EXPERIMENTAL IRONCLAD:
A CONSTRUCTION AND EARLY OPERATIONAL HISTORY
OF THE USS *GALENA*

A Thesis

by

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ABSTRACT

Experimental Ironclad:
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This thesis analyzes the construction and early operational history of the USS *Galena*, a Civil War ironclad. It uses the *Galena* to examine the initial selection process for ironclads, to assess the ability of Northern industry to respond to the technical challenges of the war, to take a closer look at the often contentious process of ironclad construction, and to analyze the impact of this experimental design on the type of ironclads chosen to prosecute the war.

The *Galena* was built as one of three experimental designs early in the war. The other two, the *New Ironsides* and the *Monitor*, were relatively successful, while the *Galena* had mixed results. She proved a tactical failure but a strategic success in the critical summer of 1862. Although unable to perform as well as expected, she had both a psychological and a physical impact during the Peninsula Campaign, playing a critical role in the salvation of General George Brinton McClellan's army after the Seven Days.

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INTRODUCTION

America's Civil War, contrary to popular belief, did not create a revolution in naval design. At best, the sectional conflict provided "a rich testing ground for the technology of modern war."[1] European navies, especially those of Great Britain and France, took the lead during the preceding decade in exploring experimental technologies. These wary rivals supplied the needed financial backing and industrial support for the pioneering work in armor, ordnance, and ship design that so dramatically altered the composition of the world's navies by 1860. The 1850s witnessed the widespread introduction of the shell gun, rifled artillery, steam and screw propulsion, armored batteries, and iron hulled vessels. Great Britain and France each embarked on ambitious building programs designed to replace their obsolescent wooden ships with vessels incorporating the latest in naval technology. The pivotal vessel for each was the French *Gloire*, launched in November 1859, and the British *Warrior*, launched in December 1860.[2]

The ongoing revolution in naval design had not gone unnoticed or unheeded in the United States. Secretary of the Navy Abel P. Upshur called for the construction of an iron hulled vessel as early as 1841. At least three were built but proved unsatisfactory and ships of this type soon fell into disfavor among American (and European) navalists.[3]

Journal Model Followed: *Civil War History*

The threat of war in 1841-1842 prompted the issuing of a contract for the first American armored vessel to Robert L. Stevens. This armored steamer, unfinished at the outbreak of the Civil War in 1861, underwent fits and starts of construction throughout the 1840s and 1850s and was the only serious American attempt to build an armored warship during that time.[4]

The United States Congress viewed the expanded British and French fleets with some trepidation in the latter half of the 1850s. The Committee on Naval Affairs, with the assistance of the Secretary of the Navy, produced a report in January 1859 assessing the needs of the United States Navy against the capabilities of the Royal Navy, considered the potential aggressor. This report, taking recent technological advances into consideration, came to a number of conclusions. It recognized that

> Within the last fifteen years the application of steam as a motive power to naval vessels; their improved armament of heavy guns, equally applicable to shot and shell; their increased size and improved models, have revolutionized the character of naval warfare, and diminished, in a remarkable manner, the inequality between frigates and forts.[5]

Acknowledging the inability to compete with the British in terms of quantity, the report suggested that "in construction and equipment we must keep fully up with the times," with each newly constructed vessel being an improvement on its predecessor, not only in the U. S. Navy but also in the Royal Navy.[6] Although the American naval establishment was aware of British experiments with armor and included information about several ironclad batteries in an appendix to the report, the report

itself focused on the more pressing problem of applying adequate steam propulsion to the fleet. Accordingly, the committee recommended the construction of ten wooden steam ships of war, not realizing that technology, in the form of the *Gloire* and the *Warrior*, would make them second class vessels before they were ever built.[7]

