76] The dry dock was directly adjacent to the shipyard's repair facilities, and had allowed the shipyard to repair most of the longest ships of the day. By the turn of the century, UIW did considerable business repairing and dry docking vessels; many of the steam vessels operating on the coast were serviced by the yard. The loss of the hydraulic dry dock thus impacted UIW's dominance on the West Coast and the Union Iron Works Company purchased the San Francisco Dry Dock Company, located in Hunter's Point. Two floating dry docks from Hunter's Point subsequently moved to the UIW.

The newly acquired Hunter's Point yard, with its two graven docks, continued as a ship repair yard, expanding UIW's ship repair facilities. A new graven dock was built at Hunter's Point in 1916 to accommodate any size of ship then in existence, including all battleships.[77] The government negotiated with the Union Iron Works Company for the use of these facilities during WWI, and finally purchased Hunter's Point during WWII.

In 1916 the Union Iron Works Company purchased the United Engineering Company in Alameda, which became known as the Alameda Yard. UIW also expanded its shipbuilding operation into the adjacent Risdon

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[72] Walters, "American Naval Shipbuilding,"421.
[73] "Union Iron Works Company," *Pacific Gas and Electric Magazine*, 2 (1910), 256-257.
[74] In 1907, when Schwab had initially order the closure of UIW, the steel market had crashed and UIW had just lost millions of dollars completing naval contracts signed under Scott's management at the turn of the century.
[75] Matthew M. Oyos, "Theodore Roosevelt and the Implements of War" *The Journal of Military History*, Vol. 60, No. 4. (Oct., 1996), 632; "Schwab to Reopen Shipyard for Fleet," *New York Times*, October 13, 1907.
[76] Frear, "History of Bethlehem," 240.
[77] H. P. Pitts, "Union Iron Works at San Francisco," *Pacific Service Magazine* (June 1916), 8.

Yard to operate a United States Destroyer Plant, known as the Risdon Plant, for the Navy. The former Risdon Iron and Locomotive Works[78] was purchased by a subsidiary of the U. S. Steel Corporation in 1912 and they leased the area to the government during the war.

The Modernization of UIW

During the 1910s, two types of related modifications occurred at the yard. The first type involved upgrading utilities, expanding facilities to accommodate increased production, and incorporating new trends in shipbuilding based on scientific management and naval design requirements. Notable construction included a new power plant, a new plate shop, new foundries, and new slipways. The second change was the removal of the Irish Hill neighborhood, and the clearing of the front entrance to the site, making way for a grand entrance and a new office building befitting the yard's new status.

Scientific Management and its Influence at UIW

The 1890s saw the introduction of scientific management to the shipbuilding industry. Scientific management was a set of measures calculated to decrease costs and increase efficiency while boosting the rate of production and involved such principles as deskilling, mechanization, standardization, interchangeable parts, piecework, and hourly wages. Henry G. Morse and his business partner, Henry Lysholm, were two of the most influential forces behind the application of scientific management to the shipbuilding industry. Morse came out of the bridge building industry, where he oversaw such reforms as design uniformity and subassembly lines for prefabricated parts. These developments became possible through the standardization of everything from the language of blueprints to individual parts and the spacing of rivets.

In 1899 Morse started his own shipbuilding plant, the New York Shipbuilding Company, in Camden, New Jersey, and introduced such widely influential changes to the industry that he earned the moniker, "the father of modern shipbuilding." Three aspects of shipbuilding at New York Ship transformed the industry, shifting shipbuilding toward prefabrication. First, Morse housed the entire shipbuilding process under a single roof, which prevented bad weather from stopping work and compromising the integrity of building materials. Second, Morse dramatically reduced the time and cost required to fabricate and transport ship parts. Third, the overhead crane system not only helped to speed up production, but also allowed for heavy machinery to be installed on the slips rather than at a separate outfitting dock. Other shipyards of the time, including UIW, followed New York Ship's efforts in streamlining production and increasing the use of overhead cranes, but they did not invest in the expensive upgrades associated with housing the entire shipbuilding process under a single roof.

Henry Lysholm was largely responsible for perfecting the most important element of Morse's system: streamlining production through the "American method," otherwise known as the "mold system," "factory principle," "universal system," or "template system." As discussed above, custom fitting the plates individually to their positions on a hull was tedious, and the process often required time-consuming alterations. Adoption of the lofting method by the leading nineteenth-century shipyards improved this

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[78] The Risdon Iron and Locomotive Works moved to the southeast portion of the Union Iron Works/Bethlehem Steel Shipyard when it acquired the Pacific Rolling Mills site in 1900. Like the Union Iron Works, Risdon was originally an ironworks that moved into shipbuilding, particularly gold dredges, while continuing to make parts for ships and for a wide variety of other industries, with a product line ranging from bolts to highly specialized machinery. "The Risdon Iron and Locomotive Works," *Pacific Gas and Electric Magazine* (1911), 307, 331.

process. Morse's system offered further refinement by creating molds, out of which were made templates used to produce plates that fit exactly to the frame when the time came to rivet them. In addition to speeding up production and dramatically reducing costs, this method led to a shift in the guiding principles of shipbuilding; engineering for efficient production displaced speed and seaworthiness. This sacrifice stemmed from the requirement for highly accurate blueprints as well as from the requirement to fit prefabricated plates reliably to the frame of a ship. These two requirements conspired to favor more geometric and industrial (rather than graceful and curvilinear) ship forms. They likewise fostered modularity. The variety of ship forms predictably decreased so that standardized plates could be prefabricated for more than one type of ship and for more than one ship at a time.[79]

Upgrades at UIW
Bethlehem's Union Iron Works Company implemented several of Morse and Lysholm's methods of shipbuilding during the early 1910s, including the replacement of the 1880s plate shop and mold loft and the rearrangement storage yard, cranes, and rail lines (Figure 9). Simultaneously, UIW increased its office space and blueprint storage.[80] A new power station also centralized the yard's power and supported the yards increased use of electric power.

Prior to 1912, isolated steam-powered plants generated electricity for all machinery in the plate shop (Building 109), woodworking shop (Building 108), boiler shop, machine shop (Building 113/ffoundries) and foundry, as well as for the steam compressors used for air tools and other pneumatic tools. In 1912, the yard switched from internally generated power to electric power supplied by PG&E and fed to the yard from a new powerhouse, Building 102. The new power station transformed every aspect of the yard and gave operators in Building 102 complete control of all the electrical power circuits in the various shops around the yard.[81] Numerous alterations and improvements occurred in the machine shop and the foundry in response to the increased availability of electricity and the introduction of independent motors for running tools.[82]

Several alterations at UIW during the 1910s were similar to those of Henry G. Morse at the New York Ship, implementing the emerging principles of scientific management and efficiency in shipbuilding and design. Rebuilding the plate shop (Building 109), rearranging the metal shops and storage areas, constructing new foundry buildings (Buildings 115 and 116), and further expanding the rail lines were all attempts to streamline production and to conform the yard to the leading ideas in shipbuilding. These improvements, along with the expansion of the slipways, the joining of the machine shops and the construction of a longer dry dock, ensured that UIW would continue to build and repair efficiently the ships of the day. These upgrades, occurring in tandem with worker incentives for increased production, both of which occurred nationally across the shipbuilding industry, allowed UIW to cut dramatically the time required to build a ship, and this proved decisive as demand spiked in WWI. These pre-WWI modifications also allowed UIW to remain competitive as a leading shipbuilding yard during the war.

Major alterations to the yard's entrance also reveal the growing division between shipyard workers and managers at UIW. Under Schwab's guidance, management at the Union Iron Works Company, created a

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[79] Ibid., 192-202.
[80] "Record Yard for the Union Iron Works Co.," *International Marine* (1916).
[81] "Modern Facilities for Building Modern Liners," *Pacific Marine Review*, 25 (August 1928), 359.
[82] Pitts, "Union Iron Works," 3-5.

public façade befitting the yard's role as the centerpiece of its growing shipbuilding complex on the West Coast. Prior to the mid-1910s the shipyard lacked a public front and a grand entrance to the yard. The shipyard's management started transforming the character of the yard's entrance by removing the cottages, boarding houses and saloons of the mainly unskilled laborers along Illinois Street. Prior to WWI, portions of the Irish Hill neighborhood at 20th and Illinois Streets and on the bluff east of Illinois and 22nd Streets were removed as well. A fence was built along the north side of 20th and Illinois Street and double gatemen's houses were also added during the 1910s. Frederick Meyer's classically-detailed office building at the corner of 20th and Illinois Street, Building 101, created an entrance showcasing the yard and its management. This new office building corresponded with the general increase of office space during the first two decades of the twentieth century, resulting in the implementation of Evans' and Taylor's new management principles outlined above.

As the United States entered WWI, UIW was the centerpiece of its commercial shipbuilding presence on West Coast. Developments during the pre-war period exhibit a continuous pressure to modernize the yard in order to retain its status as the main commercial shipbuilding yard on the coast and in the country. Although the yard embraced the efficiency measures popular at the time, it also maintained and expanded its capacity to fabricate its own components, distinguishing it from the prefab yards built for the war. This decision had a lasting impact on the success of the yard after WWI and during WWII. It also resulted in the ongoing use and maintenance of the machine shop, Building 113/114, and the persistence of the yard's 1880s layout, which distinguishes the Union Iron Works/Bethlehem Steel Shipyard from other extant shipyards.

World War I

World War I broke out in Europe in the summer of 1914, but the United States remained officially neutral until April of 1917. The United States shipbuilding industry expanded to repair Allied ships, replace merchant ships sunk by U-boats, and to support the growth of the U.S. Navy in preparation for the anticipated American entry into the war. This wave of shipyard expansion and modernization, like the changes that gripped UIW in the 1910s, took place nationwide. President Wilson formed The United States Shipping Board (USSB) near the beginning of the war to manage the construction of new ships and to direct funds for the construction of new shipyards and the expansion of existing yards. The Emergency Fleet Corporation (EFC) was incorporated in April of 1917 as a publicly funded corporation to assist the distribution of funds.

President Wilson called for a special session of Congress to declare war after German U-boats sunk three American supply ships en route to England in March of 1917. With the onset of war, the country needed ships to move millions of men and supplies to Europe. The government immediately requisitioned over 430 steel ships for the war effort in 1917, and 75 percent of the nation's shipyards began to build for the Navy.[83] Navy Secretary Josephus Daniels quickly determined that anti-submarine destroyers and their ability to target U-boats would determine the outcome of the war. In order to meet this crucial need in a limited amount of time,

[83] Ibid., 106.

a new approach to ship construction was necessary.[84] The country immediately needed to switch shipyard production from larger battleships and battle cruisers to destroyers.[85]

As a result, UIW became the main commercial yard in the San Francisco Bay Area to build naval vessels for WWI.[86] Although there were other yards fulfilling government contracts (e.g. Moore & Scott), Bethlehem's shipyards, headed by UIW, remained the major shipbuilder on the West Coast during the war. The yard produced sixty-six destroyers and eighteen submarines along with cargo vessels and tankers (see Appendix A).[87]

The U. S. Navy Destroyer Plant at UIW

During WWI, destroyers saw extensive deployment as escorts, patrols, and raiders. They were especially important as the primary fleet defense against torpedo attacks from submarines and small surface craft. By the summer of 1917, Navy Secretary Daniels determined that the government needed some 200 some destroyers, and he met with all of the commercial yards able to produce warships to formulate a plan to meet the country's demand for destroyers.[88] Bethlehem offered to build two destroyer plants for the government, at the government's expense, and to build 150 destroyers in eighteen months. According to William Walters,

> The program called for the construction of two 'assembling yards,' each with up to twenty shipways. One of these plants would be located near Bethlehem's Fore River yard in Massachusetts and the second on land adjacent to the Union Iron Works on the San Francisco Bay. The firm also outlined plans to build various shops to produce turbines, boilers, and other equipment. Bethlehem offered to construct these facilities at no profit to itself, and noted that after the war the 'assembling yards' and shops 'would remain the property of the government.' Bethlehem's only profit would come from the ships it produced.[89]

In contrast, the other yards agreed to take on contracts for 25 destroyers each if the government paid to expand their facilities. In October of 1917, Congress approved $350 million to fund the construction of destroyers and ordered more than 265 destroyers.[90] The EFC joined with the larger commercial shipyards to build and operate specialized facilities for the mass production of destroyers.[91]

These yards, of which UIW is a primary example, worked closely with government officials, particularly as officials assumed greater control over the commercial yards that operated newly built naval-owned yards and

[84] United States Shipping Board, "Annual Report of the United States Shipping Board," House Documents (Government Printing Office, 1918), 129.
[85] William J. Williams, "Josephus Daniels and the U.S. Navy's Shipbuilding Program During World War I," *Journal of Military History*, 60 (1996), 7.
[86] Wayne Bonnett, *A Pacific Legacy: A Century of Maritime Photography, 1850-1950* (San Francisco, 1991), 12.
[87] "Bethlehem's Pacific Coast Shipyards," (Wilmington: Hagley Museum and Library, 1940), 6.
[88]The list of yards specializing in warship construction is a familiar list of the leading shipyards in the country: the Bath Iron Works in Maine; Bethlehem's Fore River Shipbuilding Company near Boston; the New York Shipbuilding Corporation in Camden, New Jersey; the William Cramp and Sons Company in Philadelphia; the Newport News Shipbuilding and Dry Dock Company in Virginia; and the Union Iron Works on San Francisco Bay. Williams, "Josephus Daniels and the U.S. Navy's Shipbuilding Program During World War I," 21.
[89] Ibid.
[90] Benedict Crowell and Robert Forrest Wilson, *How America Went to War: An Account from Official Sources of the Nation's War Activities, 1917-1920.* (Yale University Press 1921), 466.
[91] William D. Walters, "American Naval Shipbuilding," 422.

were filled almost exclusively with government contracts. When the EFC was first formed, its primary functions were placing contracts and developing ship designs. The EFC hired naval architects to design the ships needed for the war effort.[92] As the shipbuilding program expanded, the EFC also took on managerial functions at the commercial yards; the Corporation built "an organization which would supplement the functions usually served by the yard managements and would in many cases in fact supersede them."[93] EFC formed a Supply Division to centralize supply chain management for all its ships. This division organized the supply chains for almost 150 shipyards across the country.[94] EFC's Division of Shipyard Plants oversaw engineering and technical aspects at commercial yards fulfilling government contracts. The engineers of this division oversaw all plans for and supervised all aspects of new shipyard construction funded by the EFC.[95]

During the war, the EFC oversaw the building of the government-owned destroyer plant adjacent to UIW and run by Bethlehem's Union Iron Works Company. The plant was built on the adjacent old Risdon Works site, which was owned by a subsidiary of the U. S. Steel Corporation. The EFC designed the new plant according to modernization and efficiency trends pioneered earlier in the century, included competition between shipyards and worker incentives to increase productivity see the Labor History section, p. 61-63. A single structure covered the four slips, adjacent to a new plate shop. This layout followed Morse's principles of Scientific Management, which emphasized cranes for moving equipment and specified roofs over shipbuilding areas to prevent delays caused by bad weather. Thanks to this new yard, destroyer production spiked. In 1914, the average total latency to make a destroyer was two and half years from Congressional authorization until the boat's commissioning. At the UIW-run United States Destroyer Plant, shipbuilders turned out destroyers at the rate of three per month.[96]

Prefabrication Yards

The great demand for ships during WWI resulted in a further push for speed and efficiency, giving rise to prefabrication yards. Building on the techniques used at New York Ship starting at the turn of the century, the Navy requisitioned specialized yards to assemble ship components, which were fabricated by steel mills nationwide. [97] In order to improve standardization, modularity, and ease of construction, naval engineers designed ships with simple lines, flat decks, and few curves.[98] Arguably, this process represents a throwback to the separation of metal works and shipbuilding during the Civil War, but with the advantage of standardization and detailed plans that eliminated the inefficiencies inherent to customization.

The Hog Island Yard, Harriman Yard, and Newark Bay Shipyard were all prefab yards designed and paid for by EFC. The American International Shipbuilding Corporation at Hog Island, constructed for approximately $65,000,000, was the largest of these yards, covering 846 acres with 50 slips.[99] Thiesen writes that "Hog Island became the assembly area of a nationwide shipbuilding factory, to which structural steel fabricators shipped parts from all corners of the United States."[100] In addition to the standardization of components,

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[92] Thiesen, *Industrializing American Shipbuilding*, 205.
[93] Board, "Annual Report of the United States Shipping Board," 119.
[94] Ibid., 149-150.
[95] Ibid., 122.
[96] Shipbuilding Division Bethlehem Steel Co., *A Century of Progress: 1849-1949* (San Francisco, 1949), 16.
[97] Tyler, *The American Clyde*, 107.
[98] Board, "Annual Report," 129.
[99] Ibid., 130.
[100] Thiesen, *Industrializing American Shipbuilding* , 206.

prefabrication also entailed the standardization of ship designs at each yard so that the same ship design could be used repeatedly. Quivik describes the WWI prefabrication process:

> Such a wartime effort entailed, for the first time in U. S. history, the prefabrication of components and the standardization of ship designs to facilitate prefabrication. Standardization did not occur nationwide as in World War II, however. Rather, each shipyard designed its own standardized ship, which it could build in multiple copies. Not only did inland plants produce machinery for use on ships; such plants also fabricated pieces of hulls. Inland shops cut, bent, rolled, and punched steel plates and shapes. The shipyards themselves became more specifically sites for assembly and erection.[101]

Although Quivik notes that the WWI prefabrication network did not reach later levels of national standardization, the EFC did have Class A and B vessels designed by naval architects and produced at its prefab yards. By 1918, the EFC attempted to standardize building methods at all the yards under its supervision.[102] This process was incomplete by the end of WWI; it would have to wait until WWII.

In contrast to the prefab yards, UIW continued to fabricate its own components during the war. Remaining an integrated yard, it was able to build, equip, outfit, and drydock all on one site. UIW continued to manufacture boilers and turbines on site during WWI, while it continued to improve on existing techniques. The plant built the new tooling on site, including air drills and riveters specifically designed for small work.[103] The yard additionally conducted repair work during the war, which required custom work that more closely resembled the old lifting process than the new prefabrication methods.[104]

The End of the War

In early October of 1918, Germany unexpectedly entered into discussions with United States to sue for peace. Mutiny broke out in the German Navy and revolution quickly swept the country. A provisional government assumed power and agreed to an armistice, signed on November 11, 1918.[105] Few of the ships contracted by the government in 1917 were complete at the time of the armistice and the prefab yards had just started delivering ships. Many of the ships under contract continued to be built into the 1920s, including the majority of the destroyers and submarines built by UIW. The hundreds of ships that were either completed or were in the slips just a year after the declaration of war has been cited by many as a great achievement of the shipbuilding industry, even if many of those ships never saw battle. Historian David Budlong Tyler argues that the shipbuilding program "was an important factor in convincing the Germans that they could not win [the war] with their submarines."[106] The failure of the government to mobilize earlier, however, was not to be repeated during WWII.

UIW's successful adaptation to prefabrication and its successful destroyer plant had allowed the yard to make a substantial contribution to the WWI shipbuilding program. Its ship repair business, while likewise contributing substantially to WWI, was the key to the yard's continuation at the end of the war. The yard's

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[101] Quivik, "HAER: Kaiser's Richmond Shipyards," 11.
[102] Thiesen, *Industrializing American Shipbuilding* , 207.
[103] Fred H. Colvin, "Methods in a Shipbuilding Plant," *American Machinist,* 54, (1921), 673.
[104] Wayne Bonnett, *Build Ships! Wartime Shipbuilding Photographs San Francisco Bay: 1940-1945* (Sausalito, 1999), 98.
[105] Williams, "Josephus Daniels and the U.S. Navy's Shipbuilding Program During World War I," 34.
[106] Tyler, *The American Clyde,* 108.

capacity to build on site all the components necessary to fabricate and repair a ship became a major selling point during the interwar period. As the yard attempted to lure civilian contracts in the post-war years, its marketing literature emphasized that unlike specialized shipbuilding yards, its pattern, foundry, erecting and machine shops were equipped "to undertake any engineering construction," allowing for more flexibility in fulfilling commercial shipbuilding contracts.[107]

The Interwar Period

Government contracts vanished by the early 1920s, triggering a national depression in shipbuilding that persisted through the mid-1930s. Most American shipyards were liquidated and layoffs occurred across the country.[108] Many of the country's oldest yards, as well as the WWI prefab yards, were forced to close with the disappearance of government contracts and with the onset of the Great Depression. William Cramps & Sons, one of the original steel ship builders, shut their doors in 1927. The massive yard at Hog Island was disassembled, and the site later became Philadelphia's airport.[109] A soap factory took over the Harriman prefab yard in the mid-1920s.

Bethlehem's shipyards, on the other hand, managed to retain their prominence at the end of WWI through the 1920s and 1930s.[110] In 1924, Bethlehem reorganized its West Coast shipbuilding operation and the Union Irons Company was folded into the Bethlehem Shipbuilding Corporation. During the 1920s, the yard was reorganized to focus on ship repair and thus continued operations through the lean years that ensued. UIW did build a number of tankers and barges during this time, but output was minimal enough that the old Iron Works Shipbuilding yard is often spoken of as being reopened in the mid-1930s.[111] During the 15 years after WWI, all the yards that survived scaled back their facilities and only a handful of new oceangoing ships were produced in the entire country.

The United States Maritime Commission

As the threat of a second world war loomed on the horizon in the mid-1930s, few operating shipyards still had the facilities to build oceangoing vessels. The first clear signs of European conflict spurred the government to action. It feared a repeat of WWI, when the shipbuilding drive began too late and over 80 percent of the tonnage authorized for the war was actually launched after its end.[112] In the summer of 1936, Congress passed the Merchant Marine Act, which created the United States Maritime Commission and granted it the powers of the former United States Shipping Board.

President Roosevelt appointed five men to the U. S. Maritime Commission in 1936 to direct the country's shipbuilding program. The main objective of the Commission was "the creation of an adequate and well-balanced merchant fleet to provide shipping service on all routes essential for maintaining the flow of

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[107] "The Union Plant of the Bethlehem Shipbuilding Corporation, a Consistent Producer of Good Naval and Mercantile Vessels," *Pacific Marine Review* 15 (1928), 358.
[108] Quivik, "HAER: Kaiser's Richmond Shipyards," 13.
[109] Thiesen, *Industrializing American Shipbuilding*, 208.
[110] Quivik, "HAER: Kaiser's Richmond Shipyards," 15.
[111] "Bethlehem's Pacific Coast Shipyards." 6. See Frederic Chapin Lane, *Ships for Victory; a History of Shipbuilding under the United States Maritime Commission in World War II* (Baltimore: Johns Hopkins Pres, 1951), 45 for a brief discussion on the yard reopening to take on Maritime Commission contracts.
[112] Bonnett, *Build Ships! Wartime Shipbuilding Photographs San Francisco Bay: 1940-1945*, p. 24.

commerce of the United States."[113] The Commission was further directed to coordinate with the Navy Department so that vessels would be designed for easy conversion to wartime transportation and supply vessels in the case of national emergency or national defense.

The first job of the Commission was to survey the existing status of the American merchant marine and to create a long-range program for required additions and replacements.[114] The Commission adopted a long range plan calling for fifty new ships a year over the next ten years. It further developed standardized plans for the cargo ships that it planned to build, implementing for the first time a nationally standardized ship design.[115] The Commission also collaborated with shipbuilders to develop "plans for the economical construction of vessels and their propelling machinery, of the most modern economical types, giving thorough consideration to all well-recognized means of propulsion and taking into account the benefits accruing from standardized production where practicable and desirable."[116] The Maritime Commission quickly determined that the shipyards of the San Francisco Bay were the only yards on the Pacific Coast with facilities sufficient to build oceangoing merchant vessels. [117] At the same time, Congress increased Naval appropriations, resulting in the reactivation of Navy yards and a small number of new warship contracts. Authorization of contracts for both naval and merchant ships caused the immediate rehabilitation and expansion of existing yards.

Modernization at UIW

In 1936 the UIW yard received contracts from the U.S. Navy for two 1500-ton destroyers, the first of more than seventy ships the yard would build for WWII.[118] To complete these initial contracts and to prepare for the impending wave of government contracts, UIW again undertook a round of modernization and expansion in its history. The yard had made few modifications since WWI, so it needed an infrastructural upgrade as well as new tools and shop facilities. This round of modernization also allowed the UIW yard to institute some of the shipbuilding optimizations used during WWI at the prefab yards on the East Coast and at the adjacent U.S. Destroyer Plant. The most notable change during the upgrade, however, was the broad adoption of welding.

The 1936 modifications to the yard resulted in only a few new buildings (Buildings 50, 103, 105, 110, 119, and 120) but transformed how the existing spaces were utilized and how materials moved around the site. The 1936 modernization aimed to improve the movement of material from storage areas through the shops and to the slipways; to improve power distribution; to provide space and facilities for welding and sub-assembly fabrication; to provide workers' facilities and improve working conditions; and to provide storage space and parking. Besides new bathrooms and the changing use of existing open spaces, the most notable addition was a new boiler house (Building 103) installed at the end of 20th Street. The upgrades resulted in moving the materials through the fabrication process in as straight a line as possible, a design optimization that would prove to be a major factor in WWII shipyard design. At UIW, these upgrades allowed for materials to move "in a line from steel plate and shape storage, and sub-assembly spaces to the building ways. It is also true of

[113] Merchant Marine Act of 1936, Section 210.
[114] Ibid.
[115] Quivik, "HAER: Kaiser's Richmond Shipyards," 14.
[116] Merchant Marine Act of 1936, Section 212(c).
[117] Quivik, "HAER: Kaiser's Richmond Shipyards," 1.
[118] "Bethlehem's Pacific Coast Shipyards," 6.

movement of material and equipment through the machine shop [Building 113], the forge shop [Building 105], the mill-pattern-joiner shop [Building 108], or the pipe [Building 38] and copper shop [Building103] to either the building ways or the outfitting docks."[119] The other major transformation was the repurposing of open spaces for pre-assembly, indicating a planned shift toward welding and pre-assembly at the yard.

Welding and Pre-Assembly
Before the 1930s, welding was mainly used for ship repair. For instance, UIW started using electric welding by the early 1910s to repair boilers and defective steel casting.[120] During WWI, however, engineers realized that welding held many advantages over riveting, particularly with respect to time and labor costs. Most significantly, welding drastically reduced hull construction time in the slipways, which were always a bottleneck in shipbuilding. In addition, welding could reduce the weight of the hull by removing the need for thousands of rivets.[121] Welding did not, however, replace riveting overnight. Rather, it was adopted gradually as the industry came to accept it as a strong and safe method of joining steel. The American Bureau of Shipping approved of welded hulls in 1927.

Starting in the 1920s, shipyards internationally began to move toward the extensive pre-assembly of ship components that utilized welding rather than riveting. Pre-assembly was not new to shipbuilding; it had been used in the WWI prefabrication yards. World War I yards pre-assembled components for cargo ships, including floors, bulkheads, deck girders, deck houses, and stern assemblies. Pre-assembly allowed for sections of the ship to be constructed and then moved to the slipways.[122]

During WWII, shipyards relied heavily on both welding and pre-assembly to meet the growing demand for ships. Starting with the first round of Maritime Commission ships, plans specified welding methods and encouraged "shipyards to devise assembly plans that could save labor or speed production."[123] Ship contracts were awarded in batches of four to six units at a time, which provided direct incentives for shipyards to employ pre-assembly and standardization in order to accelerate production of the batch of identical ships.[124] When building in volume, shipyards could prefabricate the various pieces, construct subassemblies, and then quickly assemble multiple ships in the slipways with minimal retooling, few adjustments, and little reworking of parts.

Scaling up production required space and cranes. Space was not an issue when shipbuilding consisted of riveting a hull from the keel on up. [125] Pre-assembling, however, required large areas, preferably areas lying between the fabrication shop and slipways, where workers could layout and assemble sections with easy access to welding equipment and cranes. Allocating these large areas often proved difficult for older yards, resulting in piece-by-piece assembly on the ways.[126] UIW provided space for pre-assembly near the slipways and infrastructure upgrades to the slipway superstructure provided more flexibility for welding in the ways.

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[119] "Bethlehem Reconditions Potrero Works of Union Plant," *Pacific Marine Review*, 35 (1938), 23.
[120] R. H. Fenkhausen, "Electricity in the Union Iron Works," *Journal of Electricity Power and Gas*, 31 (1913), 440.
[121] Quivik, "HAER: Kaiser's Richmond Shipyards," 118.
[122] Ibid., 112, 118.
[123] Ibid., 120.
[124] Bonnett, *Build Ships!*, 25.
[125] Nancy Goldenberg, Jody R. Stock, "National Register of Historic Places: Richmond Shipyard Number Three, Kaiser Shipyards, Richmond, California," (1999), 18.
[126] Quivik, "HAER: Kaiser's Richmond Shipyards," 20.

Welding platforms were also installed at the yard. This configuration was improved upon at the New Yard, built adjacent to UIW by the U. S. Navy in 1940, where considerable room was given for pre-assembly.

By 1939, the Commission deemed its plan for 50 ships a year to be inadequate, and the program was doubled, then tripled, before the first contracts were complete.[127] At the end of 1940, nineteen yards were building ships for the Commission, and some of these yards agreed to expand their capacity in order to produce Naval warships.[128] With existing plants at capacity, new shipyards would need to be built. The Merchant Commission chose the Pacific Coast to build expansive new ship yards because open areas were still available along the shoreline. With this investment, the San Francisco Bay Area became the nation's largest shipbuilding center by the end of the war.

The Bethlehem Shipbuilding Corporation was in a unique position with the country once again on the brink of war. Bethlehem was a leader in steel manufacture, shipbuilding, and ship repair on both coasts.[129] Once again, Bethlehem reorganized. The Bethlehem Steel Company, Shipbuilding Division was formed in November 1938, and the Potrero Yard (as UIW was known during the 1920s and 1930s) became the San Francisco Yard. Bethlehem received some of the first Maritime Commission contracts and in 1939 UIW received contracts for five C-1B cargo vessels.[130] The experience of building these vessels convinced the yard that they needed larger facilities to take on Navy contracts. To this end, the Navy built the New Yard on the site of the WWI destroyer plant.[131] By 1940, Bethlehem was balancing both Commission and Navy contracts, and UIW had landed additional naval contracts for twenty destroyers and four cruisers.

World War II and UIW's Contribution to the War Effort

Although the Commission and the Navy were authorized to spend funds for shipbuilding and shipyard expansion, it was the National Defense Appropriation Act in the spring of 1940 that unleashed billions of federal dollars for the war effort.[132] With this event, the United States once again made the transition to a wartime economy. The government became the main client of the entire national shipbuilding industry. By this time, the shipbuilding industry was habituated to working with the government.[133] Its leaders were accustomed to seeking government financial support and accepting supervision.
During WWII, two government agencies oversaw shipbuilding during the war: the Navy Department and the United States Maritime Commission. By 1941, the Navy and the Commission were competing for available slipways, and in March of that year, shipyards were divided between the two.[134] UIW became a Navy yard. After the Japanese bombed Pearl Harbor in December of 1941, the United States officially entered the war and Roosevelt created the War Production Board. The Board quickly ballooned to an 18,000-person agency

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[127] Marshall Maslin, *Western Shipbuilders in World War II, a Detailed Review of Wartime Activities of Leading Maritime and Navy Contractors* (Oakland, 1945).
[128] Quivik, "HAER: Kaiser's Richmond Shipyards," 22.
[129] Lane, *Ships for Victory; A History of Shipbuilding under the United States Maritime Commission in World War II*, 33.
[130] Bethlehem Steel Co., *A Century of Progress: 1849-1949*, p. 20, 25.
[131] "Bethlehem's Pacific Coast Shipyards," 6.
[132] Marilyn M. Harper, John W. Jeffries, William M. Tuttle, Jr., Nelson Lichtenstein, and Harvard Sitkoff, eds., "World War II and the American Home Front Theme Study," History and Education National Register (National Park Service, 2004), 11.
[133] Lane, *Ships for Victory*, 3.
[134] Bonnett, *Build Ships!*, 27.

intended to oversee "conversion to war production and coordinate material and production priorities."[135] The Board continued to grant contracts but national coordination of materials and production schedules was not achieved until 1943 with the formation of a Controlled Materials Plan and Roosevelt's establishment of Office of War Mobilization.[136]

During WWII, UIW occupied a similar position to its role during the First World War. The yard had recently undergone modernization, and it operated a prefabrication yard while continuing to run an integrated yard and a repair facility. UIW again was able to embrace the newest technologies and shipbuilding methods, in this case welding and pre-assembly, while also running the largest and best equipped commercial repair yard in the country, with a machine shop unrivaled on the West Coast.[137] The UIW, along with the New Yard, turned out 72 ships during the war (see Vessel List). They were mainly destroyers varying between 14,000 to over 37,000 displaced tons, but the yard also built the Commission's five cargo ships in 1940 to 1941, as well as destroyer escorts, aircrafts transport lighters, and self-propelled lighters under Navy contract. Four high speed anti-aircraft cruisers were built at the New Yard between 1941 and 1945. Although this performance was on par with its WWI output, it was only one tenth the quantity produced by the new prefab yards such as Kaiser's Richmond yards. UIW's true contribution to the war was its repair record: 2,500 ships. It was also the only yard to repair submarines; however, this facility is no longer extant and stood several block to the northeast of the Pier 70's district. The yard's flexibility guaranteed its lasting impact and its contribution to WWII.

The New Yard

Three main types of ships were built during WWII: the Navy's capital ships and cruisers; the Maritime Commission's cargo vessels; and the Navy's smaller vessels and landing crafts. The latter two were needed in such numbers that subassembly and even assembly line practices were used to build them. The Navy's larger capital ships and cruisers required "massive and complete facilities for individualized production."[138] These facilities were also able to utilize some methods of subassembly and mass production methods, particularly the incorporation of much of the fitting out into subassembly, but they were limited often by space.[139]

The Navy built the New Yard in 1940 specifically to produce anti-aircraft cruisers. [140] Between 1941 and 1945, this yard built four cruisers of 46,000 displaced tons each. The Bureau of Ships drafted contract plans for these vessels "showing detailed specifications" but the working plans were prepared by the building yard, allowing UIW to optimize for its yard layout.[141] The New Yard combined preassembly and individual production necessary for anti-aircraft cruisers. The New Yard optimized its layout for pre-assembly and for welding, following the "turning flow" design. While not as efficient as straight-line flow of materials used in the new WWII shipyards, turning-flow designs, where materials moved through the yard parallel to the shoreline, were employed at older urban yards during the war, which had less space. At the New Yard, also to save space, preassembly was completed on welding platforms adjacent to the slips. Even with this space

[135] Harper et al., "World War II and the American Home Front Theme Study," 11.
[136] Ibid., 12.
[137] Shipbuilding Division Bethlehem Steel Co., *Bethlehem Ship Repair Facilities* (New York: Bethlehem Steel Company, 1947), 24.
[138] F. G. Fassett, ed., *The Shipbuilding Business in the United States of America,* Vol. I (New York, 1948), 201.
[139] Ibid., 225.
[140] Bethlehem Steel Co., *A Century of Progress: 1849-1949*, p. 24.
[141] E. L. Cochrance "Shipbuilding," *Public Administration Review,* 5 (1945), 330.

saving design, the New Yard greatly expanded the footprint of the WWI destroyer yard.

Ship Repair Facilities

Ship repair was the main contribution of UIW to the WWII effort. During the Second World War, the yard built over 70 ships, but it repaired 2500. The repair yard, which contained structures and even equipment that dated back to the origins of steel shipbuilding in this country, was one of the best and the largest commercial repair yards in the country.

In 1945 a *Fortune* magazine article argued that for the Pacific Fleet, repair was more crucial than construction, and the UIW shipyard was at the heart of the repair cycle as it aided the naval yards in their repair duties. *Fortune* continues, "It was not a job for the Pacific Coast 'miracle men' who had captured the public imagination and fat Maritime Commission contracts with their new methods of prefabricated shipbuilding. This was work called for improvisation by men and machines, and familiarity with naval craft."[142] The UIW had knowledgeable workers and had maintained the facilities to offer the breadth of services required for repair work. Their ability to fabricate any replacement part made them especially invaluable to the maintenance of the Pacific Fleet.

The first wartime repair at the yard started when the battleships that survived Pearl Harbor began to limp into the yard. The yard repaired the *USS California, USS Maryland, USS Mississippi, USS Nevada,* and the *USS Pennsylvania*.[143] Examples of other ships overhauled include the *SS Nieu Amsterdam*, the Navy troop transport *Monticello* (formerly the captured Italian luxury liner *Conte di Savoia*), and a 25,000-ton aircraft carrier. The most famous repair job was the 1942 installation of a second battery on the *USS Pennsylvania*. UIW finished the repair, which other yards had estimated would take almost a year, in just 88 days.[144]

New dry dock facilities were installed at UIW after the Navy took over the Hunters Point dry dock facilities. The Navy built a new pier (Pier 70) at UIW, adding 2000 feet of additional berthing space as well as a 14,500 ton capacity dry dock, making UIW "the largest privately operated ship-repair facility in the country.[145] During WWII, UIW was able to dock 29 vessels at one time.[146]

In 1945, *Fortune* noted that older buildings at the yard were filled with what appeared to be disused tools and spaces: the "art of shipbuilding outgrows and discards its old tools. The art of ship repair keeps them against the day when it might possibly need them again."[147] Thanks to this collection of tooling and supplies accumulated over its history as well as a work force that knew how to use them, the yard was able to repair a steel ship from almost any period. This was clearly a point of pride. If a part was not immediately available on the West Coast, UIW could make it in-house, since UIW's active machine shops were also the most complete and most modern on the West Coast.[148] The yard could repair ships over 30,000 tons and it successfully

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[142] "West Coast Yards, Navy Repairmen," *Fortune* (1945), 129.
[143] Carey & .Co. "Seawall Lot 349 at Pier 70, Building 12 Complex San Francisco Electrical Reliability Power Project Setting Analysis," (2003), 2.
[144] Bethlehem Steel Co., *A Century of Progress: 1849-1949*., 22.
[145] "West Coast Yards, Navy Repairmen," 232.
[146] "Bethlehem's Repair Facilities at San Francisco," *Pacific Marine Review,* 43 (1946), 15.
[147] "West Coast Yards, Navy Repairmen," 232.
[148] "Bethlehem's Repair Facilities at San Francisco," 14.

modernized older ships in the fleet in record time.[149]

The End of the War

At the end of the war and the completion of all government contracts, the UIW yard became a dry dock and ship repair and conversion facility. By the end of the war the yard occupied 65-acres, and contained five floating dry docks (Dry Dock #1), two leased from the Navy, and eight slipways varying in length from 390 to 640 feet.[150] During the late 1940s the yard continued to receive conversion contracts from Navy, Army, and commercial shipping firms. The yard continued to build naval ships into the 1960s and barges into the 1970s. The yard also built the tubes for the BART tunnel under the bay linking San Francisco and the East Bay. In the early 1980s, the Bethlehem Corporation sold the shipyard for one dollar to the San Francisco Port. Todd Shipyards purchased much of the machinery. Today, BAE Systems San Francisco Repair leases portions of the yard from the Port of San Francisco and continues to operate a repair facility, including two floating dry docks, onsite. The 1884 machine shop remained in use at the yard throughout the twentieth century and was vacated in 2004.

Summary

UIW was one of the original steel hull shipyards in the country. UIW vigorously participated in every trend in steel shipbuilding, and the yard embodies each of those trends. UIW was an industry leader at the turn of the twentieth century and continued successfully to adopt emerging practices in prefabrication and design standardization, while retaining its original capacity to fabricate all ship components on site. UIW made significant contributions to every war effort from the Spanish-American war through WWII. The yard has produced hundreds of ships and repaired thousands, including each of the most influential types of vessels in each war. UIW furthermore originated steel shipbuilding on the West Coast, and for most of its history served as the headquarters of domestic shipbuilding and ship repair for the Pacific. The yard's lasting contribution to the national steel shipbuilding industry was its breadth and flexibility, and its consistent balance of emerging technology with the older arts of shipbuilding required for repair work. It is this diversity that permits the Union Iron Works/Bethlehem Steel Shipyard to convey its national significance under Criterion A for each phase of expansion and modernization in shipbuilding, rather than just a single period, and to convey its historic association to the birth and development of the United States steel hull shipbuilding industry.

[149] Ibid., 14.
[150] Bethlehem Steel Co., *A Century of Progress: 1849-1949*, p. 32.

Labor History

The following section on labor history supports the Criterion A context statement presented above. Without the critical contributions of labor, the Union Iron Works/Bethlehem Steel Shipyard could never have achieved its many successes. This section describes these important contributions, but is not by itself the bases for the nomination of the district.

General Introduction

Union Iron Works/Bethlehem Steel Shipyard is the oldest private American shipyard with a continuous record of ship production and ship repair from the late nineteenth century through the period of significance and beyond, to the present day.[151] An important aspect of this long and distinguished record is the story of generations of shipyard workers who struggled to maintain their livelihoods and craft traditions in spite of many challenges: the hostility of employers to organized labor, a volatile maritime economy that undermined job security and stable union organization, changes in production technology and shipbuilding methods, industrial reforms such as scientific management, and wartime production speed-ups. Strong traditions of craftsmanship survived at UIW even during World War II, when the yard's program of complex naval construction and ship repair required a highly skilled labor force despite the general trend to de-skilling in shipbuilding and other defense industries. Women and African Americans entered the story of UIW during World War II, as they waged a brave struggle against prejudice, to establish their rights to be hired and trained for skilled work.

Union Iron Works, 1883-1916

Employer Rhetoric and Shipyard Class Divisions

Nineteenth-century shipyard employers often spoke of the shipyard as a community of shared interests. Irving M. Scott, general manager of Union Iron Works from 1861-1903, declared himself "the real friend of the workmen." [152] John Roach, whose Chester, Pennsylvania shipyard was a UIW rival for naval contracts in the 1880s, developed what he called a theory of co-operation between management and labor, telling his employees, "This is the Age of Cooperation. Labor and capital must cooperate in order that both shall derive the greatest advantage from their efforts." [153]

UIW and other shipyard employers ensured the cooperation and loyalty of skilled production workers was through preferential hiring of employee family members. Shipyard apprenticeship, for example, had been considered a family privilege from the colonial period of American history. Charles Cramp, manager of the William Cramp & Son's shipyard in Philadelphia, explained that, "In our yard we allow every man to put his sons in as apprentices in preference to anybody else from the outside. If a workingman is a machinist and wants his son to learn pattern-making, that boy has preference over all others." [154] At UIW, not only did

[151] U. S. Department of Commerce Maritime Administration, Office of Ship Construction ,Division of Production "Report on Survey of U. S. Shipbuilding and Repair Facilities," 1980, p. 15.
[152] Joseph Aaron Blum, "San Francisco Iron: The Industry and its Workers – from the Gold Rush to the Turn of the Century" (M.A. thesis, San Francisco State University 1989), 182.
[153] Leonard Alexander Swan, Jr., *John Roach Maritime Entrepreneur* (New York, 1980), 65-66.
[154] Thomas R. Heinrich, *Ships for the Seven Seas: Philadelphia Shipbuilding in the Age of Industrial Capitalism* (Baltimore, 1997), 96-97.

brothers James and Peter Donahue found the business, they also counted two other brothers, Michael and Thomas, as their employees.[155]
Despite their paternalist rhetoric and hiring practices, shipyard owners and managers, who were industrial leaders in a powerful urban business class, had vastly different interests from those of their working-class employees. The evolution of UIW is a case in point. The Donahue brothers (Peter and James) who established Union Iron Works in 1849 were self-made men who had apprenticed in the iron trades. Like most of their employees, they had begun their careers as journeymen mechanics at a time when most of the firms in the San Francisco iron industry were small local shops "operating with primitive pre-industrial craft traditions and technology," [156] states labor historian Joseph Blum. By the time the shipyard was established at Pier 70 in the1880s, UIW, with Irving M. Scott at the helm, had outgrown its roots as a small, informal family firm fostering social bonds between craftsmen and employers. UIW had become a corporation with a rigid hierarchy whose officers and managers "had mostly come to define themselves as bosses" intent on maximum production and unsympathetic to the claims of organized labor. [157]

Class distinctions between workers and employers were expressed spatially by the different work settings in the shipyard. In the early nineteenth century, master ship builders, apprentices, and journeymen had worked together in the shops and yard, keeping the same hours. Apprentices sometimes received room and board in the master's household. UIW's general manager Irving M. Scott, for example, had apprenticed as a draftsman and mechanic in Baltimore in the 1850s. By the late1880s, owners and managers like Scott worked in offices, along with naval constructors, professional designers and engineers as well as clerical staff, and UIW built its first office building during the 1890s (Building 104). Shipyard managers conducted business such as negotiating contracts, corresponding with private and government clients, and handling accounts. Shipyard production workers had little direct contact with managers or owners. Instead, they worked under powerful foremen and spent their working days operating heavy machinery on a noisy shop floor or out in the yard.[158]

Managers at American shipyards increasingly controlled capital – or means of production – too. Both UIW's Irving M. Scott and Charles Cramp, for instance, were technically managers who worked for a salary, but as stockholders in their respective firms they also owned the shipyards' real estate and shop buildings. At wood shipyards of the early to mid-nineteenth century, carpenters employed by the firm typically owned the hand tools with they built the ships. The carpenters' tools were described by a census official as "the outfit of broad-axes, adzes, saws, bevels, chisels, calking-irons, mallets, rules, etc."[159] In the steel shipyards of the 1880s and 1890s, however, few shipyard workers owned their own equipment; shipbuilding had become a capital intensive industry using heavy production machinery owned by employers.[160]

Recessions Undermine Shipyard Jobs and Labor Union Organization
The paternalist rhetoric of nineteenth-century shipbuilders was little comfort for shipyard workers suffering frequent layoffs in a volatile maritime economy. According to maritime historian Thomas Heinrich, recessions plagued the shipbuilding industry more than any other sector of the American economy. The typical pattern in peacetime shipbuilding throughout the late nineteenth and early twentieth centuries was one

[155] Polk's San Francisco City Directory, 1852-1853 (San Francisoc, 1853).
[156] Blum, "San Francisco Iron," 113.
[157] Ibid., 152.
[158] Heinrich, *Ships for the Seven Seas*, p. 94.
[159] Ibid., 21.
[160] Ibid., 94.

of "long depressions and short recoveries." Or, as Philadelphia shipbuilder Charles Cramp recalled, "Most of the shipyards have gone under on account of periods of depressions, at which time grass and tomato vines grow on the wharves, and at other times there was a gorged condition, then a famine, then a gorge."[161]

The volatility of the maritime economy made shipyard workers vulnerable both to anti-union open shop campaigns and to frequent and sometimes massive layoffs. During a recession, the shipyard labor force might contract as much as 60 percent, threatening workers' livelihoods and posing severe challenges to the establishment of stable union organizations. Irving M. Scott and thus continually hired and fired workers according to the volume of shipyard work; the labor force might double or contract by more than half in a matter of months. Laborers at UIW did hold one advantage over the labor force in other shipbuilding centers like Philadelphia: Because San Francisco did not always have an adequate supply of skilled labor for UIW, Irving M. Scott sometimes tried wage cuts before resorting to drastic reductions in the labor force.[162]

Long-term shipyard production jobs were rare during peacetime. Every shipyard had a few fortunate shipyard workers who were employed for years or even decades; however, such workers were a distinct minority, singled out for special attention by shipyard managers and the local press. For example, the *San Francisco Examiner* reported that UIW president John A. McGregor gave Patrick O'Neil a $1,000 bonus in 1914 for completing fifty years of continuous employment at the firm. In 1914 John O'Neil worked in the shipyard bolt and rivet department, but he began his career at UIW when it was a foundry run by Peter Donahue, and saw "several generations of apprentices enter the works." [163] O'Neil's career was unusual. Most shipyard production workers in the late nineteenth and early twentieth centuries more or less constantly searched for work and sometimes abandoned the shipyards altogether for work in engineering shops or more stable industries.[164]

Unionization proved difficult among shipyard workers. In iron and steel shipyards, skilled production workers operated in a variety of trade-specific labor markets, a trend underscored during recessions, when laid off ship carpenters sought work in other shipyards, boilermakers and machinists looked for work in engineering firms, and sailmakers switched to tentmaking. The extraordinary diversity of crafts involved in iron and steel shipbuilding – about forty distinct trades, as opposed to the dozen involved in wood shipbuilding – impeded the development of working-class solidarity in late nineteenth-century American shipyards. Craft unions were for the most part organized by individual trades rather than by industry. The relatively small size of the American iron and steel shipbuilding industry in the nineteenth century added to the fragmentation of shipyard labor unions. In contrast to powerful British craft unions that organized thousands of workers in scores of shipyards, even the most important American shipyard craft unions, such as the San Francisco or Delaware Valley locals of the International Brotherhood of Boilermakers and Iron Shipbuilders of America, were small, struggling organizations.[165]

Labor Relations at UIW under Irving M. Scott Management

Shipyard owners and managers in late nineteenth-century American shipyards were unanimous in their hostility to organized labor. John Roach told new employees at his Pennsylvania shipyard, "You may enjoy

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[161] Heinrich, *Ships for the Seven Seas*, 101.
[162] Ibid., 97, 146.
[163] "Fifty Years' Service Wins $1,000 Reward," *San Francisco Examiner*, September 9, 1914, p. 5/1.
[164] Heinrich, *Ships for the Seven Seas*, 97-98.
[165] Heinrich argues that the diversity of crafts in steel shipbuilding was perhaps matched only by the variety of trades in locomotive building. Heinrich, *Ships for the Seven Seas*, 94-96.

yourselves with your unions just as you do with your religion or your politics, but while you are in my workshop you must conform to my rules."[166] Joseph Blum describes Irving M. Scott as a local "champion" of a "rationalizing and disciplinary trend" in nineteenth-century industry, who assumed his managerial position in 1861 and "spent the rest of his life attempting to increase management's control over production, while limiting the influence of the workers." [167] In keeping with this description, Scott outlined a long list of grievances against the San Francisco iron molders union in an article he wrote for the *Overland Monthly* in 1891, complaining bitterly that the union had tried to take control of the shop away from management in the matter of wages, hours, apprentices, foremen, and work rules.[168]

To fully appreciate the intensity of Irving M. Scott's long battle with organized labor, it may be helpful to review his early career at UIW, when the firm was an iron works focusing on production of mining and railroad equipment. In 1859 Scott was a twenty-two-year-old machinist and draftsman working in a Baltimore machine shop, supervising construction of steam fire engines. When the firm failed, he helped dispose of its machinery at a sheriff's sale, where he sold a fire engine to Peter Donahue, founder and managing partner of UIW. Scott inquired about job prospects in California and promptly got hired for the UIW drafting department.

Scott reported to UIW the same day he arrived in San Francisco in 1860. "Little did he then imagine," historian Hubert Howe Bancroft wrote, "that he was soon to be placed in sole charge of those works, and to develop them into the largest and most successful manufactory of the kind on the Pacific coast."[169] Just over a year after joining the ranks of the UIW drafting department, Scott was superintendent of the company. He defined the history of the organization for the next four decades.[170]

Irving M. Scott gained control of UIW through precocious managerial ability. He imposed a new form of industrial discipline on what he described as a family firm run not by the management but by the men. Under Peter Donahue's management, UIW workers were allowed to chat, read, smoke and drink during business hours, and take breaks when they pleased, as Scott told Bancroft's interviewer, Col. Morrison, in 1891, "Mr. Donahue's establishment was filled with relatives. There was no regularity and no rules. If the men got dry they went out to the corner saloon and took a drink and if they felt a little dry they went out and got another one. Everything went on pretty much as they pleased."[171] Discipline at the firm was particularly lax during the winter of 1861 after the sudden resignation of the company foreman, at a time when Peter Donahue was away on business in Sacramento.[172] In Donahue's absence, Hubert Howe Bancroft recounted, Scott "took charge of the establishment, and with such excellent results that on the return of the proprietor he was appointed superintendent, with authority to make and enforce such regulations as seemed to him best."[173]

As general manager, Scott imposed strict and unprecedented control over labor. He closed all entrances to the plant except one, where he installed a watchman who had orders to prevent workers from leaving the

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166 Swan, *John Roach*, 67.
167 Blum, "San Francisco Iron," 126.
168 Irving M. Scott, "Iron Molders Union No. 164, of San Francisco," *Overland Monthly* 17 (March 1891), 299.
169 Bancroft, *Chronicles of the Builders of the Commonwealth*, 452.
170 Teiser, "The Charleston," 42.
171 Irving M. Scott Interview, 22.
172 Teiser, "The Charleston,"42.
173 Bancroft, *Chronicles of the Builders,* 453.

premises without permission. Scott then issued a set of prohibitions on informal behavior so that he, rather than the workers, would control the shop floor and the pace of work. These new work rules caused "quite a disturbance in the works." Indeed, UIW workers rebelled against Scott's new shop rules and threatened to strike, but Donahue supported the new regulations. Thirty years later, Scott claimed, That discipline is maintained today [1891] in the Union Iron Works and is what has made it famous."[174]

Workplace rules such as those introduced by Scott at UIW in the early 1860s were a common form of management control over labor in the mid- nineteenth century. Labor historian Harry Braverman notes that industrial managers, especially in larger firms, clamped down on the characteristic informality of early nineteenth-century workshops by enforcing "rules against [workplace] distractions (talking, smoking, leaving the workplace, etc.) that were thought to interfere with application."[175] Scott further emphasized that his "complete system" of industrial discipline included the shop foremen. He held them to an exacting standard, making no allowance for error.[176] It is likely that Scott had been accustomed to this form of industrial discipline in Baltimore workshops, where he received his early training.

Irving M. Scott instituted a multi-tiered power structure at UIW. Most of the foremen worked their way up through the ranks of skilled workers in the various shops. They represented a new hierarchy of authority characteristic of large foundries like UIW, both in San Francisco and other industrial cities at the time. The foremen occupied an uneasy role between the increasingly estranged interests of management and workers, and a "fierce struggle for their loyalty" ensued.[177] For instance, when labor leader Frank Roney entered the Union Iron Works in San Francisco in the mid-1870s, he found the firm's iron molders racing against each other to "secure the favor of the foreman and through that means retain steady employment." Roney claimed that the skilled workers at UIW labored "to the point of exhaustion" and described Henry Dimmick, the UIW foundry foreman in 1876, as a brutal bully, a "foul-mouthed…ignorant, passionate savage…How a man like this has lived so long in this place is beyond my comprehension."[178] In his diary Roney recounted his struggle to avoid a showdown with Dimmick, whose menacing presence on the shop floor made Roney's ten-hour days in the foundry almost unendurable.[179]

UIW Apprenticeship

One of the most hard-fought labor disputes at UIW began when Irving M. Scott attacked the apprentice system, provoking a long battle with the San Francisco iron molders union. Scott replaced skilled journeyman with low-paid apprentices to save labor costs, then replaced apprentices in four-year training programs with shipyard laborers who were the most marginal group of shipyard workers. The San Francisco molders union understood Scott's actions as an attack upon their livelihoods, craft traditions, and job security. It fought back with strikes and demands for hiring limits on apprentices.

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[174] Irving M. Scott Interview, 23; Bancroft, *Chronicles of the Builders*, 454.
[175] Harry Braverman, *Labor and Monopoly Capital: The Degradation of Work in the Twentieth Century* (New York, 1998), 62.
[176] Hubert Howe Bancroft, "Irving Murray Scott, Biographical Sketch #2," Bancroft Library Manuscript Collection, 7, quoted in Blum, "San Francisco Iron," 131-132.
[177] Blum, "San Francisco Iron," 121.
[178] Richard Prime Boyden, "The San Francisco Machinists from Depression to Cold War, 1930-1950" (Ph.D. diss., University of California, Berkeley,1988), 67-68; Frank Roney Diary, quoted in Blum, "San Francisco Iron," 137.
[179] Roney wrote, "Worked today 10 hours and made about 500 lbs. castings. It seems to me that Dimmick is getting somehow down on me…. I have the fear that I may be necessitated to leave my work through the overbearing conduct of Dimmick. Ibid., 137-138.

The San Francisco iron molders' union struggle against Irving M. Scott fits into the larger context of apprenticeship in iron and steel shipbuilding in the late nineteenth century. After the Civil War, the traditional artisanal apprenticeship, in which a young worker was educated by his master in all aspects of the shipbuilding trade, was almost unheard of in American shipyards. However in Philadelphia and other Delaware Valley cities where iron shipbuilding first developed in the United States, a new form of industrial apprenticeship emerged and later spread to other areas of the country. Instead of learning the whole shipbuilding process, apprentices were trained in a variety of individual trades.[180]

Some yards required formal indentures with signed apprentice contracts, as they had in the early years of wood and iron shipbuilding, while others did not. [181] UIW offered four-year industrial apprenticeships for shipyard production workers. Charles C. Murphy completed a four-year apprenticeship as a ship carpenter at UIW from 1901-1905. His certificate of apprenticeship stipulated the following conditions: a young man had to be at least eighteen years old when he began his training; and he had to work 300 full days of the year during each of the four years. Murphy's certificate shows that between 1901 and 1905, apprentice machinists, pattern makers, joiners and shipwrights earned subsistence wages of $4 per week for the first year, $5 for the second, $6 for the third, and $7 for the fourth.[182]

At UIW and most other nineteenth century shipyards, on-the-job training for apprentices was provided by skilled journeymen in the various crafts, but ultimate power over apprentices was held by the shipyard owners, who traditionally employed apprentices under contract. The rules governing apprentices were very strict. They could be dismissed on the slightest pretext. If they quit, they were essentially blackballed in the industry. Historian B.E. Lloyd offered a succinct description of the attitude of San Francisco bosses toward their apprentices: "The good boy is promoted, the bad boy discharged." [183]

Duval Williams, a ship fitter apprentice, experienced this culture first hand. In 1899 he was working on the *Chitose*, a cruiser commissioned by the Japanese Imperial Navy, when a fight broke out among rivet heater boys on the lower deck. Williams claimed he stopped only to watch the fight, but Jim Todd, the yard superintendent, accused him of being the ringleader, and told him to take a month's vacation saying, "'You get out of here. You know what I told you. You take your vacation.' And I said to myself yes and I'm takin' a vacation for good." [184] The apprenticeship was terminated and the superintendent would not take Williams back.

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[180] Heinrich, *Ships for the Seven Seas*, 85.
[181] The Harlan and Hollingsworth shipyard in Wilmington, Delaware had about sixty apprentices during the 1880s, paying them wages of fifty cents a week plus board and laundry. At the Cramp shipyard in Philadelphia, apprentices in highly skilled trades, such as patternmaking and engine building, received four years of training by foremen and senior workers. The Roach shipyard in Chester, Pennsylvania had no formal indenture or provision for room and board, but the yard typically had about thirty young men in a modified apprenticeship program to learn the more skilled jobs such as fitting the joinery or casting marine engines. Thiesen, *Industrializing American Shipbuilding*, 97; Swan, *John Roach*, 61-62; Heinrich, *Ships for the Seven Seas*, 85.
[182] Union Iron Works, "Certificate of Apprenticeship," 1901-1905, SAFR 13704, San Francisco Maritime Museum Artifact Collection, J. Porter Shaw Library, San Francisco Maritime Museum, San Francisco, CA,.
[183] B. E. Lloyd, *Lights and Shades in San Francisco* (San Francisco, 1876), 312.
[184] DuVal Williams Oral History Interview with Karl Kortum, 1963, pp. 12-13. On file, J. Porter Shaw Library, San Francisco Maritime National Historic Park.

In the late nineteenth century, as the standards of apprenticeship became more fluid, the line between the status of an apprentice and a laborer was not always clear. Shipyard laborers (often called helpers) provided essential manual labor but were the most exploited and expendable class of shipyard workers. Like apprentices, they worked for menial wages, but in contrast they received little formal training and had poor job prospects. At UIW and the Cramp yard in Philadelphia, helpers were typically either young men or boys, but the Roach yard in Chester, Pennsylvania, employed large numbers of immigrant laborers; the Newport News shipyard in Virginia employed many African American laborers. In the late nineteenth century helpers constituted up to twenty percent of the labor force in an iron shipyard, and were most often employed in rivet gangs or ship fitting gangs. [185]

As noted earlier, Irving M. Scott began his campaign against the apprentice system in 1869 as a way of reducing labor costs, and continued the campaign after UIW established the shipyard at Potrero Point in 1883. Scott replaced skilled journeymen earning a living wage of about $4.00 per day with young workers earning subsistence wages. At a time when skilled workers were trying to prevent erosion of apprenticeship traditions, Scott waged an assault on those traditions by calling the young workers “apprentices” whether they were serving true four-year apprenticeships or were functioning essentially as helpers.

Laborers responded angrily, if in futility, to Scott’s system. Iron molder and labor leader Frank Roney called abbreviated apprenticeships a form of “white slavery,” arguing that boys who had not undergone a four-year apprenticeship would never learn to become “competent mechanics” but would be trained for only one simple task previously done by a journeyman, to the detriment of both.[186] In 1869 the San Francisco iron molders union went out on strike against UIW, and were decisively defeated; the strikers lost their jobs and the union was shattered. When the molders reorganized in the late 1870s, they confronted the apprenticeship issue again. Scott took the position that the proprietors of UIW could hire whomever they pleased.[187]

In the 1880s and 1890s UIW hired apprentices in increasing numbers to take the place of skilled journeymen, who earned much higher wages. One iron worker claimed that “in many shops fully one-third of those who work at the trades are apprentices.” [188] The San Francisco iron molders union tried (but failed) to limit the hiring of apprentices by demanding a ratio of one apprentice to every eight journeymen molders, to uphold the pride of skilled workers, and to ensure the labor market value of journeyman workers who feared losing their jobs to low-paid apprentices.[189] Instead, DuVal Williams story tended toward the new norm. In 1899 he earned only four dollars a week for the job of laying half the nickel steel deck on a ship, while a full-fledged mechanic earned four dollars a day laying the other half of the deck, working at the same pace.[190]

[185] Thiesen, *Industrializing American Shipbuilding*, 95.
[186] Frank Roney, Untitled Ms. Concerning Apprenticeships, F. Frank Roney Papers, Bancroft Library Manuscript Collection, no date, quoted in Blum, “San Francisco Iron,” 168.
[187] Ibid., 298.
[188] Iron-Worker, “The San Francisco Iron Strike,” *Overland Monthly*, 6 (July 1885), 43.
[189] For background on the use of union work rules to protect worker control of production, see David Montgomery, *Workers’ Control in America: Studies in the History of Work, Technology, and Labor Struggles* (Cambridge, 1979), 15; Iron-Worker, “The San Francisco Iron Strike,” 46.
[190] DuVal Williams Oral History, 10-11.

Skilled journeymen had covert ways of fighting back against management when they did not succeed with overt measures such as strikes or efforts to limit the hiring of apprentices. Because they were responsible for on-the-job training, journeymen could quietly refuse to offer instruction to workers who were not genuine apprentices. Historian Richard Boyden describes this as a "tradition at least as old as craft guilds, and…still very much alive today... As one San Francisco machinist who 'stole the trade' by failing to serve an apprenticeship remembers, 'the old equipment took ingenious people to run it. They passed this knowledge on to their children, or to you if they liked you. But if they didn't there was no way you would be able to work.'"[191]

San Francisco Iron Workers Strike of 1885

The inability of the San Francisco iron molders union to prevail in earlier strikes against UIW management reflected a more general trend to weakness among American shipyard labor unions in the 1870s and early 1880s. For example, Delaware Valley shipyard craft unions were not strong enough to launch successful strikes individually and never even tried to organize a broader industrial movement uniting all shipyard workers. Ship carpenters in Philadelphia and Camden, New Jersey, were decisively defeated in 1883 when a seven-week strike for higher wages resulted in employers' imposition of the open shop. The system endured until World War I.[192]

An 1885 iron workers' strike in San Francisco offers a compelling contrast to the 1883 ship carpenters strike in the Delaware Valley. The San Francisco strike was called to protest a sudden wage reduction by UIW and other local iron works firms during an economic recession, but the full significance of the strike went far beyond the immediate issue of wages. The strike galvanized San Francisco metal trade workers, who established permanent San Francisco unions in each craft – molders, machinists, patternmakers, blacksmiths, and boilermakers – for the first time.[193] The strike succeeded in large part because individual iron trades unions established a united front in negotiations with employers, and in the process created a model for union organizing throughout the country.

Before the 1880s, San Francisco labor unions were fledgling organizations, described by historians William Issel and Robert Cherny as lasting "but a month, a year, sometimes a few years, with only a few surviving much longer. Local unions appeared, fell apart, then reappeared later in a different form. Activists created citywide central bodies, but they usually soon disappeared, to be replaced by some new group."[194] At the time of the notification of the UIW wage cut on February 7, 1885, the only San Francisco metal workers with union organizations were the iron molders and blacksmiths. The molders had a much stronger union and led the strike. Joseph Blum describes the San Francisco Iron Molders Union of the 1880s as an organization with two main functions: "welfare and combat." Like other benevolent societies of the period, unions offered their members a financial safety net for the adversities of life – illness, accidents, unemployment, and death. The molders' union was also, however, a "fighting organization" determined to confront employers to win decent wages and working conditions, as well as respect for skilled craft work on the shop floor.[195]

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[191] Boyden, "San Francisco Machinists," 27-28.
[192] Heinrich, *Ships for the Seven Seas*, 96.
[193] Ira B. Cross, *A History of the Labor Movement in California* (Berkeley, 1935), 273.
[194] William Issel and Robert W. Cherny, *San Francisco, 1865-1932: Politics, Power, and Urban Development* (Berkeley, 1986), 80.
[195] Blum, "San Francisco Iron," 144-145.

Striking workers formed a committee with representatives from each of the iron trades unions. This was the starting point of a central organization that would soon be formed to represent all the iron trades. Frank Roney had been advocating union federation along trade lines since 1869, and, according to labor historian Ira B. Cross, saw the strike of 1885 as a "long-awaited opportunity." Roney proposed an iron trades federation to the strike committee, which approved the plan, leading to formation of the first iron trades council in the United States, known as the Federated Iron Trades Council. The council included the molders, machinists, patternmakers, blacksmiths, and boilermakers unions, the Iron Laborers' Protective Association, and the Amalgamated Society of Engineers. Cross described Roney as the national pioneer of the trade federation idea: "He was, as far as I know, the original proponent of the plan in accordance with which the building trades councils, printing trades councils, iron trades councils, and similar groups are now organized." [196] In 1890 the new organization was renamed The Iron Trades Council of San Francisco.

Of course strikes and trade federations did not always succeed in San Francisco. UIW and other employers decisively defeated the iron molders' union during a strike in 1890. However, the 1885 strike was part of what Issel and Cherny describe as a broad revival of the labor movement in San Francisco in the 1880s in a context of increasing industrialization and emerging class consciousness. It was a new period of growth and stability in the local and state labor movement in which "an increasing number of organizations survived the crises – depression, lost strikes, employer opposition – that had spelled death for earlier efforts." [197]

The Charleston, UIW's First Steel Warship, Ushers in a Period of Good Labor Relations

Before the 1880s private shipyards had not played a significant role in naval shipbuilding in peacetime, and only occasionally during wartime. Large naval ships had been built for the most part in East Coast Navy yards. [198] The Navy's decision to turn to private shipbuilders for construction of steel ships for the "New Navy" in the early 1880s, however, prompted major development and modernization programs at shipyards in both San Francisco and the East Coast. Naval contracting was viewed by both shipyard employers and labor unions as an excellent remedy, at least in the short-term, for the instability of the American shipbuilding industry – one of the few areas of agreement between labor and management.[199] It was within this context UIW that established its new steel shipyard in 1883.[200] Three years later, in December 1886, UIW won the contract bid for Navy's Cruiser No. 2, the *Charleston,* the first modern steel warship to be built on the Pacific Coast. The contract created hundreds of new jobs and led to a brief but vital period of cooperation between labor and management.

Despite his bitter denunciations of the San Francisco iron molders' union during the 1885 strike at UIW, Irving M. Scott's determination to win Navy contracts tempered his outlook and strategy after 1886.[201] A new naval appropriation on March 3, 1885, called for private contracts for two steel gunboats and two steel cruisers. UIW's successful bid for the *Charleston* contract not only put the UIW shipyard on the map, it also

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[196] Cross, *Labor Movement in California* , p.167.
[197] Issel and Cherny, *San Francisco, 1865-1932*, 80-81.
[198] John G. B. Hutchins, *The American Maritime Industries and Public Policy, 1789-1914, An Economic History* (Cambridge, Mass., 1941), pp. 456-457.
[199] Heinrich, *Ships for the Seven Seas*, 98.
[200] The Cramp shipyard in Philadelphia spent over $350,000 on new equipment, including $50,000 for hydraulic riveters and other hydraulic machinery. The Newport News shipyard in Virginia began construction of a new shipyard for both warships and commercial steamships in 1890. Hutchins, *American Maritime Industries* , 457-458.
[201] Blum, "San Francisco Iron," 175.

opened a new era of ship construction in California, which Ruth Teiser explains, spurred the growth of California's heavy industries more generally.[202]

After UIW was awarded the *Charleston* contract, Scott and the iron workers entered a honeymoon period of almost three years, allowing UIW to establish the yard and a solid reputation for Navy shipbuilding. When Scott returned from Washington with the *Charleston* contract, UIW workers sent a delegation to his house, where the molders union serenaded him and presented him with an eight-foot long floral model of the *Charleston*. Scott promised that the contract would provide 1000 jobs for the coming year and wished the workers "a full-round prosperous time and the substitution of arbitration in the place of strikes and persuasion in place of force." [203]

Ironically, UIW faced a labor shortage when construction of the Navy cruiser *Charleston* got underway in 1887.[204] The only large shipyard in the San Francisco Bay Area at the time was the Mare Island Naval Shipyard in Vallejo, a wood shipyard engaged primarily in repair of naval ships. Both the San Francisco and East Bay waterfronts had a number of smaller boat yards and ship repair facilities, but the local supply of skilled shipyard workers was insufficient for UIW's naval construction program. Irving M. Scott, meanwhile, was under tremendous pressure to live up to his commitments. Initially, he planed to hire skilled workers in Europe, a decision that stirred controversy. When a *San Francisco Examiner* reporter questioned him about this plan, Scott replied angrily, "It's nobody's damned business whom we employ if the Government is satisfied with the work we turn out." [205] The *San Francisco Chronicle* later reported that UIW had in fact hired many Scottish and English workers who had found their own way to the shipyard; none of them had been recruited as contract labor. Skilled workers at UIW in 1887 earned $3.50 per day for a ten-hour day, a higher wage rate than on the East Coast or Britain because of a differential in the cost of living [206]

Steel Shipbuilding Transforms Production Technology and Shipyard Skills
The *Charleston* and other steel ships of the "New Navy" in the 1880s heralded a dramatic transformation in shipbuilding production technology that had begun with iron shipbuilding in the early to mid-nineteenth century. The proximity of the earliest iron shipbuilders in Pennsylvania's Delaware Valley to foundries, rolling mills and other suppliers, underscored the unprecedented place of metal trades workers in shipbuilding.[207] Increased mechanization characterized the iron and steel shipbuilding industry too. Still, the industry sought the skills and fundamental knowledge of wood shipbuilders and shipwrights in the construction of the new boats. UIW fostered the sometimes uneasy melding of two traditionally separate trades in the creation of a new and modern shipbuilding industry.

While some shipyards made a successful transition from wood to iron and steel shipbuilding, many of the pioneering iron shipbuilding firms, like UIW, were iron works that got their start in shipbuilding by producing machinery or propulsion systems. UIW built no ship hulls before establishing its shipyard, but had previous experience building and repairing steamship and steamboat engines, boilers and pumps. UIW workers built the engines and boilers for Mare Island's Navy battleship, the *Saginaw*, in 1858-59, and assembled the

[202] Teiser, "The Charleston," 39.
[203] *Mining and Scientific Press*, quoted in Blum, "San Francisco Iron," 182.
[204] Teiser, "The Charleston," 46.
[205] Irving M. Scott quoted in *San Francisco Examiner* December 24, 1886, as quoted in Teiser, "The Charleston," 47.
[206] *San Francisco Chronicle*, March 24, 1887, p.8, as quoted in Teiser, "The Charleston," 47.
[207] Heinrich, *Ships for the Seven Seas*, 51-52.

monitor *Camanche,* whose parts were manufactured in the East and sent around Cape Horn to San Francisco in 1863.[208] According to maritime historian John G. B. Hutchins, boilermakers, machinists and iron founders were drawn to iron and steel shipbuilding because "there was much similarity, in the cutting, bending, punching and fastening of the plates, between the two kinds of work."[209]

Wood shipbuilders transitioned more tentatively into iron and steel shipbuilding. Maritime historians have found a great deal of regional variation in the degree to which wood shipbuilders participated in the new technology of iron and steel shipbuilding. A study of shipyard production workers in Bath, Maine, for instance, found that only 3.1 percent of wood shipyard workers made the transition from wood to steel during the first decade of steel shipbuilding; most of the workers in the new steel shipyards were members of a younger generation just starting their careers. In the Delaware Valley, wood ship workers were far more open to iron shipbuilding; at least thirty percent of apprentices in a Wilmington, Delaware wood shipyard later found work in local iron and steel shipyards. As maritime historian William Thiesen argues, given a choice, a wood shipbuilder would probably remain a woodworker, out of loyalty, familiarity and genuine fear of a loss of prestige and wages with the new technology. However, this fear was often trumped by a greater one: the prospect of unemployment drove thousands of woodworkers into the iron and steel shipbuilding trades.[210] One can assume that UIW attracted wood shipbuilders in significant numbers. When Irving M. Scott established the UIW steel shipyard in 1883 he hired a wood shipbuilder, James Dickie, as yard superintendent. James and his brother John Dickie had operated the Dickie Brothers boat yard in San Francisco's Potrero district where Pier 70 was established. Their brother George W. Dickie worked at UIW as chief engineer and later became an officer of the firm. He designed some if UIW's most ingenious and celebrated shipyard equipment, including a hydraulic lift dock and machinery for the *Oregon*. George Dickie also had a background in wood shipbuilding and had served as chief constructing engineer at San Francisco's Risdon Iron Works. And the Dickie brothers had all learned wood shipbuilding at their father's shipyard in Scotland. [211] Although there are no readily available statistics on the number of wood shipbuilders who transferred to steel shipbuilding in San Francisco, it is reasonable to assume that James Dickie recruited skilled wood shipbuilders (including Dickie Brothers employees) for the new shipyard at UIW.

In general, those wood shipbuilders who did make the transition to metal ships, did so smoothly. In 1889 the Chief of the U.S. Naval Bureau of Construction reported that "It has been the impression of many people that there would be some difficulty in getting the ship carpenters to change from wood to steel. This is all a mistake. It is the experience of the Cramps, the Roaches, and the Union Iron Works of San Francisco that

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[208] Thomas Reaney, who established the Reaney, Neafie & Co. shipyard in Philadelphia, had worked as a foreman in a boiler shop; John Roach, who established the John Roach & Son steel shipyard in Chester, Pennsylvania, had a background as an engine builder and iron foundryman. Many of these firms built their first iron ships by subcontracting or partnering with wood shipyards, such as the William Cramp and Son's shipyard in Philadelphia; Cramp was hired to provide hull designs and to supervise hull construction and launching. Some of the machine and engine shops later hired their own workers for hull design and construction, becoming full-service shipyards. See Hutchins, *American Maritime Industries*, 449-450; Irving M. Scott Interview, p.3; Bancroft, *Chronicles of the Builders*, 462; Teiser, "The Charleston," 41-43.
[209] Hutchins, *American Maritime Industries*, 449-450.
[210] Nathan Lipfert, "The Shipyard Worker and the Iron Shipyard," *The Log of Mystic Seaport*, 35 (Fall 1983), 83-84; Thiesen, *Industrializing American Shipbuilding*, 91-92.
[211] Teiser, "The Charleston," 44.

these men make the very best of workmen. All they need is a little breaking in." [212] Others echoed these sentiments, claiming that former wood shipbuilders were not just fit for and willing to work in the new industry, but comprised the best men in the industry. American government and naval officials consequently encouraged wood shipyard workers to learn iron working skills to build the new iron and steel ships.[213] Despite increased mechanization and loss of responsibility among carpenters, the transition from wood to iron and steel shipbuilding was a process that "generally magnified the role of skilled shipyard labor."[214] Iron shipbuilding brought new skilled trades into the shipyards – engine building, shipfitting, boilermaking, anglesmithing, and hull plating. Coppersmiths who had sheathed timber hulls on wood ships earned higher wages as skilled pipefitters and pipemakers. Wood workers in iron shipyards lost their primary role in hull construction, but they were still employed in shipyard mold lofts, where shipwrights used half-hull models to arrange frames and hull plates, and ship carpenters built wood templates of hull designs. Ship carpenters were also employed on the berths, where they built wood staging and scaffolding to support iron workers during hull assembly. Shipwrights in iron shipyards maintained the important responsibility of launching ship hulls. Since iron ships often had wood interiors, the work of "inside" ship joiners jobs stayed very much the same – building pilot houses, wood railings, cabinets and other ship furniture.[215]

Turn of the Century: Revival of Labor Unions and a Strike for a 9-Hour Day

The United States plunged into a severe depression in 1893, leading to layoffs and setbacks in union organizing at UIW and other American shipyards, but economic prosperity returned by the close of the decade. Labor unions revived too – stronger than ever. San Francisco iron workers, including those at UIW, waged a successful strike for a nine-hour work day.

Employers and labor unions opened the new century prepared for battle, both in San Francisco and other industrial cities throughout the country. Two shipyard unions associated with the American Federation of Labor gained thousands of new members at the turn of the century. The International Brotherhood of Boilermakers and Iron Shipbuilders locals expanded membership in both San Francisco and the Delaware Valley, while the International Association of Machinists (IAM) organized a national campaign that increased membership from 15,000 in 1898 to over 40,000 in 1900. The national IAM also launched a campaign for shorter hours – the only nationwide machinists' strike in American history. In 1901 San Francisco machinists joined the national IAM campaign by initiating a strike for a nine-hour day against UIW and other iron works, but employers were ready to fight back. They organized the broad-based San Francisco Employers' Association in 1901, which labor historian Ira B. Cross describes as secretive and equipped with a "huge war chest" and "plans drawn up for a life and death struggle with the unions over the issue of the 'closed shop' or 'open shop.'" [216]

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[212] Lipfert, "Shipyard Worker," 81.
[213] In his study of the American shipbuilding industry, government researcher Henry Hall wrote, "A ship carpenter makes as good a man for the iron-ship yard as does the boiler-maker." Theodore Wilson, chief of the U.S. Navy's Bureau of Construction and Repair, agreed with Hall, claiming that the "best men that can be found in the iron-ship-building yards are those who formerly worked on wooden vessels." Thiesen, *Industrializing American Shipbuilding*, 91.
[214] Heinrich, *Ships for the Seven Seas*, 84.
[215] Thiesen, *Industrializing American Shipbuilding*, 93; Heinrich, *Ships for the Seven Seas*, 84.
[216] The shipwrights union, a branch of the Brotherhood of Carpenters and Joiners, was still influential in the twentieth century; but the wood workers' shipyard departments and union memberships in a steel shipyard were relatively small compared to those of boilermakers who gained jurisdiction over most of the work involved in hull construction. Heinrich, *Ships for the Seven Seas,* 144; Richard Boyden, "Breaking the Color Bar in Wartime Bay Area Shipyards,

San Francisco iron trades workers defeated the Employers' Association, underscoring the strength of union power. The strike lasted two years and succeeded because a revived Iron Trades Council supported it and 4,000 workers from ten different trade unions joined it. The San Francisco Employers' Association tried to defeat the strike by cutting off supplies to smaller firms, but the strikers carried on for ten months. The small firms were the first to grant the workers' demand for a nine-hour day and the following year it became an industry standard in San Francisco. UIW granted to grant the nine-hour day to its laborers on March 21, 1903; it was apparently the very last of the San Francisco iron and steel works to do so. [217]

The national IAM strike for the nine-hour day was successful only in San Francisco and Chicago, the two strongest pro-union cities in the United States. Striking machinists and boilermakers who walked out of Delaware Valley shipyards to support the IAM's campaign in 1901 were decisively defeated and took over ten years to recover. Philadelphia's Cramp shipyard, New York Ship and other conservative employers fired labor organizers and joined other metal trades firms in a new open shop drive.[218]

Impact of Mechanization on Shipyard Skills

The economic prosperity that fueled major clashes between employers and labor unions at the turn of the century also fostered intensive capitalization and mechanization of shipbuilding at large shipyards throughout the country. UIW was perhaps unique among the large American shipyards in its capacity to design and build complex new equipment rather than purchase it from suppliers. UIW's state-of-the-art machinery required a new breed of highly skilled machinists and machine operators. Despite the trend to intensive mechanization, however, some forms of hand construction were still used in shipbuilding well into the twentieth century. Skilled labor remained in particularly high demand at UIW.

The cost of shipbuilding increased dramatically in the new century. Nineteenth-century ships, whether of wood, iron or steel, were custom built – "piece by piece one angle iron at a time or one plate at a time," as UIW's DuVal Williams once said – and much of the work was done with hand tools and manual labor. These boats cost about $50,000. [219] By the first decade of the twentieth century, the investment in large shipyards approached $1,000,000. Shipbuilding had become a large-scale, capital intensive business in which employers used every means possible to reduce labor costs through mechanization. John G. B. Hutchins described the machinery used in large shipyards at the time: "Powerful traveling cranes, electrical and hydraulic tools, powerful machines for cutting, punching, and bending, and precision lathes and milling machines became standard equipment. Pneumatic riveters were developed, beginning about 1896, to increase the speed and accuracy of erection."[220]

UIW's labor history begins to distinguish itself at this point. Unlike its East Coast counterparts, UIW built much of the yard's own machinery. Whereas East Coast laborers generally assembled boats from parts

1941-1942" (February 1992), 5; Boyden, "San Francisco Machinists," 68-69; Cross, *Labor Movement in California* , 239.
[217] Ibid., 240-241; *San Francisco Call* , March 14, 1903, p. 9/4; Ibid., , March 15, 1903, p. 34/4.
[218] Boyden, "San Francisco Machinists," 68-69; Heinrich, *Ships for the Seven Seas*, 146.
[219] DuVal Williams Oral History, 10-11; Thiesen, *Industrializing American Shipbuilding*, 98.
[220] Hutchins, *American Maritime Industries*, 460.

purchased elsewhere, at least quarter of UIW's workers engaged in the production of parts on site. [221] The *San Francisco Call* called attention to UIW's custom manufacturing capabilities in an article praising the "greatest single casting ever made on the Coast." Iron molders spent three months preparing for the 150,000-pound casting for a plate-bending machine to be used in UIW shops constructing naval combat ships.[222] *Machinery* published photographs of some of the most impressive equipment at UIW – shell drilling machines, hydraulic riveting machines, vertical bending rollers, a large horizontal turning mill, and a traversing planing machine – noting that most of the new machines were produced by UIW workers. Similarly, the journal *Marine Engineering* described in detail UIW's state-of-the-art machinery, including a huge vertical boring mill that could simultaneously bore and turn a 30-foot diameter wheel with a 10-foot face, and a custom-designed planing and slotting machine used to face off large surfaces such as engine beds.[223]

The impact of new technologies varied considerably from one craft to another. In some trades, mechanization and technological change clearly undermined the old traditions of skilled labor. For instance, semiskilled machine operators using drop forges, presses, and standardized jigs replaced journeymen blacksmiths who once hand crafted ship fittings. Increased mechanization also accelerated the trend toward division of labor for certain skilled workers. Riveters who had performed the crucial work of setting and bolting hull plates in the nineteenth century saw the work parceled out to two new trades – bolters and platesetters.[224]

Despite changes in production technology, skilled shipyard workers still played a central role in production. Thomas Heinrich argues that most of technological changes taking place at the time actually increased the demand for skilled laborers capable of working with complex new machinery on the shop floor. Electric tools made the job for drillers who worked on hull assembly less arduous, but the job required essentially the same skills as it had been done by hand. Skilled workers sometimes replaced unskilled workers as materials handling mechanized. UIW, for example, had twenty-one traveling cranes including five cranes capable of raising 50 tons each and six cranes that raised 20 tons; sixteen of the 21 were operated electrically. These cranes eliminated jobs for yard workers who had hauled materials by hand or with hand carts, but created jobs for skilled crane operators and riggers who lifted and placed heavy ship components with great skill and precision. [225]

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[221] J. Richards, "The Union Iron Works: The Famous Ship Yards of the Pacific Coast, Where the Oregon and Other Noteworthy Vessels Have Been Built," *Machinery,* 6 (September 1899).
[222] *San Francisco Call,* April 11, 1897, p. 8/1.
[223] Richards, "Union Iron Works;" "Shipbuilding Plant of the Union Iron Works at San Francisco," *Marine Engineering* (January 1900), 14-16.
[224] Labor historians have long debated the impact of technological change on the labor process. Harry Braverman argues that employers used new technology and new forms of industrial management to restructure production into small discrete tasks that required relatively little training. He calls this process the "destruction of craftsmanship," and posits that employers sought to "strip the workers of craft knowledge and autonomous control and confront them with a fully thought-out labor process in which they function as cogs and levers." Labor historians argue that Braverman's emphasis on de-skilling fails to take account of a process of re-skilling that characterized periods of technological change. David Montgomery further asserts that employers' de-skilling strategy often failed, especially in shipbuilding and other engineering industries in which new, complex machinery and production processes required a skilled labor force, leading to an enhanced role for certain categories of workers. Heinrich, *Ships for the Seven Seas*, 140; Braverman, *Labor and Monopoly Capital*, 94; Heinrich, *Ships for the Seven Seas*, 4-5, 140-142; Montgomery, *Workers' Control in America;* David Montgonery, *The Fall of the House of Labor: The Workplace, the State, and American Labor Activism, 1865-1925* (Cambridge, Mass., 1987).
[225] Ibid., 122-123, 140; Richards, "Union Iron Works."

The hand-held pneumatic riveting gun, widely introduced in United States shipyards by the 1890s, is described by Thomas Heinrich as the shipbuilding industry's "most celebrated tool." It used pneumatic power, rather than hand power, to hammer a rivet into a hole. However, the riveter still had to be a skilled worker trained in both right-hand and left-hand riveting. The pneumatic riveting guns also cost less than electric and hydraulic riveting machines and were much faster than traditional hand riveting; it took about one minute to drive a rivet by hand compared to six or seven seconds with a pneumatic machine. Employers liked the lower labor costs associated with pneumatic riveting, a result of both increased riveting speed and reductions in the size of riveting gangs. Pneumatic riveting reduced a four-man hand riveting gang to three men: one riveter (instead of two) to drive the rivet; a bucker-up (also called holder-on) to resist the blows of the riveter; and a heater-boy to supply hot rivets. For workers, the pneumatic riveters meant not only a loss of skilled jobs but also sharply increased incidence of hearing loss.[226]

Even after the widespread use of pneumatic riveting at the turn of the century, skilled hand riveting was still required for narrow spaces, light work, or finished surfaces where machines might produce scarring. As late as 1906, 59 percent of all hull rivets processed by New York Shipbuilding Co. were driven by hand. UIW continued to employ hand riveters throughout World War I. Charles Walsh described the process at UIW. His first job in 1917 was to pass hot rivets to a riveter who used a wood mallet. Walsh was soon promoted to the position of heater boy. He used a heating pot, "filling it with blacksmith's screenings, tamping it down, forming the rivets in a circle in the pot and covering them with hot coal shavings. There was a valve beneath to control the air flow. The rivets had to be white hot."[227]

Industrial Reformers and the Efficiency Movement
Technological innovations of the late nineteenth century coupled with new ideas about efficiency and production management in the early twentieth century. Some reformers, like R. S. Hubbard, advocated for radical changes that would reduce "as far as possible the number of operations which can only be carried out by skilled labor." He even suggested that all curved or irregular ship components be replaced with straight ones, which could be produced by machines.[228] The most influential efficiency expert of the early twentieth century, however, was Frederick Winslow Taylor. Taylor's emphasis on the "one best way" to perform a job was unprecedented in industrial management. Managers before Taylor had assumed a right to control production workers through assignment of tasks, but had rarely sought to dictate "*the precise manner in which work is to be performed.*"[229] UIW sought to introduce a Taylor disciple, Naval constructor Holden Evans, to the San Francisco yard in 1906. Again, however, Taylorism was slower to take hold in San Francisco than in shipyards back East. UIW retained an unusually high number of skilled laborers.

Historian Daniel Nelson singles out Mare Island Naval Shipyard, under the guidance of naval constructor Holden Evans, as the only shipyard in the country that fully introduced scientific management and "truly represented Taylor's ideas." Evans implemented Taylor's ideas at Mare Island between 1901 and 1917. One of his first applications of scientific management – time-studies at the Mare Island blacksmith shop – attracted

[226] Thiesen, *Industrializing American Shipbuilding*, 95-96, 181-182.
[227] Roy Willmarth Kelly and Frederick J. Allen, *The Shipbuilding Industry* (Boston, 1918), 145.
[228] R. S. Hubbard, "Shipyard Economies Part I" *Marine Engineering,* 9 (January 1904), 13.
[229] Braverman, *Labor and Monopoly Capital*, 62.

national attention in technical journals. Evans used oil-burning forges instead of coal, to reduce time wasted in "waiting for a heat." The oil forges also produced a cleaner environment and cut fuel costs. [230]

Evidently, UIW followed developments in scientific management, for Evans' innovations at Mare Island led to a job offer from UIW in 1906. In his autobiography, Evans describes a dramatic dinner meeting in with UIW president John McGregor at San Francisco's St. Francis Hotel. McGregor, with the approval of Bethlehem chairman Charles Schwab, offered Evans not only the vice-president's job at UIW, but also a promise of rapid promotion as president of the firm. Evans was tempted, but declined the offer to continue his work – his avowed mission to "[blaze] the path to efficiency and economy, the path which others could easily follow" – at Mare Island."[231] The Navy cut Evans' mission short. He had faced growing resistance not only from shipyard workers but also from Navy officials at Mare Island and in Washington D.C., who regarded his reforms as a threat to the naval establishment. [232] Bethlehem Shipbuilding Company offered him the job of leading shipbuilding during World War I at the Sparrow's Point shipyard near Baltimore.

Naval architects and marine engineers did not always accept the recommendations of shipyard reformers. For example UIW's chief engineer, George W. Dickie, objected to straight work, arguing that a streamlined hull could only be built with curved plates.[233] Henry Morse conducted pioneering experiments in standardized shipbuilding at New York Shipbuilding Company before World War I. He used precision templates to manufacture duplicate vessel parts for sister ships, but Morse's early system of fabrication and pre-assembly was feasible only for the flat hull parts in a ship's square midship sections. Plates still had to be bent according to a custom-made pattern to produce intricate components for the bow and stern.[234]

The labor movement was quick to perceive scientific management as a threat to both worker autonomy and union work rules. Not only did scientific management call for centralized planning and routing of the phases of production, but also systematic analysis of each task; detailed instruction and intense scrutiny of worker performance of an assigned task; and wage incentives to inspire compliance. According to historian David Montgomery, opposition and "mass anxiety" gripped metal trades workers from about 1908-1910. Indeed, opposition "spread much faster than its practice. The very appearance of stopwatches, time cards, or measurements of machine cutters, beds or T-bolts that so much as hinted at standardization was enough to trigger anxious caucuses of craftsmen, strikes, or beatings of those who seemed to be collaborating with systematizers." Workers interpreted these "trappings" of the Taylorism as threats to both worker autonomy and craft knowledge; San Francisco machinists argued that no "one system" or formula could accommodate the myriad variables in a given tradesman's work.[235]

Machinists and other skilled production workers of the pre-World War I generation at UIW were especially outraged by a new breed of shop foreman. Traditional foremen were tough but often highly skilled. Foremen hired by scientific managers were regarded as incompetent "efficiency bugs" allied with the firm's efficiency

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[230] Daniel Nelson, "Scientific Management, Systematic Management, and Labor 1880-1915," *Business History Review*, 18 (Winter, 1974), 488; Holden Evans, *One Man's Fight for a Better Navy* (New York, 1940), 200-201.
[231] Ibid., 201-202.
[232] Nelson, "Scientific Management," 488; Evans, *One Man's Fight.*
[233] Heinrich, *Ships for the Seven Seas*, 142.
[234] Heinrich, *Ships for the Seven Seas*, 180.
[235] Montgomery, *Workers' Control in America*, 113-114; Montgomery, *Fall of the House of Labor*, 247; editorial in International Molders Journal, cited in Braverman, *Labor and Monopoly Capital*, 94; Boyden, "San Francisco Machinists," 17-18.

engineers, the "speed and feed" men.[236] Montgomery describes the chasm in perception between shipyard employers and workers on the shop floor: "The scientifically managed factory appeared to employers to be under rational engineering control. But to craftsmen of the prewar generation that plant resembled a bedlam."[237]
One of the most persistent forms of worker protest against scientific management was deliberate output restriction. David Montgomery calls this a "covert act of disruption" on the shop floor, and one that could be practiced in both union and nonunion shops and shipyards. An industry observer in the 1920s noted that "the mere intimation that the time-study man is to make his appearance will often slow up a worker, a group, or a whole department." By using output restriction as a protest, workers were in fact reviving an old tradition that had been abolished. In the nineteenth century, craftsmen had an acknowledged right to set the pace of production, regulating output by deciding on the appropriate length and intensity of a phase of work, known as a "stint." As a form of protest in the twentieth century, "the stint had become sabotage."[238]

The combined effects of scientific management, standardization, and mechanized production threatened to undermine workers' job security and the independence of skilled craftsman in shipbuilding. However, these new trends developed much more slowly in San Francisco and the West Coast region as a whole, which retained traditions of one-of-a-kind and small-batch production far longer than the national metal working and shipbuilding industries.[239] Before World War I, most of the skilled production workers at UIW and other West Coast yards and shops were still all-around mechanics of the old school.

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[236] Ibid., 39.
[237] Montgomery, *Workers' Control in America*, 117.
[238] Ibid., 116.
[239] Boyden, "San Francisco Machinists," 29-30.

Part II: World War I

Introduction

In 1915 most steel ships were still tailor-made and highly skilled workers were required to build them, but there had been profound changes in shipbuilding methods and technology since the establishment of the Union Iron Works shipyard at Pier 70 in 1883: increased division of labor, mechanization, scientific management and experiments in standardized ship design. While many of these trends accelerated during World War I, critical labor shortages during the war provided shipyard workers with a rare period of full employment and unprecedented power over employers. Ship builders competed for skilled workers both with other shipyards and other war industries. Labor turnover skyrocketed as workers moved from yard to yard seeking higher wages or promotions. Labor unions went on the offensive at shipyards throughout the country, backing up wage demands with a wave of strikes in 1916 and 1917. In response, the federal government created the Shipbuilding Labor Adjustment Board (SLAB) to mediate labor relations.[240] Shipbuilding corporations implemented a variety of strategies to bolster morale and foster production efficiency.

Most naval shipbuilding during World War I took place in existing private and naval shipyards, rather than entirely new yards, but many of the existing yards were expanded. Geographers Michael Lindberg and Daniel Todd describe Bethlehem's wartime expansion program as the largest of all the private American shipbuilders. In October of 1917, Bethlehem Steel formed a new corporation, Bethlehem Shipbuilding Corporation, to expedite wartime construction of destroyers, submarines, cargo vessels, and tankers. In the San Francisco Bay Area alone, Bethlehem Shipbuilding Corporation also managed the U. S. Destroyer yard on the former Risdon Iron Works site adjacent to UIW, where laborers built 66 destroyers. Bethlehem's subsidiary also acquired the Alameda shipyard and expanded it. Workers at Alameda built cargo ships and supplied engineering and propulsion equipment for UIW.[241]

Shipbuilding Labor Adjustment Board (SLAB) and the Pacific Coast Strike of 1917

In the summer of 1917, just a few months after the U. S. declaration of war, labor disputes over wages and working conditions were brewing at many shipyards throughout the country. There were 101 shipbuilding strikes in 1917, both before and after the United States' declaration of war in April of that year. Workers at the Cramp shipyard in Philadelphia launched 21 strikes that year – an American shipyard record – and won union recognition and 21 wage increases. Managers who had maintained open shops and paid low wages before the war capitulated completely to labor forces. While average wages for shipyard workers increased by 15 percent, wartime inflation led to a 25 percent decline in real incomes, resulting in a steeper rate of decline in real income among shipyard workers than any other group of war workers in 1917 and consequent strikes to fight for living wages.[242]

In August of 1917, the federal government took action to prevent continuous strikes from disrupting the nation's wartime shipbuilding program. Franklin D. Roosevelt, Assistant Secretary of the Navy, established the Shipbuilding Labor Adjustment Board to broker regional wartime agreements on hours, wages, working

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[240] Heinrich, *Ships for the Seven Seas*, 190.

[241] In addition to UIW, Bethlehem Shipbuilding Company yards included Fore River Shipbuilding Co.; Harlan and Hollingsworth Corporation in Wilmington, Delaware; Samuel L. Moore & Sons Corporation in Elizabeth, New Jersey; and Bethlehem Steel Corp.'s Sparrow's Point plant in Sparrow's Point, Maryland. Michael Lindberg and Daniel Todd, *Anglo-American Shipbuilding in World War II, a Geographical Perspectiv*e (Westport, Conn., 2004), 61; *New York Times*, October 16, 1917, p. 24; *San Francisco Examiner*,, October 16, 1917, p. 13/8.