The crashing of Confederate shells into the masonry walls of Fort Sumter forced the Department of the Navy to rethink its strategic mission. The Confederate States, not Great Britain, would be the immediate foe. On April 15, 1861, President Abraham Lincoln issued a call for 75,000 volunteers to put down the rebellion. Confederate President Jefferson Davis, responding two days later, authorized the issuance of letters of marque by the Confederate States of America.[8] Lincoln countered with proclamations on the nineteenth and the twenty-seventh declaring a formal naval blockade of the Southern coast. The Union Navy, which boasted only forty-two commissioned vessels, thus became responsible for blockading 3,549 statute miles of coastline and over 180 navigable harbors and inlets.[9]

Needless to say, ironclad construction was not a priority during the first months of the war. Secretary of the Navy Gideon Welles concerned himself with the basic problems at hand. First and foremost, he had to secure the defense of the nation's capitol. Steamers had to be leased or purchased to transport troops. Lincoln's proclamations meant that Welles had to oversee the improvisation of a blockading fleet. Any available vessel capable of mounting the necessary ordnance was quickly pressed into service and posted to Southern waters. Hundreds of

new sailors had to be clothed, fed, and trained. Welles faced a logistical nightmare that defied simple solutions. Finally, as in most wars, both sides predicted a speedy victory that would not justify the time and expense needed to design and build these unproven ironclad behemoths.[10] John Lenthall, Chief of the Bureau of Construction and Repair, reflected this opinion to Welles when he suggested on May 11 that "the necessarily large size, the cost and the time required for building an iron cased steam vessel is such that it is not recommended to adopt any plan at present."[11] It would take an extraordinary turn of events to modify the Navy's pragmatic decision. Such a turn was not long in coming.

The Gosport Navy Yard, near Norfolk, became an important early casualty to Southern secession. Fearful of provoking secession in neutral Virginia, President Lincoln did not fill the patronage jobs in the navy yard with Unionists. In an effort to pacify the already precarious situation, he kept the current staff, primarily Southern Democrats, in their positions. The president and the Navy Department had two causes of concern. First and foremost, the Gosport Navy Yard was the most important facility of its kind in the United States. Its dry dock, ship houses, foundries, machine shops and boiler shops were among the most modern in the navy. The loss of this capacity would be detrimental to the Union war effort.[12] Second, the USS *Merrimack* awaited engine repairs in the yard. A first class screw frigate of 3200 tons, she carried two 10-inch pivot Dahlgren guns, fourteen 8-inch carriage guns and twenty-four 9-inch Dahlgren guns, making her one of the most

formidable Union naval vessels afloat.[13] If she fell into Confederate hands, she would present an instant threat to the blockade.

A Virginia convention passed an ordinance of secession on April 17, 1861. Even though the ordinance would not be ratified by voters until April 23, the state militia immediately took steps to secure important Federal facilities, especially the Harper's Ferry armory and the Gosport Navy Yard.[14] On April 18, the Southern officers stationed at Norfolk resigned as a body. The Virginia state militia seized Fort Norfolk, the navy's powder magazine, the next day. Up to five thousand militia were rumored to be in the vicinity, waiting to seize valuable Federal assets. Commodore Charles S. McCauley, commandant of the navy yard, moved about in a befuddled state. Although the *Merrimack*'s engines had been repaired since April 18, McCauley not only refused to permit the vessel to leave for a safer port but also prevented its broadside armament from being put on board ship.[15]

Secretary Welles, kept informed of the situation in Norfolk, "became satisfied that the large amount of public property there was in a precarious condition. As a preventative, or matter of caution, it seemed to me advisable that a military force should be placed there to protect the yard, and to serve as a rallying point for Union men in case of emergency."[16] Despite the initial objections of General Winfield Scott and members of the cabinet, Welles dispatched an expedition under the command of Commodore Hiram Paulding to relieve McCauley and prevent Federal supplies from falling into the hands of the insurrectionists. However, just a few hours before the expedition

arrived in Norfolk McCauley panicked and ordered the yard's guns spiked and the *Merrimack* scuttled. By the time Paulding landed, the once proud vessel had taken on too much water to be salvaged quickly. Rumors of the rapidly concentrating militia continually filtered in, and on the evening of April 20 a nervous Commodore Paulding decided to destroy the yard's remaining facilities and evacuate its garrison to Washington. Powder trains were laid to many of the dockyard facilities and remaining ships, including the *Merrimack*. Amid some confusion the trains were lit and the remaining members of the relief expedition withdrew to their waiting vessels. The ensuing conflagration lit up the night sky as Paulding's force withdrew to Washington, satisfied they had achieved their objective of destroying any property that might be of use to the Confederates.[17]