[242] Heinrich, *Ships for the Seven Seas*, 191.

conditions, and union powers. Presidents of nearly all the major AFL shipbuilding unions signed the agreement to form the S.L.A.B. President W. L. Hutcheson of the Carpenters and Joiners refused to sign – probably holding out for closed shop recognition – but his union later chose to abide by the terms of the S.L.A.B. decision on wages and working conditions. Representatives of the U. S. Shipping Board, which was created by Congress in 1916 to regulate shipping, also signed the S.L.A.B. agreement, as did members of the Emergency Fleet Corporation (EFC), incorporated in April 1917 as the operating organization of the Shipping Board and assigned to administer the nation's wartime shipbuilding program.[243] In July of 1917, President Wilson gave the EFC the power to build ships. A year later, Charles Schwab, Chairman of the Board of Directors of the Bethlehem Steel Corporation, was appointed Director-General of the EFC. He was the fifth person to be placed in charge of the U. S. Shipping Board's building program.[244]

Economists described the urgent need for government intervention at the start of the war because of the enormous potential for unrest in the absence of a clear-cut national labor policy. They described S.L.A.B. as "perhaps the most important agency created to deal with the labor problems in the shipyards."[245] Despite many setbacks, the agency did help reduce strikes and improve labor relations throughout the country in 1918.[246]

S.L.A.B. faced its first major challenge in September of 1917: a general strike over wage demands that almost halted ship construction on Pacific Coast ports including San Francisco, Seattle, and Portland.[247] On September 18, 1917, the *New York Times* ran a front-page article on the metal trades' strike, described as "the biggest in the history of the Pacific Coast." It was estimated that 50,000 strikers had walked off their jobs in San Francisco, Seattle and Portland, tying up about 12 percent of the nation's shipbuilding program. Work at UIW was reported to be at a "standstill" after 8,500 men walked off the job, stalling completion of more than $125,000,000 in navy ship construction and threatening the award of contracts worth several million dollars for production of the wartime destroyer fleet. Edward N. Hurley, Chairman of the U. S. Shipping Board, and other Board representatives rushed to the Pacific Coast to serve as mediators between strikers and owners.[248]

San Francisco shipyard workers returned to work on October 8, 1917, awaiting the results of a S.L.A.B. conference being held in the city. Similar conferences were held in both Portland and Seattle. After contentious hearings in all three cities, S.L.A.B. declared that wage rates would be increased by 31 percent at all Pacific Yards, the same rate at which the regional cost of living had risen since June1916. The S.L.A.B. minimum wage rate established for most Pacific Coast mechanics was $5.25 (the equivalent of $85 in 2007)

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[243] P. H. Douglas and F. E. Wolfe, "Labor Administration in the Shipbuilding Industry During War Time, I," *The Journal of Political Economy*, 27 (March, 1919), 146, 150, 156.
[244] According to the *San Francisco Call*, Schwab was chosen because he was, in contrast to his predecessor, a practical builder with a national reputation. Schwab had at first refused the post, in part because of concern over a conflict of interest. He accepted only after the Shipping Board created a special committee to handle all negotiations with Bethlehem so that Schwab would not become personally involved. Schwab's biographer, Robert Hessen, gives Schwab credit for a dramatic increase in shipyard production by the fall of 1918. President Wilson and U. S. Shipping Board Director Edward Hurley were "delighted with Schwab." *San Francisco Call*, April 17, 1918, p. 3/1; Robert Hessen, *Steel Titan: The Life of Charles M. Schwab* (New York, 1975), 237-238,244.
[245] Douglas and Wolfe, "Labor Administration in the Shipbuilding Industry During War Time, I," 149-150.
[246] Heinrich *Ships for the Seven Seas*, 192.
[247] Douglas and Wolfe, "Labor Administration in the Shipbuilding Industry During War Time, I," 156.
[248] *New York Times* , September 18, 1917, p. 1, 4.

for an 8-hour day or 65.5 cents (approximately $10.60 in 2007) per hour. S.L.A.B.'s decision for the Pacific Coast region emphasized the dramatically altered relations between management and labor during the war; shipyard owners were, for the duration, "merely agents of the Government."[249]

Metal trades unions found the initial Pacific Coast S.L.A.B. wage offer unacceptable given sharp increases in the cost of living. M. J. Maguire, representing San Francisco Bay Area metal trades craftsman, insisted that, "There won't be many ships built under this scale," though he conceded that workers would be "patriotic enough" to stay on the job while a direct appeal to President Wilson was pending. [250] In response to continued pressure from the metal trades unions, S.L.A.B. eventually increased the Pacific Coast minimum wage rate 10 percent, raising the daily wage for basic trades to $5.775. Overtime, including Sundays and holidays, was paid as double time, and there was no limit on overtime.[251] S.L.A.B. also helped employers and employees in the Pacific Coast region work out an agreement for regulation of working conditions.

The S.L.A.B. developed separate regional agreements for every part of the country that varied both in wage rates and in policies toward organized labor. The Pacific Coast award included recognition for the closed shop and higher wage rates than workers in other regions. Economists P. H. Douglas and F. E. Wolfe describe this approach as "refusing to disturb the status quo…[so that] "where the closed shop existed prior to the war, as in San Francisco and the Puget Sound districts, it was continued." [252]

The S.L.A.B. agreements, particularly the Pacific Coast agreement, underscored the labor movement's power at the start of World War I. The 1917 Pacific Coast metal trades strike had pressured the federal government to issue a favorable S.L.A.B. decision on shipyard wage rates. American Federation of Labor shipbuilding unions both in San Francisco and throughout the country continued to expand their power during the war through enormous increases in membership as well.[253] Closed shop policies in San Francisco allowed unions to extend membership to large numbers of newly hired, relatively unskilled workers. Before WWI, machinists and other metal trades workers had offered union membership only to journeyman and apprentices in four-year training programs. According to Labor historian Richard Boyden, the San Francisco machinists union decided to "force" new workers in machine shops into the machinists union, "in order to enforce craftsmen's job and skill demarcations." [254]

Shipyard Labor Force in World War I: Growth, Turnover, and Ethnic Composition

At the end of 1916, the year before American declaration of war, UIW employed 3,000 people; by April 1917, when the U. S. formally declared war, UIW employed 6,000 people; and by the time of the metal trades strike in September 1917, UIW employed 9,000 people. That number doubled by December of 1918, a month after the Armistice. UIW's growth fit a national pattern.[255] The combination of huge increases in the nation's

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[249] Ibid., October 8, 1917, p. 8; Douglas and Wolfe, "Labor Administration in the Shipbuilding Industry During War Time, I," 150, 156-157; Pacific Coast SLAB decision quoted in *New York Times*, November 5, 1917, p. 1; Cost of Living Calculator, http://www.aier.org/research/cost-of-living-calculator/, accessed May 12, 2008/
[250] Ibid.
[251] Douglas and Wolfe, "Labor Administration in the Shipbuilding Industry During War Time, I," 157.
[252] Ibid., 157, P. H. Douglas and F. E. Wolfe, "Labor Administration in the Shipbuilding Industry During War Time, II," *The Journal of Political Economy*, 27 (May 1919), 369.
[253] David Palmer, *Organizing the Shipyards: Union Strategy in Three Northeast Ports, 1933-1945* (Ithaca, 1998), 5.
[254] Boyden, "San Francisco Machinists," 4-5.
[255] The Cramp shipyard in Philadelphia had 4,500 workers in 1916 and almost 11,000 at the end of the war. New York Shipbuilding Company in Camden, New Jersey, increased its work force from 5,150 to 12,372 within a few months in

shipyard labor force along with high rates of labor turnover produced extreme volatility in the labor market; nationally, the labor force increased almost tenfold within sixteen months, while the labor turnover was about 230%, the "equivalent to hiring two to three men for every man permanently retained." [256] Army expansion and heavy draft quotas in 1918 led to an acute shortage of skilled shipyard workers such as coppersmiths, chippers and caulkers, riveters, machinists, and blacksmiths. Shipyards consequently faced increased competition.[257]

The huge hiring wave during the war changed the ethnic composition of the American shipyard labor force. Before the war, most shipyard workers were white, male, native-born Americans, along with significant numbers of workers born in Britain and small numbers of German-born workers. During the war, one-fourth of the 4,200 hull workers at New York Shipbuilding Company in Camden, New Jersey were Italian, Russian, or Polish immigrants, many of whom found a permanent niche in the shipyard labor market.[258] Although they were barred from AFL labor unions and, therefore, the protections of the S.L.A.B. agreements mentioned above, African Americans generally benefited from wartime labor shortage, particularly in the south and mid-Atlantic states. Their numbers increased at shipyards and they secured more positions as skilled laborers.[259]

San Francisco's working class distinguished itself as predominantly white and Catholic, allowing it to achieve a unique cultural solidarity, very different from the heterogeneous working class enclaves on the East Coast. Nonetheless, World War I labor shortages did affect the diversity of UIW's labor force. About 60 percent of UIW's workers were native-born Americans, of whom 37 percent were born in California. Forty percent at UIW were foreign-born, almost all from European countries, with the largest foreign-born groups hailing from Italy (9.1%); Ireland (5.3%); Russia (3.5%); Scotland (3.2%); and Greece (2.6%).[260] Individual

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1917; by 1919 it was the world's largest shipyard, with almost 20,000 employees. Lindberg and Todd, *Anglo-American Shipbuilding in World War II*, 61.

[256] Douglas and Wolfe, "Labor Administration in the Shipbuilding Industry During War Time, I," 149-150.

[257] Douglas and Wolfe, "Labor Administration in the Shipbuilding Industry During War Time, II," 364.

[258] Heinrich, *Ships for the Seven Seas*, 190-191.

[259] Although labor shortages provided increased opportunities at shipyards for African Americans, persistent racism perpetuated inequality. Between 1910 and the end of World War I, the number of African Americans employed at shipyards nationwide increased from 4,347 (about 6.5 percent)to 38,723 (about 10 percent), about 80 percent of whom were employed in the South and middle Atlantic states. In 1910, at a time when almost two thirds of all shipyard workers were described as skilled, 65 percent of black workers were unskilled laborers, and the rest were classed as semiskilled machine operatives. By the end of the war, about 20 percent of African American shipyard laborers were classified as skilled workers. Most American Federation of Labor shipbuilding unions barred African American workers from membership, however, leaving them unprotected by the wartime wage provisions of the S.L.A.B. agreements mentioned earlier. For example, the S.L.A.B. award for the Southern region stipulated higher wages for white workers (known as "laborers") than for African Americans ("common laborers"), even though both groups performed the same work. The Newport News Shipbuilding and Dry Dock Company in Virginia had employed many African American workers since its establishment in 1886, and was the only shipyard in the country that employed large numbers of African American men for both highly skilled and unskilled work during the war. Herbert R. Northrup, "Negroes in a War Industry: The Case of Shipbuilding," *The Journal of Business of the University of Chicago*, 16 (July 1943), 160-161.

[260] Keith A. Terry, "An Analysis of Union Iron Works' Foreman's Index Cards, 1908-1918," undergraduate paper, San Francisco State University, History 642-Labor in the U. S. West, May, 2007, pp. 7-8. The Union Iron Works foreman's index cards are part of the J. Porter Shaw Library archive of Bethlehem Steel UIW materials. The cards include both biographical information and UIW work histories. In the spring of 2007, San Francisco State University (SFSU) history student Keith Terry, working as an intern to Marjorie Dobkin, undertook the first comprehensive statistical analysis of

shipyard crafts (and San Francisco neighborhoods) were sometimes associated with specific ethnic groups. For example, White Russians (Russians from Belarus) clustered in the UIW riveting department and formed a distinct ethnic enclave on a part of Potrero Hill known as "Russian Hill." The UIW foreman's index cards do not contain data on the race or gender of employees, but with one or two possible exceptions, the first names are all traditional male names. Few Asians worked at UIW, though the shipyard journal *Bethlehem Star* mentions a Japanese angle smith named Matuas, who led a three-man gang in the angle shop in 1918. And despite the small number of African Americans in California as a whole (six tenths of a percent in 1910, 1.5 percent in 1920) or San Francisco more specifically (two tenths of a percent in 1910, five tenths of a percent in 1920) Bay Area shipyards maintained deeply racist practices that essentially banned this minority group from employment. The Chinese, long subject to pervasive cultural and legal racism in San Francisco, fared no better. [261]

UIW Recruitment, Personnel, and Welfare Programs

Joseph J. Tynan, UIW vice-president and general manager during World War I, claimed that most of the firm's wartime workers had been selected by the federal government's labor bureau, although he was on the defensive about his employees' performance at the time he made the statement.[262] P. H. Douglas and F. E. Wolfe found that nationally, recruitment of wartime shipyard workers was "for the most part unorganized by federal government" and "movement to the yards was voluntary." They cite three factors in the successful recruitment of 285,000 wartime shipyard workers throughout the country: wages were higher than in most other industries; workers were offered protection against the military draft; and some people were motivated by patriotic feeling.[263]

Shipyard managers and government officials frequently appealed to patriotic sentiment to recruit and motivate the wartime labor force. UIW staged a flag raising ceremony to herald the American declaration of war in April 1917. San Francisco Mayor James Rolph attended the ceremony, where summoned the patriotic duty of shipyard workers by saying, "Every man is a warrior working for his country. You, boys, will not be called upon to go to the front. You are here forging the rivets for the mammoth fighting ships which will uphold our Nation's honor."[264] Charles Walsh, a riveter who worked at UIW during the war, recalled that the shipyard whistle would blow at 3 p.m. whenever the Allies won a battle. [265]

As with most wartime shipyard laborers, however, the prospect of higher pay, far more than patriotism, prompted Charles Walsh to give up his job at San Francisco's Southern Pacific Railroad yard at Third and 16th Streets for shipyard work at UIW in 1917. "I looked across the street, saw all these guys at the shipyard. They said you could make big money at Bethlehem, doing piece work." Like other casual laborers at UIW, Walsh applied for his job by going to the shipyard's south gate and standing in line, hoping to be picked by a company boss. "This guy would come out, and say, 'You, you, and you,' and the rest would have to go on

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the UIW foreman's index cards. His paper was completed in May 2007 and submitted for class credit in the SFSU History Department. An updated copy of the paper and Terry's statistical database will be on file and available to researchers at the J. Porter Shaw Library.

[261] Issel and Cherny, *San Francisco, 1865-1932,* 55-56; Boyden, "San Francisco Machinists," 82, 90; *Bethlehem Star* I (June 1918).

[262] *San Francisco Chronicle*, December 14, 1918 p. 5/1.

[263] Douglas and Wolfe, "Labor Administration in the Shipbuilding Industry During War Time, II," 374.

[264] *San Francisco Chronicle*, April 14, 1917, p. 5/2.

[265] *San Francisco Examiner*, September 29, 1982, p. ZA1.

home." [266] Workers called this hiring system the "breadline." Similar to the shape-up used for hiring longshoremen, the breadline discriminated against trade unionists and invited corruption as powerful foremen dispensed jobs in return for kickbacks or favors.[267]

In 1918 UIW and many other shipyards throughout the country established employment bureaus to handle wartime recruitment, placement, and retention of the rapidly growing labor force. Prior to 1918, only thirteen American shipyards had well-organized employment departments, but, as Joseph Larkin of Bethlehem Steel explained, the bureau was a wartime contingency to deal with a rapid increase in employees that made it "physically impossible for the management to give that intimate personal touch with the men which it would desire to give." [268] Larkin helped open the new employment bureau at UIW in a building at the main gate during the summer of 1918, thereby introducing UIW what Larkin called the "Bethlehem system." The employment bureau was run by the shipyard's service division superintendent with the co-operation of shipyard management, foremen and department heads. Its goal was to place men quickly and efficiently into the most suitable jobs. [269]

Bethlehem Steel also instituted programs at UIW to address growing tensions at the wartime shipyard. It created a new "adjustment" branch in the service department at UIW to "act as a buffer between the men and their grievances" and "give everyone concerned a fair hearing." These wartime "adjusters" took on a managerial role traditionally performed by foremen. With the yards operating at maximum capacity and a combined labor force of more than 25,000 at both the San Francisco and Alameda shipyards, "foremen do not always have the time to listen to individual complaints." [270]

General Manager Joseph J. Tynan established a small Emergency Hospital in the basement of UIW's Administration Building (Building 104) in May of 1914. It treated about 150 cases – mostly eye injuries – every day in 1918. Patients who required further treatment were transferred to an Employees' Association Hospital established in 1907 by both UIW and Risdon Iron Works employees, located near the shipyard on Pennsylvania Avenue near 18th Street. The Employees' Association hospital was supported through voluntary subscriptions of 50 cents a month per worker, paid into a general hospital fund. Workers who chose to enroll were entitled to free hospital care in case of illness or disability through accidents at work. Bethlehem gave full credit to the UIW workers not only for establishing the hospital and appointing a board of directors drawn from the ranks of shipyard workers, but also for successful collaboration with the firm on hospital management.[271]

In 1916, during the build-up to war, Bethlehem replaced the Employees' Association hospital building with a new state-of-the-art hospital at 331 Pennsylvania Avenue. Frederick H. Meyer, who also designed the new

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[266] Ibid..
[267] It is not clear when workers began using the term "breadline" to refer to this system of hiring casual shipyard labor. Boyden, "San Francisco Machinists," 22.
[268] *Bethlehem Star* Vol. I. No. 2 (August 1918); *Bethlehem Star* Vol. I No. 3 (October 1918).
[269] Ibid.*;* Ibid., Vol 1 (August 1918); Douglas and Wolfe, "Labor Administration in the Shipbuilding Industry During War Time, II," 376.
[270] Ibid.
[271] *Bethlehem Star* I No. 3 (October 1918); *San Francisco Call* October 18, 1907: 9/5; *Bethlehem Star* I No. 5 (April 1919).

UIW office headquarters (Building 101), designed the new hospital building. The *San Francisco Chronicle* described the facility as follows:

> The site of the building is at Pennsylvania street near Eighteenth street on the hills near the works. It will be of fireproof construction throughout and finished on the exterior with brick and terra cotta. The interior is planned after most modern hospital construction ideas. Provision is made for bed patients and there will also be an emergency hospital branch for employees receiving minor injuries. A department for eye ear and nose specialists is provided for, and a fully equipped dental branch will care for men who have been in the company's employment for some time. When complete, the hospital building alone will cost between $50,000 and $60,000. A dispensary for the use of the men and their families will be maintained at the hospital.[272]

The Employees' Association Hospital played an important role in hundreds of medical and surgical cases every year, and treatment for the 5,260 UIW workers who required urgent care during the 1918 Spanish influenza epidemic. According to company records, 2,594 workers were treated for the flu at the Employee Hospital and another forty-five at a temporary isolation hospital. Hospital staff, whose own ranks were decimated by the epidemic, also made home visits to the 765 workers who were being cared for by their families.[273] "One day a guy went home sick and you'd never see him again," recalled riveter Charles Walsh.[274]

In addition to providing better hospital facilities UIW hired W. J. "Safety First" Thomson as a full time Safety Engineer in October, 1917. Thomson was a former marine machinist who had served his apprenticeship at Risdon Iron Works. Over half of all shipyard accidents were eye injuries, and Thomson believed most could be prevented if workers wore goggles, especially workers using pneumatic equipment. Most of the other accidents were preventable injuries to the fingers or toes.[275]

All of these program instituted at UIW during the World War I era were part of what historian David Palmer identifies as a national Bethlehem strategy to attract and retain workers and subdue labor unrest through "paternalist welfare programs, a relatively modern personnel system, and a management style that emphasized personal contact between supervisors and workers."[276] Other shipyards established similar programs during World War I. For example, New York Shipbuilding Company in Camden, New Jersey, established a group insurance policy for all workers who had been employed for over one year; the program had 4,000 members by 1918. New York Ship also helped fund a worker death-benefit program and built new facilities and amenities for workers, including an 1800 person capacity cafeteria, sports facilities, lockers, and smoking rooms.[277]

Wartime Training Programs

Shipyards could only meet their accelerated wartime production schedules by hiring and training new and often inexperienced workers. UIW vice-president and general manager Tynan claimed that over half of

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[272] *San Francisco Chronicle*, May 13, 1916, p. 9/8.
[273] *Bethelehm Star* I No. 4 (December 1918).
[274] *San Francisco Examiner,* September 29, 1982, p. ZA1.
[275] Ibid.
[276] Palmer, *Organizing the Shipyards*, 153.
[277] Heinrich, *Ships for the Seven Seas*, 193.

the18,000 employees at UIW in December 1918 had no pre-war shipyard experience, and UIW's *Bethlehem Starr* explained that the sudden wartime expansion necessitated training "thousands of fresh mechanics and office help." [278] Similarly, of the 285,000 new shipyard workers hired nationwide during the war, a large percentage lacked critical skills and experience.[279] While many men at claimed to have prior experience when they applied for work at the shipyard, UIW had a foreman on wharf #4, who could spot the fakers by handing them a pneumatic machine and saying, "Show me." Only one in twenty passed the test. As the *Bethlehem Star* reported, "Something had to be done to weed out these fellows and to give the real experts a chance."[280]

Individual shipyards that tried to establish training programs soon found it nearly impossible to cope with thousands of workers who lacked the most elementary craft skills. The Emergency Fleet Corporation responded by organizing a national training program in November 1917. Thirty-seven training centers were established in every region of the country, where 1,100 skilled shipyard craftsmen were given six-week courses to become instructors. The craftsmen called it "going through the dope." [281] After completing the six-week EFC training course, the instructors were then assigned to training departments at individual shipyards.

The EFC compiled statistics from twenty-one shipyards showing that, on average, men could be trained for basic work in only nineteen days.[282] R. V. Rickord, who worked for the Education and Training Section of the EFC, explained that EFC trainers assembled groups of four to ten workers to learn "a series of representative jobs… starting with the easiest job and proceeding to greater difficulty." A person's professional background affected his learning curve in the new trades; not surprisingly, men who had been rock drillers or cowpunchers before the war made much better riveters than men who had been brokers or policemen.[283]

Assessments differ on the effectiveness of the EFC training program. R. V. Rickord hailed the EFC training program as a "short-cut over [the] old apprentice system." [284] However, many skilled workers who had served four-year apprenticeships followed by years of on-the-job experience were dubious about the merits of EFC training. The president of the boilermakers' union scorned the program, commenting, "Standing a few plates of iron up and driving a few rivets in it and then having [a trainee] knock the rivets out again [are] so ridiculous that a practical man would never stop to consider [them]." Historian Thomas Heinrich posits that graduates of EFC programs were vital to the war effort, but "never attained the productivity rates that had been common in prewar shipbuilding."[285] In any case, the EFC training programs were extended into 1919 after the war was over, and included courses for experienced shipyard workers who wanted to learn new skills. The foremen of welders and burners at Bethlehem's San Francisco and Alameda yards returned from a six-week training course in electric welding at an EFC school in Schenectady, New York and "came back

[278] *San Francisco Chronicle*, December 14, 1918; *Bethlehem Star* Vol. I No. 5 (April, 1919).
[279] Douglas and Wolfe, "Labor Administration in the Shipbuilding Industry During War Time, II," 378-379.
[280] *Bethlehem Star* Vol. I No. 4 (December 1918).
[281] Heinrich, *Ships for the Seven Seas*, 193; Douglas and F.E. Wolfe, "Labor Administration in the Shipbuilding Industry During War Time, II," 378-379; R. V. Rickord, "Training Workers for the Shipyards; Short Cut Over Old Apprentice System," *Marine Engineering*, 24 (January 1919), 38-42.
[282] Douglas and Wolfe, "Labor Administration in the Shipbuilding Industry During War Time, II," 378-379.
[283] R.V. Rickord, "Training Workers for the Shipyards," 39-40.
[284] Ibid.
[285] Heinrich, *Ships for the Seven Seas*, 193.

brimful of enthusiasm and totally converted."[286] Only during World War II, however, did widespread use of welding occur.[287]

Programs for Wartime Production Speed-Ups: Standardization, Recreation, Competition
Unlike most East Coast wartime assembly yards that adopted New York Ship's fabrication and pre-assembly line methods to reduce hull construction time, Bethlehem Steel's Bay Area yards remained essentially traditional during World War I. They did build ships according to standard designs produced by the Navy Department, leading to some efficiencies in production and adopted such practices as "pre-assembly of bulkheads prior to their placement in the hulls," but continued to build from the keel up and rivet parts on the slipways.[288] Moreover, UIW workers discovered that so-called "standard" ship designs were often changed during the course of wartime construction and found themselves having "to tear down and start all over again."[289] As UIW riveter Charles Walsh explained, however, "We worked under tough bosses in those days. Rough bosses, and Bethlehem expected a good day's work….You had to hit the ball in those days."[290] Speed and efficiency were of the essence. Historian Stephen Canright argues that the "key to production speed" at UIW and the other Bethlehem Bay Area yards lay not in innovative shipbuilding methods, but in management's emphasis on maintaining a "highly motivated workforce, working long hours at peak speed."[291]

UIW and other wartime shipyards tried a variety of methods to boost worker morale. They sponsored social, athletic and automotive clubs to establishing marching bands that performed during parades and played for visiting dignitaries and celebrities. UIW paid workers bonus rates for every piece that exceeded the day's assignment, and UIW paid for those bonuses in gold coins.[292]

Bethlehem fed its employees too. In the first week of November 1918, just before the Armistice, Bethlehem opened a large new cafeteria complex occupying two square blocks at UIW near the main shipyard entrance, at 20th and Illinois Streets. San Francisco Mayor James Rolph and other dignitaries attended the opening ceremonies, and the UIW band provided musical entertainment. Architect James Miller designed the buildings, which accommodated 2,000 people and provided hot meals day and night. Workers found cigar, fruit, candy stands, and soda fountains in the cafeteria as well. Bethlehem also planned Cafeterias for its shipyards in Alameda and Oakland, and Sidney Hoedemaker, assistant manager of catering at the Palace Hotel -- one of San Francisco's finest – was placed in charge all three. Diners paid for their meals with coupons worth thirty cents, a rate made possible through government subsidies. Federal authorities recognized quite simply that "our workers must be fed, the same as the soldiers, so we can build ships."[293]

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[286] *Bethlehem Star* Vol. 1 No. 5 (April 1919).
[287] Thiesen, *Industrializing American Shipbuilding*, 185; Kelly and Allen, *Shipbuilding Industry*, 62.
[288] Stephen Canright, "Men of Steel: Working in the Bethlehem Alameda Shipyard, June 1918," *Sea Letter,* 60 (Summer 2001), 16.
[289] *Bethlehem Star* I No. 1 (June 1918).
[290] *San Francisco Examiner*, September 29. 1982, p. ZA1.
[291] Canright, "Men of Steel," 16.
[292] *San Francisco Examiner*, September 29. 1982, p. ZA1.
[293] *San Francisco Examiner*, November 3, 1918 p. 4N; Ibid., August 8, 1918, p. 4/1; *Bethlehem Star* Vol. I No. 3 (October 1918).

Managers also created friendly shipyard competitions to foster efficiency and speed during wartime. For example, Bethlehem Shipbuilding Co. vice-president Joseph W. Powell set up a competition between UIW and Bethlehem's Fore River shipyard in Quincy, Massachusetts, on the production of destroyers in 1918. UIW workers raised $20,000 on the wager. Another competition involved a wager that any team from any department of Oakland's Moore Dry Dock could beat any similar team from UIW.[294] UIW and other wartime shipyards posted the results of these competitions in their own newspapers or journals. The UIW journal *Bethlehem Star* also had a regular feature called "Shop Reports," which highlighted notable speed records and production goals in various shipyard departments, along with folksy, good-humored comments on individual workers and biting remarks about the German enemy – "Kaiser Bill" or "The Hun."

The most dramatic shipbuilding speed contests in World War I focused on riveting. UIW rivet gangs won "world records" for speed in 1918, reported both in the San Francisco press and the UIW shipyard journal *Bethlehem Star*. By winning these "world records," UIW rivet gangs became standard bearers for the whole emergency war effort and the race to build destroyers to protect the Allied fleet. The champion rivet gangs won wage bonuses too. Joseph Torres, who used a hydraulic bull riveting machine set a record, driving 6,075 rivets in one day's work. Another shipyard soon broke Torres' record, but UIW set a world record in October 1918 that held until the end of the war. [295] Charles Schwab, in his capacity as Director-General of the EFC, sent a telegram of congratulations to the world champion riveters at UIW, announcing a forthcoming visit to UIW on July 4, 1918, to observe another world record – launchings of nine ships in a single day. [296]

Schwab believed in the motivating power of competitions and publicized notable wartime achievements of both shipyard managers and workers. He created a Competitive Department in the EFC to evaluate the production rates of all American shipyards, awarding blue, red, and yellow flags to the top three yards every month, and medals to three men who had made notable contributions at each of the winning plants. He also established a $10,000 bonus with his own money (later matched by several shipyard owners) to be awarded to the workers in the shipyard that produced the largest surplus production. On that July 4, 1918 visit, Schwab awarded badges to UIW shipyard workers with four months' service, stating that they could "meet the boys of the Navy and the Army and hold [their] heads high." [297]

Post-War Decline in Shipbuilding

For UIW and other major American shipyards, the wartime shipbuilding program continued for three and a half years after the Armistice of November 1918, until government contracts were completed. The year 1922 marked the end of most World War I naval and merchant marine shipbuilding in the United States, at which point a postwar glut in inventory and international treaty restrictions initiated an interwar period of severely

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[294] Thiesen, *Industrializing American Shipbuilding*, 200-201; *San Francisco Examiner*, February 6, 1918, p. 11/8; Ibid., June 3, 1918, p. 3/5

[295] UIW and other American shipyards used indoor stationary hydraulic bull riveting machines. Canright explains that the big hydraulic riveters were used during World War I to "prefabricate structural elements prior to installation in the hull. Pieces such as deck beams, made up of several pieces of flat bar and angle iron, could be riveted together much more quickly using the heavy stationary machine than by either hand or air riveting." *San Francisco Examiner*, September 29. 1982, p. ZA1; *Bethlehem Star* I, 1 (June 1918); Canright, "Men of Steel," 18.

[296] *San Francisco Examiner*, July 3, 1918, p .11/2.

[297] Hessen, *Steel Titan*, 243; Charles Schwab quoted in *Bethlehem Star*, 1 (August 1918).

limited naval shipbuilding.[298] UIW fared better than most yards, largely due to its highly skilled labor force and limited wartime shift to pre-assembly production and welding.

The long drought in interwar shipbuilding was extreme even by the standards of the typically volatile American maritime economy. Two major East Coast shipyards, Philadelphia's Cramp and New York Ship, tried to counteract the interwar shipbuilding depression by branching out into shipping – an unwise corporate strategy that Thomas Heinrich argues resulted in the closure of Cramp in 1927 and the near failure of New York Ship.[299] New York Ship and Bethlehem's Fore River yard in Quincy, Massachusetts, were the only two private yards that had a steady flow (sometimes a trickle) of naval contracts during the interwar period, but even they were often contracted for ship conversions rather than new construction. Other shipyards survived on very scarce naval work, merchant shipbuilding contracts, ship repair, the luxury yacht market, and various forms of non-marine production.[300]

UIW completed its last naval contract in January 1924 and did not secure a new one until 1936.[301] The yard stayed afloat mostly through repair work. It also built some tankers and barges, and some ships for the Inter-Island Steamship Company, based in Hawaii.[302] Similarly, Bethlehem's Alameda yard completed its last wartime naval vessel in 1921; the yard stayed open by switching exclusively to repair work.[303] UIW general manager and vice-president Joseph J. Tynan told a San Francisco *Examiner* reporter in 1927 that the firm was determined to survive the hard times, saying "We have no intention of closing either the Alameda or Potrero works. If we can't get ships to build, we'll build something else."[304]

The long interwar shipbuilding depression produced significant weaknesses in the nation's shipbuilding sector, requiring a massive revitalization effort in the years leading up to World War II. The industry lost not only shipbuilding capacity (both shipways and production equipment) through the closure of shipyards, but also a loss of highly trained professional personnel, as naval architects, marine engineers, and draftsmen found work in other industries. Massive shipyard layoffs occurred throughout the country as well. The private shipyard labor force dropped from a high of 387,000 in 1919 to less than 50,000 in 1928. A further decline after the stock market crash of 1929 led to a four-decade low of less than 34,000 in 1933. Michael Lindberg and Daniel Todd argue that the loss of a "significant portion" of the nation's skilled shipyard workers may have been the single worst impact of the shipbuilding depression, which lasted so long (over ten years) that many skilled workers left the industry permanently.[305]

Post-War Labor Relations at Bethlehem Shipyards

The labor movement suffered significant blows throughout the country during the interwar period. The Shipbuilding Labor Adjustment Board that had negotiated regional wage rates in 1917 and 1918, dissolved in

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[298] Lindberg and Todd, *Anglo-American Shipbuilding,* 86-87.
[299] Cramp was later reopened by the navy during the build up to World War II. Heinrich, *Ships for the Seven Seas,* 197.
[300] Lindberg and Todd, *Anglo-American Shipbuilding,* 87; Heinrich, *Ships for the Seven Seas,* 6.
[301] Lindberg and Todd, *Anglo-American Shipbuilding,* 86-87.
[302] Bethlehem Steel Corp., "A Century of Progress," 6. Typescript on file, Hagley Museum and Library, Wilmington, Deleware.
[303] Lindberg and Todd, *Anglo-American Shipbuilding,* 87-88.
[304] Joseph J. Tynan in *San Francisco Examiner,* July 2, 1927.
[305] Lindberg and Todd, *Anglo-American Shipbuilding*, 68, 88; Paul R. Porter, "Labor in the Shipbuilding Industry" in Colston E. Warne, ed. *Yearbook of American Labor Volume I* (New York, 1944), 345-346.

April 1919. At around the same time, Bethlehem Shipbuilding Corporation was the first big national shipbuilding firm to sign an agreement with the thirteen AFL metal trades shipbuilding unions in Bethlehem's East Coast shipyards, an agreement that sparked many strikes that ultimately failed and rendered unions powerless.

Bethlehem intended to weaken union power with its agreement with East Coast shipyard workers. The agreement did not accord exclusive recognition to AFL unions and did not include reference to wages or real improvements in working conditions. Labor historian David Palmer describes it as a ruse designed to deceive and undercut the AFL unions and to establish management-controlled company unions (Employment Representation Plans or ERPs) in their place.[306]

National labor leaders tried to maintain peace in spite of this provocation, but local leaders called for strikes. Workers in many different crafts followed the locals, striking Bethlehem yards and many other East Coast shipyards. The East Coast left unions themselves vulnerable to attack because they engaged in individual, craft-based strikes, and were no match for Bethlehem, which, David Palmer explains, "had its own high powered legal department that litigated almost every attempt to organize." Only industry-wide strikes could beat powerful employers like Bethlehem. With an anti-labor administration in the White House, historian Palmer argues, "union locals lost their last leverage point and collapsed. Only individual activists remained, if they were lucky enough not to lose their jobs." [307]

UIW and other Bay Area shipyards were not part of the Bethlehem agreement, but their power decreased significantly as well. In San Francisco, the Bay Cities Metal Trades Council went on strike in May 1919, after shipyard owners refused a request for a conference on postwar wage rates. The strike affected UIW and all other shipyards in the Bay Area, and was supported by the local Labor Council, which contributed $100,000 to the strikers cause. After six months the strike failed, ushering in an era of anti-union open shop conditions in the metal trades.[308] Bethlehem maintained the open shop in San Francisco from 1920-1936 and, Richard Boyden notes, paid "substandard wages even to craftsmen."[309]

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[306] Ibid.
[307] Palmer, *Organizing the Shipyards*, 6, 153, 155-156, 180, 240.
[308] *San Francisco Examiner*, May 15, 1919; *San Francisco Call* May 15, 1919; *San Francisco Bulletin* May 15, 1919; Issel and Cherny, *San Francisco, 1865-1932*, 95.
[309] Boyden, "San Francisco Machinists," 21.

Part III: World War II

Introduction
Before World War II, most ships were still tailor-made, and the majority of shipyard production workers were skilled craftsmen who had learned their trades in multi-year apprenticeships followed by years of practical experience. More than 80 percent of shipbuilding jobs before the war were classified as either skilled or semiskilled.[310] World War II transformed the shipbuilding industry.

Of the almost two million shipyard production workers hired during World War II, only 10 percent had previous shipbuilding experience. The nation's shipyards succeeded in reaching President Roosevelt's production goals through use of standardized ship design and abbreviated shipyard training programs that emphasized the de-skilling of labor. Production technologies such as prefabrication and pre-assembly helped to relieve an acute shortage of skilled labor, but also threatened workers' craft traditions and job security. When labor unions protested, the federal government pressured them to accept the new shipbuilding methods as a wartime necessity. Although standardization and the reorganization of labor affected all wartime shipyards to some degree, they had the greatest impact on merchant shipbuilding.

UIW specialized in naval production during World War II. Naval ships, especially naval combat vessels, were far more complex than merchant ships and required a more highly skilled labor force. Labor historian and folklorist Archie Green, a UIW shipwright during the war, recalls that UIW built high pressure destroyers and other naval vessels that were much harder to construct than Liberty ships ("tin cans") built by inexperienced workers ("thirty-day wonders") at Kaiser in Richmond, Marinship in Sausalito, and other San Francisco Bay Area shipyards engaged in merchant shipbuilding. The "old craft traditions survived more at Bethlehem," said Green.[311] UIW built 72 ships during the war; 52 were navy combat vessels, including destroyers, destroyer-escorts, and high-speed anti-aircraft cruisers.

Ship repair and conversion, which was even more labor intensive than new ship construction also dominated UIW's wartime program. Geographers Michael Lindberg and Daniel Todd note that, "The best and brightest often found their way to ship repair yards."[312] UIW repaired or converted about 2,500 Navy and commercial ships during World War II; repairs on combat vessels included battleships, aircraft carriers, cruisers, destroyers, and destroyer-escorts.[313] Bethlehem cited UIW's 1942 modernization of the 33,100-ton battleship *USS Pennsylvania,* which involved the installation of a complete new secondary battery, as "probably the most outstanding achievement of the yard during the war." Workers completed the job in only 88 days, despite estimates that it would take five months to draw the plans and six months to complete the work.[314]

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[310] Marilyn S. Johnson, "Wartime Shipyards: The Transformation of Labor in San Francisco's East Bay," in Sally M. Miller and Daniel A. Cornford, eds., *American Labor in the Era of World War II* (Westport, 1995), 90.
[311] Archie Green, Interview with Marjorie Dobkin, July 12, 2007.
[312] Lindberg and Todd, *Anglo-American Shipbuilding*, 163.
[313] U. S. Department of Commerce Maritime Administration, Office of Ship Construction, Division of Production, "Report on Survey of U.S. Shipbuilding and Repair Facilities," 1980, p. 15; C. C. Bloch, USN(Ret.), letter to W. M. Laughton, Manager, Bethlehem Steel Company Shipbuilding Division, San Francisco Yard, 23 December, 1944. On file, Scrapbook 109, Bethlehem Steel Collection, J. Porter Shaw Library, San Francisco Maritime National Historic Park.
[314] Bethlehem Steel Corporation, "A Century of Progress," typescript, p. 7. On file, Hagley Museum.

The San Francisco machinists' union launched a major strike over wage and contract issues at UIW and other yards in May 1941, after Bethlehem refused to grant union recognition and sign a Pacific Coast contract. Workers at UIW were the most severely affected of the eleven San Francisco Bay Area yards involved in the strike. The month-long strike halted ship construction and repair in the Bay Area. It turned into a crucial test for both the labor movement and the federal government.[315] Striking machinists and tens of thousands of union supporters who refused to cross the picket lines resisted extreme pressure by unsympathetic labor leaders, the Navy, the Maritime Commission, the federal Office of Production Management, the Governor of California, the Secretary of Labor, and even President Roosevelt. The strikers finally prevailed when the National Defense Mediation Board recommended that Bethlehem join other Pacific Coast employers in signing a contract with a closed shop provision.

Unprecedented numbers of African Americans and women found new shipyard employment opportunities at UIW and shipyards throughout the country during severe wartime labor shortages. With the support of the federal government, they fought for their rights to be hired, trained, promoted, and admitted to full union membership.

Revival of Shipbuilding

Paul R. Porter, chairman of the U. S. War Production Board's Shipbuilding Stabilization Committee, cited a tendency to "peacetime doldrums and wartime booms" as one of the principal characteristics of the American shipbuilding industry.[316] The World War II generation of shipbuilding production workers included many people who had experienced one of the nation's worst and most prolonged shipbuilding depressions in the 1920s and early 1930s followed by the greatest shipbuilding boom in American history.

President Franklin D. Roosevelt ended the interwar shipbuilding depression and the decline of the U.S. Navy by initiating a naval buildup after his inauguration in 1933. The buildup began as an industrial development and employment program in the President's National Industrial Recovery Act legislation and lasted through the Second World War, resulting in the largest naval expansion program in U. S. history. An enormous merchant marine shipbuilding program began in the late 1930s when the Merchant Marine Act of 1936 established the U. S. Maritime Commission, a New Deal agency created to modernize the aging fleet of the nation's merchant marine; the Commission accelerated its production schedule after the outbreak of war in Europe in1939. The World War II shipbuilding expansion was unprecedented for its speed as well as its size. The peak of the World War I shipbuilding program had not been reached until after the Armistice in 1918. Under the Roosevelt administration, by contrast, the wartime buildup started well before the December 7, 1941 attack at Pearl Harbor and peaked in the fall of 1943, nearly two years before the war ended. In June1940, only six private shipyards were building Navy ships. Eight months later there were sixty-eight. [317]

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[315] Frederic C. Lane, *Ships for Victory: A History of Shipbuilding Under the U.S. Maritime Commission in World War II* (Baltimore, 1951), 290; "Coast Ship Strike Halts Vast Work," *New York Times*, May 18, 1941, p. E7.

[316] Porter, "Labor in the Shipbuilding Industry" 345.

[317] "Between 1940 and 1945, 197 different American shipyards turned out 9,936 naval vessels ranging from 45,000-displacement –ton Iowa class battleships to 150 ton LCT's. This effort engaged not only the largest corporate and naval shipyards in the country, but small, family-owned boat yards that had never before built naval vessels as well as firms that had previously done no shipbuilding work at all. Entirely new yards were also built from scratch. The shipyards doing naval work were located in 32 states, along the nation's three coasts, on all of the Great Lakes, and on many of its inland waterways." Lindberg and Todd, *Anglo-American Shipbuilding*, 139, 147-148; Lane, *Ships for Victory*, 8, 10, 38.

The expansion of wartime shipbuilding capacity in the San Francisco Bay Area was one of the nation's greatest industrial achievements. According to historian Charles Wollenberg, by 1944, "five billion dollars in defense contracts had made San Francisco Bay the largest shipbuilding center the world had ever seen."[318] Federal support revived UIW and other pre-war shipyards, and aided development of wartime "instant shipyards," including Marinship in Sausalito and the Kaiser shipyards in Richmond. Maritime Commission contracts helped UIW begin its recovery from the interwar depression in the late 1930s; the federal government upgraded UIW again for naval production in 1940. Most Bethlehem yards, including UIW, were assigned to naval construction during the war.[319] Apart from UIW, most major Bay Area shipyards focused on merchant shipbuilding for the Maritime Commission, while naval shipbuilding was concentrated in large pre-war yards on the East Coast. [320]

Bethlehem's national wartime production through the end of 1944 was about 70 percent Navy vessels and 30 percent cargo vessels – 38 different types of ships, from super-battleships and aircraft carriers to trawlers. E. G. Grace, president of Bethlehem Shipbuilding Company, reported that the Shipbuilding Division of the company produced a world's record total of 380 fighting and cargo ships in 1943, a fleet characterized by Secretary of the Navy Frank Knox as "bigger than most nations could boast before the war." According to E. G. Grace, Bethlehem's structure as an integrated company producing materials "all the way up from the ore in the ground to the completed ship" made possible its prodigious wartime production. [321]

Prelude to the 1941 Strike: Shipbuilding Stabilization Committee Agreement
Although private shipyard managers at UIW and throughout the country retained the primary responsibility for recruiting, training, and supervising the wartime labor force, the federal government had oversight over collective bargaining and the process of setting wage rates and working conditions through the Shipbuilding Stabilization Committee (SSC). The Committee established a two-phase process: In phase one the Committee developed regional zone standards agreements on wages and working conditions; during the second phase, labor unions and employers incorporated the standards into signed contracts.[322] Bethlehem's refusal to sign a Pacific Coast contract during the second phase provoked a major shipyard strike at UIW and ten other Bay Area shipyards in May 1941.

The Shipbuilding Stabilization Committee was created in late 1940 by Sidney Hillman, former vice-president of the Congress of Industrial Organizations (CIO), serving as Director of the Labor Division of the National

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[318] Charles Wollenberg, *Marinship at War: Shipbuilding and Social Change in Wartime Sausalito* (Berkeley, 1990), 3.
[319] The World War II build-up sparked competition between the Navy and Maritime Commissions for skilled production workers, as well as professional staff, raw materials, equipment and space. A Presidential conference on March 14, 1941 helped alleviate the competition by assigning major shipyards to either Maritime Commission or naval construction. UIW and most other pre-war Bethlehem yards were assigned exclusively to naval work. This division held for the duration of the war. See Lindberg and Todd, *Anglo-American Shipbuilding*, 142-143; Lane, *Ships for Victory*, 36-37, 57-58.
[320] Charles Wollenberg writes, "From 1941 to 1945, West Coast yards received more than half of the total Commission contracts, while the East Coast's share was less than one-third. (The remainder went to Gulf and Great Lakes yards). In contrast, the Navy's military ship construction program, which was largely accomplished by existing, old-line yards, was concentrated in the East. Well over half of naval construction contracts went to East Coast yards, while the West Coast's share was under 20 percent." Wollenberg, *Marinship at War*, 3, 19-20.
[321] "Bethlehem Yards Build 380 Ships in 1943," *Marine Engineering and Shipping Review* (January 1944), 155.
[322] Lane, *Ships for Victory*, 268, 286-287.

Defense and Advisory Commission. The SSC had two main goals – to set wage rates high enough to attract a large and capable labor force, and to prevent the instability and labor unrest that had occurred during World War I, including strike waves, wage spirals, and high rates of labor turnover. [323]

During the first half of 1941, the Shipbuilding Stabilization Committee held zone conferences throughout the country, attended by representatives of labor, management, and government. Leading national labor unions for each region represented shipbuilding employees. During the shipbuilding revival of the mid-1930s the metal trades unions of the AFL had regained their preeminence in San Francisco, Portland, and Seattle, but failed to reestablish their strength on the East Coast. In 1933, workers at New York Shipbuilding Company in Camden, New Jersey, established a new union, the Industrial Union of Marine and Shipbuilding Workers of America, which succeeded in organizing other East Coast yards and joined the CIO in 1936. During World War II AFL or CIO unions eliminated and replaced almost all shipbuilding company unions, including those at Bethlehem yards on the East Coast.[324]

The AFL was an umbrella organization for individual craft unions such as machinists, boilermakers, carpenters, and was based on an organizational structure and philosophy known as craft unionism. Workers in unions affiliated with the CIO, by contrast, were organized on an industry-wide basis; instead of being organized by individual crafts, all shipbuilding workers, for example, were united in one broad-based union. The CIO approach is known as industrial unionism. The AFL was dominant on the Pacific Coast and the Great Lakes. It served as the labor representative in the Shipbuilding Stabilization conferences for those regions. The CIO represented the Atlantic Coast region. On the Gulf Coast the two labor organizations had relatively equal strength and both participated in the stabilization conferences. The key labor negotiator for the Pacific Coast labor unions was the Metal Trades Department of the AFL, which represented the Department's five local Metal Trades Councils and thirteen international unions affiliated with the AFL: Boilermakers, Blacksmiths, Carpenters, Electrical Workers, Operating Engineers, Laborers, Machinists, Metal Polishers, Molders, Pattern Makers, Painters, Plumbers, and Sheet Metal Workers.[325]

Shipbuilding wage rates established at the zone conferences, including the basic rate of $1.12 per hour, were among the highest of all war industries. By the summer of 1941 all four regions of the country had completed Shipbuilding Stabilization Committee zone agreements, including wage rates as well as binding two-year agreements that had a no-strike, no-lockout clause.[326]

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[323] Members of the Shipbuilding Stabilization Committee included John P. Frey, president of the Metal Trades Department of the American Federation of Labor; John Green, president of the Industrial Union of Marine and Shipbuilding Workers of America (C.I.O.); H. Gerrish Smith, president of the National Council of Shipbuilders (later renamed the Shipbuilders Council of America); Rear Admiral Emory S. Land, chairman of the Maritime Commission, and Joseph W. Powell, special assistant to the Secretary of the Navy. Morris L. Cooke, member of the National Defense Advisory Commission was named chairman. As the two government agencies responsible for shipbuilding contracts, the Navy and the Maritime Commissions assumed key roles in bargaining with labor representatives on wage issues. They had agreed to recognize the wage rates established for each zone. Joseph Wright Powell, "Labor in Shipbuilding," in *The Shipbuilding Business in the United States of America* Volume I, F. G. Fassett, Jr., ed. (New York, 1948), 285; Lane, *Ships for Victory*, 272-273.
[324] Porter, "Labor in the Shipbuilding Industry," 357; Powell, "Labor in Shipbuilding," 290.
[325] Powell, "Labor in Shipbuilding," 285-286.
[326] A basic rate of $1.12 an hour was agreed upon for standard skilled mechanics at the Pacific Coast conference, and the same rate was adopted later for mechanics in the Atlantic and Great Lakes zones. A rate of $1.07 for mechanics was

Pacific Coast Master Agreement and the 1941 Strike

While the Pacific Coast Zone Conference was underway from February to April 1941, the AFL Metal Trades Department conducted simultaneous negotiations with Pacific Coast shipbuilding employers on a separate master contract known as the Pacific Coast Master Agreement. Under the terms of the Master Agreement, shipyard employers gave AFL metal trades unions a closed shop and the wages and premiums outlined in the zone agreements. The closed shop clause stipulated that AFL union membership was a requirement for employment, and all hiring had to be done through AFL unions. In return, the unions offered a no-strike pledge, as stipulated in the Shipbuilding Stabilization Committee zone agreement. Labor leaders who agreed to the no-strike clause believed that they retained the freedom to strike if employers did not adhere to zone standards and other federal guidelines. The opposing view, held by many senior government officials, claimed that the no-strike pledge was the "keystone" of the stabilization agreement and should prevail under all conditions. [327]

Historian Frederic Lane noted that, "The ink was hardly dry on the Pacific Coast Agreement when, on May 10,[1941] a serious strike began in the San Francisco Bay area." Striking machinists walked out over contract and wage demands, shutting down UIW and ten other San Francisco Bay Area shipyards with $500,000,000 in contracts for construction and repair of sixty vessels for the Navy and Maritime Commission. Bethlehem was by far the largest of the eleven Bay Area shipbuilding firms affected by the strike and was considered the "bellwether" of the group. The over-riding issue in the strike was Bethlehem's refusal to sign the Pacific Coast Master Agreement for UIW and other yards because of objections to the closed shop provision.[328] The strike was complex, however, joined by a number of labor organizations with different priorities. It elicited a variety of reactions from leaders of the labor movement.