Unbeknownst to the retreating Yankees, their efforts failed to have the desired effect. Despite the spectacular blaze and resounding explosions, many valuable facilities remained untouched or only partially damaged. The Confederacy inherited vast quantities of naval stores, machinery, and tools. The yard's graving dock, required for the maintenance of ships' hulls, survived intact. More importantly, Norfolk's forges and foundries, which would play such a crucial role in the coming months, entered Confederate service fully functional. Somehow the Federals neglected to put them to the torch. However, the most impressive acquisition lay partially submerged on the bottom of the James River. McCauley's decision to scuttle the *Merrimack* inadvertently saved the most valuable part of the ship. Even though fire

destroyed her upper works, her hull and machinery remained untouched and still usable. All she required was the application of ingenuity and vision.[18]

Fortunately for the South, Confederate Secretary of the Navy Stephen R. Mallory recognized the importance of the emerging ironclad technology. He had kept abreast of European developments, especially after the success of French ironclad batteries at Kinburn during the Crimean War. While still quartered in Montgomery, Alabama, he sent a letter dated May 10, 1861, outlining his hopes for the new navy to Charles M. Conrad, the chairman of the Committee on Naval Affairs. In it, Mallory noted,

> I regard the possession of an iron-armored ship as a matter of the first necessity. Such a vessel at this time could traverse the entire coast of the United States, prevent all blockades, and encounter, with a fair prospect of success, their entire Navy.
>
> If to cope with them upon the sea we follow their example and build wooden ships, we shall have to construct several at one time; for one or two ships would fall an easy prey to her comparatively numerous steam frigates. But inequality of numbers may be compensated by invulnerability; and thus not only does economy but naval success dictate the wisdom and expediency of fighting with iron against wood, without regard to first cost.[19]

Mallory knew the South did not currently possess the industrial capacity to build such a vessel. He closed his letter to Conrad by assuring the chairman that "an agent of the department will leave for England in a day or two, charged with the duty of purchasing vessels, and by him the first steps in the matter may be taken."[20]

Not content to rely on efforts to obtain ironclads abroad, Mallory, having moved to Richmond with the rest of the government, broached

the idea of a domestically built ironclad to Lieutenant John M. Brooke. Brooke, cognizant of the Confederacy's limited industrial capacity, came up with a simple design during the middle of June. This design, modified after consultations with John L. Porter, a constructor at the Gosport yard, became the basic plan for many of the Confederate ironclads built during the course of the war. Informed by the Tredegar Iron Works in Richmond that engines for such a craft were beyond its capabilities, the designers searched for alternatives. Confederate Chief Engineer William P. Williamson suggested they try to salvage what they could from the *Merrimack*, which had been freed from its resting place on May 30 by the Baker Wrecking Company. Porter and Brooke agreed that their design could be modified to fit the *Merrimack*'s hull, and submitted a report to Mallory on June 25 recommending that course of action. Revised plans were presented to the Secretary on July 10, and on that same day he authorized the conversion of the hulk into an ironclad warship.[21]

Rumors of a Confederate ironclad made their way around Washington, especially after the loss of the Gosport Navy Yard. Whether or not these rumors were true, they prompted not only speculation, but also action. As early as June 24, Congress passed a joint resolution instructing Secretary Welles to investigate the possibility of completing the Stevens battery. Welles duly appointed a board whose report, issued at the end of the year, recommended against any further expenditures by the government towards what seemed a financial sinkhole.[22] The battery returned to its intermittent retirement after

briefly raising its head, not appearing again until after the war.