San Francisco Local 68 of the International Association of Machinists (AFL) and the East Bay Union of Machinists (CIO) launched the strike. The San Francisco AFL machinists initially declared that they were striking for higher wages, $1.15 per hour instead of the $1.12 called for the in the Pacific Coast zone standards agreements. They indicated as the strike progressed, however, that they might be willing to compromise on their wage demands if Bethlehem signed the Master Agreement. The *New York Times* reported on May 22, 1941 that, "The strike leaders have made no secret of the fact that Bethlehem was the mark at which the strike was aimed and that there would be no compromise on any other issue until

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agreed to in the Gulf zone. (In April 1942 the rate was adjusted to $1.20 per hour for all four zones at a labor management conference sponsored by the Stabilization Committee in Chicago.) Shifts in premiums varied by region. On the Pacific Coast workers got time and a half for overtime; swing shift workers got ten percent bonuses, and graveyard shift workers got 15 percent bonuses. According to the Bureau of Labor Statistics, weekly take-home pay for shipyard workers in October of 1943 was the second highest of all war workers, with a national average of $62.91 per week; average hourly earnings, including overtime and shift premiums, were $1.31. Straight time hourly earnings, eliminating shift differentials and overtime, averaged $1.15. Better shift premiums and the high proportion of workers employed on the swing and graveyard shifts resulted in Pacific Coast laborers earning the highest real earnings. Powell, "Labor in Shipbuilding," 290; Lane, *Ships for Victory,* 412.

[327] Ibid., 287.

[328] Ibid.; "Coast Shipyards On Defense Work Stopped By Strike," *New York Times*, May 11, 1941, p. 1; "Coast Shipyards Shut by Pickets; Return Rejected," in Ibid., May 13, 1941, p. 1; "Coast Ship Strike Halts Vast Work," in Ibid., May 18, 1941, p. E7.

Bethlehem signed an iron-clad union contract." [329] The East Bay CIO machinists supported the strike in opposition to the master agreement negotiated between the AFL and the employers, charging that the agreement was the result of secret negotiations and collusion between the Metal Trades Department of the AFL and shipyard employers.

The AFL machinists struck UIW and other San Francisco yards where they had jurisdiction, and the CIO machinists struck in the East Bay. AFL union members showed their solidarity by refusing to cross picket lines in the East Bay. Although only about 1,200 AFL machinists and 700 CIO machinists were directly involved in the strike, about 18,000 to 20,000 other workers on both sides of the Bay refused to cross the machinists' picket lines and stayed out of the yards.[330] UIW, which had about 5,000 employees in May 1941, was the largest of the struck shipyards and the most severely affected; about 900 of the 1200 striking AFL machinists worked at Pier 70 and other Bethlehem shipyards in the Bay Area. [331] The *New York Times* described the picket line at the main gate Pier 70 in a front-page article on May 13, 1941:

> A crowd estimated by Police Captain John A. Reed at 5,000 to 7,000 men gathered at 8. A.M., when the day shift ordinarily would go on. A picket line of several hundred strikers had been established there at 6:30. It was augmented by men coming off the night shift and by other craftsmen who ordinarily would have gone through the gates at 8. Only a few police were in evidence…. Every one was in good humor. No attempt was made to stop automobiles going in to the yard's parking lot, where officials as well as workmen leave their cars, and the office staff and maintenance men walked through the gates unmolested. There was no sound of riveting or other work from within the plant, however, and the big smokestacks stood against the sky with no smoke coming from their mouths.[332]

Support for the strike varied. Harvey Brown, national president of the AFL International Association of Machinists, and the Bay Cities Metal Trades Council, supported the strike for part of the time, not primarily on the wage issue but in order to force Bethlehem to sign the Pacific Coast Master Agreement. He maintained this argument even after meeting with President Roosevelt, who deemed the strike unpatriotic. Other prominent labor leaders were vocal opponents of the machinists' strike. William Green, president of the AFL, and John Frey, president of the AFL Metal Trades Department, described it an outlaw strike for violating the zone agreements and Pacific Coast Master Agreement.[333] John Frey tried personally to end the strike by leading a back-to-work effort at Oakland's Moore Dry Dock, but was rebuffed.[334] Culbert L. Olson, the Governor of California, and Sidney Hillman, newly appointed co-director of the Labor Division of the Office of Production Management, also tried but ultimately failed to mediate an end to the strike.

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[329] "Order Men to Pass Coast Picket Lines," in Ibid., May 19, 1941, p. 10; "Spread of Strike Now Threatening 12 Coast Yard," in Ibid., May 22, 1941, p. 19.
[330] "Coast Shipyards Shut by Pickets," 1; "OPM Seeks to End Coast Ship Strike," in Ibid., May 15, 1941, p. 19; "Coast Ship Strike Halts Vast Work," E7.
[331] Bethlehem's Alameda yards had about 100 employees at the time of the strike in May 1941. "Coast Shipyards Shut by Pickets," 1; "OPM Seeks to End Coast Ship Strike," 19; "Bethlehem Ship Plant Opens," in Ibid., June 4, 1941, p. 16.
[332] "Coast Shipyards Shut by Pickets," 1.
[333] "Takes Step to End Shipyards Strike," *New York Times,* June 10, 1941, p. 10; "Green Denounces Shipyard Strikers," in Ibid., May 12, 1941, p. 10.
[334] Lane, *Ships for Victory,* 289-290.

President Roosevelt's Secretary of Labor Frances Perkins finally sent the case to the National Defense Mediation Board (NDMB). Established by the President through an executive order on March 19, 1941, to settle labor disputes in defense industries, the NDMB recommended that Bethlehem sign the Pacific Coast Master Agreement.[335] All the other shipyards in the region had, after all, agreed to the closed shop provision. Bethlehem capitulated on June 23, 1941, and the machinists of San Francisco Local 68 returned to work on June 28, dropping their wage and overtime demands once Bethlehem agreed to sign the Master Agreement. The CIO machinists in the East Bay also returned to work provided that East Bay shipyards sign the master agreement.[336] The strike was a triumph for the machinists and their supporters in other shipbuilding trades unions, and it ultimately reaffirmed the validity of the Shipbuilding Stabilization Committee zone agreements. The stabilization agreements, followed by a surge in patriotism after the attack on Pearl Harbor, led to a sharp decline in shipbuilding strikes nationwide from 1942-1945.[337]

Charles Wollenberg states that by forcing Bethlehem and other employers to sign the Pacific Coast Master Agreement with a closed shop provision, the unions in the AFL Metal Trades Department at UIW and other Bay Area shipyards "used the national emergency to achieve one of labor's major collective bargaining goals, control of job access." The Pacific Coast Master Agreement also called for the Metal Trades unions to grant journeyman status to shipyard workers with only a few months of training – a privilege that, Wollenberg emphasizes, was traditionally granted only to workers who had completed years of apprenticeship training. "The 'de-skilling' of shipyard work had thus profoundly affected the groups represented by the Metal Trades Department. In effect, fairly small unions of skilled, white, male craftsmen had been transformed into giant, ethnically and sexually diverse organizations of semiskilled, mass-production workers."[338]

Standardization

Although standardized ship design and production began in the 1890s, and a few assembly yards used the methods during World War I, only during World War II did sufficient demand for ships exist to warrant standardization and prefabrication on a large scale. The Maritime Commission played a prominent role in the spread of prefabrication and pre-assembly methods during World War II by subsidizing construction of new shipyards, such as Bechtel's Marinship in Sausalito, that were laid out specifically for standardized shipbuilding. Charles Wollenberg describes the Marinship production method: "The twin foundations of the new process were prefabrication and preassembly. Of the 250,000 separate items that went into a Marinship vessel, most were already shaped and fitted together before the manufacturing process ever reached the shipway. Only a little over 100 separate units, some as large as an entire deckhouse, were actually assembled on the way, and another 200 items were added at the outfitting dock after launching."[339] Standardization like this required lower skill sets and learning curves; thus, standardization helped to relieve the acute wartime shortage of skilled labor. Unskilled workers could be trained to perform relatively simple tasks in a fraction of

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[335] "The NDMB was a tripartite agency with three public, four industry, and four labor members (two each from the AFL and the CIO. Its methods were mediation, voluntary arbitration, and, if they failed, fact-finding with recommendations which might be made public. In the ten months of its life the Board received a total of 118 disputes. In most cases, strikes were in progress when the agency entered the dispute; in a number of others, stoppages soon took place." Irving Bernstein, "Americans in Depression and War," U. S. Department of Labor, www.dol.gov/oasam, accessed May 9, 2008.
[336] Lane, *Ships for Victory*, 290; "C.I.O. Machinists Vote Strike End," *New York Times*, June 28, 1941, p. 9.
[337] Lane, *Ships for Victory*, 412.
[338] Wollenberg, *Marinship at War*, 52-53.
[339] Ibid., 28, 214-215.

the time that it took to train an apprentice in all the aspects of a complex shipbuilding process. The de-skilling and reorganization of labor affected nearly all defense industries during the war.[340]

Prefabrication and pre-assembly shipbuilding methods encountered considerable resistance at the start of the war, both from labor unions and from prewar old-line shipbuilding companies, including Bethlehem. The International Brotherhood of Boilermakers, Iron Shipbuilders, and Helpers, the AFL union representing 65-70 percent of West Coast ship production workers, protested the prefabrication process and the breakdown of shipbuilding skills as a threat to the craft traditions of journeymen mechanics. The Boilermakers union, comprised of more than a dozen classifications – including shipfitters, plate welders, rollermen, riggers, chippers and calkers, riveters, drillers, and reamers – described new shipyard workers who had gone through brief wartime training programs as "a motley collection of one-process worker Johnny-come-latelies."[341] Such comments reflect the widespread resentment among pre-war skilled workers and labor unions who believed that de-skilling posed a threat to worker status and job security. In response to de-skilling, the Boilermakers proposed an "interchangeability" system of production that used skilled workers for complex work in many aspects of production, but ultimately had to capitulate to prefabrication as a necessary and temporary wartime measure. They took comfort in high and stable wage rates, as well as closed shop protections. Indeed, the Boilermakers' union grew by several hundred thousand nationwide during the war, expanding from 28,609 in 1938 to 352,000 in November 1943. West Coast Boilermaker locals grew the most during the war; several had memberships of more than 35,000. [342]

Pre-war shipyard managers had their own set of objections to standardization. Most old-line shipyard managers, including many Bethlehem executives, had backgrounds in naval architecture or marine engineering; more rarely, they had begun their careers as skilled craft workers and risen through the ranks to senior management. At the beginning of World War II, Bethlehem managers acknowledged the demand for multiple production, but were skeptical that industrial methods used to produce automobiles or other industrial products could be applied to shipbuilding.[343] For example, Alfred S. Gunn, General Manager of UIW from 1927 until his death in 1944, was a Bethlehem traditionalist accustomed to tailor made ship production. He began working for UIW in 1893 as an apprentice in steel shipbuilding and was appointed Assistant General Manager of Bethlehem's West Coast Shipyards in 1915. "Thus," according to a review of UIW history, "while General Manager in World War II, [Gunn] was able to reminisce about working on the *Olympia* and the *Oregon* before the Spanish-American War and the leading part he played in the launching of eight destroyers and four cargo ships on 4 July 1918 during World War I."[344]

In contrast, new wartime emergency shipyards such as Bechtel's Marinship and the Kaiser Richmond readily adopted the new shipbuilding methods. Managers at these shipyards were construction engineers with little or no shipbuilding experience before 1941. They did not believe that shipbuilding was a unique production process, and were keenly interested in efficiency methods used in other industries. Their experience in heavy

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[340] Lindberg and Todd, *Anglo-American Shipbuilding*, 162-163.
[341] Johnson, "Wartime Shipyards," 95-96.
[342] Dorothy K. Newman, "Employing Women in Shipyards," *Bulletin of the Women's Bureau, No. 192-6* (Washington, 1944), 33; Amy Kesselman, *Fleeting Opportunities: Women Shipyard Workers in Portland and Vancouver during World War II and Reconversion* (Albany, 1990), 39; Johnson, "Wartime Shipyards," 95-96.
[343] Lane, *Ships for Victory*, 462-463.
[344] Ens. Clifford H. Hollander USN (Ret.), "Bethlehem's San Francisco Yard," *Shipmate*, 41 (July–August 1978), 19.

construction work, such as dam building, trained them to focus on the organization of industrial space and movement of materials.[345]

Naval Construction and Repair Work at UIW

Bethlehem traditionalists and Kaiser and Bechtel innovators learned from each other as the war progressed; as previously mentioned, however, prefabrication and pre-assembly methods were more widely used in merchant shipbuilding than for production of naval ships at UIW and other yards assigned to the Navy.[346] Navy ships were far more complex in design, outfitting, and construction than standard merchant ships. They were also subject to more frequent design revisions, and took far longer to build than most merchant ships. E. G. Grace, president of Bethlehem Shipbuilding Company, reported that "from the standpoint of man-hours, one battleship is equivalent to 40 Liberty ships."[347] Naval construction required skilled workers, who tended to receive higher take-home pay than those building merchant ships.[348]

UIW production workers earned honors for their skill in naval production. In December 1942 Vice-Admiral John W. Greenslade, Commander of the Western Sea Frontier, presented a Navy "E" pennant for efficiency and excellence to UIW General Manager Alfred S. Gunn, saying, "You have done a fine job here. You are building combatant ships that can't be turned out with assembly-line methods."[349] UIW won a total of three Navy "E" awards during the war for "meritorious service on the production front." C. C. Bloch, Admiral, U.S. Navy (Ret.), Chairman of the Navy Board for Production Awards specifically cited the destroyer-escort *USS Fieberling,* delivered by UIW on April 11, 1944, only 23.5 days after keel laying, as "one of the country's outstanding production records and a world record for this type of ship."[350]

Several naval ships built at UIW during the war had distinguished fighting records too. The destroyer *USS Laffey*, launched in 1941, sank four enemy destroyers and a cruiser, helped to sink one battleship, heavily damaged another battleship and shot down two torpedo planes. In 1942 the *USS Laffey* was sunk by a Japanese battleship off Guadalcanal, and was later awarded the Presidential Unit Citation for gallant performance in the South Pacific and three battle stars for World War II service.[351]

UIW's naval ship repair program tended to be more labor intensive than new construction, and required a highly skilled labor force of craftsmen, including machinists, electricians, welders, coppersmiths, blacksmiths, pipe fitters, shipwrights, boiler makers, carpenters, sheet metal workers, riveters, painters, and many other trades. Repair workers, like those building naval ships, typically received better wages due to greater overtime required to repair ships quickly and return them to service. The journal *Pacific Marine Review* emphasized that ship repair was the top priority at UIW toward the end of the war, noting that "In the spring of 1945, 80 percent of the yard's 10,500 employees were engaged in repair work – 10 hours a day, 7

[345] Lane, *Ships for Victory*, 463.
[346] Ibid.
[347] "Bethlehem Yards Build 380 Ships in 1943," *Marine Engineering and Shipping Review* (January 1944), 155.
[348] Lindberg and Todd, *Anglo-American Shipbuilding*, 138-139, 142-143, 163.
[349] The Navy's "E" pennants and the Maritime Commission's "M" pennants were merit awards intended to arouse patriotic spirit and inspire workers to increase production – a message broadcast in every possible medium during the war. "'E' Awarded for Warships," *New York Times*, December 13, 1942, p. 49.
[350] C. C. Bloch, USN (Ret.), Letter to W. M. Laughton, Manager, Bethlehem Steel Company Shipbuilding Division, San Francisco Yard, 23 December, 1944. On file, Scrapbook 109, Bethlehem Steel Collection, J. Porter Shaw Library.
[351] Ibid.

days a week." [352] Among the ships that UIW workers overhauled were the 25,000-ton aircraft carrier *Essex* and the "battle wagons" *California*, *Mississippi*, *Nevada*, and *Maryland.*

Repair workers used dry docks to lift ships from the water for inspection and hull maintenance. Specialized workers known as drydockers and waysmen were essential to dry dock operations, not only for raising and lowering UIW's floating dry docks and maintaining their positions, but also for "walking" a ship into a dry dock in line with carefully set blocks. Labor historian Tim Kelley states that UIW had "four small wooden-hulled floating dry docks" at the start of World War II, and added a 600-foot steel-hulled floating Dry Dock #1 in 1943. Kelley adds that the dry dock, was "in virtually constant 24-hour use for the duration of the war."[353] The 22,000-tons dock, often described as the largest privately-owned dock on the Pacific Coast, was built at Bethlehem's Fabricated Steel Construction Division's Shop at Alameda. Bethlehem described the dry dock as "the solid-trough type, built in three sections, [with] sixteen water-tight compartments which can be filled and emptied individually. It is self-docking, that is, the end sections can be detached and used to raise the center sections, and the center section, in turn, can be used for docking the two end sections." [354]

Marine machinists, who represented one of the most essential trades involved in ship repair, worked on a huge variety of machinery and hardware, including the "main engines, gears, shafting, bearings, electric motors, winches, valves, watertight doors, pumps, and many other items." UIW employed highly skilled machinists, including many with international backgrounds in the world's leading ports and shipyards. Some UIW machinists were former ship engineers, the sea-faring mechanics who operated the ships' engines and were capable of doing ship repair without blueprints. Marine machinists engaged in repair work at UIW were divided into two main groups: "inside" workers assigned to the yard's machine shop, and "outside" workers assigned to the ships in dry dock. An inside machinist might, for example, be required to repair a 75-foot long tail shaft, a job requiring a high degree of skill and specialized machinery including enormous lathes, vertical boring mills, horizontal mills and hydraulic presses. Some of the machines used in repair work were developed at UIW during World War II and won a War Production Board Citation. Richard Boyden explains that outside machinists, who typically worked in gangs of from three to six men, often worked "in the engine room, using portable machines like grinders, and hand tools like hammer, chisel, and file. These jobs harkened back to an earlier time." [355]

Welding as New Production Technology
During World War II, ships at UIW and other American shipyards were mostly welded, although the older technology of riveting was still used for some structural work. Welders, rather than riveters, were the main production workers both on the shipways and in the subassembly areas of shipyard shops.[356] Shipyards had

[352] "Bethlehem's Repair Facilities," 14.
[353] Tim Kelley, "Ship Repair Yards and Dry Docks in San Francisco 1941-1955," (San Francisco, n.d.), 2, 7-8.
[354] Bethlehem Steel Corporation, "A Century of Progress," 4.
[355] Boyden goes on to say that outside machinists worked "on steam turbine engines, and the job of lining up and boring the water-tight bearing at the stern of the ship where the tail shaft emerged to connect with the propeller." Boyden, "San Francisco Machinists," 14, 19-21.
[356] In 1936, welders were 4.3 percent of all private shipyard workers and riveters were 0.8 percent. In 1943, welders were 9.7 percent of all private shipyard workers, by far the largest single category. The next largest were shipfitters at 5.4 percent. Riveters were 0.2 percent in 1943. Palmer, *Organizing the Shipyards*, 104; H. Gerrish Smith and L. C. Brown, "Shipyard Statistics," in Fassett, *Shipbuilding Business*, 186. Based on Monthly Labor Review, Bureau of labor Statistics, U. S. Department of Labor, Washington, DC.

used acetylene welding on a limited basis during World War I, and the Emergency Fleet Corporation training programs began to teach the new technology of electric welding to workers around the country, including those at UIW, in 1918-1919. [357] After World War I, shipyard welding declined until being reintroduced in barge construction in the early 1930s. By 1936 welding was the fastest growing shipbuilding trade. In the early 1930s, after the Navy and Commerce Department instituted mandatory performance tests for welders, UIW established a welding school. A federally funded upgrade of the UIW shipyard in the late 1930s also included new welding facilities and equipment in the shipbuilding ways, reflecting a "recognition of the trend toward welding in ship hull assembly [that] is evident in the rearrangement of the Union Plant." [358]

In 1948 maritime historian John Hutchins described welding as "the most significant development in speedy ship construction since World War I." [359] Since ship frames and plates could be welded together much faster than they could be riveted, welding led to substantial decreases in overall time required for hull construction and helped alleviate the wartime labor shortage. One welder, using either oxyacetylene gas or electricity, could attach plates to the hull as quickly as a four-man riveting gang.[360] Welding required less skill and physical strength than riveting, which meant that many new, inexperienced shipyard workers, including women, were successfully trained as welders during the war.

Wartime Training Programs

Charles Wollenberg describes World War II shipyards as "gigantic experiments in industrial education." Nationwide, less than 10 percent of the nearly two million shipyard workers employed during the war had previous shipbuilding experience. Tens of thousands of shipyard workers, both men and women, had no relevant craft skills whatsoever before the war, including, Dorothy Newman once wrote, many "who had never held tools before, much less seen a ship under construction." [361]

Although there are no readily available statistics on the skill levels or work histories of UIW wartime production workers as a whole, a survey of the members of one shipyard department – the submarine painters – provides some basis for comparison and suggests that UIW employed a higher percentage of skilled workers than the majority of wartime shipyards. Sixty-six submarine painters worked at UIW during World War II, only two of whom worked at UIW before the war, and one of whom had worked at a Kaiser Richmond shipyard during the first year of the war. Thus, only three of the sixty-six (5 percent) had previous shipbuilding experience. Ten other submarine painters (15 percent) in the department had been employed as

[357] *Bethlehem Star*, 1 (April 1919).

[358] "The large welding slab of heavy steel channel construction is located on the west side of the building ways with ample room for sub-assembly and is served by the elevated crane ways alongside the ways. Four new 1000 ampere 65 volt multiple operator welding generator sets were installed, making a total of nine such units. The entire shipbuilding way superstructure was wired for conveniently located outlets where portable reactor houses could be plugged in to serve as welders on the job. Seventy-five of these portable resistor reactor houses are kept in good working condition. Each generator set will supply power to 15 welders." "Bethlehem Reconditions Potrero Works," 25.

[359] Hutchins, "History and Development of Shipbuilding 1776-1944," in Fassett, *Shipbuilding Business*, 59.

[360] Thiesen, *Industrializing American Shipbuilding*, 185.

[361] Wollenberg, *Marinship at War*, 45-46; Powell, "Labor in Shipbuilding," 292; Newman, "Employing Women in Shipyards," 2.

painters before the war, and many others had previously worked in other defense plants or in related fields such as construction.[362]

Most shipyards promoted pre-war skilled workers to supervisory roles; some skilled workers served as shipyard instructors and others became pace setters, or leadermen. For example, Frank Fontana, who worked at UIW before the war, was made leaderman of the yard's submarine painters. UIW supervisors did not always have prior shipyard experience, but some had managerial or shipyard skills acquired in other defense plants or the military: A. J. Nagey, the supervisor of the submarine painters' department, was a former U. S. Marine; Jasper Stallone, the department's night leaderman, had prior experience as a welder in a Pennsylvania defense plant.[363]

The available pool of highly skilled workers was far too small to provide all the leadership training that was so desperately needed. As a result, supervisors and instructors were recruited from the ranks with unprecedented rapidity. Instead of prolonged 3-5 year apprenticeships resulting in highly skilled journeymen eligible for maximum pay, inexperienced "learners" progressed through abbreviated phases of training through on-the-job training as handymen or helpers. Typically they attained the status (and the wage rate) of skilled mechanics in months instead of years."[364]

Shipyard employers and supervisors provided the most crucial training for production workers in World War II. UIW demonstrated its industrial leadership during the war by training workers for its own shipyard as well as other Bethlehem yards, including the one in Alameda and the San Pedro Yard, in Los Angeles. World War II yards developed training programs and instruction manuals as early as 1940, and were generally much better prepared than managers had been during the First World War. The Bethlehem training manual, which simplified training to the most basic elements, was considered an industry model. The federal government published it for distribution in other shipyards. A typical Bethlehem trainee spent one hour a day in classes and the rest of the day working under the guidance of supervisors. At first welders were in training for about twelve weeks, but training programs were shortened – to eight, five, and three weeks – as the war progressed and the labor shortage became more acute.[365]

Public schools played an important supporting role for the training of wartime shipyard workers. This was especially true for new Maritime Commission yards on the Gulf and West Coasts. These new yards, lacking a strong nucleus of skilled workers, at first relied almost completely on public schools for basic training. Sidney Hillman, Director of the Labor Division of the Office of Production Management during the war, coordinated federal agencies for training shipyard and other defense workers. The President also directed him "to undertake full responsibility of getting the necessary workers into the industries claiming manpower shortages."[366]

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[362] John Shinn, "Who's Who Among the Painters of the World's Best Submarines," n.p. (San Francisco, [1945?]), 9, on file, San Francisco Public Library History Room, San Francisco Public Library; C. C. Bloch to W. M. Laughton, December, 1944.
[363] Shinn, "Who's Who Among the Painters."
[364] Newman, "Employing Women in Shipyards," (1944), 2; Lane, *Ships for Victory*, 258-259.
[365] The manual was: Shipbuilding Division, Bethlehem Steel Co., *An Introduction to Shipbuilding*, (Washington, 1942). Bethlehem Steel Corp., "A Century of Progress," p. 7; Lane, *Ships for Victory*, 259-260.
[366] In June of 1940 the U. S. Office of Education began financial support for public school training programs for shipyard and other defense workers. During the war, as competition for workers grew more intense, shipyards established

Shipyard Labor Force Expansion
Geographers Michael Lindberg and Daniel Todd argue that the persistent shortage of labor in American shipbuilding and other defense industries was the single most significant threat to wartime production, even more serious than the shortage of raw materials or equipment.[367] The massive recruitment of shipyard labor during World War II, just one facet of the nation's overall mobilization for defense work, succeeded in spite of critical labor shortages.

The Great Depression created a glut of unemployed workers who found positions in the shipbuilding industry from the late 1930s through 1941. Only three percent of them had previous shipbuilding experience, underscoring how massive the expansion of the shipbuilding was at this time. Critical labor shortages began in late 1942, with the start of production at many new shipyards adding to the demand posed by expansion of pre-war yards. The shortage continued into the peak war production period in 1943, recurring in late 1944 and early 1945. The loss of skilled workers to the military, through both enlistments and the draft, had a particularly significant impact on the labor market because it was a one-way movement that represented a decline in the overall labor force. Shipyards competed for labor with each other and with other defense industries, particularly the aircraft industry, which required similar skills. Many skilled workers, especially in California and the Pacific Northwest, shifted between shipyards and aircraft plants during the war, based on demand and wage rates.[368]

Despite these labor challenges, shipbuilding was the leading U. S. employer of all nonagricultural industries from 1943-1945, employing almost 80 percent of all workers in heavy industry. After a precipitous decline in shipbuilding employment during the 1930s, almost two million new shipyard workers were hired during World War II. World War I shipbuilding employment peaked in 1919 at 387,000, sank to a four-decade low of 34,000 in 1933, and rebounded to 120,000 by 1939, including 6,000 in the San Francisco Bay Area. By

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"vestibule schools" for training new hires. Shipyards also developed partnerships with schools to offer supplementary training for workers seeking new skills or promotion; supplementary training was usually conducted in shipyard training areas. For shipbuilding, 436,930 were enrolled by the public schools in pre-employment courses, and 970,056 in supplementary courses. Federal agencies that trained shipyard workers included not only the Office of Production Management, but also the Works Progress Administration, National Youth Administration, Apprentice Training Service of the Department of Labor. Lane, *Ships for Victory*, 261-262.

[368] Since shipbuilding was considered an "essential industry" by the federal government, draft-age men working in shipyards were sometimes eligible for six-month draft deferments. During peak production years, 1942-1943, many deferments were granted. By 1945 Allied victories led to a decline in the demand for ships, draft boards gave fewer deferments, and the draft had a major impact on the shipbuilding labor force nationwide. Joseph Wright Powell, special assistant to the Secretary of the Navy, found that the loss of skilled workers to the military during the last year of the war and the substitution of fewer skilled workers resulted in reduced production levels and increased costs. The maritime journal *The Log* emphasized the impact of military enlistments and the draft on Bay Area shipyards in 1943: "For months past *The Log*, as the result of expressions of great concern by Pacific Coast shipbuilders, has constantly drawn attention to the danger of continuous withdrawals of trained technicians from the shipyards by the Draft Boards. To give some conception of what these withdrawals have meant *The Log* quotes what has happened in some of the leading West Coast yards: Bethlehem Steel, San Francisco. Period: December, 1941, to February, 1943. Drafted 2,422. Enlisted, 2,943. Moore Dry Dock, Oakland, Period, Pearl Harbor to December, 1942, Drafted, about 4,000, Enlisted, about 4,000." Lindberg and Todd, *Anglo-American Shipbuilding*, 161-163; Wollenberg, *Marinship at War*, 43; Powell, "Labor in Shipbuilding," 163, 290; "Shipyards Face Serious Labor Problem," *The Log*, 38 (May, 1943), 47.

1943-1944 the number of American workers employed in all private shipyards was about 1,400,000, and navy yards employed over 300,000. The Bay Area had 244,000 shipyard workers, forty times the number in 1939. Bethlehem counted more than 25,000 employees in the Bay Area at peak employment in 1943.[369]

Labor Recruitment and Wartime Migrations

Wartime labor shortages raised alarms at the highest levels of government. The Director of the Maritime Commission, Admiral Emory Scott Land, tried to get the federal government to play a greater role in recruitment by proposing an involuntary labor draft for shipbuilding and other defense industries, but the proposal was defeated by protests from labor unions and civil liberties organizations. Shipyard employers and union labor offices retained primary responsibility for recruitment and hiring of wartime workers. The U. S. Employment Service, with offices in each district, helped direct workers to shipyards that were hiring, and apportioned workers among the various defense industries.[370]

Recruitment efforts changed dramatically over the course of the war, as did the composition of the labor force. As a national firm, Bethlehem had a recruiting advantage at first. During the buildup to war UIW's Assistant General Manager, W. Miller Laughton, toured Bethlehem shipyards around the country to recruit skilled workers for UIW's naval construction program, literally hiring men off staging areas.[371] As the wartime labor shortage grew more acute in 1942, however, Bethlehem, Kaiser, and many other large shipbuilding firms developed national recruitment programs. They targeted people from areas with labor surplus, such as the rural South and the Midwest, to work in regions with acute labor shortages such as the West and Gulf Coasts, which had the largest and most rapid expansion of shipyards.[372]

Labor shortages during the Second World War were so acute and prolonged that by late 1942 the shipyard labor market expanded to include production workers never seriously considered by most shipbuilders before the war: Women and African Americans are the most famous newcomers to Bay Area shipyards, but migrants from Oklahoma ("Okies"), high school students, and elderly and disabled workers joined the ranks as well. Katherine Archibald, a UC Berkeley graduate student in sociology who worked as a steamfitter at Moore Dry Dock in Oakland from 1942-1944, recalled that "multitudes came to the shipyards. And the shipyards absorbed them all. Color, age, sex, soundness of limb did not matter; whoever could walk or lift a welder's

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[369] Joseph Wright Powell, a former naval constructor and general manager of Fore River Shipbuilding Company, was named vice-president of Bethlehem Shipbuilding in charge of new construction in 1917. During World War II he served as special assistant to the secretary of the navy on new warship construction and served on the Shipbuilding Stabilization Committee. Powell, "Labor in Shipbuilding," 284-285; Palmer, *Organizing the Shipyards,* 7; *San Francisco Daily Commercial News*, December 30, 1943, Bethlehem Steel Shipbuilding Company, San Francisco Yard, Scrapbook 109, J. Porter Shaw Library.

[370] Wollenberg, *Marinship at War*, 41; Powell, "Labor in Shipbuilding," 290.

[371] According to a retired naval officer, Ens. Clifford H. Hollander, "One workman recalls standing on a staging, working on overhead cables in a ship in the Bethlehem Quincy Yard, when he chanced to look down and saw a well-dressed gentleman with a flower in lapel looking up at him and observing him while at work. The gentleman [W. Miller Laughton] talked to him for awhile and then asked him if he would like to come to San Francisco to work for the San Francisco Yard. The workman said he would and was immediately transferred to San Francisco under contractHollander, "Bethlehem's San Francisco Yard," 20.

[372] Lindberg and Todd, *Anglo-American Shipbuilding*, 161-162; Eric Arnesen and Alex Lichtenstein, "Introduction," in Katherine Archibald, *Wartime Shipyard* (Urbana, 2006), xv.

stinger was welcomed."[373] Marinship once counted more than half of the San Francisco Symphony, a crew of Australian men who were waiting for their own ship to be repaired, and inmates from nearby San Quentin Prison, "including," notes Charles Wollenberg, "a bank robber whose expertise with explosives was particularly useful during the yard's initial construction."[374]

The eight million people who moved to the Pacific Coast were part of what historian David Kennedy calls a "great wartime demographic reshuffling." Nationwide, one fifth of the country's population left home for defense work or military service during the four years of the war. 500,000 new migrants arrived in the San Francisco Bay Area from 1941-1945, a population increase of about 30 percent. In 1945, *San Francisco Chronicle* reporter, Morton Silverman, dubbed this regional demographic change, economic boom, and geographical transformation "The Second Gold Rush." [375]

One of the most profound and lasting impacts of this great migration was an increase in the regional black population. Migrants from the rural South created what Charles Wollenberg calls "a new black frontier." While African Americans from the rural South moved to other cities of the North and West, the demographic shift in the San Francisco Bay Area was particularly phenomenal. The African American population increased from fewer than 20,000 in 1940 to greater than 60,000 in 1945; it quadrupled in San Francisco, grew by ten times in Richmond and Vallejo, and by 700 times in Marin County. "By 1945," Wollenberg states, "blacks had replaced Asians as the Bay Area's largest non-white minority."[376] The brunt of racial discrimination in the San Francisco Bay Area, so long targeted towards Asians, shifted toward blacks as well. Despite facing discrimination on the job and in the communities where they lived, often in temporary war housing projects, many of the African American war migrants stayed on as residents after the war was over, permanently altering the racial composition of cities in the San Francisco Bay Area and other regions of the country.

The Wartime Innovation of Women's Shipyard Employment

Shipyards began to hire women in the spring and summer of 1942. By 1943 there were 160,000 women shipyard production workers, and by 1944 women comprised ten to twenty percent of the nation's shipyard labor force doing almost 200 different jobs in both commercial and navy shipyards. As Dorothy Newman wrote, "Times have changed with lightning speed."[377] According to Charles Wollenberg, the San Francisco Bay Area and greater Pacific Coast "led the way. While Pacific Coast firms employed 36 percent of all shipyard labor by the end of 1944, they were responsible for 55 percent of the nation's female shipbuilders."[378]

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[373] Archibald, *Wartime Shipyard* (Berkeley, 1947), 2.
[374] Wollenberg, *Marinship at War*, 42-43.
[375]David M. Kennedy, *The American People in World War II: Freedom From Fear, Part Two* (New York, 1999), xiv,322-323; Wollenberg, *Maringship at War*, 2.; Johnson, "Wartime Shipyards," 89; Morton Silverman, "The Second Gold Rush Hits the West," San *Francisco Chronicle,* April 25-May 20, 1943.
[376] Wollenberg, *Marinship at War*, 70-71.
[377] Newman, "Employing Women in Shipyards," (1944), 1.
[378] The tens of thousands of women employed by shipyards during the war were part of a tremendous national expansion of the female labor force, which increased by six million, or 50 percent. Although a majority of women working in shipyards and other defense industries were wage earners before the war, new job opportunities enabled many to switch from low-paying "women's work" in the service sector to production jobs in heavy industry that paid 40 percent more. Ibid., 1, 18; Wollenberg, *Marinship at War,* 59-60.

While most women shipyard production workers were not hired until the spring and summer of 1942 during a period of acute labor shortages, UIW began hiring women welders as early as 1941. Agnes Cecelia Hummell Meeks worked as a welder building new ships at UIW from 1941-1944. Her sister and sister-in-law, Josephine Gaines and Billie Meeks, also worked as welders, while her husband Raleigh Meeks was a shipwright at UIW working on conversion of cruise ships for the Navy. Agnes Meeks worked during the day and her husband worked the swing shift so that they could take turns caring for their two young sons. She and her family had moved to California from Kentucky in 1941 during the build-up to war. They were living in San Francisco and already working at UIW when the Japanese bombed Pearl Harbor in December 1941. Agnes Meeks recalled, "We were both scared and angry. Living there on the coast in that large city that had military bases, defense plants, and factories that produced materials for the war effort, caused us to be frightened for the safety of our young sons…so we felt the strong need to continue to work there to help defend our country."[379]

Dorothy Newman characterized the employment of women in shipyard production jobs as a measure of desperation, undertaken at the last minute, with little preparation. Shipyard managements "plunged headlong" into hiring women, defying centuries of tradition with a rapidity "that was nothing less than daring in an industry so bound in the tradition of dirt, sweat, and rough and tumble, so thoroughly male that any woman who ventured into a yard was greeted with hooting and whistling."[380] In response, President Roosevelt urged Admiral Land, head of the Maritime Commission, to make women welcome in wartime shipyards through planning of new amenities – cafeterias, rest rooms, toilets, wash rooms, and locker rooms. Women's rest rooms were designed for World War II-era warehouses and shops at Pier 70 and other shipyards throughout the country. Still, Newman argued, such amenities and were "as nothing compared with the mental hurdles" women faced.[381]

The story of Mary Ann Cox, a young woman who worked as a helper on a riveting gang at UIW in 1943, illustrates the complex gender dynamics at shipyards. Cox encountered a paternalist environment in many respects. Two of her male co-workers offered to pay her union dues so that she could save money out of her $25 per week salary. When one of the men later bought her a diamond ring, Cox's supervisor advised her not to accept the gift, warning that her co-worker would expect a shipyard romance in return for the ring. He further protected Cox from potentially inappropriate advances by transferring her to an office job. While well-intentioned, the supervisor's actions reveal an overall conservative understanding of the place of women at a shipyard. Still, Cox still spent plenty of time around the ships, delivering supply slips from the shops to the ships. She joined the Boiler Makers Union too – and paid her own dues.[382]

Demand for female labor force some unions to change age-old traditions, for the closed shop clause of the Pacific Coast Master Agreement required all production workers in AFL yards to have union membership as a condition of employment. In July 1942, women welders from Marinship staged a demonstration at the headquarters of the San Francisco local of the AFL Boilermakers Union, the largest shipbuilding union on the

[379] Agnes Meeks, "Biography Form," Rosie the Riveter World War II Home Front National Historical Park, July 26, 2004.
[380] Newman, "Employing Women in Shipyards," (1944), 3.
[381] A survey conducted by the Women's Bureau found women's facilities inadequate and often located far from the ships where many women were working. Ibid., 3, 55-57; Bethlehem Steel Co. Shipbuilding Division, "Plan, San Francisco Yard," May 1944, Sheet 28.
[382] Mary Ann Cox, interview with Marjorie Dobkin, February 22, 2007.

West Coast, to protest its continued refusal to admit women. Two months later, in September 1942, the Boilermakers' executive council finally capitulated, but the union made clear in its resolution to amend the constitution that female membership represented a temporary wartime measure.[383]

Women found new opportunities in wartime shipyards, but they also encountered discrimination in job placement and promotion. Women production workers were usually assigned as shipyard welders not only because it was the largest shipyard craft with the greatest demand for workers, but also because welding and prefabrication were considered light work suitable for women, who were not deemed to have mechanical minds and who might find welding akin to sewing. By late 1943, about one fourth of all women production workers were welders, but by then women had also branched out into work as laborers, electricians, and then into almost every shipbuilding craft. [384]

Similarly, women gradually gained greater independence and wider access to the wartime shipyard. Katherine Archibald described the shift at Marinship. At first, "Men were amazed. Groups would gather about a lone girl welder and stare at her and her handiwork as at a circus freak. For their work at welding plates, the women were put at first in open sheds 'where everybody could keep an eye on them.' Not until the fall [of 1942) were they permitted on the hulls as workers, and even then they were stationed only on the top decks." By the spring of 1943, the novelty of women's shipyard production work had worn off, and women had become "a stable and inevitable factor in the economy of the war-time shipyard."[385]

African American Shipyard Workers

African Americans had few opportunities for employment during the early years of the prewar shipbuilding expansion. Both employers and labor unions, including leading AFL Metal Trades unions such as the Boilermakers and Machinists, excluded blacks from shipyard production work. Economist Herbert Northrup pointed out that the racial policies of three large AFL Metal Trades unions – Machinists, Electrical Workers, and Plumbers and Steamfitters – had not altered since World War I. "The first still excludes Negroes by a provision in its ritual; the latter two have no stipulation in their bylaws but do likewise by tacit consent."[386]

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[383] Ibid., 24-25; Kesselman, *Fleeting Opportunities*, 17; Wollenberg, *Marinship at War,* 61-62.

[384] Considerable evidence exposes discrimination against women in shipyard promotions during the war. For example, Kay Davis, at Marinship, was the only woman shipyard production foreman in the whole country. The Women's Bureau survey of 35 shipyards found that most women were simply denied promotion; others were working as skilled craft workers or group leaders but classed as helpers at lower wage rates. The survey found "resistance on the part of foremen, management, or the unions to allowing women equal opportunity with men for supplementary training, upgrading, and supervisory work." By 1944, Dorothy K. Newman could write, "Among the most common occupations for women in the shipyards at the present time are welding, gas burning (acetylene burner operator), helping shipfitters, painting, tending toolcribs, operating machine tools, sheet-metal fabrication and assembly, and bench and assembly work, especially on electrical equipment. Of special importance is the large proportion of women recorded as welding, burning, riveting fabricating, drafting, and working in the mold loft as participants in shipfitting operations." Newman, "Employing Women in Shipyards," (1944), 20-21, 33-35; Archibald, *Wartime Shipyard*, 15, 38; Wollenberg, *Marinship at War,* 63-64.

[385] Archibald, *Wartime Shipyard*, 16.

[386] Herbert Northrup contends that during World War II African Americans fared best at East Coast shipyards between New York and Wilmington, North Carolina, due in large part to the work of the IUMSWA and the CIO. IUMSWA, founded in 1933, had racially integrated locals from its inception. Fred Stripp, "The Treatment of Negro-American Workers by the AFL and the CIO in the San Francisco Bay Area," *Social Forces*, 28 (March 1950), 332; Northrup, "Negroes in a War Industry," 163, 166, 172.

Many other defense industries and government agencies practiced similar policies of racial exclusion; before the war, African Americans comprised ten percent of the national population, but just three percent of workers in all defense industries.[387] As it did for women, wartime labor shortages forced the shipbuilding industry to open employment to African Americans. And although UIW did not see as dramatic a rise in the number of African Americans employed at the San Francisco shipyard as did Marinship or Kaiser, it too played a role in this pivotal moment of African American history and the history of the San Francisco Bay Area.

A. Philip Randolph, president of the Brotherhood of Sleeping Car Porters union, organized a national protest – a 1941 March on Washington Movement – to pressure the federal government to outlaw racial discrimination. The prospect of what Randolph called a "thundering march" of as many as 250,000 black people in the nation's capital, "to wake up and shock white America as it has never been shocked before," convinced President Roosevelt to take action. Just before the march was to take place, Roosevelt declared his intention to issue an executive order banning discrimination. The march was then cancelled. On June 25, 1941, Roosevelt signed Executive Order 8802, creating a Fair Employment Practices Committee (FEPC) to ban racial discrimination in government hiring, including any defense industry with government contracts. The order gave the FEPC the power to investigate complaints and take action against discrimination; however, historian Marilyn Johnson describes the FEPC as a "toothless agency," since it lacked full regulatory power over private employers or labor unions. In 1943, after mounting evidence of the defense industry's reluctance to comply with the executive order, Roosevelt increased the budget and staff of the agency.[388]

CIO Machinists Local 1304 in the East Bay initially resisted integration, but it became one of the first skilled craft unions in the Bay Area to admit black workers. Since most West Coast shipyards were affiliated with the AFL, however, the CIO's action did not have a significant regional impact. Indeed, West Coast shipyards employed almost no black workers at all before regional labor shortages worsened in February 1942. According to C. L. Dellums, Pacific Coast head of the Brotherhood of Sleeping Car Porters as well as a leader of the Northern California National Association for the Advancement of Colored People (NAACP), all Bay Area shipyards counted just one black employee between them when the FEPC was established. While shipyard employers blamed unions and closed shop agreements for racist hiring policies, Dellums was convinced that shipyard employers bore primary responsibility. The FEPC generally agreed. Still, Dellums had no love for the San Francisco machinists' union, referring to their local, Lodge 68 of the International Association of Machinists (IAM), "that lousy organization."[389]

The story of Charles Sullivan, a skilled machinist and an African American, helps to explain Dellums' criticism of the San Francisco Machinists' Union. UIW offered Sullivan employment in September 1941. The sincerity of UIW's job offer to Charles Sullivan is open to question, since UIW managers were well aware of the machinists' union policy and, according to Richard Boyden, "knew the outcome would be negative for

[387] "FEPC," Eleanor Roosevelt National Historic Site, National Park Service, http://www.nps.gov/archive/elro/glossary/fepc.htm, accessed May 16, 2008.
[388] Ibid.; Johnson, "Wartime Shipyards," 100.
[389] C. L. Dellums was also uncle of Oakland Mayor (in 2008) and former Congressman Ron Dellums. Richard Boyden, "Breaking the Color Bar in Wartime Bay Area Shipyards, 1941-1942" (February 1992), 5-6, 8-12; Johnson, "Wartime Shipyards," 101; Northrup, "Negroes in a War Industry," 165.

Sullivan."[390] Regardless, Charles Sullivan did eventually get his job at UIW, with the help of the FEPC, the regional office of the NAACP, and President Roosevelt. During the year-long campaign, Charles Sullivan's case became a "cause célèbre."[391]

According to the closed shop clause of the Pacific Coast Master Agreement, Sullivan, like all other prospective employees, had to present evidence of union membership before being hired; however, San Francisco Lodge 68 of the International Association of Machinists "had been an exclusively white union with a policy of racial exclusion since the union's was first organized during the San Francisco metal trades strike of 1885." It refused to admit Sullivan as a member, telling him that there were no new openings because some members were unemployed and seeking work. The union later tried to blame UIW for barring Sullivan's employment. Lodge 68 leaders claimed that UIW machinists refused to work with Sullivan, but UIW machinists later voted 59 to 3 in favor of allowing Sullivan to work in their shop.[392]

Sullivan took his case to the FEPC, which had succeeded in placing a few black workers in East Bay shipyards. Lodge 68 officials refused to attend FEPC hearings on Sullivan's case in 1941. It took a public appeal from President Roosevelt himself, in July 1942, to obtain a machinists' union clearance for Sullivan that would enable him to take the job offered by UIW. Even then, Lodge 68 did not give Sullivan union membership. The IAM at both the national and local levels refused membership to non-whites throughout the war. A separate system was created for Sullivan and hundreds of other black machinists who worked at UIW and other San Francisco yards and shops. They were given work permits rather than union memberships, and were required to pay for the permits in monthly installments that added up to the same cost as a full membership. This system insured that blacks remain excluded from unions and, therefore, shipyard jobs once the wartime emergency ended. In 1948 most machinists' locals in the San Francisco Bay Area admitted blacks, "despite the exclusion clause in the lodge ritual." Local 68 did not.[393]

Training and Promotion of Black Shipyard Workers

In September 1942 African Americans were ten percent of the national population, but only 5.5 percent of the nation's 1,200,000 shipyard workers. By March 1943, the percentage of African Americans had risen to 8.4 of all shipyard workers and 9.2 percent in the larger yards employing at least 5,000. Black shipyard workers found that overcoming discrimination in the hiring process was just the first of many hurdles in shipyard employment; like women, they were also subject to discrimination in job placement and promotion. Marilyn Johnson argues that occupational and cultural stereotypes influenced the channeling of black workers into hard outdoor hull assembly work during the war. Herbert Northrup's study of African American shipyard workers in World War II found that they were "confined to unskilled occupations." In the Bay Area, too, Katherine Archibald observed that African Americans at Moore Dry Dock were "mainly employed for

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[390] Boyden's research on the Sullivan case at UIW was based on FEPC files. Bethlehem records on the case are apparently unavailable. Richard Boyden, communication with Marjorie Dobkin, April 18, 2008.
[391] Boyden, "Breaking the Color Bar," 1, 6, 11.
[392] On many other issues, Machinists' Lodge 68, which had shown great courage and determination in leading the May 1941 shipyard strike in the San Francisco Bay Area, was "radically democratic." "In 1934," states Richard Boyden, "they were the first of the old-line AFL unions to advocate a general strike in support of the longshoremen. During the Second World War, they were one of the few shipyard unions to maintain a staunch defense of wages and working conditions. They also maintained deeply ingrained traditions of racial prejudice and exclusion." Ibid., 1-2, 11-12. Ibid., 11-12.
[393] Ibid., 12; Northrup, "Negroes in a War Industry," 166; Stripp, "Treatment of Negro-American Workers," 31.

relatively unskilled labor," although she noted that some black workers participated in every major shipbuilding trade, "except steamfitting and pipefitting, from which union regulations excluded them."[394]

Management, unions, and government financed training programs colluded to exclude non-whites from the skilled trades. Federally funded defense training schools provided a pipeline to shipyard work for many newcomers during the war, but relatively rarely for black trainees. Training schools would not recommend blacks for jobs, and shipyards would not hire them. Whereas twenty percent of black shipyard workers were skilled during World War I, only 3.1 percent of black shipyard workers performed skilled jobs in 1942. Herbert Northrup attributes this decline to better training and upgrading opportunities for blacks in World War I.[395]

The vast majority of African American shipyard employees in the San Francisco Bay Area worked as laborers rather than as skilled craftsmen, regardless of their qualifications. For example, Boilermakers Local 6 told Lulden Love, a laborer at UIW, that the union did not accept black members. This policy prevented Love from securing a promotion to skilled work as a chipper and caulker in 1942. In testimony before the FEPC, both the Boilermakers' union and UIW management denied responsibility for discrimination against Love or other black workers but, as Richard Boyden argues, "It is safe to assume that the numbers of non-white first class mechanics in most trades at this and other Bay Area shipyards was very small."[396]

Black women faced even greater obstacles to skilled trades than black men. Even in shipbuilding regions employing significant numbers of African Americans, black women worked as laborers, sweepers, and cleaners. A U. S. Department of Labor Women's Bureau study found that only 14 of 32 shipyards in the survey employed black women as shipyard production workers, such as welders and machine operators. Seven of the fourteen were U. S. Navy Yards. The survey bulletin argued that African American women should be treated on an equal basis with white women and noted that at those shipyards where black and white men and women worked side by side, they did so "with no apparent difficulty."[397]

Layoffs of Women and African Americans

Former journeyman welder, Priscilla Shelton puts UIW's role in this context of race, gender, and wartime production. Mrs. Shelton is an 89-year old African American woman who attended high school in San Francisco before the war. While her husband and three brothers were serving in the Army, Priscilla Shelton decided to "help the soldiers" by working on the home front. She trained for six weeks to learn shipyard welding and then worked as a welder at UIW for a whole year without taking a single day off. "We had to go down in the double bottom of the ship and weld down there, and we had to pull our own heavy line and machine. I loved it, it was different. It got me away from cooking and cleaning. I was doing men's work and I thought it was easy." In many ways, Priscilla Shelton's story is an exception to the general rule; she recalls that most of the women she knew at the yard worked as maid staff and cleaners, including her sister-in-law,

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[394] Johnson, "Wartime Shipyards," 92; Northrup, "Negroes in a War Industry," 162-164; Archibald, *Wartime Shipyard*, 61.
[395] Boyden, "Breaking the Color Bar," 7, 13-14; Northrup, "Negroes in a War Industry," 162.
[396] Boyden, "Breaking the Color Bar," 12-13.
[397] Kesselman, *Fleeting Opportunities,* 41-42; Newman, "Employing Women in Shipyards," (1944), 16.

Drucilla Cook. Like most women, however, Priscilla Shelton found herself unemployed despite her hard work in late 1944. "Our boss informed us that they didn't need the ladies any more."[398]

Wartime introduction of women and African Americans to shipyards and other defense industries proved short-lived indeed. The mammoth wartime shipbuilding program that had lasted almost seven years began to decline in early 1945, as the U. S. Navy cancelled ship orders after the victory of Allied forces in Europe. More than 170 large naval ship contracts were cancelled in the first few months after Japan's surrender in August 1945. The impact on the nation's shipbuilding labor force was abrupt and dramatic. According to Michael Lindberg and Daniel Todd, "As shipyard workers…left the yards in droves and the Navy began canceling orders, the shipyards scaled back their operational levels. Shifts were reduced dramatically, overtime ended and the necessity to employ women and African Americans had vanished and thus their fates were sealed." [399]

Women faced disproportionate and discriminatory layoffs and pay reductions toward the end of the war, leading Katherine Archibald to comment, "Masculine hopes for total exclusion of the intruding group were well on the way to fulfillment." Archibald predicted a rapid return to tradition in both women's employment patterns and gender relations. She lamented, "Still beyond the horizon was the day when a woman might be trained as an electrician or a welder and might confidently expect equal consideration with a man on the basis of capacity alone."[400]

Black workers faced a similar fate. It was, Charles Wollenberg notes, "a classic case of 'last hired first fired.'" In July 1945, 20,000 blacks worked at shipyards in the San Francisco Bay Area. Two months later that number declined to 12,000, and, by May 1946, had declined to an "insignificant number." Specific figures for UIW are not readily available. Despite little opportunity for skilled industrial work, and rising unemployment, about 85 percent of black migrants to San Francisco remained after the war was over. Similarly, writes Marilyn Johnson. "Although unions and shipyards soon disposed of these workers, East Bay cities were burdened with thousands of unemployed, ill-housed newcomers after the war."[401]

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[398] Priscilla Shelton, "Biography Form," Rosie the Riveter/World War II Home Front National Historical Park, March 22, 2004; Priscilla Shelton, Interview with Marjorie Dobkin, February 23, 2007.
[399] Lindberg and Todd, *Anglo-American Shipbuilding,* 200.
[400] At Marinship, women made up 20 percent or more of the production work force from the fall of 1943 through the end of 1944. By July 1945, however, only 940 female craft workers remained out of a total production work force of 7,200. By August 31, Marinship employed only 538 women in the crafts. Charles Wollenberg writes, "In spite of these overall numerical gains, the employment gender gap reappeared in the postwar era. The bulk of jobs lost to women after the war were well-paying industrial positions. In California, for example, 145,000 women were working as production workers in October 1944; one year later, the figure was only 37,000. Women were increasingly forced back into low-paying service and clerical jobs. In 1946 the Women's Bureau found that 75 percent of former female war workers were still in the labor market, but the majority had suffered significant income declines. Seventy percent of jobs available for women by June 1946 paid less than 65 cents per hour, while only 40 percent of jobs available for men paid that little. The gap between male and female wages grew in the immediate postwar years until it exceeded even that of the late 1930s. In 1939 the average woman worker earned 62 percent of that earned by the average man; by 1950 the figure was 53 percent." Archibald, *Wartime Shipyard*, 29-30, 38-39; Wollenberg, *Marinship at War,* 68.
[401] According to Charles Wollenberg, San Francisco's black population had grown to over 40,000 by 1950. By 1960 it was nearly 75,000. "During the war about 75 percent of San Francisco black heads of households were classified as skilled industrial workers, the great majority of them in the shipyards. In 1948 only about 25 percent of black workers were still in industrial jobs, while over half were employed as unskilled laborers or service workers. More than 15

Post War Period
Within a year or two of the end of the war, almost all of the wartime "instant shipyards" began to close. Many pre-war old line shipyards also closed or were sold off soon after the war, including the Cramp shipyard in Philadelphia. Lindberg and Todd note that "Almost overnight, the American shipbuilding industry lost no fewer than 25 shipyards from its rolls." [402] Federal government goals for reduction of national shipyard employment from a wartime peak of 1,700,000, to 300,000 by the spring of 1946. Marinship in Sausalito formally closed in May 1946, and the federal Surplus Property Administration (SPA) scheduled sales of the government properties of Marinship and the four Kaiser Richmond shipyards. In contrast to this bleak forecast for the shipbuilding industry regionally and nationwide, UIW and two yards in Alameda (General Engineering and United Engineering) learned that their Navy programs were scheduled to continue for the time being, and the Maritime Commission was to retain Bethlehem Alameda.[403]

UIW and a few other San Francisco Bay Area shipyards continued to thrive after the war. In April 1947, *Pacific Marine Review* published the results of a survey designed to dispel constant rumors that "Pacific Coast shipbuilding is dead, that all the re-conversion work is going to the Atlantic Coast yards." It found several Bay Area yards busy with repair and re-conversion work: Bethlehem Alameda employed 3300 men and was building two large passenger ships, Moore Dry Dock employed 1500, and UIW employed 3200.[404] F. Conlin, advertised UIW's postwar vitality when he published an article in *Pacific Marine Review* describing how UIW machinists "overhauled a section of one of the larger crankshafts ever to come into any West Coast machine shop." The 96-ton crankshaft was from the M/S *Poelau Laut*, a 535-foot combination freight and passenger vessel built in Amsterdam in 1929. [405] Workers at Pier 70 also reconverted Army transport ships into combination cargo-passenger vessels.[406] The maritime journal *Argonaut* offered an optimistic forecast for UIW in the postwar period. "Backed by almost a century of shipbuilding experience, staffed by experienced experts in all crafts, and equipped with machinery and facilities virtually unequalled on the Pacific Coast, Bethlehem's San Francisco yard faces the future confidently and with its hopes high." [407]

As a postwar global power the U. S. made a transition from a peacetime shipbuilding decline to a Cold War program of steady naval shipbuilding. Navy buildups occurred in the 1950s (Korean War) 1960s (Vietnam War) and 1980s (President Reagan's "600 ship navy"), but the nation's naval program was concentrated in an ever smaller group of shipbuilders. [408] Bethlehem gradually reduced shipbuilding operations by selling or closing its shipyards throughout the country. In 1982 Bethlehem sold the venerable Pier 70 shipyard to the City and County of San Francisco, Port Authority, for $1.00. Since 1982 the Port of San Francisco has leased Pier 70 to a number of different shipbuilding firms, including Todd Shipyards and San Francisco Dry Dock. The yard has not engaged in new naval construction for some time, but BAE Systems still operates Pier 70 as

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percent of Bay Area black men were unemployed in 1948, nearly three times the state-wide rate for all persons." Wollenberg, *Marinship at War, 82*-83; Johnson, "Wartime Shipyards," 102.
[402] Ibid.
[403] "Disposal of Shipyards," *San Francisco Chronicle*, February 6, 1946, p. 1/7.
[404] "San Francisco Bay Shipyards," *Pacific Marine Review*, 44 (April 1947), 93.
[405] F. Conlin, "Bethlehem Overhauls Largest Crankshaft," *Pacific Marine Review*, 43 (September 1946), 54.
[406] Bethlehem Steel Corp., "A Century of Progress," 8.
[407] "History of the San Francisco Yard," *Argonaut*, 11.
[408] Lindberg and Todd, *Anglo-American Shipbuilding*, 201-202.

a repair yard, a remarkable feat of survival that highlights the historic district's unique status as the nation's longest continuously operating shipyard.

Criterion C: Industrial Architecture and Design

The Union Iron Works/Bethlehem Steel Shipyard is significant under Criterion C at the national level as a district that represents a distinctive and exceptional entity, and that illustrates important trends in industrial architecture from 1884 to 1945. The complex displays the changes that industrial architecture in general, and shipyard buildings in particular, underwent during the district's 61-year period of significance. This section will examine the functional and aesthetic forces that determined the appearance of the buildings, the layout of the yard, and how these forces related to the larger national context of factory design from 1880 to 1945.

Union Iron Works/Bethlehem Steel Shipyard's built environment subdivides into three periods, each corresponding to larger national trends in industrial architecture. The first period, from 1883 to 1900, includes the first Union Iron Works buildings at Potrero Point: heavy, unreinforced masonry buildings in the American round-arched style, and the first architect-designed office building. Architecture from the second period, from 1900 to 1918, exhibits experimentation with new construction technologies, including reinforced concrete and structural steel frames. Additional architect-designed buildings were also erected at this time. They reflect the architectural and physical separation of management from labor. The final period, from 1936 to 1945, includes the construction boom leading up to, and during WWII, primarily involving steel-framed buildings with corrugated iron cladding.

Beginnings: Pre-1880 Industrial Architecture

The earliest factory buildings in the United States were textile mills, built of wood. Before engineers could accurately calculate forces acting on structures, builders relied on construction methods and materials based on tradition. The easy workability and high tensile strength of wood offered economic advantages in construction, while the flexibility of wood-framed buildings helped lessen the effects of machinery vibration. Drawbacks of wood construction include its flammability and limited strength. Although builders used wood siding on factories in sparsely populated areas throughout the nineteenth century, urban fire codes prohibited it in cities. As large timbers became more expensive, builders turned to alternative construction methods.[409]

The evolution from wood to iron to steel in ship construction paralleled a similar evolution in the use of materials in industrial building design and construction. Design changed from vernacular to engineered, buildings became more specialized, and materials more durable. Prior to the 1840s, common industrial buildings included gristmills, sawmills, and blacksmith shops – necessary components of every American community. Knowledge of the construction and operation of such structures formed the "common engineering knowledge" upon which builders could draw for the construction of larger industrial buildings.[410]

As manufacturing became more complex, the increasing scale and complexity of industrial operations required a degree of specialization and detailed construction knowledge offered only by professionals. Owners sought engineers, with specialized knowledge of both construction and manufacturing processes, to design their industrial buildings. Industrial engineering became a profession by the turn of the century; this new subfield concerned itself with labor, management, factory operation and efficiency, and the design and

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[409] Betsey Hunter Bradley, *The Works* (New York: Oxford University Press, 1999) 133-134.
[410] Bradley, *The Works*, 16. "Common engineering knowledge" is a term coined by historian John Stilgoe, referring to customary American building practices.

construction of new industrial buildings. It was only after the turn of the twentieth century that architects were commonly involved in the design of new industrial buildings.[411]

1883-1896: Late Nineteenth-Century Industrial Architecture

The earliest buildings at the UIW Shipyard, built of heavy brick masonry and designed by a civil engineer, reflect several national trends in industrial architecture at this time (Figure 5). First, the yard itself is typical of late-nineteenth century factory layouts. The buildings incorporate form-giving functional elements standard to industrial buildings of the period. They are representative of at least two of the three industrial building types of the day: the production shed and the loft. Stylistically, all of these buildings exemplify the American round-arched style, a style brought to the United States by German immigrants during the 1840s (see “Style” discussion, below).

Layout

The initial development of Union Iron Works consisted of six main buildings and a wharf.[412] The machine (Building 113), erecting, and smith shops and the pattern house stood south of 20th Street. North of 20th Street, along the shoreline, stood the ship assembly area - plate shop, slip way, wet basin, and wharves. The dispersal of various functions into separate buildings, and the distance between buildings, was typical of industrial sites in general in this period.

During most of the late nineteenth century, factory layouts were confined by pre-electric power distribution systems and material handling systems that necessitated limited space between buildings. These restrictions also had to be balanced by the need for fire separation, daylight and ventilation.[413]

Before the widespread use of electricity, power distribution in industrial complexes came from a series of shafts or cables rotated by a centralized steam engine. These spinning shafts and belts, called millwork, penetrated into the different buildings. Instead of individual motors, a complex network of belt transmissions and clutches connected to the engine room powered individual machines. Because shorter lines of millwork resulted in less friction and more power, the layout of industrial complexes centered on the engine room.

The material handling requirement for short lines of travel between buildings also encouraged compact industrial sites, with railways and cartways running into and out of buildings. Workers typically used jib cranes to move materials on and off carts, as millwork occupied the upper reaches of the factory and prevented the use of overhead traveling cranes.[414] With improvements in electricity came overhead cranes, easing the movement of materials.

In contrast to many modern industrial facilities where all activities are housed under one roof, older industrial plants housed different activities in separate structures.[415] The original Union Iron Works buildings, including the Machine Shop (west portion of Building 113), Blacksmith Shop (east portion of Building 113), Foundry,

[411] Bradley, *The Works*, 17-24.
[412] Sanborn Insurance Company Map, San Francisco, Vol. 5 (1886), sheet 153.
[413] Bradley, *The Works*, 56.
[414] Bradley, *The Works*, 99.
[415] Bradley, *The Works*, 83.

and Engine Room, illustrate this. The various shops were spread among separate buildings to prevent fires and to provide adequate light and ventilation. The Machine Shop and Foundry stood close to the Engine Room for easy access to power, while the Blacksmith/Boiler shop and Pattern House stood apart, on the east side of Georgia Street, providing a separation to mitigate their greater risk of fire. Both the Machine Shop and Blacksmith/Boiler Shop were on Napa (now 20th) Street, with a north-south rail line running between them to move heavy parts to the docks for assembly. Connected by rail to the rest of the complex, the wooden Plate Shop (then called the “Ship Shop”) stood north of 20th Street, with easy proximity to the wharf.

Function

During this period, the technological advancements made in industry affected industrial architecture in general, and shipyard buildings in particular. New power generation and transmission methods, new transportation systems, and newer, more efficient labor methods changed the way industry used buildings.[416]

Industrial buildings of this era responded to physical demands. For example, machines could create potentially damaging vibrations, so builders used thick walls and robust framing to resist vibration and oscillation.[417] Long, uninterrupted stretches of wall are particularly vulnerable to vibrations, so pilasters and short-wall turnouts helped break walls into smaller segments. Large windows, roof monitors and skylights brought natural light and ventilation. Materials such as brick and large timbers resisted fire. Especially fire-prone activities, such as forging, typically were isolated in separate buildings.[418] A complex material handling system, consisting of cranes and railways, tied the discrete buildings into a unified whole.

The extant original UIW building, Building 113/114, exemplifies the characteristics described above. Both the former Machine and Blacksmith/Boiler shops feature a three-galley space with the central galley served by an overhead traveling crane. Riveted steel columns support both overhead crane tracks and fink roof trusses. Large arched windows on all sides of the building provide optimal visibility, while skylights bring additional light into the interior. A ventilator along the ridgeline helps circulate fresh air. The northeast corner of the Machine Shop also features a mezzanine level initially used as the shipyard’s primary office. Rails and track ran through all portions of the buildings, some of which remain.

Building Types

Although only Building 113/114 survives from the original UIW complex, lithographs, Sanborn maps and descriptions portray the five main buildings at the original Works. These sources show a Foundry building, south of the Machine Shop, as well as a high, four-story Pattern House. [419]

The Machine Shop (Building 113/114, western half), Blacksmith and Boiler Shop (Building 113/114, eastern half), and Foundry are all typical of the production shed. Buildings of this type were one story rectangular structures, often of great width and of any required length. Their engineering permitted wide spans, considerable height, and the strength and stability to handle traveling cranes. Exterior brick walls were most common, with an interior frame of wood, iron, or steel. Roofs usually incorporated lighting and ventilation

[416] Thiesen, *Industrializing American Shipbuilding*, 169.
[417] Bradley, *The Works*, 110.
[418] Bradley, *The Works*, 117.
[419] The Machine Shop to the west and Boiler/Blacksmith Shop buildings (east) were Joined together in 1914 by a connector structure to form the present-day Building 113/114.

and featured a distinctive profile.[420] Building 113/114, the remaining structure from this period, illustrates this building type well. One story high, it features brick walls and a structural steel frame supporting not only the roof, but also traveling cranes (installed in the 1890s). Its roof has skylights and a ventilating monitor, providing the requisite distinctive profile (Figure 49, 50, 51, and 52).

The Pattern House, Building 112 (constructed c. 1885, demolished after WWII), illustrates the second common industrial building type – the industrial loft. Industrial loft buildings consisted of two or more stories, featuring an elevator, hoist, or other means of vertical circulation. Materials were often heavy timber, with stone or brick exterior walls. [421] (Later, reinforced concrete or steel frame replaced heavy timber.) The Pattern House clearly reflected these trends. This four-story building featured brick walls, a heavy timber frame,[422] an elevator at one end, and a hoist at the other.[423] Later industrial lofts at Pier 70 include Building 111 (1917) and Building 2 (1941/44), both warehouse buildings.

Style

Over time, the specialized functions and uniform styling of industrial buildings gave rise to a discernible industrial aesthetic. In the mid- and late nineteenth century, when architectural styles favored ornamentation, engineers sought simplicity, designing for function rather than architectural effect. Designers used the inherent expressive qualities of masonry, such as color, bond pattern and load-supporting arched openings. The intrinsic aesthetic qualities of the material led designers to the American round-arched style.[424]

German immigrants – and in particular, a number of central European immigrant architects, including Charles Blesch, Henry Engelbert, and Alexander and Edward Saeltzer – brought the round-arched style to America beginning in the 1840s. It quickly became popular for industrial buildings. The *Rundbogenstil*, as it was known in Germany, relied on locally available materials, including brick, and blended elements of classical and medieval styles. Characteristics, besides the use of arches, include pilasters and horizontal bands forming grids, brick corbelling, and molded surrounds around door and window openings. Segmentally arched windows also appeared by the mid-nineteenth century. The American round-arched style found favor with builders because its basic architectural language was already familiar to masons and owners.[425]

All of the original Union Iron Works buildings in the yard displayed this style. The surviving Building 113/114 features arched windows, brick corbelling, and rows of pilasters. The corbelling and prominent window sills along the mezzanine level form horizontal bands. Illustrations of the now-demolished early 1880s Pattern House, and the south wall of Building 105, remaining from a building constructed c. 1890, also display this style (Figure 43).

The First Office Building

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[420] Bradley, *The Works*, 39.
[421] Bradley, *The Works*, 37. Although Building 104 is trimmed with sandstone, stone buildings in general are absent from this site.
[422] "Plans of the San Francisco Yard," Bethlehem Steel Company Shipbuilding Division (San Francisco, 1944), Sheet 32.
[423] Sanborn Map, 1886. Vol. 5, Sheet 153.
[424] Bradley, *The Works*, 234-235.
[425] Bradley, *The Works*, 235-237.

Building 104, standing north of Building 113 across 20th Street, was the yard's first dedicated office building (Figure 42).[426] From the mid-1880s until 1896, the Union Iron Works executive offices occupied a corner of the Machine Shop (Building 113), while bookkeepers, draftsmen and clerks were in the Boiler House basement. UIW also maintained administrative offices in downtown San Francisco; in 1895, these downtown offices stood at 222 Market Street.[427] In 1896, UIW constructed Building 104 to achieve many goals: to consolidate its offices, to offer an "elegant suite" for executives, and both to integrate the shipyard's two drafting rooms (shipyard and engineering) and to enhance working conditions for these staff.[428]

This new office building reflects several general trends in industry and industrial architecture. The period from the mid-nineteenth century to the turn of the twentieth century saw the expansion of administrative functions and the ensuing need to house them. During the early years of this period, the factory office tended to be humble, either housed in a small freestanding structure or in a portion of a main building, as was the case at Union Iron Works. Later, larger administration buildings provided more room for executive offices, engineers, and drafting. As the latter half of the nineteenth century progressed, factory offices were more likely to be imposing, architect-designed structures. Many of these offices also featured an attic drafting room.[429] Building 104, with both "elegant" offices for executives and an attic drafting suite, followed this pattern.

Building 104 was also the first Union Iron Works building designed by a prominent architectural firm, Percy & Hamilton. Both George Percy (1847-1900) and Frederick Hamilton (1851- 1899) came from Maine and worked extensively in native granite prior to moving west. Both men began their careers apprenticing with eastern architects – Hamilton, with Boston architect Hammatt Billings, and Percy with Portland, Maine architect Francis H. Fassett. Both men also likely gained exposure while in the northeast to the work of Henry Hobson Richardson, whose work influenced many of their later California commissions, such as the Greystone Cellars in St. Helena and the Sharon Building in Golden Gate Park.[430] The two men also designed an office and museum for the California Academy of Sciences on Market Street, completed 1899, and a building for Wells Fargo at 2nd and Mission, completed 1897. In addition, the partners were responsible for several houses and churches in pacific Heights, including the First Unitarian Church at Franklin and Geary, completed 1887, and the Seventh Day Adventist Church at California and Broderick, completed 1892. Stylistically, Building 104 conforms to the trend toward a higher design aesthetic for this building type. It combines elements of the Renaissance style with the Richardsonian Romanesque (in its arched openings and deep reveals), and includes large quoins, a rusticated base, and a prominent central entry. The building has a formality suitable for an office building, while its mass implies a strength and durability appropriate for an iron works. The arched brick aesthetic also blended well with the existing American round-arched style factory buildings already on site.

Comparisons

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426 *The Engineering Record*, 41 (March 10, 1900), 227.
427 Industry 1895, in Ruth Teiser Manuscript Collection, Series 6, Subseries 3, Box 146, File 10, Folder 10, J. Porter Shaw Library; *San Francisco Call* July 26, 1896, p. 10/2.
428 *San Francisco Call* July 26, 1896, p. 10/2.
429 Bradley, *The Works*, 35-37.
430 David Parry, "Percy & Hamilton," *Encyclopedia of San Francisco*, http://www.sfhistoryencyclopedia.com, accessed 12/4/2007.

Illustrating the universality of these trends is the Sacramento Rail Yard, a contemporaneous industrial site comparable to Union Iron Works, established by the Central Pacific Railroad in the 1860s. Near the western end of the trans-continental railroad, it featured maintenance and construction buildings similar in scale and layout to those at Union Iron Works. It evolved to become the largest West Coast railroad construction and repair shop,[431] much like Union Iron Works' status as the premiere West Coast ship construction and repair yard. The initial group of Sacramento Rail Yard buildings featured a large machine shop, accessory storage buildings, and a steam engine power plant. Currently, the 237 acre site features 34 buildings and structures that retain historic significance. (By contrast, the Union Iron Works/Bethlehem Steel Shipyard retains 45 historically significant buildings and structures. Most of these are World War II vintage).

The layout of the original buildings centered on the large steam engine, which powered millwork line shafts to separate buildings. Although the steam engine and its building have disappeared, the brick Blacksmith Shop, built in 1869, still stands. The one-story building featured brick walls, with pilasters framing each round-arched window opening. Wooden trusses supported the corrugated iron roof and provided open floor space for equipment. The roof monitor included pivot windows to help dissipate heat from the shop floor. Hoods and stacks along the exterior walls exhausted smoke from the forges.[432]

The Sacramento Rail Yard Blacksmith Shop is directly comparable to Building 113/114 at Union Iron Works. They are stylistically similar, with arched windows, pilasters and corbelling consistent with the American round-arched style. Both buildings are brick, with trusses supporting corrugated iron roofs. Both have monitors for ventilation, and both had chimney stacks penetrating the roof. Both also formed core parts of large West Coast industrial complexes.

The comparison of these two complexes shows that during this period, industrial buildings were more-or-less interchangeable. While industrial sites included different building types, such as lofts, sheds and powerhouses, few industrial building types were industry-specific. This changed as the twentieth century developed.

1900-1918: Early Twentieth-Century Architecture

The next phase of Union Iron Works begins just before the turn of the twentieth century. Several important events at this time impacted industrial environments. The widespread use of electricity had pronounced effects on the layout of factory spaces, and allowed for shop arrangements that optimized the production process. Electricity meant that industrial buildings no longer needed to cluster around the engine room.[433] For shipyards, new shipbuilding techniques, including templating, increased production efficiency and required substantial capital investments in new buildings, as did increasing specialization of workers and a boom of white-collar jobs. Industrial engineering, in its infancy in the late 19th century, became an influential discipline, and architects began to consider seriously the requirements of industrial buildings for the first time. Finally, WWI required more ships, spurring the growth of shipyards' physical plants. The Union Iron Works/Bethlehem Steel Shipyard's architectural landscape embodies all of these changes.

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[431] "Southern Pacific Sacramento Yards," *Historic American Engineering Record* (2001), 1.
[432] "Southern Pacific Sacramento Yards," *Historic American Engineering Record* (2001), 95.
[433] Theisen, *Shipbuilding,* 183.

New construction methods also had an important impact on industrial architecture during the early twentieth century. Reinforced concrete became popular because of its strength, fire resistance, and relatively low cost. Steel-framed structures clad with corrugated iron panels first appeared at this time, providing flexibility and speed of fabrication with fire resistance. The older technology of iron roof trusses further developed to produce a variety of industrial roof forms, such as sawtooth and Aiken. Brick remained in use, but primarily as a veneer for concrete structures. Both structurally and stylistically, this period is marked by eclecticism and experimentation.

Stylistically, the influence of the Ecole des Beaux Arts began to be seen, particularly in the architect-designed buildings constructed along 20th Street during this period. The architects commissioned for these buildings either trained at the Ecole, as did Charles Peter Weeks, or were influenced by its teachings, as was Frederick H. Meyer. The academic Beaux-Arts style taught at the Ecole strongly influenced American architecture from 1885 to 1920. Its principal characteristics included symmetry, spatial hierarchy, and references to classical models.

The 1893 World Colombian Exposition in Chicago popularized Beaux-Arts aesthetic and urban planning principles. The “White City,” as it was known, featured a strong rectilinear plan, monumental Beaux-Arts buildings covered in white stucco, a uniform cornice line, and coordinated ornamentation. A movement termed “City Beautiful” grew out of this fair, which had a strong impact on San Francisco. Daniel Burnham, the fair’s main designer, proposed a widely-exhibited, mostly unrealized, urban plan for the San Francisco in 1904 that incorporated many City Beautiful ideals. The 1915 Panama-Pacific International Exhibition was built on the 1893 Colombian Exposition model and featured a strong Beaux-Art theme, as did the San Francisco Civic Center of the same period.

A confluence of these trends occurred at Union Iron Works. The overwhelming majority of buildings constructed at this time were concrete, sometimes in combination with other materials such as brick, wood or steel. Some of the buildings were architect-designed and prominently located in the district, reflecting both the influence of the Ecole de Beaux Arts and Bethlehem Steel’s desire to express its corporate image. The utilitarian buildings, by contrast, were stylistically varied, ranging from those with applied ornament and enriched surfaces (Building 111), to pure expressions of function (Buildings 115 and 116).

Reinforced Concrete

> Reinforced concrete has provided for the manufacturer an entirely new building material. Indestructible, economical and fireproof, it offers under most conditions features of advantage over every other type of construction.[434]

The use of reinforced concrete construction, beginning in the late nineteenth century, was one of the most important developments in the history of industrial architecture, enabling engineers to build factories more efficiently.[435]

Reinforced concrete construction revolutionized an ancient technology. The Romans discovered concrete in the second or first century B.C., thereby transforming the architecture of antiquity. However, Roman concrete differed from modern concrete in several ways, including composition, finishing, and most importantly, its

[434] *Reinforced Concrete in Factory Construction*, (New York, 1907), 1.
[435] Lindy Biggs, *The Rational Factory* (Baltimore and London, 1996), 81.

lack of ferrous metal reinforcement.[436] Reinforced concrete became common around the turn of the twentieth century and continued to be a popular choice for industrial buildings up until World War II.[437] The technology allowed four important developments in factory construction: it reduced floor vibration from machines, it required fewer interior columns than earlier construction types, its strength allowed greater window areas, and it allowed buildings to be much larger than before. Perhaps most importantly, it was almost completely fireproof.[438]

When steel-reinforced concrete became more commonly available in the early twentieth century, industrial builders, impressed by its structural merits, were among the first to realize its potential.[439] Although reinforced concrete offered superb physical qualities, such as high strength and fire resistance, its aesthetic qualities (or lack thereof) were considered a challenge to early twentieth century designers. The problem led to experiments with many modalities. These included attempts to replicate familiar architectural elements – such as columns, arches, corbels and pediments – in concrete; the use of various styles in the search of an appropriate vernacular; and in cladding the concrete structure with other materials, such as brick or stucco.[440] The Union Iron Works/Bethlehem Steel Shipyard presents a broad spectrum of experiments with reinforced concrete technology.

Architect-Designed Buildings

As a prominent industrial company, Bethlehem Steel desired to project a powerful corporate image, and used architecture as a public relations tool. The company initiated a modernization program shortly after acquiring Union Iron Works and commissioned two new buildings in prime locations on 20th Street. The first, completed in 1912, was a Powerhouse (Building 102), while the second, completed in 1917, served as an expended corporate office (Building 101). Both were designed by prominent local architects – the Powerhouse, by Charles Peter Weeks, and the Office Building, by Frederick H. Meyer – and both were expressions of the Classical Revival Style, influenced by the Ecole des Beaux-Arts.

Architect Charles Peter Weeks was born in Ohio in 1870 and attended the Ecole des Beaux-Arts in Paris, where he trained in the atelier of Victor Laloux, one of the most prominent French architects of the time and the most popular mentor among American architects studying in Paris. In 1902, Weeks joined John Galen Howard, a fellow student of Laloux, in the New York firm of Howard & Cauldwell. Weeks then followed Howard to Berkeley in 1903/04 to assist with the design of the new campus for the University of California, the largest Beaux-Arts project in the U. S. Weeks next joined San Francisco architect Albert Sutton in 1903 to form Sutton & Weeks. After Sutton moved to Oregon in 1910, Weeks worked independently until joining forces with William Peyton Day in 1916.

It was during his solo period that Weeks designed the Powerhouse, along with several prominent residences, including 2150 Washington Street for Mary Louise Phelan, sister of former Mayor James Duval Phelan. The Phelan house was a Renaissance Revival-style building sharing many features with the UIW Powerhouse,

[436] Henry J. Cowan and Peter R. Smith, *The Science and Technology of Building Materials* (New York, 1988) 120.
[437] The first reinforced concrete structures in the San Francisco Bay Area appeared in the 1880s. The Ernest Ransome family, based in Oakland and San Francisco, was the most important U. S. manufacturer until around 1906. Bradley, *The Works*, 155.
[438] Biggs, *Rational Factory*, 83-83.
[439] Bradley, *The Works*, 155-160
[440] Bradley, *The Works*, 240.

including bilateral symmetry (a hallmark of Beaux-Arts planning), a hipped, clay tile roof, and arched window openings. Literature of the period ascribed Building 102 to the "Spanish Renaissance" style, most likely because of the prominent clay-tile roof.[441] With Day, Weeks later designed Shriner's Hospital (1923), the Huntington Hotel (1924), and the Mark Hopkins Hotel (1925). Weeks died on March 25th, 1928 under mysterious circumstances – found dead in the living room of his apartment by his wife's maid.[442]

Week's 1912 Powerhouse (Building 102) is a celebration of the shipyard's modernization, allowing for further upgrades as the yard became electrified and power sources centralized (Figure 40). The new Powerhouse supplied various types of power, including a.c., d.c., hydraulic pressure, and compressed air for pneumatics, to the entire UIW yard.[443]

Like many of the other buildings of this period, Building 102 is a reinforced concrete structure, here clad with stucco. The building is five bays wide and one deep. A large arched multi-lite window occupies each bay; the central bay on the south elevation contains the main entry doors. A keystone tops each arched opening, and a shell-motif frieze runs beneath the overhanging eaves of the clay-tiled hipped roof. The interior of the main level is similarly polished, featuring a hexagonal tile floor with a Greek key border, a Cararra glass wainscot, and an exposed wood ceiling with steel trusses.

In contrast to the refined interior finishes, four large electrically-powered air compressors furnished power for the pneumatic tools. These compressors remain, forming a sculptural centerpiece for the building interior. For general power distribution, the power plant also had two rotary converters.[444]

The ornamented powerhouse is a common San Francisco building typology, related to the City Beautiful's desire to beautify ordinary industrial structures. Willis Polk, one of San Francisco's most influential architects of this period, and Frederick H. Meyer both designed several Classically-styled powerhouses in and around San Francisco in the first decades of the twentieth century for the Pacific Gas and Electric Company.[445] Prominent among these is the Jessie Street Substation, by Willis Polk (1905).[446] Such powerhouses were built on City Beautiful ideals to create sanitary, orderly, beautiful and modern cities. The typically exhibited a refined and orderly use of ornamentation.

By updating the infrastructure at UIW, Building 102 paved the way for further improvements. In 1916, *The Pacific Service Magazine* described how the new powerhouse affected "nearly every other feature of the works":

> With the coming of central station energy came also numerous alterations and improvements of the departments; main line shafts and countershafts were eliminated, doing away with the use of belting, and all machine tools were directly connected to individual motors, which, besides

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[441] *Pacific Service Magazine*, 8 (June1916), 4-5.
[442] David Parry, "Architects' Profiles: Pacific Heights Architect #20 – Charles Peter Weeks," *McGuire Real Estate*, http://www.classicsfproperties.com, accessed 12/4/2007.
[443] Pitts, "Union Iron Works at San Francisco."
[444] *Pacific Service Magazine*, 8 (June1916), 4-5.
[445] *The Architect and Engineer*, 54 (July 1918).
[446] The Jesse Street Substation was placed on the National Register of Historic Places in 1974 for architectural merit. http://www.nr.nps.gov/Red%20Books/74000555.red.pdf, accessed 12/11/2007.

making a great savings in power, made the shops light and much more inviting to the workmen.[447]

With these alterations and improvements, along with the need for more ships during World War I, came other new buildings. Building 108 (Planing Mill/Joinery), and Building 109 (the Plate Shop) were built at the same time as the Powerhouse; several other buildings followed between then and the end of World War I. This growth, and the destruction of the hydraulic dry dock during the 1906 earthquake, also caused the modification of most of the northern waterfront features and the expansion of rail lines.

Just west of Building 102 stands Building 101(Figure 39), erected in 1917 and designed by Frederick H. Meyer. Like Building 102, Building 101 has stucco cladding and classical detailing. Prominently situated at the corner of 20th and Illinois Streets, at the entry to the shipyard, this building represents not only the growth of the shipyard and the concomitant need for more administrative offices, but also the desire to express and promote the company's position as the leader of the shipbuilding industry on the West Coast.

Unlike Charles Peter Weeks, the architect of Building 102, Frederick Herman Meyer (1876-1961), had no formal architectural training, but like many architects of the period, he trained by apprenticing in various architectural firms. A San Francisco native and son of a cabinetmaker, Meyer's first partnership was with architect Samuel Newsom, with whom he designed large residential projects. In 1902, Meyer partnered with Smith O'Brien, designing office buildings such as the Rialto Building at 116 New Montgomery and the Humbolt Bank Building at 785 Market Street. On his own from 1908, he worked with John Galen Howard and John Reid, Jr., on the layout of the new City Beautiful-inspired San Francisco Civic Center. Meyer and Reid designed the Civic Auditorium (1915 – now the Bill Graham Civic Auditorium).[448] Meyer's portfolio also included other shipyard projects, including a Powerhouse for Bethlehem's Alameda yard,[449] and the complete design of the Pacific Coast Shipbuilding Company's yard in Bay Point, approximately 35 miles east of San Francisco, completed in 1918.[450]

Specifically designed to be "imposing," Building 101 marks the entry into the industrial streetscape of 20th Street. Bethlehem required the building in order to keep pace with the "enormously increased business of the Potrero plant and its branch across the bay," in Alameda, according to the San Francisco *Chronicle*. Architect Frederick H. Meyer told the *Chronicle* in January 1917 that the building, then under construction, would be the largest and best equipped private office building in the West, accommodating 350 clerical, professional and executive staff.[451]

The white Neoclassical office building asserts Bethlehem Steel's desire to associate urbane taste with its corporation. Its location at the shipyard, rather than downtown, and its housing of administrative functions for

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447 *Pacific Service Magazine*, 8 (June1916), 4-6.
448 David Parry, "Meyer, Frederick Herman," *Encyclopedia of San Francisco*, http://www.sfhistoryencyclopedia.com/articles/m/meyerFrederick.html, accessed June 9, 2008.
449 The Union Iron Works Powerhouse, as the building is called today, was listed on the National Register of Historic Places in 1980. "Union Iron Works Powerhouse," National Park Service, *http://www.nps.gov/nr/travel/wwIIbayarea/uni.htm*, accessed November 30, 2007.
450 M. B. Levick, "The Architect and the Shipbuilding Industry," *The Architect and Engineer*, and "Pacific Coast Shipbuilding Company, Bay Point CA," http://www.coltoncompany/shipbldg/ussbldrs/prewwii/shipyards
451 *San Francisco Chronicle* January 27, 1917 11/3

both the Pier 70 facility and, as noted above, for Bethlehem's Alameda yard, indicates the importance Bethlehem associated with the yard. In placing the building so prominently, Bethlehem also continued the nineteenth-century tradition of centrally locating the office or placing it near the main gate, facilitating better supervision, expressing management's power, and underscoring the separation of blue collar and white collar work. [452]

Unlike Building 102, the use of reinforced concrete on Building 101 was confined to the floor slabs. The walls were constructed using an older technology, unreinforced brick masonry.

Pier 70 Concrete Utilitarian Structures

During the same era that Bethlehem Steel was commissioning architect-designed buildings of reinforced concrete, it was also building utilitarian warehouses of the same material. Notable new pre-WWII concrete buildings, in addition to Building 102 discussed above, include Building 38 (Pipe and Electric Shop, 1915), Checkhouse No. 2 (1916), Buildings 115 and 116 (Foundry and Warehouse, 1917), and Building 111 (Warehouse, 1917). These buildings exemplify the period's aesthetic experimentation.

Building 38 (Figure 32), erected in 1915, stands at the southern edge of an open yard. Board-formed reinforced concrete comprises the exterior load-bearing walls, while steel interior columns support the wood second floor and the corrugated steel roof. On all four elevations traditionally-dimensioned double-hung wood sash windows penetrate the walls. Structurally, therefore, this building constitutes a hybrid: while the exterior walls are concrete, in other respects the building is a wood and steel frame structure. On the north and south elevations, a shaped parapet provides Mission Revival character. Mediterranean and Mission-style architecture inspired many early concrete buildings, since designers felt that the stucco cladding and monolithic character of these styles was similar to concrete.[453]

Building 111 (Figure 48) displays another approach to concrete industrial architecture. Completed in 1917 to serve primarily as a warehouse, it also contained finely-detailed, richly-finished offices at the north end. Unlike Building 38, this multi-story loft building is of concrete-frame construction. Exterior walls are non-load bearing brick, while floors are concrete slab. Original windows – also unlike Building 38 – are expansive steel sash units (except for the office portion, which are wood). Brick clads this building, which was a popular response to the perceived aesthetic challenges of the new material. Brick stylistic vocabularies had developed over the centuries, and brick also had the advantage of blending well with existing urban or plant structures. During the 1910s, constructions costs for a brick-clad concrete structure and an all-concrete one were similar; however, owners most likely paid a premium for the elaborately coursed brickwork of Building 111. [454] In terms of exterior expression, the building's designers adopted traditional styling, consisting of segmentally arched openings at the high first story, cast stone keystones, headers and sills, and a corbelled brick cornice. This vernacular clads the industrial grid of windows, piers and floor slabs with a familiar language.[455]

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[452] Bradley, *The Works*, 36.
[453] Bradley, *The Works*, 240.
[454] Bradley, *The Works*, 241.
[455] An example of a similar approach is found in Factory No. 2 for the Dayton Engineering Laboratories building (c. 1916; Dayton, Ohio) or Albert Kahn's "Building B" at Ford Motor Company's Highland Park Plant (1910-1914). Most of Kahn's buildings at the Highland Park plant were similarly of concrete, with brick facing. A closer example is the American Can Company Building, at Third and 20th Streets in San Francisco, begun in 1915 and displaying a similar aesthetic concept.

Although Building 11l, like earlier UIW buildings (Building 113-114 and Building 104 in particular), sports a brick exterior, its window openings in particular reveal the new structural approach. The square heads of the upper floor openings (the ground floor openings are segmentally arched), the proportion of window to solid wall, and the shallower reveals, illustrate some of the possibilities of the new concrete structural system. Concrete headers replace the arches, allowing squared openings without the wood or steel headers that would have appeared on earlier unreinforced masonry buildings where arches were omitted; the thinner reveals represent the greater material efficiencies of concrete: the massive walls of an unreinforced masonry building were no longer required for structural support.

Building 115/116 (Figure 53), constructed in 1917, the same year as Building 111, demonstrates a third approach to reinforced concrete design. Here, the reinforced concrete frame is unsheathed, with no ornamental devices to mask the innate expressiveness of the concrete itself. Concrete piers and spandrels alternate with wide expanses of steel sash window – the proportion of void to solid is here even greater than seen on Building 111. This approach is perhaps the most modernist – or at least the one that would be most admired by advocates of the Modern Movement, which was developing at this time.

The construction of Building 115/116 corresponds to the infancy of U. S. modernism. In 1932, Philip Johnson and Henry-Russell Hitchcock wrote, "On the whole, American factories, where the client expects no money to be spent on design, are better buildings and at least negatively purer in design than those constructions in which the architect is forced by circumstances to be more than an engineer."[456] However, what Hitchcock and Johnson defined as "modernism" was as rare in American industrial architecture during this period (1900-1918), as it was in American architecture generally. European architects, however, took a different approach. Such industrial projects as Peter Behren's Turbine Erecting Shop for A.E.G. (Berlin, 1909) and Hans Poelzig's Water Works (Posen, 1911), published in the *American Architect* in 1917, show a willingness to break with the past and explore new vernaculars for the new materials and functions of industrial building. Albert Kahn remarked upon the confusion in industrial architectural design in the U. S. compared to Europe, where such architects as Peter Behrens developed a new methodology based upon simplification, the avoidance of traditional applied ornament, functionality, and the intelligent use of materials. While this approach ultimately spread to all types of architecture, Kahn, like Hitchcock and Johnson, notes that the approach in the U.S. was first adopted by industrial architects and engineers.[457] Building 115/116 represents, therefore, either a precursor to or a very early example of Modern Movement principles applied to industrial architecture.

The First Steel Framed Buildings

Although the vast majority of steel frame buildings in the Union Iron Works/Bethlehem Steel Shipyard date from WWII and the years immediately before, steel frame buildings first appear here just before WWI. Like Building 115/116, these buildings are devoid of extraneous ornament. Steel frame structures from the 1900 to1918 period include Building 21 (c. 1900), Building 108 (1911/1913), and Building 109 (1912). Buildings 108 and 109 combine a steel frame with wood floors and ceilings.

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[456] Henry-Russel Hitchcock and Philip Johnson, *The International Style* (New York, 1932; reprint, 1995), 53.
[457] Bradley, *The Works*, 246-247.

In addition to reinforcing concrete, builders began to use steel as the structural frame for industrial buildings in the late nineteenth century. Steel's great strength, standardized dimensions, and speed of assembly through riveting made it a fine choice for industrial buildings. Steel, cast iron, and wrought iron were initially used in brick structures for internal columns and roof trusses.[458] The earliest UIW buildings at the yard, including Building 113/114, followed this model. Around 1900, handbooks of steel design became available, and during the first decade of the twentieth century, curtain wall construction appeared. These walls consisted of steel load-bearing columns with non-load bearing cladding, initially of brick, tile or concrete. After this first decade, the all-masonry curtain wall was replaced by one of corrugated sheet metal and steel sash windows, often over a low brick wall, three-to-four feet high, used as a moisture barrier.[459] While the earliest steel frame structures in the district do not rest on a low masonry walls, those constructed in the 1930s do. These structures will be discussed in the section dealing with World War II and its prelude, below.

Along with steel structural framing came two additional fire-resistant ferrous metal building materials: corrugated sheet metal, used for wall and roof cladding, and steel sash windows. Both materials were galvanized to improve corrosion resistance. Because a steel structural frame eliminated the need for a load-bearing enclosing wall, very thin materials could form the new curtain wall. Ferrous sheet metal panels corrugated for strength and galvanized for rust resistance came into common use as roofing and wall sheathing during the late nineteenth century. In addition to low cost and ease of fabrication, the fire resistive properties of corrugated sheet metal made it a popular material for industrial buildings. Sheet metal-clad buildings were already in construction and publication in the 1870s, and Building 113/114, of 1885-1886, features corrugated galvanized iron roof cladding. [460]

Metal windows were available as early as 1860, but did not become common in the U. S. until after 1910, when several manufacturers began to offer them.[461] New technology, borrowed from the rolling industry, allowed mass production of these windows, while urban fires – including San Francisco's in 1906 – increased their popularity. Being mass produced, these windows were also reasonably priced. In addition, they were durable, easily transported, and available in a wide variety of types, including double-hung, pivot, projecting, austral and continuous.[462]

Pier 70 Early Steel-framed Buildings

The first buildings at Union Iron Works, represented now by Building 113/114, featured corrugated iron roofs. The earliest steel frame building in the district, Building 21, was built not by Union, but by Risdon Iron Works in 1900. UIW's first steel frame, corrugated metal-clad buildings were Building 108, of 1911 and 1913, and Building 109, of 1912.

Risdon Iron Works, occupying the southeast portion of the Union Iron Works/Bethlehem Steel Shipyard, constructed Building 21 circa 1900. It stands as the district's earliest steel-framed, sheet-metal clad structure

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[458] Bradley, *The Works*, 144.
[459] Bradley, *The Works*, 147
[460] Bradley, *The Works*, 142-143
[461] Bradley, *The Works*, 166.
[462] Steel windows continued to be popular through WWII, when cheaper, non-corroding aluminum windows supplanted them. Sharon C. Park, "The Repair and Thermal Upgrading of Historic Steel Windows," *Preservation Briefs 13* (Washington D.C.: US Government Printing Office) 2.

(Figure 26).[463] This two-story, rectangular-plan building features a striking double gable roof, each gable sporting a wide roof monitor.

Having served various functions over time, the building exemplifies the flexibility of steel frame and galvanized sheet metal construction. Because curtain walls do not support the building, they are relatively easy to reconfigure. The building has served as a power house, transformer house, machine shop, electric sub-station, and electrical shop. Based on an historic photograph, the north elevation has been reconfigured, and now displays a different pattern of openings. Because of the building's age, the number of uses it has housed, and its service through two world wars, it is easy to understand the numerous changes. The alterations to the north elevation illustrate the adaptability of curtain wall construction.

Building 108 (Figure 45), constructed in 1911 and 1913, was the first building at UIW constructed by Bethlehem Steel to feature a steel frame with corrugated galvanized iron cladding. The building was constructed as a Joiner shop and Sawmill, and continued to function similarly throughout its period of significance. The earlier, western half of the building features steel sash ribbon windows, while the eastern half, completed two years later, features wood. The differing window types could relate to different daylighting needs on one side of the building versus the other, or to differences in the availability of the materials when each portion of the building was constructed.

Building 109, Plate Shop #1, was completed 1912, replacing two earlier similarly-functioned buildings at the same site (Figure 46).[464] New power sources, changes in engineering processes, and the desire to build larger ships contributed to the need to replace the earlier structures.[465]

The 1912 Plate Shop is a steel frame structure with corrugated sheet metal cladding. Unlike the earlier shop structures, it included a semi-enclosed foundry at the west end; like both earlier structures, it had a second story mold loft, here for the production of templates from which plates were cut. The building sports an Aiken roof, consisting of alternating high and low bays with associated roof monitors, maximizing daylighting into the mold loft.[466] Windows are wood sash (at the north elevation) and steel sash (at the south) arranged in continuous horizontal ribbons.