President Lincoln called Congress together for a special session that began on July 4. At this time, Welles, drawing upon material gathered by Commander John A. Dahlgren, presented a report describing the current condition of the Union Navy and offering suggestions for its improvement. The Secretary noted that "other governments, and particularly France and England, have made [iron-clad steamers] a special object in connexion with naval improvements." He conceded that "the period is, perhaps, not one best adapted to heavy expenditures by way of experiment, and the time and attention of some of those who are most competent to investigate and form correct conclusions on this subject are otherwise employed." Nevertheless, he recommended "the appointment of a proper and competent board to inquire into and report in regard to a measure so important."[23] The Secretary's report closed by requesting permission to proceed with the construction of ironclad vessels if the board's investigation found them feasible.[24]

Senator John W. Grimes of the Naval Affairs Committee took up Welles' cause. Prompted by a Navy Department that not only heard rumors of Confederate ironclads with trepidation but also cast a wary eye towards European intervention, Grimes reminded his colleagues that "however valueless or valuable armored ships may be as cruisers, they certainly are destined to be valuable for the defense of harbors." He introduced a bill on July 19 "to provide for the construction of one or more armored ships."[25] The bill passed after a bitter two week struggle,

during which time the Stevens lobby was dealt its final blow. Congress approved the act on August 3, 1861, authorizing Welles "to appoint a board of three skilful naval officers to investigate the plans and specifications that may be submitted for the construction or completing of iron or steel-clad steamships or steam batteries." The act also appropriated $1,500,000 for ironclad construction should the board's report be favorable, marking the entrance of the Union into the developing race for naval supremacy of the Eastern seaboard.[26]

Secretary Welles, having received the necessary authorization from Congress, initiated a series of actions designed to achieve timely results. Deciding that the government navy yards would not be responsible for construction of the first ironclads, he turned to the private sector. On August 7 he published an advertisement soliciting

> offers from parties who are able to execute work of this kind, and who are engaged in it, of which they will furnish evidence with their offer, for the construction of one or more iron-clad steam vessels of war, either of iron or of wood and iron combined, for sea or river service, to be of not less than ten nor over sixteen feet draught of water; to carry an armament of from eighty to one hundred and twenty tons weight, with provisions and stores for from one hundred and sixty-five to three hundred persons, according to armament, for sixty days, with coal for eight days. The smaller draught of water, compatible with other requisites, will be preferred. The vessel to be rigged with two masts, with wire-rope standing rigging, to navigate at sea.
>
> A general description and drawings of the vessel, armor, and machinery, such as the work can be executed from, will be required.
>
> The offer must state the cost and the time for completing the whole, exclusive of armament and stores of all kinds, the rate of speed proposed, and must be accompanied by a guarantee for the proper execution of the contract, if awarded.
>
> Persons who intend to offer are requested to inform the department of their intention before the 15th August, instant, and to have their propositions presented within twenty-five days from

this date.[27]

Having made his wishes known to Northern industry, Welles proceeded to the next item on his agenda.

The day after publishing this announcement, Welles appointed three naval officers members of a board to assess proposals received. The Secretary originally approached John Lenthall, Chief of the Bureau of Construction and Repair, to oversee the selection and construction process. Despite the rumors of Confederate ironclad construction, Lenthall, like most of the other bureau chiefs, remained skeptical of these experimental vessels. He exempted himself from the board by claiming that his bureau was already taxed to its limits.[28] Welles then designated Commodore Joseph Smith, Chief of the Bureau of Yards and Docks and a close personal friend, as senior officer of the board. To aid Smith, the Secretary appointed two assistants: Commodore Hiram Paulding, the man who burned the Gosport Navy Yard, and Commander Charles H. Davis. The board was ordered to "convene at the Navy Department as early as practicable, and . . . make a written report of the result of its investigations of the subject."[29]

The board met for the first time on September 5 and began to work its way through the incoming proposals. On September 16 the naval officers submitted their "Report on Iron Clad Vessels" to Secretary Welles. Admitting at the outset that they had "no experience and but scanty knowledge in this branch of naval architecture," they considered it "very likely that some of our conclusions may prove erroneous."[30] The board had requested the services of a naval constructor to act as a

technical advisor, but none were available, forcing them to draw upon their own experience and the reports of others.