1936-1945 - World War II and its Build-up

[463] The data upon which this date is based is somewhat contradictory. See the description section of this document for further information.
[464] 1886 Sanborn Insurance Company Map, San Francisco, Vol. 5 and Sheet 153. The first, constructed c. 1885, is listed as a "Machine Shop" and "Mold Loft" on the 1886 Sanborn maps. Descriptions of function in an early article clarify that the "Machine Shop" or "Ship Shop" actually included "handling, rolling, planing, drilling, counter-sinking, punching, shearing and fitting the plates and ribs of the ship." These functions, then, were very similar to that of a Plate Shop. The second, larger building appears on the 1889 Sanborn and this building is called out as a Plate Shop with a second story Mold Loft.
[465] New templating methods pioneered by Henry G. Morse for the New York Shipbuilding Company beginning in 1899 sped production and decreased cost. Thiesen, *Shipbuilding*,188-192; also see discussion in the Criterion A section of this document.
[466] This roof form is named after Henry Aiken, a consulting engineer practicing in Pittsburgh in the early twentieth century. Bradley, *The Works*, 259.

A developing trend towards specificity during the World War II era led the Union Iron Works/Bethlehem Steel Shipyard to become more typical of shipyards than of plants for other industries, especially in terms of its layout. While other industries were attempting to place the entire production process within one building, this was not the case in the shipbuilding industry. Instead, shipyard designers focused on housing the process in a series of buildings, layout areas, and slips, connected by a material handling system, laid out in an efficient straight line (or a variant if necessary because of limits on space).

UIW saw little facilities expansion or modernization between 1918 and 1936. As documented in the Criterion A discussion, demand for new ships declined precipitously after WWI, and many shipyards in the U. S. closed. UIW, with its ability to repair as well as to build ships, was able to remain functioning, better positioning itself to obtain government contracts once war work resumed. In 1936, Bethlehem Steel began to upgrade its UIW facilities. They constructed or expanded ten buildings between 1936 and 1940. Another 123 buildings or features at the yard were built or modified from 1941to 1945.[467] This unprecedented build-up not only dramatically increased the shipyard's ability to produce, but also changed its look, feel, and layout.

At the same time, the war created an emergency situation requiring the construction of new ships – and therefore new shipbuilding facilities – as quickly as possible. The majority of new buildings from this period – similar to other WWII shipyards – were steel frame construction with corrugated metal cladding – relatively quick to erect. Those constructed in the 1930s have a brick base; those constructed after 1940 do not. Steel frame buildings, including pre-fabricated structures, became especially popular during WWII for both military and civilian industrial uses because of their relative ease and speed of construction.

Concrete structures, such as Warehouse No. 2 of 1941, continued to be built, as did many smaller wood frame buildings, most providing worker amenities. While the buildings of this period were similar in size, design and layout to those at other shipyards; they were not necessarily typical of industrial buildings in general during this period. This was due to trends in industrial building design towards functional specificity: the desire for industrial buildings to respond as directly as possible to the industrial processes contained within.

Industrial Architecture

Industrial engineers and their desire to develop rational production processes revolutionized the factory design of this period. As part of this rationalization, they sought to make industrial buildings as functional as possible to optimize manufacturing efficiency. The factory building itself was considered a machine for efficient production.[468] Because of this, industrial buildings became less generic and more industry specific. "The plant must be built around the process" became the axiom of production engineers.[469] According to a source from 1940: "Each industry – as chemical, textile, machine parts, etc. – presents special problems involving column spacing, floor and building heights, ventilation, lighting, etc., all of which influence plant design and building costs. Requirements may vary even within an industry, depending upon the particular type of product made."[470]

[467] "Plans of the San Francisco Yard," Bethlehem Steel Company Shipbuilding Division, 1944, Sheet 1.
[468] "Industrial Building Types Studies," February 1940, in Kenneth Reid, A.I.A., ed., *Industrial Buildings, The Architectural Record of a Decade*, (New York, 1951), 1.
[469] Reid, *Industrial Buildings* 1
[470] Reid, *Industrial Buildings* 3.

Production Processes and Architectural Design

Improvements in production technology in the early twentieth century increased potential for faster production and greater output. This potential could only be realized with major reorganization of the factory – in the processes as well as the buildings that housed them. The automobile and aeronautics industries led these developments, especially the collaborative work of Henry Ford and Albert Kahn. The latter designed approximately 2,000 factory buildings between 1900 and 1940. These projects increasingly reflected his belief that factories should be designed around production processes, rather than the other way around. Improvements in construction technology and power distribution allowed him to realize these goals.

Kahn's collaboration with Ford at River Rouge, in Dearborn, Michigan, exemplifies his design ideas. Because it was designed initially to manufacture ships, River Rouge is especially relevant to the Union Iron Works/Bethlehem Steel Shipyard. Ford designed Building B, the first building at River Rouge, to assemble Eagle Boats, submarine chasers for World War I. Seventeen hundred feet long by three hundred feet wide, the building's size dwarfed all earlier factories. The building contained a three-story high open space, allowing the ships to pass through as they were assembled. Here, the designers attempted to apply continuous conveyor-assembly production techniques to mass-produce ships. The experiment proved unsuccessful, with few ships completed. According to military historian David Hounshell; "Among the most prominent [reasons for failure] were the company's unbridled confidence in the wide applicability of its assembly line methods, as well as its failure to recognize that marine engineering involved design problems and construction techniques different from auto making."[471]

Kahn also designed the building to convert easily to automobile production once the war work was completed, inserting three floors and retooling for Model T production after the War.[472] The failure of the building to work for shipbuilding may be because the requirement to convert the building later to automobile production took precedence over shipbuilding, reinforcing the concept of functional specificity.
Building B, and the failure of Ford to build Eagle Boats within it, illustrates that the processes of building a ship are different than those of other industries, and that if mass production techniques are to be applied to shipbuilding, they must be applied differently. By implication, it shows that since buildings were designed around production processes, buildings to house the ship assembly process needed to be inherently different from buildings for other industries. If the processes contained in Building B had been more ship-specific, Building B might not have been so easily converted to auto production after the war, and Ford may thus have been more successful at building Eagle Boats.

The relevance of the Building B experiment to Pier 70 is evident in the design of the Building 12 Complex, known as the New Yard during WWII (figures 21, 23, 24 and 30). The New Yard was clearly designed around a very ship-specific production process. While the buildings of the complex link together (joined by party walls and rail lines), Unlike Building B at River Rouge, they remain separate structures, each housing a specific function. Functions more appropriately occurring outdoors or on the water were relegated to layout yards or slips. We will examine this production process, and how it is reflected in the Building 12 Complex, in greater detail below.

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[471] David Hounshell, "Ford Eagle Boats and Mass Production during World War I," in Merritt Roe Smith, ed., *Military Enterprises and technological Change, Perspectives on the American Experience* (Cambriege, 1985), 175.
[472] Biggs, *The Rational Factory*, 145

Style
Architecturally, the large industrial "machines" built between the Wars reflected general stylistic trends. European Modernists' application of non-traditional styling to industrial and other buildings prior to World War I became known as the Modern Movement. The other modernist styles of the era – Art Deco and Moderne – were also reflected in industrial architecture. At UIW, Building 40 (Figure 33), constructed in 1941 as the Employment Office annex, shows the influence of the Moderne with its two-story, beveled, glazed stair tower and entry. The entry door surround is faceted, with a simple, projecting overhang above.

Worker Amenities
The role of workers also changed, particularly during WWII, when massive labor pools, round-the clock operation, and wartime production schedules made intense demands on both worker and employer. Worker amenities, like cafeterias, washrooms, and health care facilities, helped get top performance from the workers. These amenities were prominent in the World War II build-out at Union Iron Works.

UIW
UIW buildings followed general industrial trends in the choice of building material – primarily steel, with some concrete – and in the increased build-out of worker amenities at the yard. UIW buildings from this period, however, were not stylistically veneered with Modern Movement or Moderne facades (Building 40, described above, is the exception); the necessity to build quickly and economically rendered such stylistic veneers superfluous. Nor was there an attempt to house the entire shipbuilding process under one roof, as was common in other industries. However, UIW did follow the most important trend in industrial architecture, that of functional specificity: the plant was built around the process. As at other shipyards, the various shipbuilding processes were housed in separate buildings or areas of the site and linked by a material movement system. The following subsection discusses this general trend in shipyards at this time.

Shipyard Architecture
Unlike other industries, U. S. shipbuilding languished after World War I. Since the U.S. entered that war late, many of the ships constructed for WWI were actually completed after the war. Many of these were stored, sold, or scrapped. With the Depression came even more maritime cutbacks. Despite the slowdown, shipbuilding technology advanced. Ships became faster, safer, and larger. Designers envisioned new types of vessels, including aircraft carriers and small landing crafts.[473] Changes in ships and technology resulted in changes in shipyards and their buildings, particularly in the age of functional specificity. The transition from riveting to welding, for example, brought modifications to the shipyard and its buildings, and new attitudes toward labor brought more worker amenities. Techniques of mass production, perfected in other industries, were also applied to shipbuilding. And as in other industries, worker amenities at the shipyard also expanded during this period, with convenient cafeterias, washrooms, locker rooms and health facilities added. All of these developments were reflected in shipyards generally, and in the Union Iron Works/Bethlehem Steel Shipyard in particular.

The ability to pre-assemble small components into large assemblies was an important factor in the shipbuilding speed records achieved during WWII. The pre-assembly zone became a defining element of WWII, and the feature that clearly distinguished these new yards from older ones. New shipyards were

[473] Bonnett, *Build Ships,* 18-21.

specially designed with ship construction efficiency in mind, and featured “straight-line” flow of materials (or “turning flow” or “angle flow” variants) that eliminated wasteful material transportation.

Straight-line flow required a site with inland depth so that materials could enter the yard, be processed and fabricated in a linear flow, and arrive at the shoreline for final assembly at the shipways. If the site had limited space inland but a lengthy shoreline, as with Union Iron Works, the turning flow design was used.[474] In this method, materials entered parallel to the shoreline, were processed in a straight-line flow, and then turned at right angles to be assembled on the shipways.[475] Despite the option of the turning flow process, shipyard designers preferred straight flow, where property depth permitted. As Harry Gard Knox explained, “To whatever extent they depart from a straight line flow, some handling efficiency is apt to be lost.”[476]

Pre-assembly depended on a continuation of the trend, begun before WWI, to modify the ship’s form to support ease of construction rather than optimal performance. Ship design became standardized. Engineers were able to adapt mass production techniques from other industries and apply them to shipbuilding, especially where parts were interchangeable, and clients ordered multiple quantities of identical ships.[477] This process brought increases in construction speed and efficiency, but required larger open spaces for layout and powerful cranes integrated into an extensive materials handling system.

Welding also impacted shipyard layout and design. Shipyards erected specialized welding platforms large enough to handle ship components, and the infrastructure to support this technology. While engineers during WWI began to realize the advantages of welding over riveting, the change did not take place overnight, and it was not until 1927 that the welded hull was approved by the American Bureau of Shipbuilding.[478]

The following section will examine how these general trends in the design of shipyards were reflected at UIW.

Rapid Growth at UIW

In 1936, the federal government expanded shipyard infrastructure across the country, funding $10,013,000 in improvements at Bethlehem Steel’s Union Iron Works.[479] This led to a major round of modernization and expansion, including an infrastructure upgrade and new tools and shop facilities. Most notably, these upgrades facilitated welding processes. Many of the upgrades focused on space utilization and material movement, both within existing buildings and in the yard overall. These improvements sought, to the extent possible in an existing yard, to provide a straight line pattern for the movement of materials.[480]

New buildings dating from these pre-war upgrades were all steel frame, with steel sash windows and doors. Walls were glazed to the maximum extent possible, and stood over a five-foot brick wall, with corrugated metal panels over the windows and cladding the roofs. Building interiors, for both new and existing structures, were painted white to improve lighting and therefore increase worker safety. Each building was

[474] Also see Criterion A context in this document for discussion of the “turning flow” layout design.
[475] Bonnett, *Build Ships*!, 50.
[476] Harry Gard Knox, “Multiple Yards,” in Fassett, *Shipbuilding Business*, 213.
[477] Bonnett, *Build Ships!*, 25
[478] Quivik, “Kaiser’s Richmond Shipyards,” 18.
[479] “Bethlehem Reconditions Potrero Works of Union Plant.”
[480] “Bethlehem Reconditions Potrero Works of Union Plant,” 23.

also equipped with Holophane Prismatic Refractor lighting fixtures, in sufficient quantity to eliminate shadows. New buildings in addition provided ample room around tools for swinging large work, while existing buildings were retooled to provide additional space to the extent possible.[481] Buildings erected during the war years were of similar construction; however, the masonry base, provided on the earlier structures as a moisture barrier, was omitted from the war-era structures, streamlining their construction. By 1945, UIW included over 150 separate buildings, piers, slips, wet basins, and assembly yards. Approximately 60 of these elements were actual buildings. An extensive material handling system and service trench tied these separate components into one unified whole.

In 1940, UIW was contracted, along with only five other private shipyards nationwide, to perform Navy work exclusively.[482] To promote this contractual arrangement, the federal government made further investments in UIW. Most notable was the "New Yard," now known as the Building 12 Complex, located at the site's southeast quadrant, where Risdon Iron Works once stood. A major upgrade to the rail system united the new facility with the rest of the shipyard.

The Building 12 Complex, comprising Buildings 12, 15, 16, 25, 32, and 66, was built predominately in 1941 to construct anti-aircraft cruisers. Building 12**,** which housed the Plate Shop and Mold Loft, measures 248'-2" x 242'-2" in plan by 59'-6" tall, and is, as was most typical of this period, of steel frame construction with corrugated steel cladding. The complex lacks a stylistic veneer, but displays a visual power derived from its massing and the rhythm of its openings and roof monitors.

This complex and the other developments at UIW from this period reflect the concept of functional specificity in several ways. Most important was the rationalization of the work flow process by establishing a straight or turning flow pattern. The desire for efficient work flow affected building placement and adjacencies, as well as the material handling system connecting the buildings. Other examples of functional specificity include the establishment and strategic placement of welding platforms and assembly layout areas, and adjacencies to slips, where final assembly and fitting out occurred.

Buildings 12, 15, 32, and 16 connect on at least one elevation (figures 21, 23, 30 and 24 respectively). Within, they form a single interior space. While the compact Building 12 complex approaches the industrial ideal of containing an entire production process within one space, much of the assembly took place on open platforms or in adjacent slips. Spatial constraints most likely dictated the compact form, as well as the turning, rather than the straight-flow process. At shipyards where space constraints were not a factor, not only was the straight flow arrangement used, but the buildings remained widely spaced. Richmond Shipyard Number 3 is a good example of a contemporaneous shipyard, arranged to permit straight flow, with ample space between buildings.

Part of the 1936 upgrades throughout the shipyard included new worker amenities. As at other industrial complexes, facilities such as washrooms, locker rooms, and cafeterias were built throughout, close to where people concentrated, based on the idea that improving facilities would improve performance. Building 25, nestled in a courtyard formed by much larger industrial buildings, exemplifies such amenities (Figure 28).

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[481] "Bethlehem Reconditions Potrero Works of Union Plant," *24.*
[482] After the attack on Peral Harbor, the Navy program expanded. By spring of 1942, over 60 yards were employed by the Navy. Bonnett, *Build Ships!* 25.

This steel framed, steel clad structure encloses rows of toilets, urinals, and gang washbasins. Other washrooms were scattered throughout the yard – some remaining. Building 11, now housing artist studios, included a cafeteria.

The first aid facility occupied part of Building 51, which was an addition to the north elevation of Building 104, turning the 1896 building's former "T" shaped footprint into a rectangle. Offices occupied the upper two floors, while the first aid station, with separate areas for men and women, was located on the ground floor. This steel-framed addition features a continuous ribbon of large multi-lite windows. The continuous window wall – essentially a curtain wall – was typical of the new buildings of this period at UIW, as well as a general trend in industrial architecture.

Conclusion

During each of the three periods, the Union Iron Works/Bethlehem Steel Shipyard illustrates general trends in industrial architecture. During the first period, from 1884-1900, the initial brick masonry buildings display the American round-arched style. The second period, from 1900-1918, reflects the use of new building technologies, particularly reinforced concrete. The construction of administration buildings at this time illustrates the growing role of management, the desire for physical separation of management from labor, and the influence of the Ecole des Beaux-Arts on American architecture. The third period, from 1918-1945, shows the influences of mass production, welding, and the desire to construct functionally specific buildings and spaces. The Union Iron Works/Bethlehem Steel Shipyard remains an exceptional and distinctive entity of national stature, reflecting developments in industrial architecture and shipyard design.

While the buildings at Pier 70 are significant because they represent important trends in industrial architecture over a 61 year period, they also form an exceptional, distinctive entity. Of the nation's major 1880s shipyards, only Newport News, in Virginia, and Pier 70 survive today. Most surviving World War II shipyards, such as Kaiser's Richmond Shipyard Number Three, represent only one time period. UIW's survival over its long history has left an impressive architectural record, telling the story of the evolution of industrial architecture, and of shipyards specifically, during a period of profound technological and stylistic change in American architecture.

Integrity

The Pier 70 Historic District retains its historic integrity. It is able to convey its role in the birth and expansion of this country's steel hull shipbuilding industry (see criterion A). The district also retains its historic integrity to reflect the development of industrial architecture from the 1880s to 1945 (see criterion C). The seven aspect of integrity are discussed below.

Location

The Union Iron Works/Bethlehem Steel Shipyard has expanded over the years but retains integrity of location. The yard retains it original relationship with the shoreline and with the city street grid. Apart from the waterfront features, the vast majority of extant buildings and structures remain in their historic locations.

Design

The Union Iron Works/Bethlehem Steel Shipyard was first designed in the early 1880s to build and repair steel hull ships. The district retains aspects of its original design and is an expression of the subsequent evolution in shipyard design throughout the period of significance.

The original plan for the UIW shipyard shows a basic distinction between the machine shop on the south side of 20th Street and the plate shop and waterfront features on the north side, with means to move materials between the two. This basic layout continued through WWII. The district was originally an integrated yard and continued to build ships and retain the ability to manufacture all the parts for a ship throughout its period of significance. Although the yard modernized and expanded several times, its basic layout remained. This occurred, in part, because the use of an area generally remained constant although the buildings or structures were replaced. For example, outdated plate shops were replaced by new plate shops, and slips and wharfs were rebuilt in similar locations. From 1900 until the end of WWII, the southeastern portion of the Union Iron Works/Bethlehem Steel Shipyard was developed as a second shipyard within the district, first by Risdon in 1900, then by EFC for WWI, and finally, by the Navy for WWII. This facility was completely rebuilt three times within the period of significance. The basic layout of the slips, shoreline, and plate shop remained the same from WWI to WWII, although the facilities themselves were rebuilt and enlarged.

The Union Iron Works/Bethlehem Steel Shipyard's properties were designed to move materials through the yard toward the slips or outfitting wharfs. The general placement of slips, wharfs, and wet basins is essential to understanding the historic design of the shipyard and is integral to the yard retaining its integrity of design and expressing its significance (see criterion A). Although the existing waterfront features have either lost their integrity or were rebuilt after the period of significance, these non-historic components continue to express the connection between the contributing elements of the district and the historic shipbuilding activities that occurred along the waterfront. In this regard, the recognition of some of these non-historic waterfront features is essential to maintaining the district's integrity of design.

Setting

The historic setting of the Union Iron Works/Bethlehem Steel Shipyard was the industrial zone of Potrero Point situated along the deep waters of the bay. In the 1880s, the area surrounding the Union Iron Works contained industrial uses mixed with residential and commercial. The city street grid extended to the edge of the district and the shipyard was situated along the shoreline. Although the city has extended past Potrero Point, these basic characteristics of the historic setting remain.

Demolition of Irish Hill and the expansion of the yard into the bay did alter the character of the Union Iron Works/Bethlehem Steel Shipyard and changed the relationship between the built environment and the adjacent natural features. These changes, however, all occurred during the period of significance and play a role in expressing the district's significance. They do not impact the integrity of the district's setting.

Essential to the setting of the district and its ability to reflect the historic functions of the shipyard is the development along the shoreline. The yard's expansion into the bay is conveyed by the existing wharfs, piers, and slips. This expansion is essential to understanding the character and development of the site. The slips, dry docks, piers, and wharves all play a vital role in defining the character of the yard and conveying how the district "is situated and its relationship to surrounding features and open spaces."[483] In short, the built features along the shoreline help to convey the historic function of the district's contributing elements, namely shipbuilding and repair. Without any physical record or recognition of hull construction or outfitting activities, the district loses its character and its ability to express its significance. Therefore, the waterfront features are integral to the district's integrity of setting.

Materials

The Union Iron Works/Bethlehem Steel Shipyard retains a high degree of integrity of materials. Limited adaptive reuse of the district after the period of significance has resulted in few alterations to original materials. The few adaptive uses that have occurred, such as conversion to art studios and automobile storage, have mostly left the materials largely unaltered. Although the shipyard has been largely repaved, the slips filled in, and the wharves rebuilt, almost all other existing structures and infrastructure components possess their key exterior materials. The materials show some degradation from exposure and neglect, but clearly identify the district as an industrial shipyard.

Workmanship

The workmanship of the Union Iron Works/Bethlehem Steel Shipyard retains a very high degree of integrity across the range of architectural styles and construction methods. The junction of older buildings with newer buildings through the district's 62-year period of significance illustrates two or more separate periods of workmanship within the same building. Strong examples of workmanship, from steel riveting, to brick detailing, to board-formed concrete, to wood-framed construction still stand and bear witness to Pier 70's industrial heritage.

Feeling

The Union Iron Works/Bethlehem Steel Shipyard clearly provokes the feeling of an historic shipyard. The integrity of location, design, setting, workmanship and materials at the site combine to convey the district's strong character as an historic shipyard.

Association

The Union Iron Works/Bethlehem Steel Shipyard retains its integrity of association with shipbuilding and ship repair. The yard is the longest continually operating ship repair facility in the country. Buildings remain from the original Union Iron Works period, associated with the birth of the nation's steel ship building industry, and from all subsequent waves of development associated with the national shipbuilding industry. Subsequent periods of expansion and modernization reflected in the district are directly associated with this country's war efforts from the Spanish-American War through WWII.

Archeological Resources

As a site that has been in almost continuous use since 1885, subsurface or underwater areas may yield information that can contribute further to our understanding of Pier 70 and the industrial processes that occurred there. This is especially true of wharves that have been rebuilt many times in the same approximate

[483] National Parks Service, "How to Apply the National Register Criteria for Evaluation," ed. Interagency Resources Division National Register Branch (Washington, DC, 1997), 45.

location, slips that have been infilled, and site features such as rail lines and paving stones that have been paved over. Unique to Pier 70 we have resources that are half above and half below ground. Further evaluation would occur once they excavation occurs to determine whether or not these features have integrity or are eligible resources.

Please see Figure 16 for site plan showing extant contributing buildings, and buildings demolished after 1945.

Primary Sources

Archival Collections

Bancroft Library, University of California, Berkeley
Biographical Materials Relating to Irving Murray Scott, Hubert Howe Bancroft Collection

Hagley Museum and Library, Greenville, Delaware
Bethlehem Steel Corporation, Predecessor and subsidiary companies, 1860-1947

J. Porter Shaw Library, San Francisco Maritime National Historic Park
Ruth Teiser Manuscript Collection
San Francisco Maritime Museum Artifact Collection
Scrapbooks, Bethlehem Steel Collection
Souvenir Album of the San Francisco Strike of 1901

Rosie the Riveter World War II Home Front National Historical Park
Biography Forms

Interviews & Oral Histories

Archie Green, Interview with Marjorie Dobkin, July 12, 2007.

DuVal Williams Oral History Interview with Karl Kortum, 1963, on file at J. Porter Shaw Library, San Francisco Maritime National Historic Park.

Mary Ann Cox, interview with Marjorie Dobkin, February 22, 2007.

Priscilla Shelton, Interview with Marjorie Dobkin, February 23, 2007.

Newspapers & Periodicals

American Machinist
The Architect and Engineer
The Argonaut
Bethlehem Star
Bulletin of the Women's Bureau
Engineering Magazine
International Marine
Journal of Electricity Power and Gas
The Log
Marine Engineering and Shipping Review
Marine Review
Mining and Scientific Press

New York Times
Overland Monthly
Pacific Marine Review
Pacific Service Magazine
Public Administration Review
San Francisco Call
San Francisco Chronicle
San Francisco *Daily Commercial News*
San Francisco Evening Bulletin
San Francisco Examiner
San Francisco Newsletter and California Advertiser
Scientific American
Shipmate

Books, Pamphlets, and Dissertations

Archibald, Katherine, *Wartime Shipyard: A Study in Social Disunity* (Berkeley: University of California Press, 1947; reprinted Urbana: University of Illinois Press, 2006).

Bancroft, Hubert H., *Chronicles of the Builders of the Commonwealth*, Vol. I (San Francisco: The History Company, 1891).

The Bay of San Francisco, Vol. 1(San Francisco: Lewis Publishing Co., 1892).

Bennett, Frank M[arion], *The Steam Navy of the United States* (Pittsburgh: Nicholson, 1896).

_____________________, *The Monitor and the Navy under Steam* (Boston and New York: Houghton, Mifflin and Company, 1900).

Bethlehem Steel Co., Shipbuilding Division, *An Introduction to Shipbuilding: Training within Industry: Labor Division, War Production Board* (Washington, DC: United States Government Printing Office, 1942).

_________________, *Bethlehem Ship Repair Facilities* (New York: Bethlehem Steel Company, 1947).

_________________, *A Century of Progress: 1849-1949* (San Francisco: Bethlehem Steel, 1949).

California State Agricultural Society, *Report of the Visiting Committee of the State Agricultural Society* (Wilmington, Del.: Hagley Museum and Library, 1859).

Cross, Ira B., *A History of the Labor Movement in California* (Berkeley: University of California Press, 1935).

Crowell, Benedict, and Robert Forrest Wilson,, *How America Went to War: An Account from Official Sources of the Nation's War Activities, 1917-1920* (New Haven: Yale University Press, 1921).

Evans, Holden, *One Man's Fight for a Better Navy* (New York: Dodd, Mead & Company, 1940).

Fassett, F. G., ed., *The Shipbuilding Business in the United States of America*, I (New York: Society of Naval Architects and Marine Engineers, 1948).

Haldane, John Wilton Cuninghame, *Steamships and Their Machinery from First to Last* (London: Spon, 1893).

Hopkins, Caspar T. , George C. Perkins, Andrew Crawford, Charles L. Taylor, and Charles B. Stone, *Report on Shipping and Ship-Building to the Manufacturer's Association, the Board of Trade and the Chamber of Commerce* (San Francisco: Joint Committee of the Three Associations, 1884/1885).

Hutchins, John G. B., *The American Maritime Industries and Public Policy, 1789-1914, An Economic History* (Cambridge: Harvard University Press, 1941).

Kelly, Roy Willmarth, and Frederick J. Allen, *The Shipbuilding Industry* (Boston: Houghton Mifflin Company, 1918).

Lloyd, Benjamin E., *Lights and Shades in San Francisco* (San Francisco: A. L. Bancroft, 1876).

Maslin, Marshall, *Western Shipbuilders in World War II, a Detailed Review of Wartime Activities of Leading Maritime and Navy Contractors* (Oakland: Tribune Press, 1945).

Mitchell, J., *Shipbuilding and the Shipbuilding Industry* (London: Sir Isaac Pitman & Sons, Ltd., 1926).

Polk's San Francisco City Directory.

Pollock, David H., *Modern Shipbuilding and the Men Engaged in It* (London: E. & F. N. Spon 1884).

Reinforced Concrete in Factory Construction (New York: The Atlas Portland Cement Company, 1907).

Shinn, John, "Who's Who Among the Painters of the World's Best Submarines," (San Francisco: n.p., [1945?]), on file, San Francisco Public Library History Room, San Francisco Public Library.

Articles

Douglas, P. H., and F. E. Wolfe, "Labor Administration in the Shipbuilding Industry During War Time, I," *Journal of Political Economy*, 27 (March 1919): 362-398.

__________________________, "Labor Administration in the Shipbuilding Industry During War Time, II," *Journal of Political Economy*, 27 (March 1919): 145-187.

Frear, Hugo P., "History of Bethlehem's San Francisco Yard, Formerly Union Iron Works," in *Historical Transactions: 1893-1943* (New York: Society of Naval Architects and Marine Engineers, 1945): 238-241.

Kenny, E. F., "The Development and Use of Steel in Shipbuilding," in *Historical Transactions, 1893-1943*, (Westport, Conn.: Greenwood Press, 1945): 442-451.

Northrup, Herbert R., "Negroes in a War Industry: The Case of Shipbuilding," *Journal of Business of the University of Chicago*, 16 (July 1943), 160-172.

Porter, Paul R., "Labor in the Shipbuilding Industry" in Colston E. Warne, ed., *Yearbook of American Labor Volume I* (New York: Philosophical Library, 1944), 345-353.

Powell, Joseph Wright, "Labor in Shipbuilding," in F. G. Fassett, Jr., ed., *The Shipbuilding Business in the United States of America,* Volume I, (New York: Society of Naval Architects and Marine Engineers, 1948): 271-280.

Richards, J., "The Union Works: The Famous Ship Yards of the Pacific Coast, Where the Oregon and Other Noteworthy Vessels Have Been Built," *Machinery*, 6 (1899).

Rickord, R. V., "Training Workers for the Shipyards; Short Cut Over Old Apprentice System," *Marine Engineering*, 24 (January 1919), 38-42.

Sammis, L. Walter, "The Relation of Trust Companies to Industrial Combinations, as Illustrated by the United States Shipbuilding Company," *Annals of the American Academy of Political and Social Science,* 24 (1904): 241-270.

Silverman, Morton, "The Second Gold Rush Hits the West," San *Francisco Chronicle,* April 25-May 20, 1943.

Teiser, Ruth, "The Charleston: An Industrial Milestone," *California Historical Society Quarterly,* 25 (March 1946): 39.

"West Coast Yards, Navy Repairmen," *Fortune* (1945).

Other

Merchant Marine Act of 1936.

Sanborn Fire Insurance Co., "San Francisco: Union Iron Works," 1889-1945.

U.S. Department of Commerce Maritime Administration, Office of Ship Construction ,Division of Production "Report on Survey of U.S. Shipbuilding and Repair Facilities," 1980.

United States Shipping Board, "Annual Report of the United States Shipping Board," 99 (Washington, DC: Government Printing Office, 1918).

Secondary Sources

Books, Pamphlets, & Dissertations

Biggs, Lindy, *The Rational Factory* (Baltimore and London: Johns Hopkins University Press, 1996).

Blum, Joseph Aaron, "San Francisco Iron: The Industry and its Workers – from the Gold Rush to the Turn of the Century" (M.A. thesis, San Francisco State University 1989).

Bonnett, Wayne, *A Pacific Legacy: A Century of Maritime Photography, 1850-1950* (San Francisco: Chronicle Books, 1991).

_____________, *Build Ships! Wartime Shipbuilding Photographs San Francisco Bay: 1940-1945* (Sausalito: Windgate Press, 1999).

Boyden, Richard, "The San Francisco Machinists from Depression to Cold War, 1930-1950" (Ph.D. diss., University of California, Berkeley, 1988).

Bradley, Betsey Hunter, *The Works* (New York: Oxford University Press, 1999).

Braverman, Harry, *Labor and Monopoly Capital: The Degradation of Work in the Twentieth Century* (New York: Monthly Review Press, 1998).

Brechin, Gray, *Imperial San Francisco: Urban Power, Earthly Ruin* (Berkeley: University of California Press, 1999).

Cowan, Henry J., and Peter R. Smith, *The Science and Technology of Building Materials* (New York: Van Nostrand Reinhold Company, 1988).

Crawford, Michael J., Mark L. Hayes, and Michael D. Sessions, *The Spanish American War: Historical Overview and Select Bibliography* (Washington, DC: Naval Historical Center, Dept. of the Navy, 1998.

Gran, Andrew, *Bethlehem Steel* (New York: Princeton Architectural Press, 1999).

Heinrich, Thomas R., *Ships for the Seven Seas: Philadelphia Shipbuilding in the Age of Industrial Capitalism* (Baltimore: Johns Hopkins University Press, 1997).

Hessen, Robert, *Steel Titan: The Life of Charles M. Schwab* (New York: Oxford University Press, 1975).

Hitchcock, Henry-Russel, and Philip Johnson, *The International Style* (New York: The Museum of Modern Art, 1932; reprint, W. W. Norton & Co., 1995).

Issel, William, and Robert W. Cherny, *San Francisco, 1865-1932: Politics, Power, and Urban Development* (Berkeley: University of California Press, 1986).

Kennedy, David M., *The American People in World War II: Freedom From Fear, Part Two* (New York: Oxford University Press, 1999).

Kesselman, Amy, *Fleeting Opportunities: Women Shipyard Workers in Portland and Vancouver during World War II and Reconversion* (Albany: State University of New York Press, 1990).

Lane, Frederic Chapin, *Ships for Victory: A History of Shipbuilding under the United States Maritime Commission in World War II* (Baltimore: Johns Hopkins University Press, 1951).

Lindberg, Michael, and Daniel Todd, *Anglo-American Shipbuilding in World War II, a Geographical Perspective* (Westport, Conn.: Praeger, 2004).

McClelland, Linda F., *National Register Bulletin: How to Complete the National Register Registration Form*, (Washington, DC: National Parks Service, 1997).

Montgomery, David, *The Fall of the House of Labor: The Workplace, the State, and American Labor Activism, 1865-1925* (Cambridge: Cambridge University Press, 1987).

________________, *Workers' Control in America: Studies in the History of Work, Technology, and Labor Struggles* (Cambridge: Cambridge University Press, 1979).

National Parks Service, "How to Apply the National Register Criteria for Evaluation," Interagency Resources Division, ed. (Washington, DC: National Parks Service, 1997).

Naval Historical Center and the Ships History Branch, "Dictionary of American Naval Fighting Ships," Naval Warfare Division, ed. (Washington, DC: Department of the Navy, 1991).

Palmer, David, *Organizing the Shipyards: Union Strategy in Three Northeast Ports, 1933-1945* (Ithaca: Cornell University Press, 1998).

Swann, Leonard Alexander, *John Roach, Maritime Entrepreneur* (New York: Arno Press, 1980).

Thiesen, William H., *Industrializing American Shipbuilding: The Transformation of Ship Design and Construction, 1820-1920* (Gainesville: University of Florida Press, 2006).

Tyler, David Budlong, *The American Clyde* (Newark: University of Delaware Press, 1958).

Wollenberg, Charles, *Marinship at War: Shipbuilding and Social Change in Wartime Sausalito* (Berkeley: University of California Press, 1990).

Articles

Bernstein, Irving, "Americans in Depression and War," U. S. Department of Labor, www.dol.gov/oasam, accessed May 9, 2008.

Boyden, Richard Prime, "Breaking the Color Bar in Wartime Bay Area Shipyards, 1941-1942" (February 1992).

Hamilton, Cynthia Rose, "General Stores and Mold Loft Building, Harriman Yard of the Merchant Shipbuilding Corporation, National Register Nomination," U. S. Department of the Interior, National Park Service, 2003.

Harper, Marilyn M., John W. Jeffries, William M. Tuttle, Jr., Nelson Lichtenstein, and Harvard Sitkoff, eds., "World War II and the American Home Front Theme Study," (Washington, DC: National Park Service, 2004).

Hessen, Robert, "The Transformation of Bethlehem Steel, 1904-1909," *Business History Review*, 46 (1972): 339-360.

Hounshell, David, "Ford Eagle Boats and Mass Production during World War I," in Merritt Roe Smith, ed., *Military Enterprises and technological Change: Perspectives on the American Experience* (Cambridge: MIT Press, 1985).

"Industrial Building Types Studies," February 1940, in Kenneth Reid, A.I.A., ed., *Industrial Buildings, The Architectural Record of a Decade*, (New York: F. W. Dodge Corporation, 1951).

Johnson, Marilyn S., "Wartime Shipyards: The Transformation of Labor in San Francisco's East Bay," in Sally M. Miller and Daniel A. Cornford, eds., *American Labor in the Era of World War II* (Westport: Praeger, 1995).

Kelley, Tim, "Ship Repair Yards and Dry Docks in San Francisco 1941-1955," (San Francisco: Workplace History Organization, n.d.).

Lipfert, Nathan, "The Shipyard Worker and the Iron Shipyard," *The Log of Mystic Seaport,* 35 (Fall 1983), 83-84.

Nelson, Daniel, "Scientific Management, Systematic Management, and Labor, 1880-1915," *Business History Review,* 48 (1974): 479-500.

Oyos, Matthew M., "Theodore Roosevelt and the Implements of War," *Journal of Military History*, 60 (October 1996): 631-655.

Park, Sharon C., "The Repair and Thermal Upgrading of Historic Steel Windows," *Preservation Briefs 13* (Washington D.C.: US Government Printing Office).

Parry, David, "Meyer, Frederick Herman," *Encyclopedia of San Francisco*, http://www.sfhistoryencyclopedia.com/articles/m/meyerFrederick.html, accessed December 4, 2007.

__________, "Percy & Hamilton," *Encyclopedia of San Francisco*, http://www.sfhistoryencyclopedia.com, accessed December 4, 2007.

Quivik, Fredric L., "Historic American Engineering Record: Kaiser's Richmond Shipyards," National Park Service, 2004.

"Southern Pacific Sacramento Yards," *Historic American Engineering Record* (2001).

Stewart, Robert C., "Historic American Engineering Record: *U.S.S. Olympia*," U. S. Department of the Interior, National Park Service, 1998.

Stripp, Fred, “The Treatment of Negro-American Workers by the AFL and the CIO in the San Francisco Bay Area,” *Social Forces*, 28 (March 1950): 330-332.

“The Transformation of Bethlehem Steel, 1904-1909,” *Business History Review,* 46 (1972), 344-46.

Walters, William D., "American Naval Shipbuilding: 1890-1989," *Geographical Review*, 90 (2000): 418-431.

Williams, William J., "Josephus Daniels and the U. S. Navy's Shipbuilding Program During World War I," *Journal of Military History*, 60 (1996): 7-38.

Other

Adams, George R., "U. S. Navy Yard, Mare Island, National Register Nomination," United States Department of the Interior, National Parks Service, 1974.

Beard, Frank A., and Robert L. Bradley, "Portsmouth Naval Shipyard National Register Nomination," United States Department of the Interior, National Park Service, 1977.

Cardwell, Kenneth H., "U. S. Navy Yard, Mare Island, National Register Nomination," U. S. Department of the Interior, National Parks Service, 1985.

Carey & Co., Inc., "Seawall Lot 349 at Pier 70, Building 12 Complex San Francisco Electrical Reliability Power Project Setting Analysis," 2003.

"Finding Aid,” Herbert Lee Seward Collection, Stephen B. Luce Library, State University of New York, Maritime College, http://www.sunymaritime.edu/stephenblucelibrary, accessed June 9, 2008.

Goldenberg, Nancy, and Jody R. Stock, "National Register of Historic Places: Richmond Shipyard Number Three, Kaiser Shipyards, Richmond, California," 1999.

Hefner, Robert J., "Bayles Shipyard National Register Nomination," U.S. Department of the Interior, National Park Service, 1999.

McVarish, Douglas C., "Philadelphia Naval Shipyard Historic District, National Register Nomination," U.S. Department of the Interior, National Park Service, 1999.

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Figure 1. Aerial view of the Pier 70 Historic District with properties identified by name or number.

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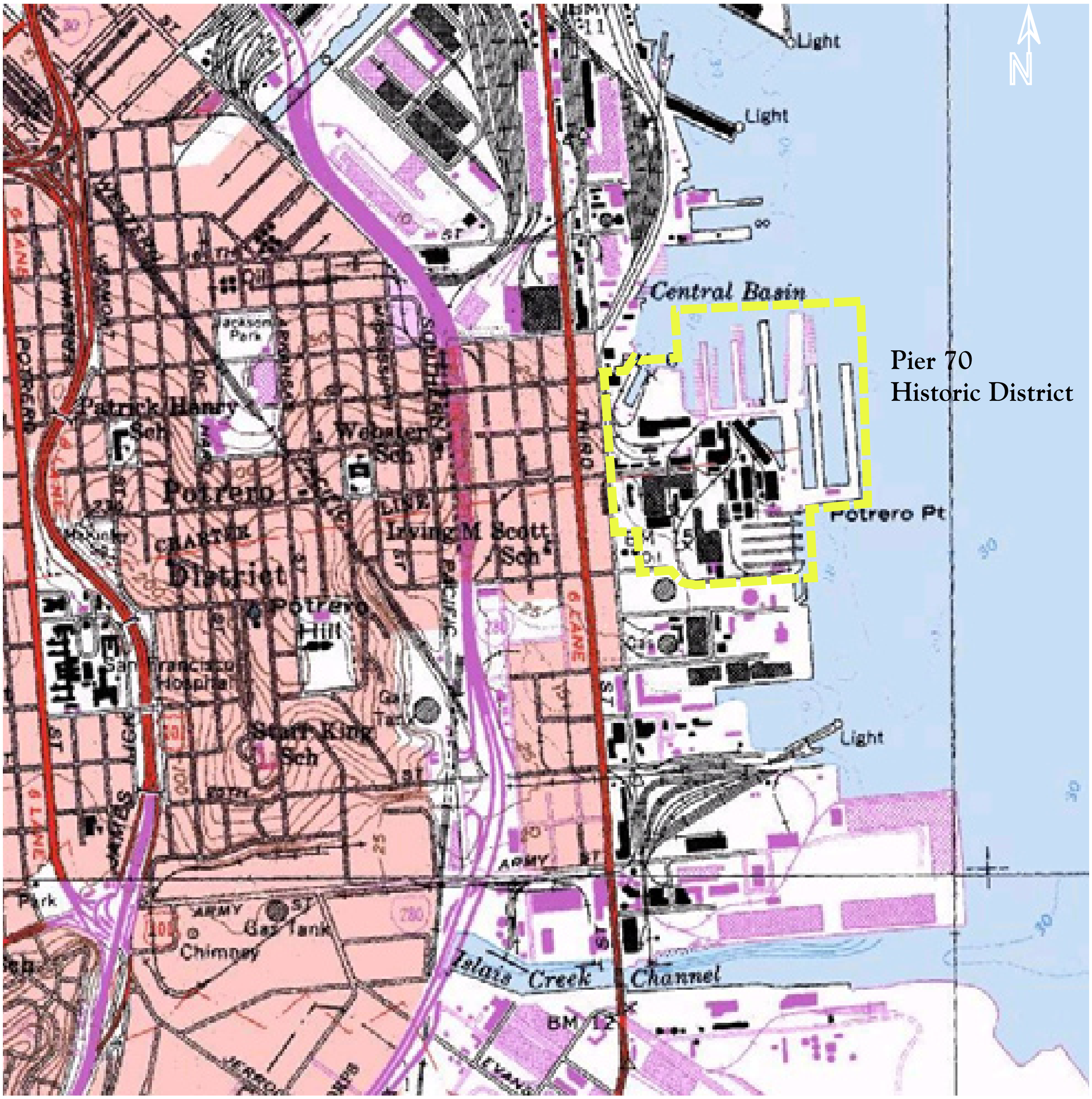

Figure 2. Pier 70 Historic District Location Map.
USGS 7.5 Series Topographic Map, San Francisco North, 1978.

Figure 3. Ownership Map of the Pier 70 Historic District. Boundaries shown above are approximate and are roughly based on the 1886, 1899, and 1914 Sanborn Maps.

Union Iron Works Shipyard in 1884
Boundary estimated from 1886 Sanborn

Risdon Iron and Locomotive Works
(1900-1911)

Pacific Rolling Mills (1868-1900)
Boundary estimated from 1886 Sanborn

Boundary of the WWI U. S. Destroyer Plant
operated by Union Iron Works Company
Owned by the U. S. Steel Products Company
(U. S. Steel Corp. Subsidiary)

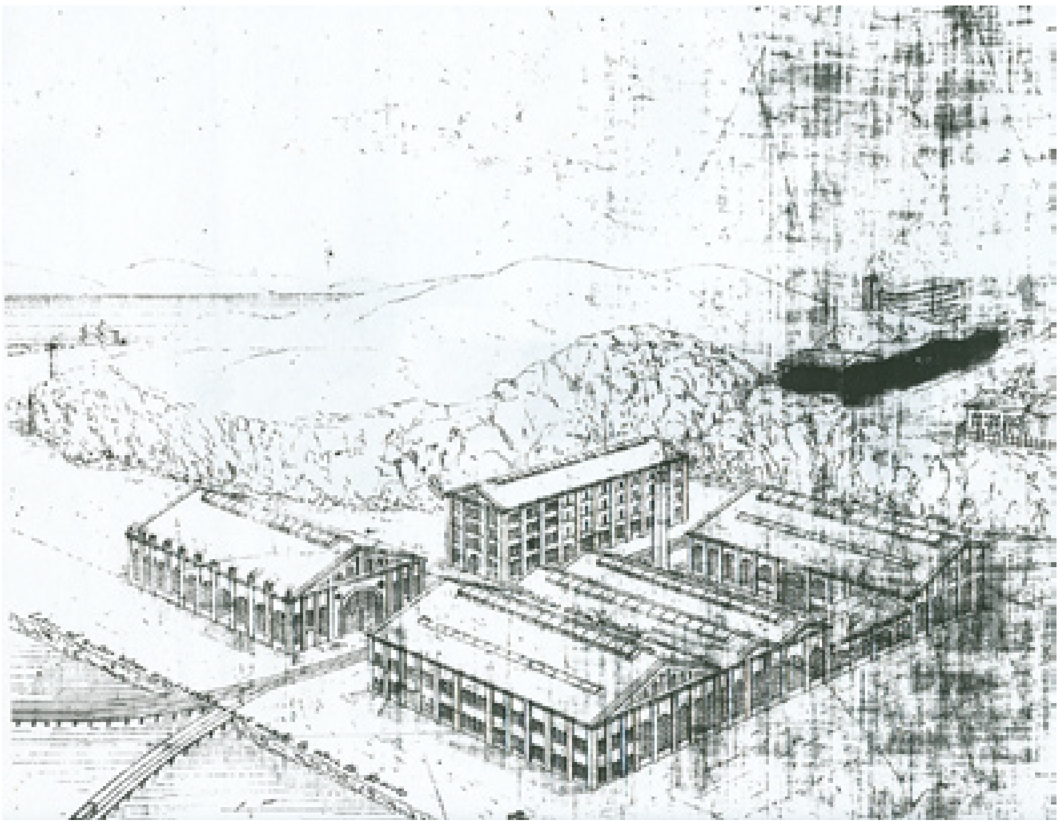

Figure 4. An 1884 line drawing showing the extent of Irish Hill behind the original Union Iron Works buildings. San Francisco Maritime Museum.

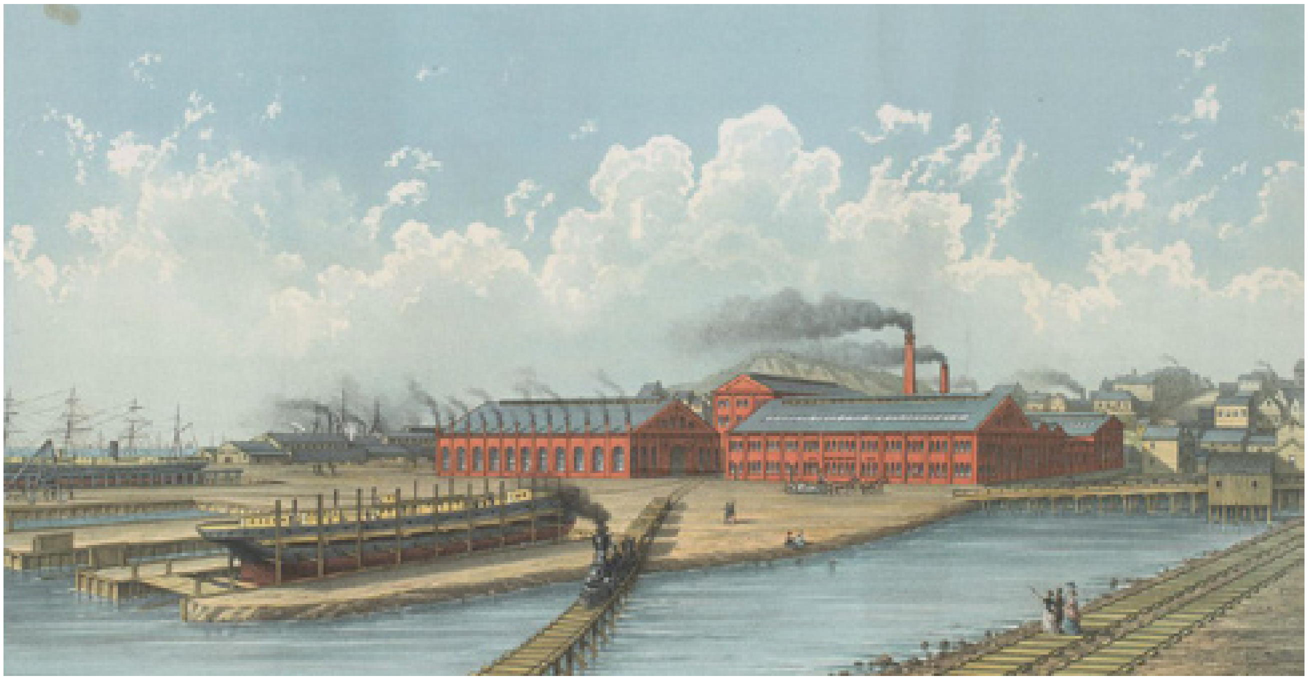

Figure 5. 1880s view of Union Iron Works showing the early development of the waterfront and Building 113 before it was connected in 1914. This view fails to show the plate shop at the head of the slipways. Note the bridge access to the yard along 20th Street and Irish Hill rock outcropping in the background. Pacific Rolling Mills is visible to the southeast.
Bancroft Library, University of California at Berkeley.