Before making its final recommendations, the board briefly examined the current debate over armored warships. Two schools of thought dominated the debate within naval circles. The first envisioned ironclads in a coastal and harbor defense role, usually in conjunction with shore-based fortifications. The board acknowledged the utility of such vessels, noting that "for river and harbor service we consider iron-clad vessels of light draught, or floating batteries thus shielded, as very important; and we feel at this moment the necessity of them on some of our rivers and inlets to enforce obedience to the laws."[31] However, the board also recognized the limitations of these vessels, especially against masonry emplacements ashore.

The second school, primarily composed of members of the British and French naval establishments, thought that ironclad steamers represented the future of ocean-going cruisers. The board was "skeptical as to their advantage and ultimate adoption."[32] They listed a number of disadvantages inherent to ironclad construction, including "the enormous load of iron, as so much additional weight to the vessel; the great breadth of beam necessary to give her stability; the short supply of coal she will be able to stow in bunkers; the great power required to propel her; and the largely increased cost of construction."[33] While acknowledging the primacy of ironclads in ship to ship combat, they pointed out that the greater speed of wooden cruisers allowed those vessels to pick and choose their fields of battle. Despite their

disinclination towards ironclad cruisers, the board remained conscious of French and British efforts, noting "whilst other nations are endeavoring to perfect them, we must not remain idle."[34]

Smith, Paulding and Davis grappled not only with what kinds of ironclads to build but also where to build them. Ordnance tests conducted in Europe and the United States indicated that these vessels required at least $4\frac{1}{2}$ inches of iron plate to resist standard naval armaments. Unfortunately, there were no mills in the United States capable of rolling plates of that thickness. Plates of $4\frac{1}{2}$ inches could be hammered out, but rolled plates proved more resilient to shot and shell. English contractors possessed both the requisite rolling machinery and the shipbuilding expertise needed by the Union Navy. However, the board voiced two objections to signing contracts with the English. First, "a difficulty might arise with the British government in case we should undertake to construct ships-of-war in that country."[35] Second, and perhaps more important, "we are of opinion that every people or nation who can maintain a navy should be capable of constructing it *themselves*."[36]

The naval board ultimately adopted a pragmatic construction strategy based on the requirements of the current conflict and the vessels of foreign navies. The board recognized that current demands required "vessels invulnerable to shot, of light draught of water, to penetrate our shoal harbors, rivers and bayous" and recommended "the construction of this class of vessels before going into a more perfect system of large iron-clad sea-going vessels of war." Although uncertain

of the ability of such vessels to bear the necessary armor, the board bowed to necessity and advised that they be built. Meanwhile, they suggested that the United States carefully observe the progress of the British and the French in ironclad construction so larger and more technologically advanced vessels could be built when circumstances permitted.[37]

Secretary Welles, reviewing the board's actions for Congress in December, 1861, acknowledged the obstacles faced during the selection process. He noted that "the difficulty of combining the two qualities of light draught and iron armor, both of which are wanted for service on our coast, could not be entirely overcome; but the board, in this new branch of naval architecture, has, I think, displayed great practical wisdom . . ."[38] The vessels finally chosen reflected different schools of naval thought, producing a true light draught ironclad, a prototype cruiser capable of dealing with the *Gloire* and the *Warrior*, and a hybrid gunboat that never quite found its own identity.