Figure 6. The Shipbuilding Process at Union Iron Works during the 1880s.
This map shows the basic process of hull construction and outfitting at the yard. A ship's design or **plan** originated in the yard's office in the Machine Shop's mezzanine (Building 113). Loftsmen laid down the lines of hull on the **mold loft** floor by scaling up from wood models or plans. Full-sized templates for the hull plates were measured on the floor, cut, and moved downstairs to the plate shop. Workers moved steel plates from the **storage yard** to the **plate shop**, where skilled workers cut the steel plates, carefully trimming them to match the templates. Workers moved the plates on carts to the hull on the **slip**, cranes positioned plates, and rivetting gangs riveted the plates to the hull. After the hull was complete, it was launched, moved to the **outfitting dock**, and fitted with propulsion systems, infrastructure, and crew quarters. Components for a ship's engine or boiler often started as wood patterns produced by pattern makers in the **pattern house**. Propulsion-related components were cast in the **foundry** and moved to the **machine shop** or **boiler shop**. Completed engines, boilers, and other components were moved by rail to the **outfitting dock**.

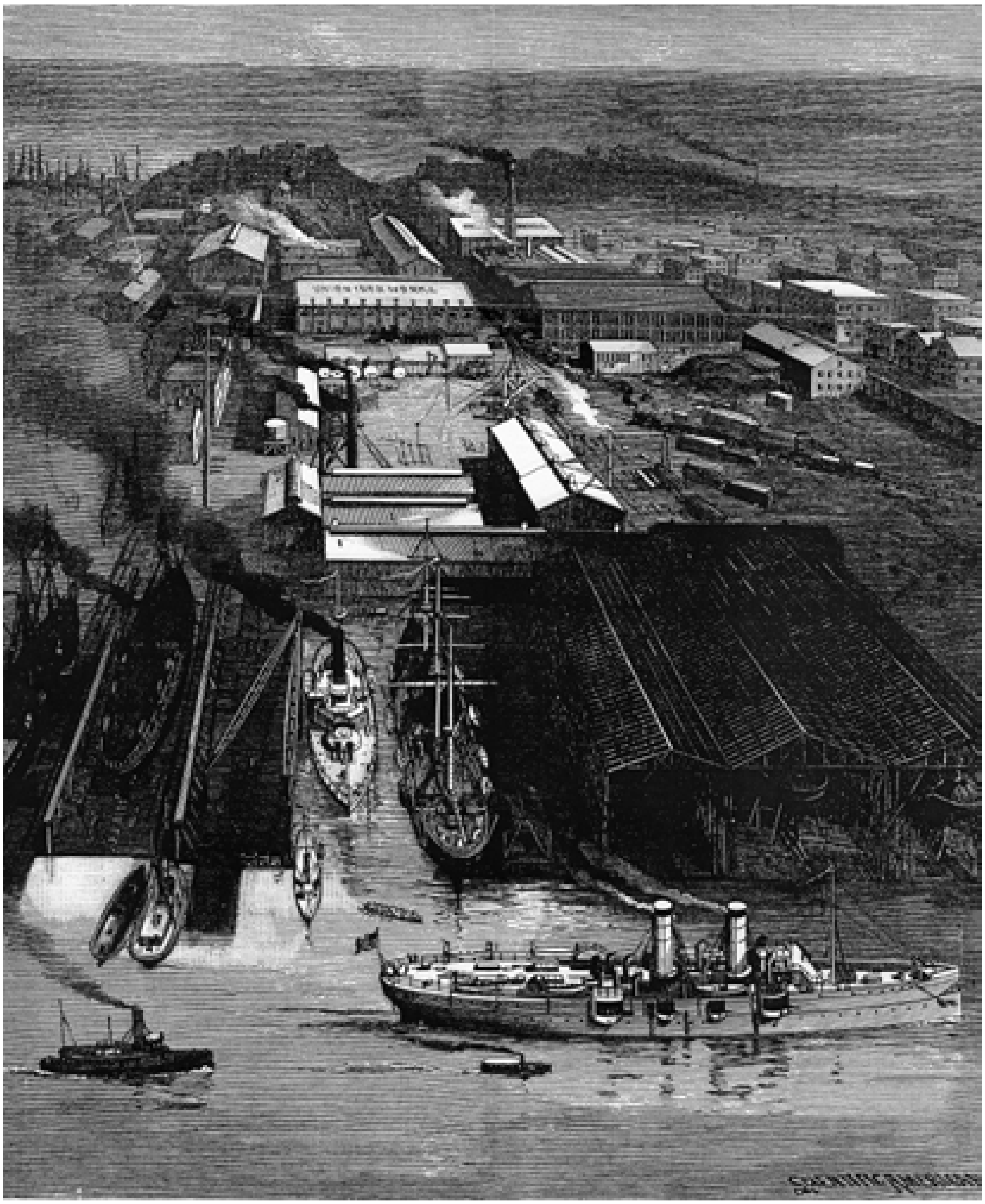

Figure 7. 1892 *Scientific American* View of Union Iron Works
This view shows the plate shop, the hydraulic dry dock, the truss structures and cranes over the slips, and the storage areas south of the plate shop as well as the machine and metal shops shown in earlier views.

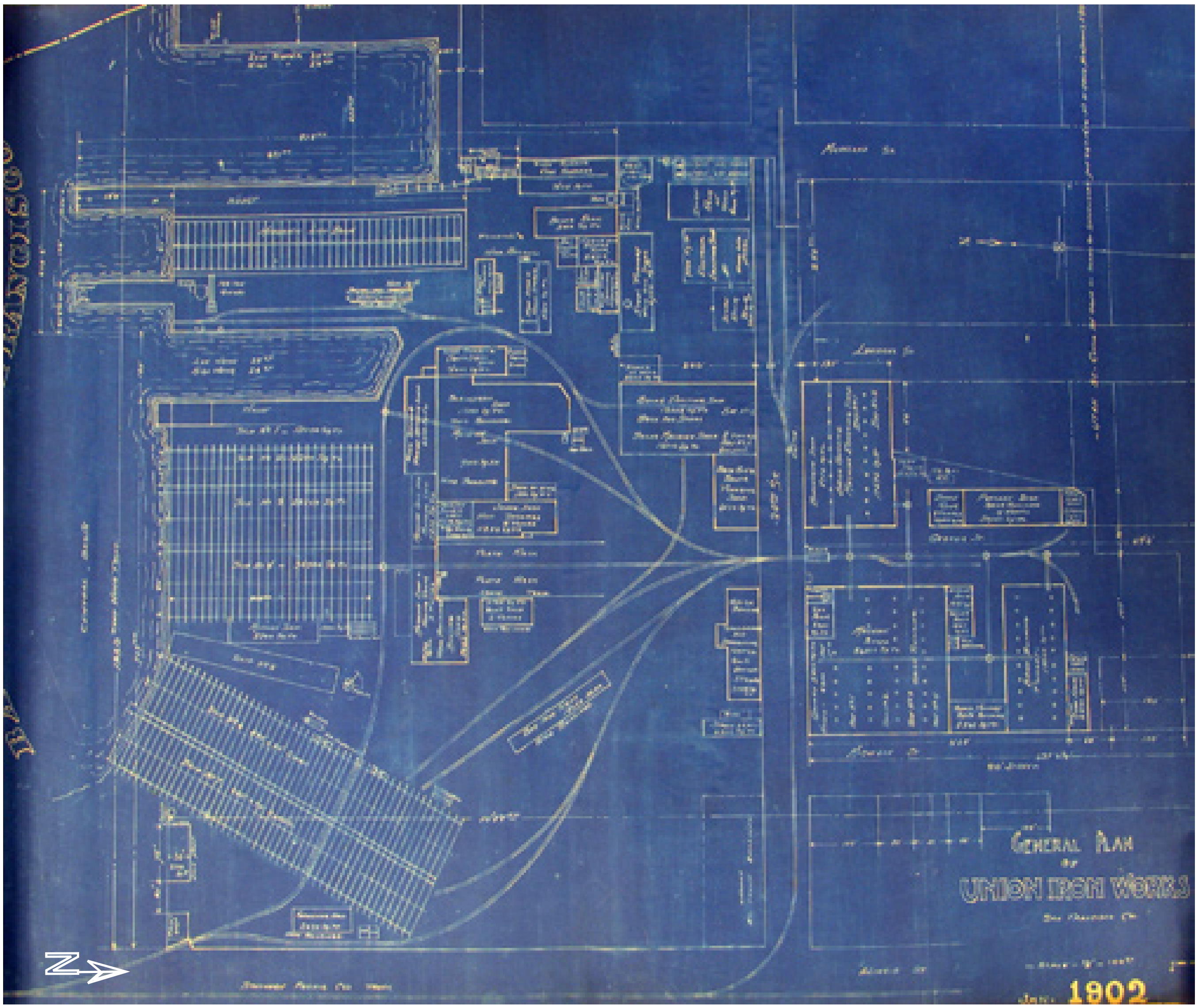

Figure 8. 1902 General Plan of the Union Iron Works. San Francisco Maritime Museum.

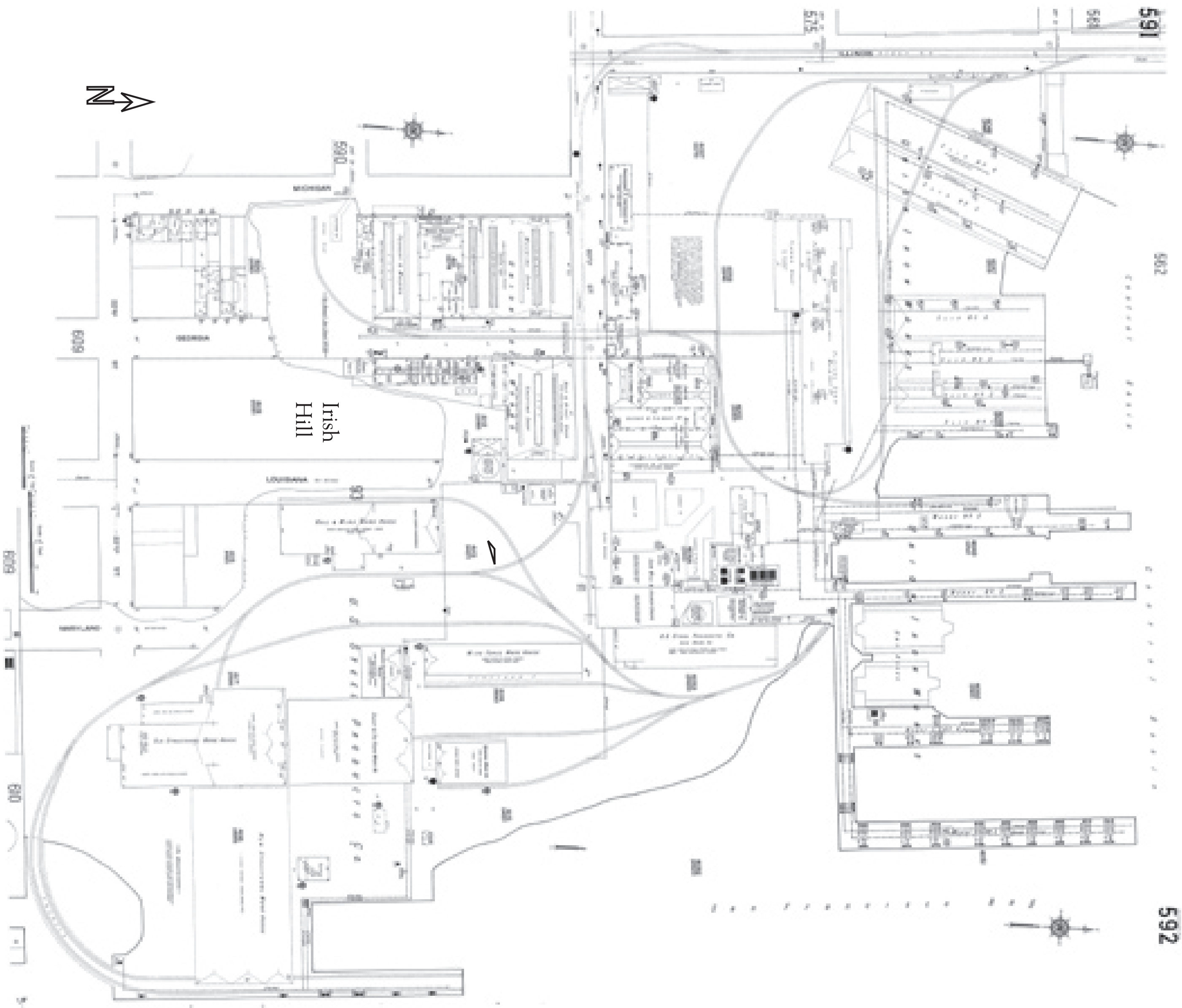

Figure 9. 1914 Sanborn Insurance Company Map of Union Iron Works.
Note that U. S. Steel Products Co. is the owner of the former Risdon shipyard and that the Risdon buildings were mainly used for warehouses prior to WWI. The majority of the streets shown on this maps are labeled as unopened or impassable.

Figure 10. View of Union Iron Works around 1917. San Francisco Maritime Museum.

Figure 11. View of Union Iron Works during WWI. San Francisco Maritime Museum.

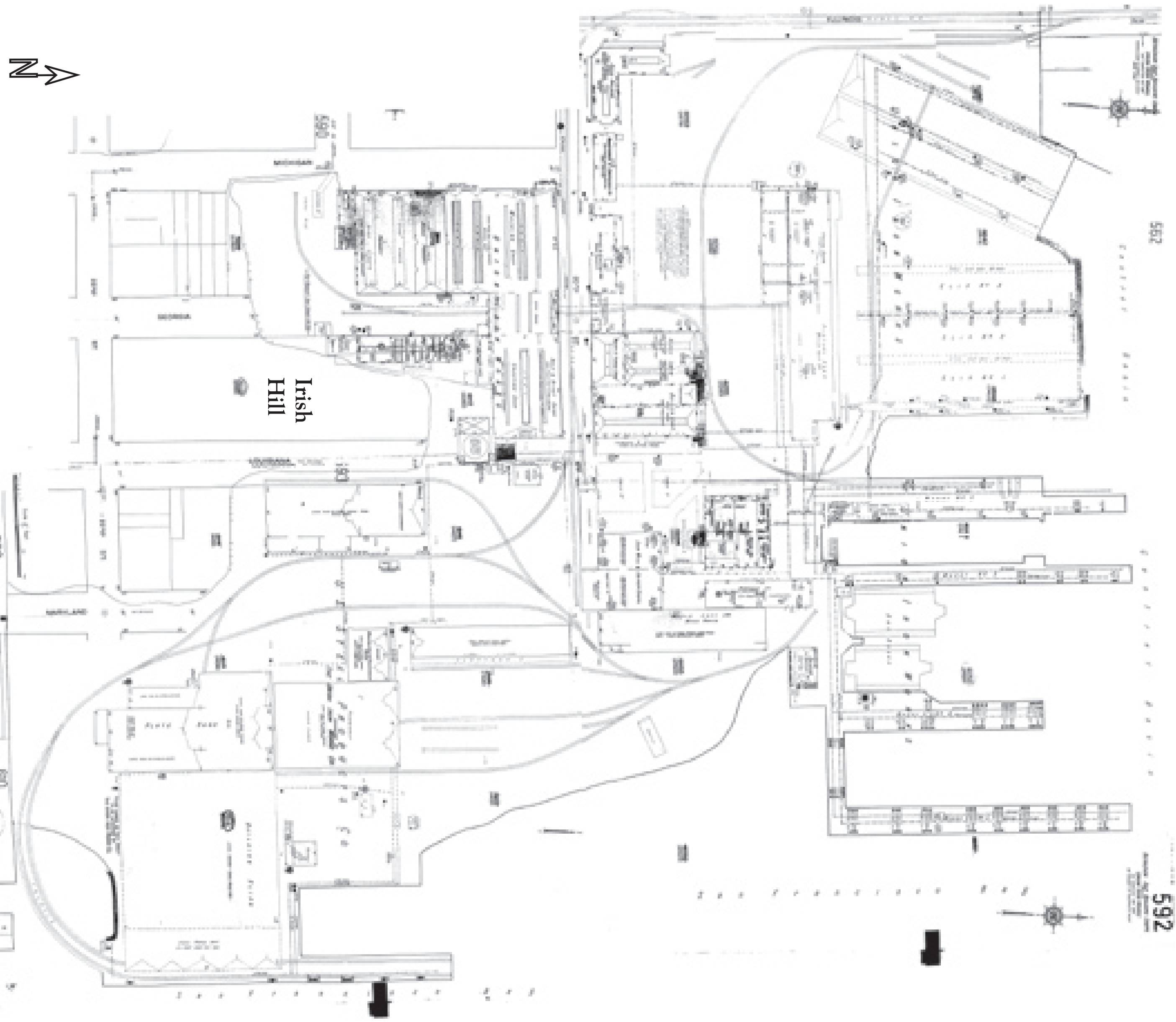

Figure 12. 1936 Sanborn Insurance Company Map showing the yard during the 1936 upgrades and before the Building 12 Complex replaced the WWI destroyer shipyard in the southeastern corner.

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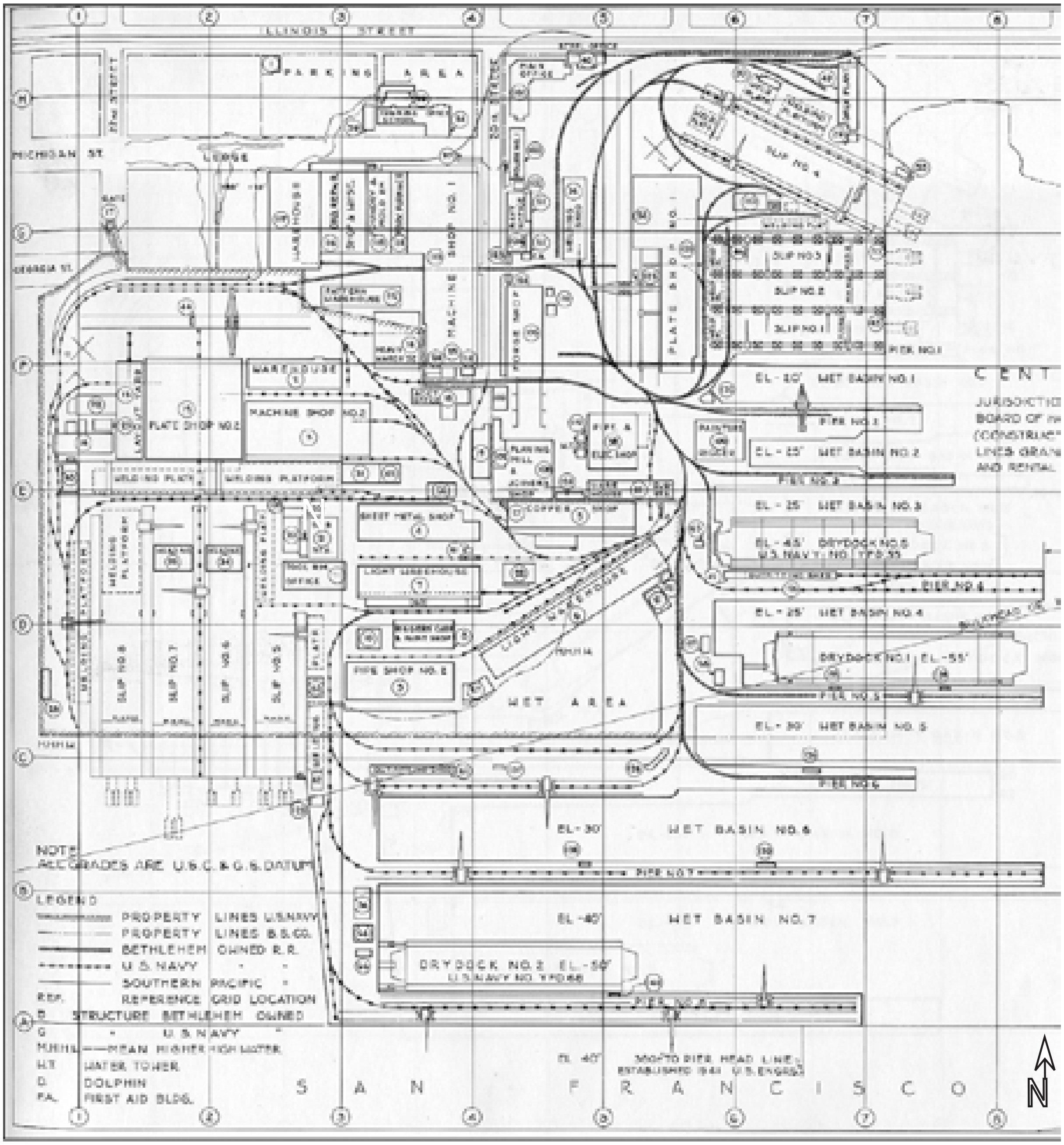

Figure 13. 1945 Site Plan showing the yard's maximum build out at the end of World War II. The New Yard or Building 12 Complex is shown in the lower left corner.

Figure 14. The Shipbuilding Process at the New Yard during World War II.
This map shows the basic process of hull construction and outfitting at the New Yard. The working plans for a ship were drafted in the **administration office** (Building 101) or naval office (Building 104). Plans were laid down in the **mold loft**; templates were cut and moved downstairs to the plate shop. Cranes moved steel plates from the **storage yard** to the **plate shop** and workers cut and bent plates to match the templates. Plates were joined into sub-assembles, when called for, and moved by rail or crane to **welding platforms**, where parts were joined into even larger sections, such as deck houses, and bow and stern assemblies. Cranes moved completed sub-assemblies to the slips. When the hull was completed it was launched and moved to **outfitting docks**. During WWII outfitting tasks were housed in specialized finishing and engineering buildings and were supported by various warehouses. Cranes and rail lines moved outfitting components through the yard to the outfitting dock.

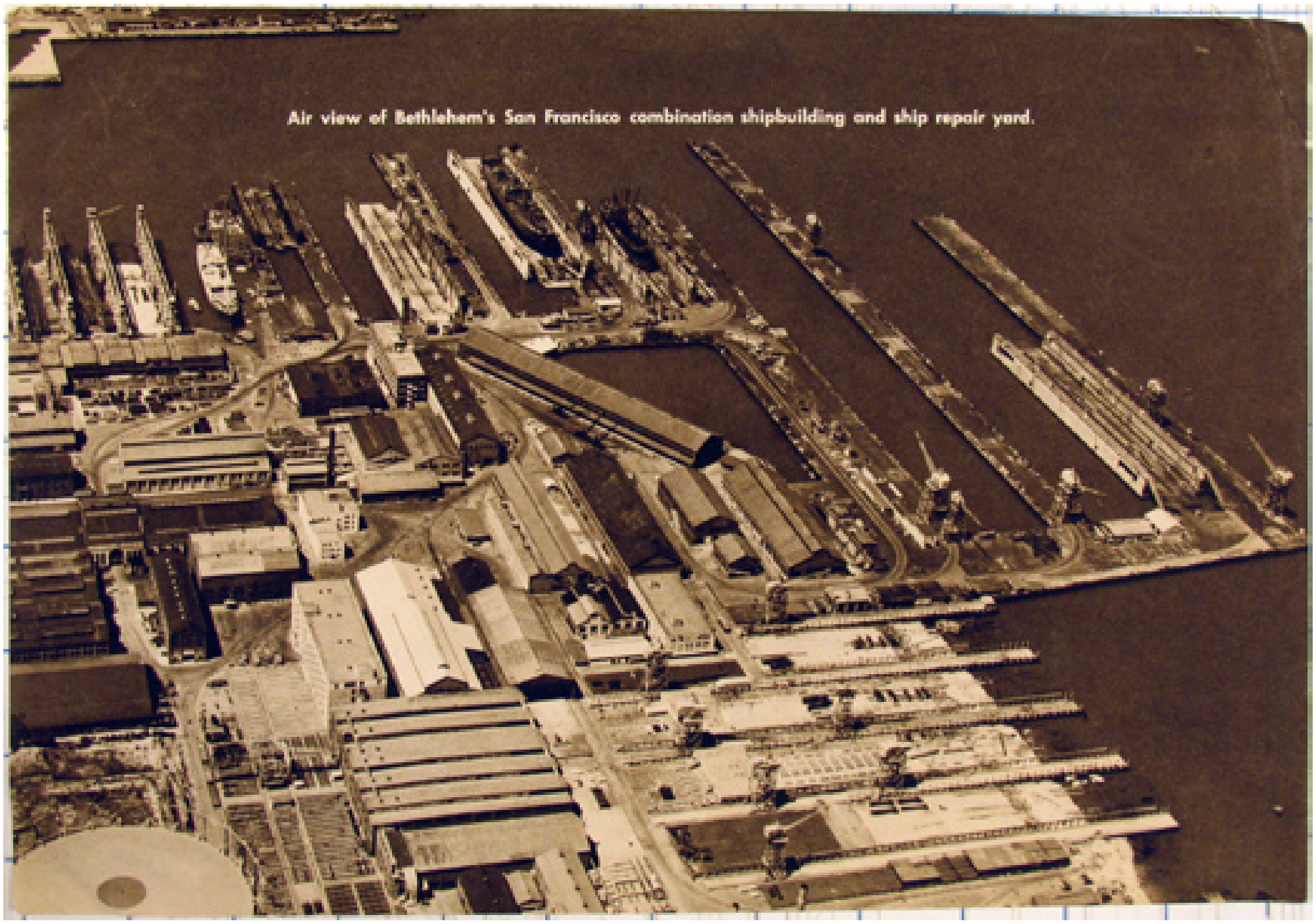

Figure 15. World War II aerial view of the yard**.**

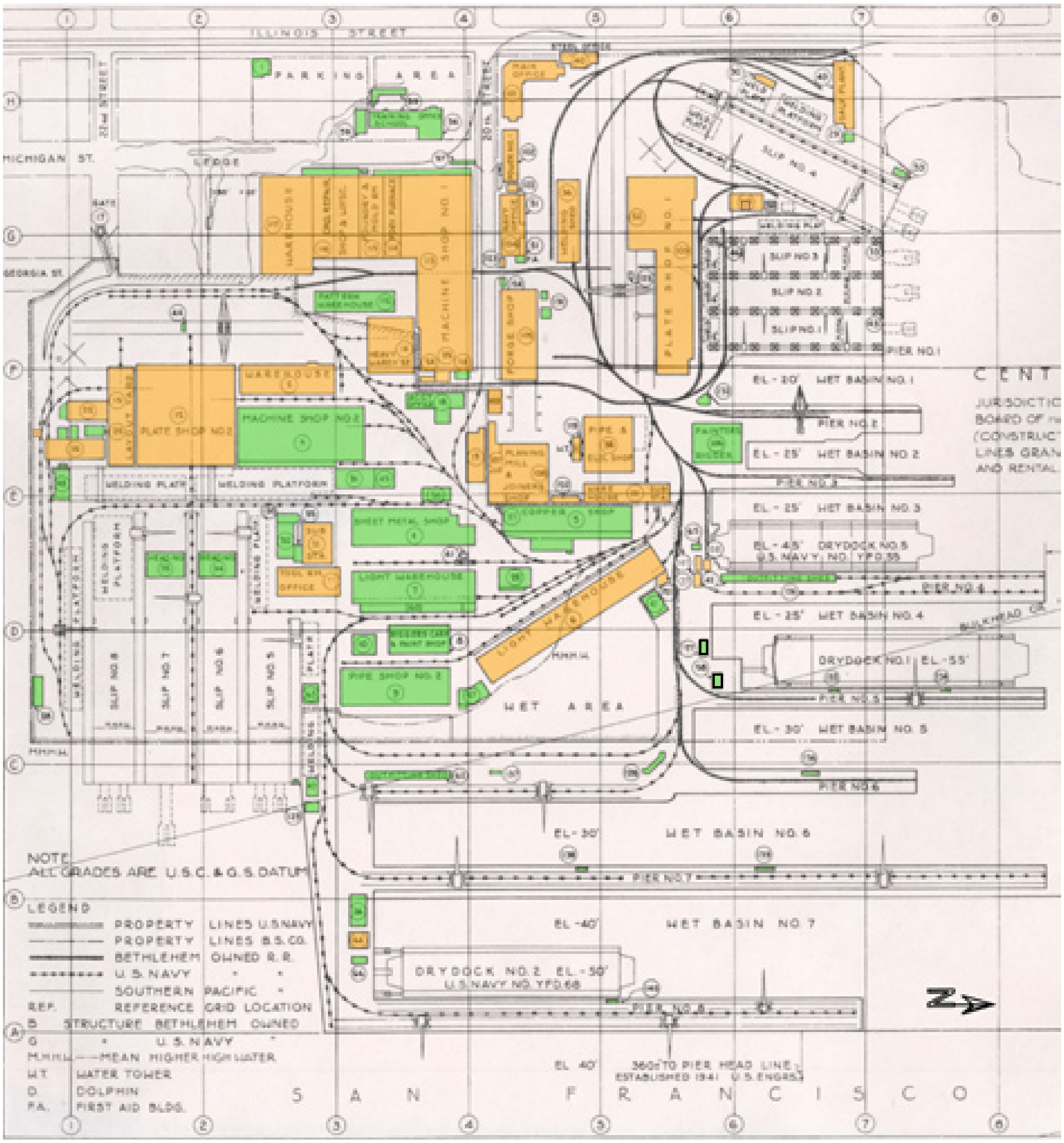

Figure 16. Extant and Demolished Buildings.
The color-coding on this 1945 site plan shows the buildings current standing in orange and the buildings demolished after 1945 in green. Building 66, a welding shed associated with the Building 12 Complex is not shown on this map and is extant.

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Figure 17. Contributing and Non-Contributing Properties

Historic Significance

Contributing

Non-contributing

Figure 18: Building 2, west elevation.

Figure 19: Building 6, west elevation.

Figure 20: Building 11, east elevation.

Figure 21: Building 12, east elevation.

Figure 22: Building 14, west and south elevations.

Figure 23: Building 15, south elevation.

Figure 24: Building 16, east elevation (top), and furnace off the west elevation (bottom).

Figure 25: Building 19, south elevation

Figure 26: Building 21, north elevation

Figure 27: Building 24, south and east elevations.

Figure 28: Building 25, south elevation with Buildings 15 and 16 in the background.

Figure 29: Building 30, west elevation.

Figure 30: Building 32, west elevation.

Figure 31: Building 36, south elevation.

Figure 32: Building 38, north elevation.

Figure 33: Building 40, rear.

Figure 34: Building 49, north and east elevations.

Figure 35: Building 110 and Building 50 (Building 50 is the structure at right), east elevation.

Figure 36: Building 58, south and west elevations.

Figure 37: Building 64, north elevation.

Figure 38: Building 66, south elevation.

Figure 39: Building 101, west and south elevations.

Figure 40: Building 102, south elevation.

Figure 41: Building 103, north elevation.

Figure 42: Building 104, south elevation.

Figure 43: Building 105, west and south elevations.

Figure 44: Building 107, north elevation.

Figure 45: Building 108, north elevation.

Figure 46: Building 109, north elevation.

Figure 47: Building 110, east elevation.

Figure 48: Building 111, west elevation.

Figure 49: Building 113/114, west elevation.

Figure 50: Buildings 115/116, east elevation.

Figure 51: Building 117, northeast corner.

Figure 52: Building 119, east elevation.

Figure 53: Building 120, west elevation

Figure 54: Building 121, north elevation

Figure 55: Building 122, south elevation.

Figure 56: Building 123, southeast corner.

Figure 57: Irish Hill remnant, photo taken from Building 2, looking west.

Figure 58: Slip Number 4 and cranes.

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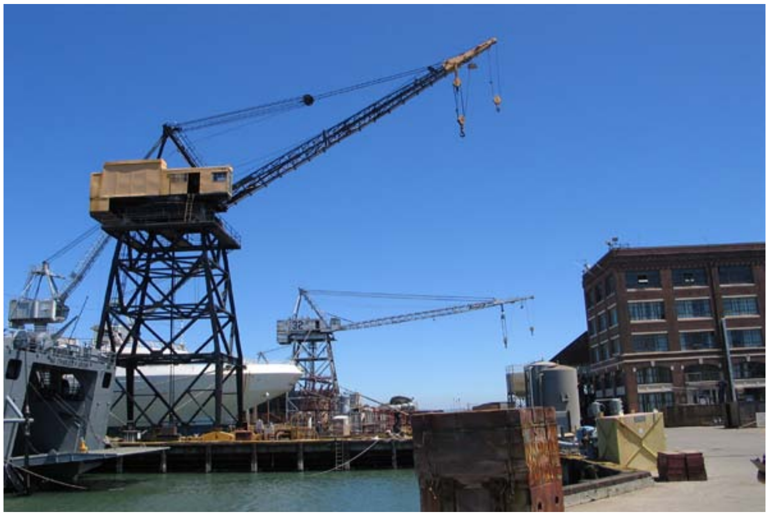


Figure 59: Crane 27 on Pier 68, Wharf 3.

Figure 60: Iron fence on 20th and Illinois Streets.

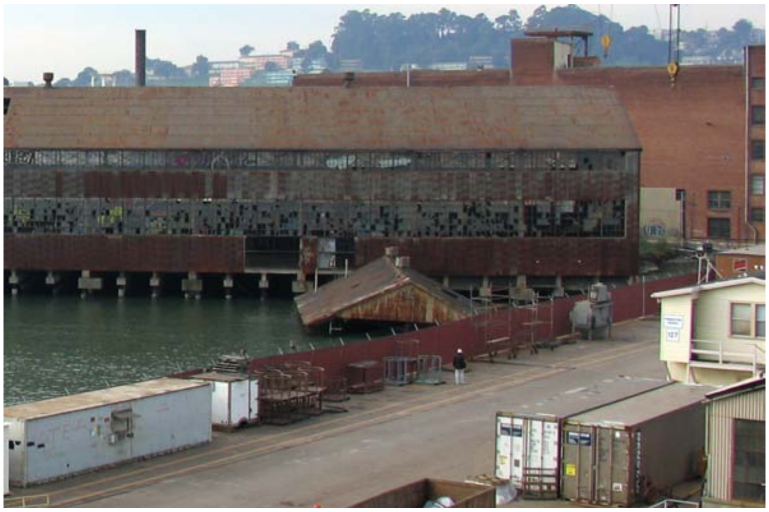


Figure 61: Building 41 (semi-submerged).

Figure 62: Building 68, south elevation. Also see Figure 64.

Figure 63: Building 127, east elevation.

Figure 64: Building 141, metal-clad structure. Building 68 in background.

Figure 65: Pier 68 from upper level of Dry Dock 2.

Figure 66: Dry Dock 1.

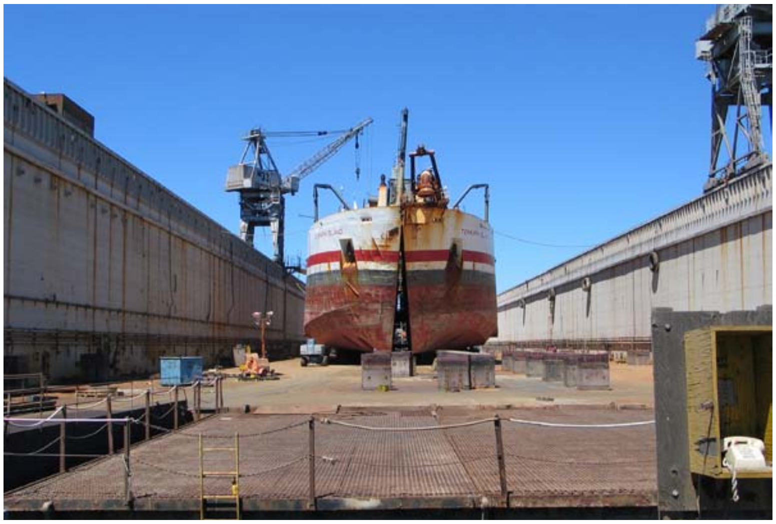


Figure 67: Dry Dock 2.

Figure 68: Dry Dock Eureka.

Figure 69: Remnants of wharf 6 and 7 extending from Pier 70.

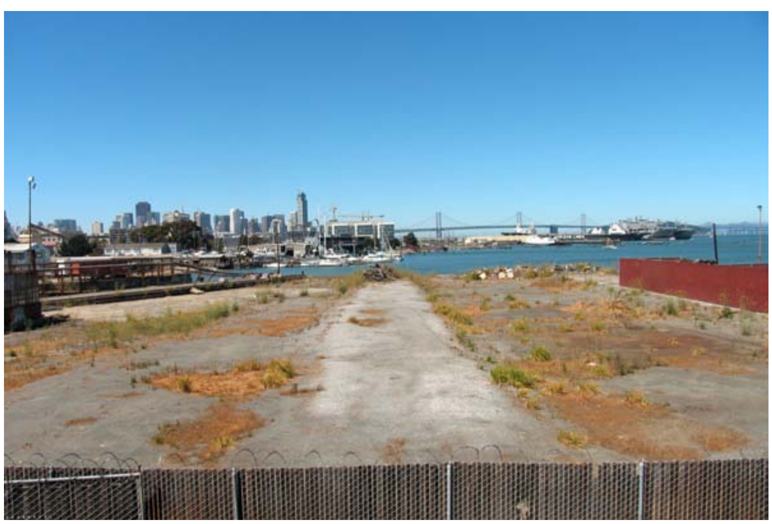


Figure 70: Slips 1,2 and 3.

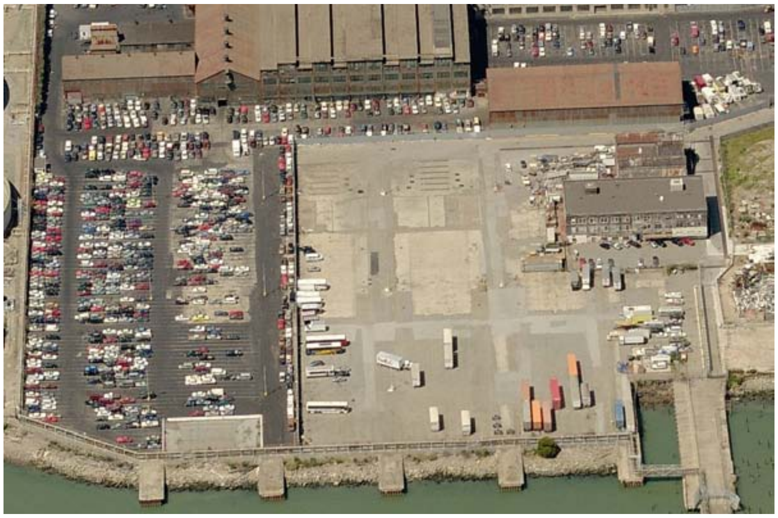


Figure 71: Slips 5-8, aerial view.

Figure 72: Cranes 6, 31, and 32.

Figure 73: Paving Stones on either side of 20th Street.

Figure 74: Rail line remnant near Slip No. 4 running toward Building 101.

Appendix A: List of Vessels Built at UIW 1884-1945

Ship Name	Owner	Type	Launched
Arago	Oregon Coal Company	Collier	2/27/1885
Adeline		Steam Launch	
General McDowell		Freighter	2/28/1885
Balboa			
Emerald		Passenger	
Premier			
Charleston	US Navy	Cruiser	7/19/1888
Pomona	Pacific Coast Line	Cruiser	
Active	US navy	Tug	
San Francisco	US Navy	Cruiser	10/26/1889
Cruiser No. 5	US Navy	Cruiser	3/3/1885
Romola		Launch	
Colis	San Francisco Co.	Tug	
Salmo			
Monterey	US Navy	Monitor	4/28/1891
Whisper			
Olympia	US Navy	Cruiser	11/5/1892
Oregon	US Navy	Battleship	10/26/1893
Columbia	US Lightship Service	Light Ship	
Fearless	US Navy	Tug	
Peru	Pacific Mail Line	Freighter	
El Primero	Edward Hopkins	Steam Yacht	
Gracie S	Bay Pilots Assn.	Pilot Boat	
Santa Lucia		Tug	
George Loomis	Standard Oil Co.	Tanker	
(15) No name		Barges	
Northern Light			
Tahoe		Passenger Freighter	
Wheeling	US Navy	Gunboat	3/18/1897
Marietta	US Navy	Gunboat	3/18/1897
Helene	Wilder Steamship	Passenger Freighter	
Farragut	US Navy	Torpedo Boat	7/16/1898
Wisconsin	US Navy	Battleship	11/26/98
Izabel	Pacific Mail Line	Water Boat	
Chitose	Japanese Navy	Cruiser	1/22/98
No name		Launch	
Senator	Pacific Coast Line	Passenger Freighter	
Maui	Wilder Steamship	Passenger Freighter	
Berkeley	San Francisco Co.	Ferry	
St. Paul	Alaska Coal Co.	Freighter	
Sadie	Alaska Coal Co.	Tug	
Fearless	Spreckels Co.	Tug	
Wallula	Oregon Railraod	Tug	
Union	Union Iron Works	Tug	
Ohio	US Navy	Battleship	5/18/01
Wyoming	US Navy	Monitor	9/8/00
Paul Jones	US Navy	Destroyer	6/14/02
Perry	US Navy	Destroyer	10/27/00
Preble	US Navy	Destroyer	3/2/01
San Pablo	Santa Fe Railroad	Ferry	
Californian	American Mail Line	Freighter	

Appendix A: List of Vessels Built at UIW 1884-1945

Ship Name	Owner	Type	Launched
Manulani	Wilder Steamship	Passenger Freighter	
Tacoma	US Navy	Cruiser	6/2/03
Alaskan	American Hawaiin	Freighter	
Tamalpais		Ferry	
Spokane	Pacific Coast Line	Passenger Freighter	
Arizonian	American Hawaiin	Freighter	
Grampus	US Navy	Submarine	7/31/02
Pike	US Navy	Submarine	1/14/03
California	US Navy	Cruiser	4/28/04
South Dakota	US Navy	Cruiser	7/21/04
Milwaukee	US Navy	Cruiser	9/10/04
Mamaulate		Launch	
Whittler	Union Line	Passenger Freighter	
Like Like		Freighter	
Mexican	American Hawaiin	Freighter	
Columbian	American Hawaiin	Freighter	
Isthmian	American Hawaiin	Freighter	
Mauna Kea	Inter Island Line	Passenger Freighter	
Contra Costa	Standard Oil Co.	Tank Barge	
LT W. L. Murphy	US Navy	Passenger Tug	
LT J. A. Pusney	US Navy	Passenger Tug	
CAPT Anton Springer	US Navy	Passenger Tug	
No name	US Navy	Caisson	
No name		Pontoon	
F-1	US Navy	Submarine	3/12/12
F-2	US Navy	Submarine	3/19/12
Napa Valley		Ferry	
San Pedro	Santa Fe Railroad	Ferry	
Kilauea	Inter Island Line	Passenger Freighter	
H-1	US Navy	Submarine	5/6/12
H-2	US Navy	Submarine	6/4/13
H-3	US Navy	Submarine	3/14/14
No name	US Navy	Caisson	
K-7	US Navy	Submarine	6/20/14
K-8	US Navy	Submarine	7/11/14
No name	US Navy	Pontoon	
William Chatham	Loop Lumber Co.	Lumber Carrier	
Henry T. Scott		Lumber Carrier	
Aroline		Passenger Freighter	
Petroleum No. 3	Standard Oil Co.	Tanker	
Pico		Tank Barge	
Frank H. Buck	Tidewater Oil Co.	Tanker	
No name	Panama Canal Commission	Caisson	
No name	Standard Oil Co.	Barge	
No name	Union Iron Works	Dredge	
J. A. Moffett	Standard Oil of California	Tanker	
Lyman Stewart	Standard Oil of California	Tanker	
No name		Dredge	
U.I.W. No. 3	Union Iron Works	Launch	
Pacific	American South African Line	Passenger Freighter	
Eurana	American South African Line	Passenger Freighter	

Appendix A: List of Vessels Built at UIW 1884-1945

Ship Name	Owner	Type	Launched
Olinoa	Union Oil of California	Tank Barge	
La Brea	Union Oil of California	Tanker	
Los Angeles	Union Oil of California	Tanker	
D.G. Scofield	Standard Oil of California	Tanker	
Acme	Soconey-Vacuum Oil	Tanker	
Davenger	Nav. & Coal Co.	Freighter	
Maui	Matson Navigation	Passenger Freighter	
Astral	Soconey-Vacuum Oil	Tanker	
H.C. Folger	Atlantic Refining	Tanker	
J. W. Van Dyke	Atlantic Refining	Tanker	
Paulsboro	Soconey-Vacuum Oil	Tanker	
War Knight	UK Admiralty	Freighter	
War Monarch	UK Admiralty	Freighter	
Fred W. Weller	Standard Oil of New Jersey	Tanker	
A.C. Bedford	Standard Oil of California	Tanker	
Eagle	Soconey-Vacuum Oil	Tanker	
Tiger	Soconey-Vacuum Oil	Tanker	
Talabat		General Cargo	
Bessa		General Cargo	
George G. Henry	Standard Oil of New Jersey	Tanker	
War Sword	UK Admiralty	General Cargo	
J. E. O'Neil	Atlantic Refining	Tanker	
Herbert L. Pratt	Atlantic Refining	Tanker	
S. M. Spalding	Standard Oil of New Jersey	Tanker	
Paul H. Harwood	Standard Oil of New Jersey	Tanker	
W. S. Rheem	Standard Oil of New Jersey	Tanker	
W. M. Irish	Atlantic Refining	Tanker	
W. M. Burton	Atlantic Refining	Tanker	
Volunteer	US Shipping Board	General Cargo	
Wichita/Liberator	US Shipping Board	General Cargo	
No name	Union Iron Works	Dry Dock	
Challenger	US Shipping Board	General Cargo	
Redondo	A.O. Linovig.	General Cargo	
No name	Union Iron Works	Caisson	
McKee	US Navy	Destroyer	3/23/18
Robinson	US Navy	Destroyer	3/28/18
Ringgold	US Navy	Destroyer	4/14/18
McKean	US Navy	Destroyer	7/4/18
Harding	US Navy	Destroyer	7/4/18
Gridley	US Navy	Destroyer	7/4/18
War Harbour/Independence	UK Admiralty	General Cargo	
War Haven/Victorious	UK Admiralty	General Cargo	
War Ocean/Defiance	UK Admiralty	General Cargo	
War Rock/Invincible	UK Admiralty	General Cargo	
War Sea/Courageous	UK Admiralty	General Cargo	
War Cape/Triumph	UK Admiralty	General Cargo	
War Surf/Eclipse	UK Admiralty	General Cargo	
War Wave/Archer	UK Admiralty	General Cargo	
Steadfast	US Shipping Board	General Cargo	
Dreadnaught	Rolph Navigation Co.	Tug	
Undaunted	Rolph Navigation Co.	Tug	

Appendix A: List of Vessels Built at UIW 1884-1945

Ship Name	Owner	Type	Launched
R-15	US Navy	Submarine	12/10/17
R-16	US Navy	Submarine	12/15/17
R-17	US Navy	Submarine	12/24/17
R-18	US Navy	Submarine	1/8/18
R-19	US Navy	Submarine	1/28/18
R-20	US Navy	Submarine	1/21/18
Schey	US Navy	Destroyer	3/28/18
Champlin	US Navy	Destroyer	4/7/18
Mugford	US Navy	Destroyer	4/14/18
Chew	US Navy	Destroyer	5/26/18
Hazelwood	US Navy	Destroyer	6/22/18
Williams	US Navy	Destroyer	7/4/18
Crane	US Navy	Destroyer	7/4/18
Hart	US Navy	Destroyer	7/4/18
Ingraham	US Navy	Destroyer	7/4/18
Ludlow	US Navy	Destroyer	7/9/18
Burns	US Navy	Destroyer	7/4/18
Anthony	US Navy	Destroyer	8/10/18
Sproston	US Navy	Destroyer	8/10/18
Rizal	US Navy	Destroyer	9/21/18
Mackenzie	US Navy	Destroyer	9/29/18
Renshaw	US Navy	Destroyer	9/21/18
O'Bannan	US Navy	Destroyer	9/28/18
Hogan	US Navy	Destroyer	4/12/19
Howard	US Navy	Destroyer	4/26/19
Stansbury	US Navy	Destroyer	5/16/19
S-30	US Navy	Submarine	11/21/18
S-31	US Navy	Submarine	12/28/18
S-32	US Navy	Submarine	1/11/19
S-33	US Navy	Submarine	12/5/18
S-34	US Navy	Submarine	2/13/19
S-35	US Navy	Submarine	2/27/19
S-36	US Navy	Submarine	6/3/19
S-37	US Navy	Submarine	6/20/19
S-38	US Navy	Submarine	6/17/19
S-39	US Navy	Submarine	7/2/19
S-40	US Navy	Submarine	1/5/21
S-41	US Navy	Submarine	2/21/21
Heffron	US Shipping Board	Cargo Ship	
Hegira	US Shipping Board	Cargo Ship	
Chauncey	US Navy	Destroyer	9/29/18
Fuller	US Navy	Destroyer	12/5/18
Percival	US Navy	Destroyer	12/5/18
John Francis Burns	US Navy	Destroyer	11/10/18
Farragut	US Navy	Destroyer	11/21/18
Somers	US Navy	Destroyer	12/28/18
Stoddart	US Navy	Destroyer	1/6/19
Reno	US Navy	Destroyer	1/22/19
Farquhar	US Navy	Destroyer	1/18/19
Thompson	US Navy	Destroyer	1/19/19
Kennedy	US Navy	Destroyer	2/15/19

Appendix A: List of Vessels Built at UIW 1884-1945

Ship Name	Owner	Type	Launched
Paul Hamilton	US Navy	Destroyer	2/21/19
William Jones	US Navy	Destroyer	4/9/19
Woodbury	US Navy	Destroyer	2/6/19
S. P. Lee	US Navy	Destroyer	4/22/19
Nicholas	US Navy	Destroyer	5/1/19
Young	Us Navy	Destroyer	5/8/19
Zeilin	US Navy	Destroyer	5/28/19
Yarborough	US Navy	Destroyer	6/20/19
La Vallete	US Navy	Destroyer	7/15/19
Sloat	US Navy	Destroyer	5/14/19
Woodbury	US Navy	Destroyer	5/28/19
Shirk	US Navy	Destroyer	6/20/19
Kidder	US Navy	Destroyer	7/10/19
Selfridge	US Navy	Destroyer	7/25/19
Marcus	US Navy	Destroyer	8/22/19
Mervine	US Navy	Destroyer	8/11/19
Chase	US Navy	Destroyer	9/2/19
Robert Smith	US Navy	Destroyer	9/19/19
Mullany	US Navy	Destroyer	7/9/20
Coghlan	US Navy	Destroyer	6/16/20
Preston	US Navy	Destroyer	8/7/20
Lamson	US Navy	Destroyer	9/1/20
Bruce	US Navy	Destroyer	5/20/20
Hall	US Navy	Destroyer	2/18/21
Macdonough	US Navy	Destroyer	12/15/20
Ferneholt	US Navy	Destroyer	3/9/21
Sumner	US Navy	Destroyer	11/24/20
Corry	US Navy	Destroyer	3/28/21
Melvin	US Navy	Destroyer	4/11/21
San Mateo	Jas. Ralph & Co.	Ferry	
Shasta	Jas. Ralph & Co.	Ferry	
Yosemite	Jas. Ralph & Co.	Ferry	
Standard Service	Standard Oil	Tanker	
Alaska Standard	Standard Oil	Tanker	
Barge No. 5	Shell of California	Tank Barge	
Barge No. 6	Shell of California	Tank Barge	
Shaloe	Pacific Coast Line	Passenger Freighter	
Hawaii	Hawaii Mail Line	Passenger	
El Paso	Richmond & SF TPTN. Co.	Ferry	
New Orleans	Richmond & SF TPTN. Co.	Ferry	
Klamath	Richmond & SF TPTN. Co.	Ferry	
Hawaiin Standard	Standard Oil	Tanker	
General	General Petroleum	Cargo Ship	
Richlube	Richfield Oil	Tanker	
Barge No. 2	Richfield Oil	Tank Barge	
Associates	Associates Oil	Tanker	
Fresno	Southern Pacific Railroad	Ferry	
Stockton	Southern Pacific Railroad	Ferry	
Mendocino	Southern Pacific Railroad	Ferry	
	Santa Fe Railroad	Car Float	
Waialeale	Inter Island Line	Passenger/Cargo	

Appendix A: List of Vessels Built at UIW 1884-1945

Ship Name	Owner	Type	Launched
Hualalai	Inter Island Line	Passenger/Cargo	
Delta Standard		Tanker	
Humuula		Passenger	
Eleu		Tug	
Los Angeles		Derrick Barge	
Y.B.5		Deck Barge	
Y.B.6		Deck Barge	
Y.B.7		Deck Barge	
Y.B.8		Deck Barge	
Mamo			
Y.B.10		Deck Barge	
Barge No. 7		Deck Barge	
McCall	US Navy	Destroyer	11/20/37
Maury	US Navy	Destroyer	2/14/38
John F. Hartley	US Coast Guard	Revenue Cutter	
Water Nymph			
Kingfisher			
Dauntless			
Luckenbach No. 5	LuckenBach SS Co.	Tug	
Denis T. Sullivan			
David Scannell			
Leslie Baldwin			
San Gabriel			
Santa Cruz	US Navy	C1-B	10/30/41
Alcoa Pioneer	US Navy	C1-B	11/29/41
Alcoa Pilgrim	US Navy	C1-B	1/15/42
Alcoa Patriot	US Navy	C1-B	2/12/42
Alcoa Puritan	US Navy	C1-B	3/17/42
No name	US Navy	YB	4/11/42
Laffey	US Navy	DD	5/8/42
Woodworth	US Navy	DD	6/4/42
Caldwell	US Navy	DD	7/18/42
Coghlan	US Navy	DD	10/23/42
Fazier	US Navy	DD	7/30/42
Gansevoort	US Navy	DD	4/11/42
Gillespie	US Navy	DD	5/8/42
Hobby	US Navy	DD	6/4/42
Kalk	US Navy	DD	7/18/42
Oakland	US Navy	CL	10/23/42
Reno	US Navy	CL	12/23/42
Abner Read	US Navy	DD	8/18/42
Ammen	US Navy	DD	9/17/42
Mullany	US Navy	DD	10/10/42
Bush	US Navy	DD	10/27/42
Trathen	US Navy	DD	10/22/42
Hazelwood	US Navy	DD	11/20/42
Heerman	US Navy	DD	12/5/42
Hoel	US Navy	DD	12/19/42
McCord	US Navy	DD	1/10/43
Miller	US Navy	DD	3/7/43
Owen	US Navy	DD	3/21/43

Appendix A: List of Vessels Built at UIW 1884-1945

Ship Name	Owner	Type	Launched
The Sullivans	US Navy	DD	4/4/43
Stephen Potter	US Navy	DD	4/28/43
Tingey	US Navy	DD	5/28/43
Twining	US Navy	DD	7/11/43
Yarnall	US Navy	DD	7/25/43
No name	US Navy	YB	
Flint	US Navy	CL	1/25/44
Tucson	US Navy	CL	9/3/44
	US Navy	DD	
	US Navy	DD	
Stockham	US Navy	DD	6/25/43
Wedderburn	US Navy	DD	8/1/43
Foreman	US Navy	DE	8/1/43
Whitehurst	US Navy	DE	9/5/43
England	US Navy	DE	9/26/43
Witter	US Navy	DE	10/17/43
Bowers	US Navy	DE	10/31/43
Willmarth	US Navy	DE	11/21/43
Gendreay	US Navy	DE	12/12/43
Fieberling	US Navy	DE	4/2/44
William M. Cole	US Navy	DE	12/29/43
Paul G. Baker	US Navy	DE	4/7/44
Damon M. Cummings	US Navy	DE	4/16/44
Vammen	US Navy	DE	5/21/44
Putnam	US Navy	DD	3/26/44
Strong	US Navy	DD	4/23/44
Lofberg	US Navy	DD	8/12/44
John W. Thomason	US Navy	DD	9/30/44
Buck	US Navy	DD	3/11/45
Henley	US Navy	DD	4/8/45
William C. Lawe	US Navy	DD	5/21/45
Lloyd Thomas	US Navy	DD	10/5/45
Keppler	US Navy	DD	6/24/46
Lansdale	US Navy	DD	12/20/46
Seymour D. Owens	US Navy	DD	1/24/47
Hoel	US Navy	DD	
Abner Read	US Navy	DD	

Appendix B: Glossary

Anglesmith Shop: Shop where structural members of the hull are shaped. In the anglesmith shop parts are heated to make them more pliable prior to being shaped, and are often shaped by hand, using sledge hammers and levering tools. The western end of Building 109 was the anglesmith shop.

Boiler Shop The shop where the ship boilers are made. Not to be confused with the boiler house, which contains steam boilers for providing power to the shipyard.

Castings: Steel parts used in ship construction formed of molten steel poured into molds.

Erection: The process of hoisting into place and bolting up the various parts of the ship's hull, machinery, fittings, etc.

Fabricating: To punch, cut, shear, drill, bend, flange or weld hull plates from molds or templates.

Forging: Steel parts used in ship construction formed from red hot steel by means of hammering or pressing and are used where great strength is required.

Galvanizing: Process of coating metal with zinc to prevent rust.

Hull: The body of a ship, including shell-plating, framing, decks, bulkheads, keel, floors, etc.

Hydraulic Power: A form of fluid power popularized in the nineteenth century that increased the efficiency and reduced the irregularity of steam powered equipment. Hydraulic power utilizes pressurized fluid to transmit energy often by pumping liquid through cylinders to power plungers or pistons.

Integrated Yard: A type of shipyard that could produce all ship components onsite, specifically yards that produced their own propulsion and mechanical systems. These yards contained machine shops, smith shops, and foundries, along with all the tools to build ship engines and other components at the yard. The first steel hull shipyards were all integrated yards, including the Union Iron Works shipyard.

Joiner: A carpenter that specializes in finishing work. At a shipyard, joiners and carpenters are responsible for all the woodwork in a ship, specifically the joiners are responsible for all fancy woodwork, trimmings, wood railings, etc.

Launching: Transferring or sliding the ship from the slipways to the water. The ship is then moved to the outfitting piers.

Lifting: A process of producing the molds for hull members by deriving the shape and dimension of the mold from the ship as it is being erected. Rather then creating a mold from plans or models in a mold loft, which is known as lofting.

Lofting: A process in shipbuilding where the molds used to produce the hull plates and frames are produced in a mold loft and derive their shape and dimensions from plans or drawings.

Millwork: The system of belts, shafts, and pulleys used to transmit steam power (or later electrical power) throughout the shipyard to power shipyard machines and tools. A steam engine would turn the system of belts, shafts, and pulleys, which would provide the motive power. Commonly used during the nineteenth century prior to the development of individual electric motors.

Mold: A pattern used to duplicate the desired shape out of steel, usually made of thin wood or paper.

Mold Loft: A long building with wide, smooth floor on which the lines of a ship are drawn full size and from which molds are lifted. In the mold loft, loftsmen produce the mold or templates of wood or paper that are used as patterns to fabricate hull members.

Outfitting: The process of installing living facilities on a ship. Outfitting is accomplished by the electrical department, sheet metal department, paint department, and carpenter and joiner department.

Pattern Shop: The shop that makes the forms used in shaping molds to produce metal casting for machine parts.

Plates: Flat rolled steel of uniform thickness used to construct the steel hull and other ship components.

Plate Shop: Shop where plates are cut and shaped to the templates or molds supplied by the mold loft, often located near the shipbuilding way. Shaping in the plate shop is done on cold steel with heavy presses or rolls. Rivet holes are cut or drilled in the plate shop.

Pneumatic Power: Type of fluid power, where compressed air, rather than liquids as in hydraulic power, is used to provide power.

Prefabrication: Method of shipbuilding where ship components are standardized and often fabricated offsite. The process of prefabrication in shipbuilding was started by New York Shipyard at the turn of the century but was most prevalent during WWII. During WWII, the standardized of ship designs occurred nationally, allowing for ship components, including hull plates to be fabricated, and shipped to shipyard. The shipyards themselves became more specifically sites for assembly and erection of premade components, rather than yard were components were fabricated piece by piece. Prefabrication relies upon the standardization of components and the standardization of ship designs.

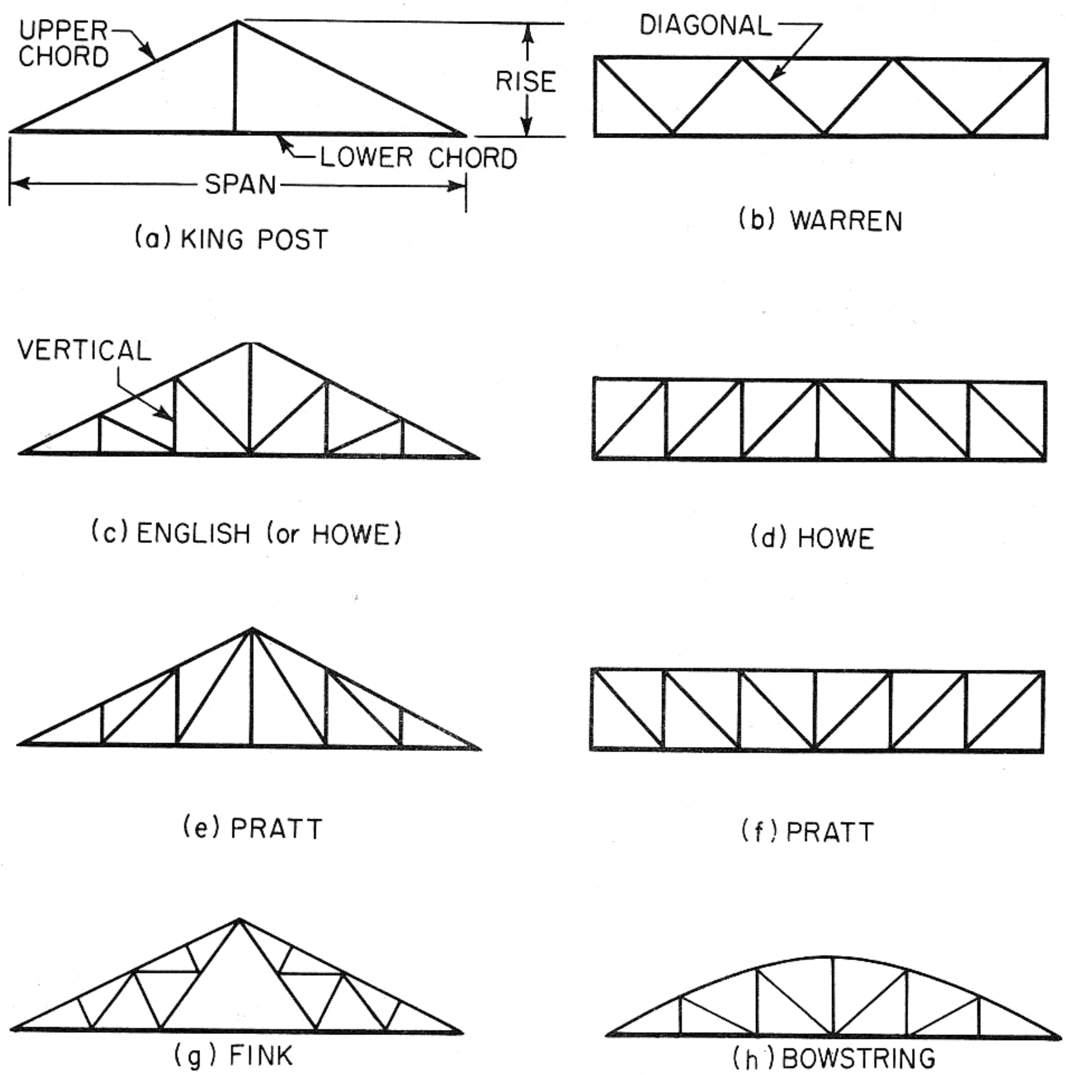
Riveting: The process of connecting metal plates using hot bolts or rivets. Riveting is done by a gang of three or four men, including a heater, a holder-on, and a riveter. The heater heats the rivets. The holder-on inserts the rivet into the hole in the plate and holds it in place. The riveter hammers the rivet in place.

Straight Line Flow: A type of shipyard layout that required a site with inland depth so that materials could enter the yard, be processed and fabricated in a linear flow, and arrive at the shoreline for final assembly at the shipways. The WWII shipyards constructed in Richmond, CA are a primary example of straight line flow shipyard design.

Template: A mold or a full size pattern.

Turning Flow: A type of shipyard layout used if the shipyard site had limited space inland but a lengthy shoreline, the turning flow design was used whereby materials entered parallel to the shoreline, were processed in a straight-line flow, and then turned at right angles to be assembled on the shipways. In a typical turning flow process, raw steel and pre-assembled machinery entered by rail at the top end of the yard and was held in storage yards until needed. The steel was then formed in the plate shop and joined into sub-assemblies. Cranes carried the sub-assemblies to the pre-hull skids where the parts were joined into even larger sections, such as deck houses, bow and stern assemblies. Complete sections were then lifted by crane to the slipways.

Truss Types:



Warships: Ships built to serve definite purpose in naval warfare. Principle types are battleships, cruisers, destroyers, and submarines.

Ways: Where the ship is built and launched. Also called slips, slipways, or shipbuilding ways.

Welding: Making a joint of metal parts by fusing them together. Welding was first used in shipbuilding with the introduction of metal hull ships in the mid-nineteenth century but was not prevalent until the 1930s. Modern welding uses an electric arc to melt steel at the joint, creating a bond at the molecular level. During WWII, welding replaced riveting as the main method of joining steel due to its efficiency and strength.

Appendix A: List of Vessels Built at UIW 1884-1945

Ship Name	Owner	Type	Launched
Arago	Oregon Coal Company	Collier	2/27/1885
Adeline		Steam Launch	
General McDowell		Freighter	2/28/1885
Balboa			
Emerald		Passenger	
Premier			
Charleston	US Navy	Cruiser	7/19/1888
Pomona	Pacific Coast Line	Cruiser	
Active	US navy	Tug	
San Francisco	US Navy	Cruiser	10/26/1889
Cruiser No. 5	US Navy	Cruiser	3/3/1885
Romola		Launch	
Colis	San Francisco Co.	Tug	
Salmo			
Monterey	US Navy	Monitor	4/28/1891
Whisper			
Olympia	US Navy	Cruiser	11/5/1892
Oregon	US Navy	Battleship	10/26/1893
Columbia	US Lightship Service	Light Ship	
Fearless	US Navy	Tug	
Peru	Pacific Mail Line	Freighter	
El Primero	Edward Hopkins	Steam Yacht	
Gracie S	Bay Pilots Assn.	Pilot Boat	
Santa Lucia		Tug	
George Loomis	Standard Oil Co.	Tanker	
(15) No name		Barges	
Northern Light			
Tahoe		Passenger Freighter	
Wheeling	US Navy	Gunboat	3/18/1897
Marietta	US Navy	Gunboat	3/18/1897
Helene	Wilder Steamship	Passenger Freighter	
Farragut	US Navy	Torpedo Boat	7/16/1898
Wisconsin	US Navy	Battleship	11/26/98
Izabel	Pacific Mail Line	Water Boat	
Chitose	Japanese Navy	Cruiser	1/22/98
No name		Launch	
Senator	Pacific Coast Line	Passenger Freighter	
Maui	Wilder Steamship	Passenger Freighter	
Berkeley	San Francisco Co.	Ferry	
St. Paul	Alaska Coal Co.	Freighter	
Sadie	Alaska Coal Co.	Tug	
Fearless	Spreckels Co.	Tug	
Wallula	Oregon Railraod	Tug	
Union	Union Iron Works	Tug	
Ohio	US Navy	Battleship	5/18/01
Wyoming	US Navy	Monitor	9/8/00
Paul Jones	US Navy	Destroyer	6/14/02
Perry	US Navy	Destroyer	10/27/00
Preble	US Navy	Destroyer	3/2/01
San Pablo	Santa Fe Railroad	Ferry	
Californian	American Mail Line	Freighter	

Appendix A: List of Vessels Built at UIW 1884-1945

Ship Name	Owner	Type	Launched
Manulani	Wilder Steamship	Passenger Freighter	
Tacoma	US Navy	Cruiser	6/2/03
Alaskan	American Hawaiin	Freighter	
Tamalpais		Ferry	
Spokane	Pacific Coast Line	Passenger Freighter	
Arizonian	American Hawaiin	Freighter	
Grampus	US Navy	Submarine	7/31/02
Pike	US Navy	Submarine	1/14/03
California	US Navy	Cruiser	4/28/04
South Dakota	US Navy	Cruiser	7/21/04
Milwaukee	US Navy	Cruiser	9/10/04
Mamaulate		Launch	
Whittler	Union Line	Passenger Freighter	
Like Like		Freighter	
Mexican	American Hawaiin	Freighter	
Columbian	American Hawaiin	Freighter	
Isthmian	American Hawaiin	Freighter	
Mauna Kea	Inter Island Line	Passenger Freighter	
Contra Costa	Standard Oil Co.	Tank Barge	
LT W. L. Murphy	US Navy	Passenger Tug	
LT J. A. Pusney	US Navy	Passenger Tug	
CAPT Anton Springer	US Navy	Passenger Tug	
No name	US Navy	Caisson	
No name		Pontoon	
F-1	US Navy	Submarine	3/12/12
F-2	US Navy	Submarine	3/19/12
Napa Valley		Ferry	
San Pedro	Santa Fe Railroad	Ferry	
Kilauea	Inter Island Line	Passenger Freighter	
H-1	US Navy	Submarine	5/6/12
H-2	US Navy	Submarine	6/4/13
H-3	US Navy	Submarine	3/14/14
No name	US Navy	Caisson	
K-7	US Navy	Submarine	6/20/14
K-8	US Navy	Submarine	7/11/14
No name	US Navy	Pontoon	
William Chatham	Loop Lumber Co.	Lumber Carrier	
Henry T. Scott		Lumber Carrier	
Aroline		Passenger Freighter	
Petroleum No. 3	Standard Oil Co.	Tanker	
Pico		Tank Barge	
Frank H. Buck	Tidewater Oil Co.	Tanker	
No name	Panama Canal Commission	Caisson	
No name	Standard Oil Co.	Barge	
No name	Union Iron Works	Dredge	
J. A. Moffett	Standard Oil of California	Tanker	
Lyman Stewart	Standard Oil of California	Tanker	
No name		Dredge	
U.I.W. No. 3	Union Iron Works	Launch	
Pacific	American South African Line	Passenger Freighter	
Eurana	American South African Line	Passenger Freighter	

Appendix A: List of Vessels Built at UIW 1884-1945

Ship Name	Owner	Type	Launched
Olinoa	Union Oil of California	Tank Barge	
La Brea	Union Oil of California	Tanker	
Los Angeles	Union Oil of California	Tanker	
D.G. Scofield	Standard Oil of California	Tanker	
Acme	Soconey-Vacuum Oil	Tanker	
Davenger	Nav. & Coal Co.	Freighter	
Maui	Matson Navigation	Passenger Freighter	
Astral	Soconey-Vacuum Oil	Tanker	
H.C. Folger	Atlantic Refining	Tanker	
J. W. Van Dyke	Atlantic Refining	Tanker	
Paulsboro	Soconey-Vacuum Oil	Tanker	
War Knight	UK Admiralty	Freighter	
War Monarch	UK Admiralty	Freighter	
Fred W. Weller	Standard Oil of New Jersey	Tanker	
A.C. Bedford	Standard Oil of California	Tanker	
Eagle	Soconey-Vacuum Oil	Tanker	
Tiger	Soconey-Vacuum Oil	Tanker	
Talabat		General Cargo	
Bessa		General Cargo	
George G. Henry	Standard Oil of New Jersey	Tanker	
War Sword	UK Admiralty	General Cargo	
J. E. O'Neil	Atlantic Refining	Tanker	
Herbert L. Pratt	Atlantic Refining	Tanker	
S. M. Spalding	Standard Oil of New Jersey	Tanker	
Paul H. Harwood	Standard Oil of New Jersey	Tanker	
W. S. Rheem	Standard Oil of New Jersey	Tanker	
W. M. Irish	Atlantic Refining	Tanker	
W. M. Burton	Atlantic Refining	Tanker	
Volunteer	US Shipping Board	General Cargo	
Wichita/Liberator	US Shipping Board	General Cargo	
No name	Union Iron Works	Dry Dock	
Challenger	US Shipping Board	General Cargo	
Redondo	A.O. Linovig.	General Cargo	
No name	Union Iron Works	Caisson	
McKee	US Navy	Destroyer	3/23/18
Robinson	US Navy	Destroyer	3/28/18
Ringgold	US Navy	Destroyer	4/14/18
McKean	US Navy	Destroyer	7/4/18
Harding	US Navy	Destroyer	7/4/18
Gridley	US Navy	Destroyer	7/4/18
War Harbour/Independence	UK Admiralty	General Cargo	
War Haven/Victorious	UK Admiralty	General Cargo	
War Ocean/Defiance	UK Admiralty	General Cargo	
War Rock/Invincible	UK Admiralty	General Cargo	
War Sea/Courageous	UK Admiralty	General Cargo	
War Cape/Triumph	UK Admiralty	General Cargo	
War Surf/Eclipse	UK Admiralty	General Cargo	
War Wave/Archer	UK Admiralty	General Cargo	
Steadfast	US Shipping Board	General Cargo	
Dreadnaught	Rolph Navigation Co.	Tug	
Undaunted	Rolph Navigation Co.	Tug	

Appendix A: List of Vessels Built at UIW 1884-1945

Ship Name	Owner	Type	Launched
R-15	US Navy	Submarine	12/10/17
R-16	US Navy	Submarine	12/15/17
R-17	US Navy	Submarine	12/24/17
R-18	US Navy	Submarine	1/8/18
R-19	US Navy	Submarine	1/28/18
R-20	US Navy	Submarine	1/21/18
Schey	US Navy	Destroyer	3/28/18
Champlin	US Navy	Destroyer	4/7/18
Mugford	US Navy	Destroyer	4/14/18
Chew	US Navy	Destroyer	5/26/18
Hazelwood	US Navy	Destroyer	6/22/18
Williams	US Navy	Destroyer	7/4/18
Crane	US Navy	Destroyer	7/4/18
Hart	US Navy	Destroyer	7/4/18
Ingraham	US Navy	Destroyer	7/4/18
Ludlow	US Navy	Destroyer	7/9/18
Burns	US Navy	Destroyer	7/4/18
Anthony	US Navy	Destroyer	8/10/18
Sproston	US Navy	Destroyer	8/10/18
Rizal	US Navy	Destroyer	9/21/18
Mackenzie	US Navy	Destroyer	9/29/18
Renshaw	US Navy	Destroyer	9/21/18
O'Bannan	US Navy	Destroyer	9/28/18
Hogan	US Navy	Destroyer	4/12/19
Howard	US Navy	Destroyer	4/26/19
Stansbury	US Navy	Destroyer	5/16/19
S-30	US Navy	Submarine	11/21/18
S-31	US Navy	Submarine	12/28/18
S-32	US Navy	Submarine	1/11/19
S-33	US Navy	Submarine	12/5/18
S-34	US Navy	Submarine	2/13/19
S-35	US Navy	Submarine	2/27/19
S-36	US Navy	Submarine	6/3/19
S-37	US Navy	Submarine	6/20/19
S-38	US Navy	Submarine	6/17/19
S-39	US Navy	Submarine	7/2/19
S-40	US Navy	Submarine	1/5/21
S-41	US Navy	Submarine	2/21/21
Heffron	US Shipping Board	Cargo Ship	
Hegira	US Shipping Board	Cargo Ship	
Chauncey	US Navy	Destroyer	9/29/18
Fuller	US Navy	Destroyer	12/5/18
Percival	US Navy	Destroyer	12/5/18
John Francis Burns	US Navy	Destroyer	11/10/18
Farragut	US Navy	Destroyer	11/21/18
Somers	US Navy	Destroyer	12/28/18
Stoddart	US Navy	Destroyer	1/6/19
Reno	US Navy	Destroyer	1/22/19
Farquhar	US Navy	Destroyer	1/18/19
Thompson	US Navy	Destroyer	1/19/19
Kennedy	US Navy	Destroyer	2/15/19

Appendix A: List of Vessels Built at UIW 1884-1945

Ship Name	Owner	Type	Launched
Paul Hamilton	US Navy	Destroyer	2/21/19
William Jones	US Navy	Destroyer	4/9/19
Woodbury	US Navy	Destroyer	2/6/19
S. P. Lee	US Navy	Destroyer	4/22/19
Nicholas	US Navy	Destroyer	5/1/19
Young	Us Navy	Destroyer	5/8/19
Zeilin	US Navy	Destroyer	5/28/19
Yarborough	US Navy	Destroyer	6/20/19
La Vallete	US Navy	Destroyer	7/15/19
Sloat	US Navy	Destroyer	5/14/19
Woodbury	US Navy	Destroyer	5/28/19
Shirk	US Navy	Destroyer	6/20/19
Kidder	US Navy	Destroyer	7/10/19
Selfridge	US Navy	Destroyer	7/25/19
Marcus	US Navy	Destroyer	8/22/19
Mervine	US Navy	Destroyer	8/11/19
Chase	US Navy	Destroyer	9/2/19
Robert Smith	US Navy	Destroyer	9/19/19
Mullany	US Navy	Destroyer	7/9/20
Coghlan	US Navy	Destroyer	6/16/20
Preston	US Navy	Destroyer	8/7/20
Lamson	US Navy	Destroyer	9/1/20
Bruce	US Navy	Destroyer	5/20/20
Hall	US Navy	Destroyer	2/18/21
Macdonough	US Navy	Destroyer	12/15/20
Ferneholt	US Navy	Destroyer	3/9/21
Sumner	US Navy	Destroyer	11/24/20
Corry	US Navy	Destroyer	3/28/21
Melvin	US Navy	Destroyer	4/11/21
San Mateo	Jas. Ralph & Co.	Ferry	
Shasta	Jas. Ralph & Co.	Ferry	
Yosemite	Jas. Ralph & Co.	Ferry	
Standard Service	Standard Oil	Tanker	
Alaska Standard	Standard Oil	Tanker	
Barge No. 5	Shell of California	Tank Barge	
Barge No. 6	Shell of California	Tank Barge	
Shaloe	Pacific Coast Line	Passenger Freighter	
Hawaii	Hawaii Mail Line	Passenger	
El Paso	Richmond & SF TPTN. Co.	Ferry	
New Orleans	Richmond & SF TPTN. Co.	Ferry	
Klamath	Richmond & SF TPTN. Co.	Ferry	
Hawaiin Standard	Standard Oil	Tanker	
General	General Petroleum	Cargo Ship	
Richlube	Richfield Oil	Tanker	
Barge No. 2	Richfield Oil	Tank Barge	
Associates	Associates Oil	Tanker	
Fresno	Southern Pacific Railroad	Ferry	
Stockton	Southern Pacific Railroad	Ferry	
Mendocino	Southern Pacific Railroad	Ferry	
	Santa Fe Railroad	Car Float	
Waialeale	Inter Island Line	Passenger/Cargo	

Appendix A: List of Vessels Built at UIW 1884-1945

Ship Name	Owner	Type	Launched
Hualalai	Inter Island Line	Passenger/Cargo	
Delta Standard		Tanker	
Humuula		Passenger	
Eleu		Tug	
Los Angeles		Derrick Barge	
Y.B.5		Deck Barge	
Y.B.6		Deck Barge	
Y.B.7		Deck Barge	
Y.B.8		Deck Barge	
Mamo			
Y.B.10		Deck Barge	
Barge No. 7		Deck Barge	
McCall	US Navy	Destroyer	11/20/37
Maury	US Navy	Destroyer	2/14/38
John F. Hartley	US Coast Guard	Revenue Cutter	
Water Nymph			
Kingfisher			
Dauntless			
Luckenbach No. 5	LuckenBach SS Co.	Tug	
Denis T. Sullivan			
David Scannell			
Leslie Baldwin			
San Gabriel			
Santa Cruz	US Navy	C1-B	10/30/41
Alcoa Pioneer	US Navy	C1-B	11/29/41
Alcoa Pilgrim	US Navy	C1-B	1/15/42
Alcoa Patriot	US Navy	C1-B	2/12/42
Alcoa Puritan	US Navy	C1-B	3/17/42
No name	US Navy	YB	4/11/42
Laffey	US Navy	DD	5/8/42
Woodworth	US Navy	DD	6/4/42
Caldwell	US Navy	DD	7/18/42
Coghlan	US Navy	DD	10/23/42
Fazier	US Navy	DD	7/30/42
Gansevoort	US Navy	DD	4/11/42
Gillespie	US Navy	DD	5/8/42
Hobby	US Navy	DD	6/4/42
Kalk	US Navy	DD	7/18/42
Oakland	US Navy	CL	10/23/42
Reno	US Navy	CL	12/23/42
Abner Read	US Navy	DD	8/18/42
Ammen	US Navy	DD	9/17/42
Mullany	US Navy	DD	10/10/42
Bush	US Navy	DD	10/27/42
Trathen	US Navy	DD	10/22/42
Hazelwood	US Navy	DD	11/20/42
Heerman	US Navy	DD	12/5/42
Hoel	US Navy	DD	12/19/42
McCord	US Navy	DD	1/10/43
Miller	US Navy	DD	3/7/43
Owen	US Navy	DD	3/21/43

Appendix A: List of Vessels Built at UIW 1884-1945

Ship Name	Owner	Type	Launched
The Sullivans	US Navy	DD	4/4/43
Stephen Potter	US Navy	DD	4/28/43
Tingey	US Navy	DD	5/28/43
Twining	US Navy	DD	7/11/43
Yarnall	US Navy	DD	7/25/43
No name	US Navy	YB	
Flint	US Navy	CL	1/25/44
Tucson	US Navy	CL	9/3/44
	US Navy	DD	
	US Navy	DD	
Stockham	US Navy	DD	6/25/43
Wedderburn	US Navy	DD	8/1/43
Foreman	US Navy	DE	8/1/43
Whitehurst	US Navy	DE	9/5/43
England	US Navy	DE	9/26/43
Witter	US Navy	DE	10/17/43
Bowers	US Navy	DE	10/31/43
Willmarth	US Navy	DE	11/21/43
Gendreay	US Navy	DE	12/12/43
Fieberling	US Navy	DE	4/2/44
William M. Cole	US Navy	DE	12/29/43
Paul G. Baker	US Navy	DE	4/7/44
Damon M. Cummings	US Navy	DE	4/16/44
Vammen	US Navy	DE	5/21/44
Putnam	US Navy	DD	3/26/44
Strong	US Navy	DD	4/23/44
Lofberg	US Navy	DD	8/12/44
John W. Thomason	US Navy	DD	9/30/44
Buck	US Navy	DD	3/11/45
Henley	US Navy	DD	4/8/45
William C. Lawe	US Navy	DD	5/21/45
Lloyd Thomas	US Navy	DD	10/5/45
Keppler	US Navy	DD	6/24/46
Lansdale	US Navy	DD	12/20/46
Seymour D. Owens	US Navy	DD	1/24/47
Hoel	US Navy	DD	
Abner Read	US Navy	DD	

Appendix B: Glossary

Anglesmith Shop: Shop where structural members of the hull are shaped. In the anglesmith shop parts are heated to make them more pliable prior to being shaped, and are often shaped by hand, using sledge hammers and levering tools. The western end of Building 109 was the anglesmith shop.

Boiler Shop The shop where the ship boilers are made. Not to be confused with the boiler house, which contains steam boilers for providing power to the shipyard.

Castings: Steel parts used in ship construction formed of molten steel poured into molds.

Erection: The process of hoisting into place and bolting up the various parts of the ship's hull, machinery, fittings, etc.

Fabricating: To punch, cut, shear, drill, bend, flange or weld hull plates from molds or templates.

Forging: Steel parts used in ship construction formed from red hot steel by means of hammering or pressing and are used where great strength is required.

Galvanizing: Process of coating metal with zinc to prevent rust.

Hull: The body of a ship, including shell-plating, framing, decks, bulkheads, keel, floors, etc.

Hydraulic Power: A form of fluid power popularized in the nineteenth century that increased the efficiency and reduced the irregularity of steam powered equipment. Hydraulic power utilizes pressurized fluid to transmit energy often by pumping liquid through cylinders to power plungers or pistons.

Integrated Yard: A type of shipyard that could produce all ship components onsite, specifically yards that produced their own propulsion and mechanical systems. These yards contained machine shops, smith shops, and foundries, along with all the tools to build ship engines and other components at the yard. The first steel hull shipyards were all integrated yards, including the Union Iron Works shipyard.

Joiner: A carpenter that specializes in finishing work. At a shipyard, joiners and carpenters are responsible for all the woodwork in a ship, specifically the joiners are responsible for all fancy woodwork, trimmings, wood railings, etc.

Launching: Transferring or sliding the ship from the slipways to the water. The ship is then moved to the outfitting piers.

Lifting: A process of producing the molds for hull members by deriving the shape and dimension of the mold from the ship as it is being erected. Rather then creating a mold from plans or models in a mold loft, which is known as lofting.

Lofting: A process in shipbuilding where the molds used to produce the hull plates and frames are produced in a mold loft and derive their shape and dimensions from plans or drawings.

Millwork: The system of belts, shafts, and pulleys used to transmit steam power (or later electrical power) throughout the shipyard to power shipyard machines and tools. A steam engine would turn the system of belts, shafts, and pulleys, which would provide the motive power. Commonly used during the nineteenth century prior to the development of individual electric motors.

Mold: A pattern used to duplicate the desired shape out of steel, usually made of thin wood or paper.

Mold Loft: A long building with wide, smooth floor on which the lines of a ship are drawn full size and from which molds are lifted. In the mold loft, loftsmen produce the mold or templates of wood or paper that are used as patterns to fabricate hull members.

Outfitting: The process of installing living facilities on a ship. Outfitting is accomplished by the electrical department, sheet metal department, paint department, and carpenter and joiner department.

Pattern Shop: The shop that makes the forms used in shaping molds to produce metal casting for machine parts.

Plates: Flat rolled steel of uniform thickness used to construct the steel hull and other ship components.

Plate Shop: Shop where plates are cut and shaped to the templates or molds supplied by the mold loft, often located near the shipbuilding way. Shaping in the plate shop is done on cold steel with heavy presses or rolls. Rivet holes are cut or drilled in the plate shop.

Pneumatic Power: Type of fluid power, where compressed air, rather than liquids as in hydraulic power, is used to provide power.

Prefabrication: Method of shipbuilding where ship components are standardized and often fabricated offsite. The process of prefabrication in shipbuilding was started by New York Shipyard at the turn of the century but was most prevalent during WWII. During WWII, the standardized of ship designs occurred nationally, allowing for ship components, including hull plates to be fabricated, and shipped to shipyard. The shipyards themselves became more specifically sites for assembly and erection of premade components, rather than yard were components were fabricated piece by piece. Prefabrication relies upon the standardization of components and the standardization of ship designs.

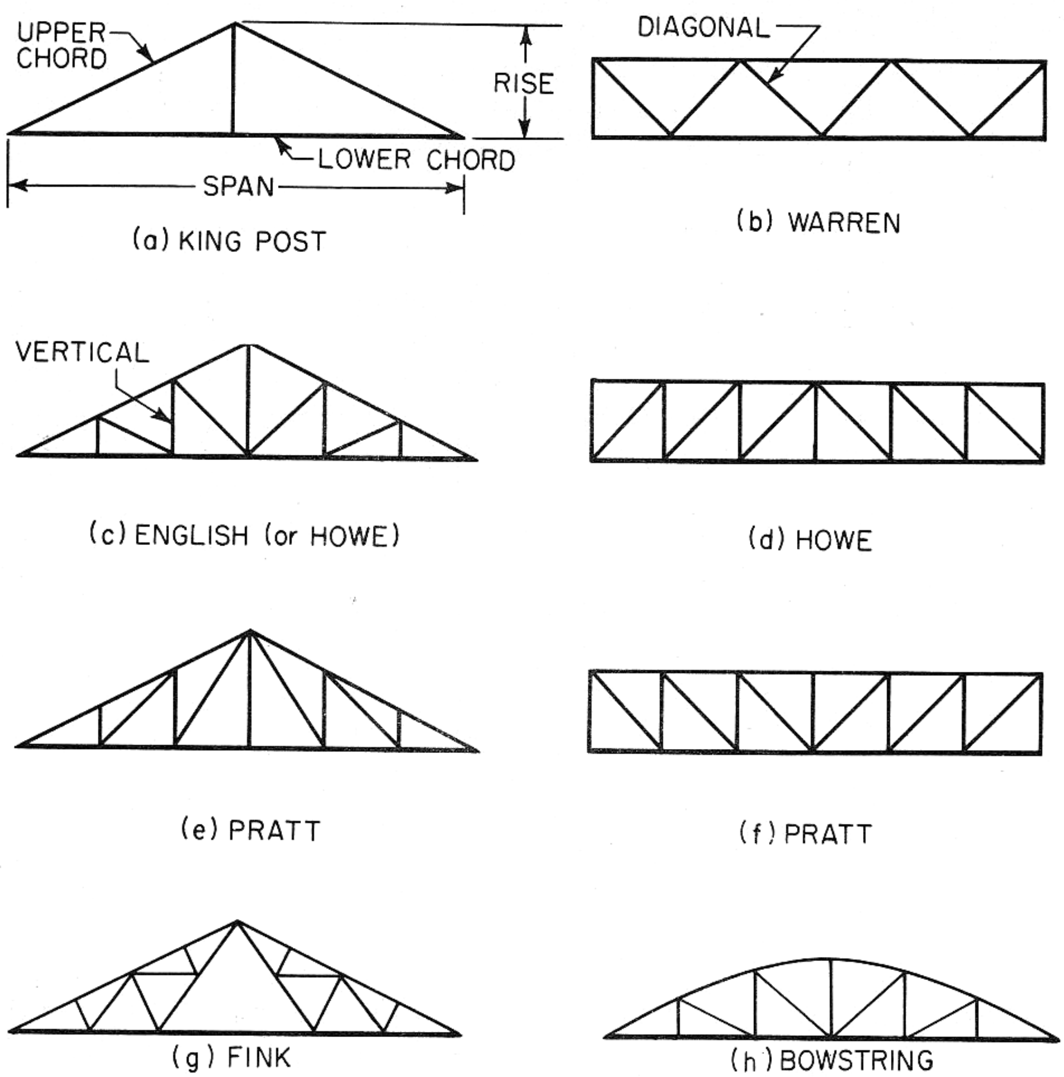
Riveting: The process of connecting metal plates using hot bolts or rivets. Riveting is done by a gang of three or four men, including a heater, a holder-on, and a riveter. The heater heats the rivets. The holder-on inserts the rivet into the hole in the plate and holds it in place. The riveter hammers the rivet in place.

Straight Line Flow: A type of shipyard layout that required a site with inland depth so that materials could enter the yard, be processed and fabricated in a linear flow, and arrive at the shoreline for final assembly at the shipways. The WWII shipyards constructed in Richmond, CA are a primary example of straight line flow shipyard design.

Template: A mold or a full size pattern.

Turning Flow: A type of shipyard layout used if the shipyard site had limited space inland but a lengthy shoreline, the turning flow design was used whereby materials entered parallel to the shoreline, were processed in a straight-line flow, and then turned at right angles to be assembled on the shipways. In a typical turning flow process, raw steel and pre-assembled machinery entered by rail at the top end of the yard and was held in storage yards until needed. The steel was then formed in the plate shop and joined into sub-assemblies. Cranes carried the sub-assemblies to the pre-hull skids where the parts were joined into even larger sections, such as deck houses, bow and stern assemblies. Complete sections were then lifted by crane to the slipways.

Truss Types:



Warships: Ships built to serve definite purpose in naval warfare. Principle types are battleships, cruisers, destroyers, and submarines.

Ways: Where the ship is built and launched. Also called slips, slipways, or shipbuilding ways.

Welding: Making a joint of metal parts by fusing them together. Welding was first used in shipbuilding with the introduction of metal hull ships in the mid-nineteenth century but was not prevalent until the 1930s. Modern welding uses an electric arc to melt steel at the joint, creating a bond at the molecular level. During WWII, welding replaced riveting as the main method of joining steel due to its efficiency and strength.

Appendix C: Pier 70 Properties

Building or Structure		Property Evaluation	Physical Data				Previous Evaluations			
Building No.	Building Name and Function	Distric Contributor	Square Feet	Construction Type	Date Built	Architect or Engineer	2001 C.W. Survey	1994 C&Co S.W. Survey	Port Historic Resources Database (ARG 1996)	SF Resource Category
2	Warehouse	C	98,804	concrete	1941/44		3D	3D	Potential district contributor	A
6	Light Warehouse	C	37,128	steel frame	1941		3D	3D	Potential district contributor	A
11	The Noonan Building (Tool Room and Office)	C	32,664	wood frame	1941		3D	3D	Potential district contributor	A
12	Plate Shop No. 2	C	118,890	steel frame/wood floor	1941		3D	3D	Potential district contributor	A
14	Heavy Warehouse	C	15,969	steel frame	1941		3D	3D	Potential district contributor	A
15	Layout Yard	C	17,134	steel frame	1941/44		3D		Potential district contributor	A
16	Stress Relieving Building	C	7,588	steel frame	1941		3D		Potential district contributor	A
19	Garage No. 1	C	6,152	steel/concrete	1941		3D	3D	Potential district contributor	A
21	Electric Shop/Substation No. 5	C	10,172	steel	1900		3B	3D	Potential district contributor	A
24	Washroom and Locker Room	C	519	concrete	1914/36/41					
25	Washroom and Locker Room	C	1,407	steel frame	1941		3D		Potential district contributor	A
30	Template Warehouse	C	991	steel/wood frame	1941		4D5		Potential district contributor	A
32	Template Warehouse	C	4,900	steel frame	1941/44		3D		Potential district contributor	A
36	Welding Shop	C	12,050	steel frame	1941		3D	3D		A
38	Pipe and Electric Shop	C	30,519	concrete	1915/41		3D	3D	Potential district contributor	A
40	Bethlehem Steel Employment Office	C	8,259	wood frame	1941		3D	3D	Potential district contributor	A
41	Fire Station (Underwater)	NC		steel	1941					
49	Galvanizing Shop	C	8,039	steel frame	c. 1940		4D5		Potential district contributor	A
50	Substation #2	C	678	steel frame	1941		3D		Potential district contributor	A
58	Pier 68 Substation #4	C	939	steel/concrete	1943					N/A
64	Substation #6	C	2070	steel frame	1945		4D5-7			A
66	Bethlehem Welding Platform	C	23,100	steel frame	c. 1945		4D5		Potential district contributor	A
68	Pier 68 Substation #7/Dry Dock office	NC		brick	Post 1945					N/A
101	Bethlehem Steel Administration Building	C	56,268	concrete	1917	F.H. Meyer	3B	3B	Potential indi. & dist. contributor	A
102	Powerhouse No. 1	C	8,428	concrete	1912	Charles P. Weeks	3B	3B	Potential indi. & dist. contributor	A
103	Steam Powerhouse No. 2	C	2,258	brick/steel	1937		3D	3D	Potential district contributor	A
104/51	Office Building	C	37,641	brick masonry	1896/1941	Percy & Hamilton	3B	3B	Potential indi. & dist. contributor	A
105	Forge Shop	C	20,111	brick/steel frame	c. 1890/1937		3D	3D	Potential indi. & dist. contributor	A
107	Union Iron Works West Lumber Shed	C	3,461	steel frame	1937		4D5		Potential district contributor	A
108	Planing Mill and Joinery Shop	C	40,846	steel/wood	1911/13		3D	3D	Potential district contributor	A
109/52	Plate Shop No. 1	C	82,099	steel/wood	1912/36		3D	3D	Potential district contributor	A
110	Yard Washroom/Locker Room	C	1,356	brick/steel	1936		3D	3D	Potential district contributor	A
111	Main Office, Warehouse and Substation No. 3	C	46,272	brick/concrete	1917		3D	3D	Potential district contributor	A
113	Machine Shop No. 1/Blacksmith Shop	C	81,964	brick masonry	1885/86/1914	Dr. D. E. Melliss	3B	3B	Potential indi. & dist. contributor	A
114	Machine Shop Storage/Foundry	C	8,800	brick masonry	1886	Dr. D. E. Melliss	3B	3B	Potential indi. & dist. contributor	A
115	Concrete Warehouse	C	12,078	concrete	1916/17		3D	3D	Potential district contributor	A
116	Concrete Warehouse	C	21,780	concrete	1916/17		3D	3D	Potential district contributor	A
117	Warehouse No. 9	C	30,940	steel frame	1937/41		3D	3D	Potential district contributor	A
119	Yard Washroom	C	3,925	brick/steel	1936		3D	3D	Potential district contributor	A
120	North Lumber Shed	C	1,392	steel frame	1936/1942		3D		Potential district contributor	A
121	Dry Dock Office	C	584	wood frame	1941		3D			A
122	Union Iron Works moved Gatehouse	C	714	concrete	1916/1941		3D		Potential district contributor	A
123	Checkhouse No. 2	C	384	concrete	1916		3D	3D	Potential district contributor	A
127	Pier 68 Production Offices	NC	1,978	wood frame	1944				Potential district contributor	N/A
141	Pier 68 Breakroom/Washroom/Restroom	NC		steel frame	Post 1945					N/A
	Whirley Crane No. 27	C			1940s				Potential district contributor	N/A
	Iron Fence on 20th and Illinios Streets	C			c. 1917				Potential district contributor	N/A
	Irish Hill Remnant	N/A			landscape feature				Potential district contributor	
	Slip #4 & Cranes	C			1941		4D2		Potential district contributor	A
	Pier 68 - 'Wharf 1	NC/Setting			1886/1915					N/A
	Pier 68 - Wharf 3	NC/Setting			1886/1918/1967					N/A
	Pier 68 - Wharf 4	NC/Setting			1918/1957					N/A
	Drydock No. 2	NC			1970					
	Drydock Eureka	NC/Setting			c.1940s, moved c.1993					
	Slip 1	NC/Setting			1886/1915/1946					
	Slip 2	NC/Setting			1900/1915					
	Slip 3	NC/Setting			1900/1915					
	Slips 5-8	NC/Setting			1941					
	Pier 70 -Wharf 6	NC/Setting			1941					
	Pier 70 -'Wharf 7	NC/Setting			1942					
	Pier 70 - 'Wharf 8	NC			1945/1980					
	20th Street Paving	NC/Setting			1890s				Potential district contributor	
	Rail lines	NC/Setting			Various				Potential district contributor	