In the eleven days between the board's first meeting and the issuing of the "Report on Iron Clad Vessels," seventeen proposals underwent the scrutiny of these skeptical officers. Five emerged from the screening process with qualified recommendations. However, the board shelved two of these proposals because of their estimated cost. E. S. Renwick of New York affixed a $1,500,000 price to his plan (equal to the entire amount allocated by Congress). Donald McKay of Boston, famous for designing clipper ships, stated that his ironclad could be built for $1,000,000. The board rejected both as too expensive and

recommended that the remaining three proposals be issued contracts.[39]

The first recommended proposal, submitted by John Ericsson of New York, was for "a floating battery . . . based upon a plan which will render the battery shot and shell proof."[40] Although unconvinced of the vessel's seaworthiness, the design so intrigued two of the three board members that they authorized its construction.[41] The result was the USS *Monitor*, which gave her name to an entire class of ships. The second proposal, tendered by Merrick & Sons of Philadelphia, was considered "the most practical one for heavy armor" by the board.[42] This belt and battery vessel, similar in armor and displacement to the *Gloire* and the *Warrior*, had the highest price of the three accepted ships, $780,000.[43] The traditional lines of the proposed vessel must have provided some comfort to the members of the board, on whose shoulders rested the fate of the Union Navy. Christened the USS *New Ironsides*, this ship participated in more engagements and fired more shots than any other Civil War ironclad.

The final accepted proposal, proffered by C. S. Bushnell & Company of New Haven, Connecticut, called for an ironclad armored on the rail and plate principle. The board expressed caution over this design, fearing "that she will not float her armor and load sufficiently high, and have stability enough for a sea vessel."[44] Still, they recommended that she be built, as long as she overcame these objections. Accordingly, on September 27, 1862, the United States, represented by Gideon Welles, entered into a contract with Cornelius S. Bushnell and Henry L. Bushnell for "an Iron-Clad vessel upon the

principle of iron rails and iron plates . . . [to] be completed and delivered at the Navy Yard, New York in four months from the date of this contract ready for trial."[45]

The contract called for a vessel one hundred and eighty feet in length, thirty six feet in breadth, and "depth of hold from inside of floor timber to underside of main deck plank twelve feet eight inches--with engines and machinery complete." When completed, the vessel had to meet a number of stipulations. First, she must have the "capacity and stability to carry and work a battery not to exceed one hundred tons weight." The battery itself would be provided by the government. Second, she must must "make a speed under steam of twelve knots, or sea miles, per hour, in smooth water, and carry coal in the bunker for ten days consumption at that speed." Third, she would "have a schooner rig, with proper square sails." Finally, she must "have stability to carry said armament, armor, boats, provisions, stores and outfits of all kinds with 2500 gallons of water in tanks, and a crew of 130 persons, with all sails set, safely at sea as a cruising vessel."[46]

The contract also contained safeguards designed to protect the government's interests. First and foremost, it allowed the Navy to assign a superintendent to the project who had "the right to reject any of the materials and work which shall not be of the best quality."[47] The terms of the contract called for the government to pay the Bushnells $235,250 for the vessel. As the contractors submitted bills for at least $20,000 approved by the superintendent, the Department of the Navy would reimburse them for three quarters of that sum. The remaining

twenty five percent was to be paid "after completion and delivery and satisfactory trial." If the contractors violated the terms of the agreement during the course of construction, all sums paid out would be returned to the government, with "said vessel with all her appurtenances [being] held by the United States as collateral security until said liquidated damages - for money advanced, shall have been paid." Finally, the contract prohibited any "member of Congress, officer of the Navy, or any person holding any office or appointment under the Navy Department" from holding shares in the vessel or gaining any personal benefit from its construction. If such improprieties occurred, the government could unilaterally declare the agreement null and void.[48]

Despite the rigid time constraints and the exacting terms delineated in the agreement, the Department of the Navy closed the contract with a clause reflecting the uncertainties of ironclad shipbuilding. In an apparent effort to reconcile evolving technology with practical necessity, the final paragraph "stipulated that any immaterial improvements which the said parties may agree to, as the vessel progresses, may be made without prejudice to principal points in this contract."[49] Such flexibility both created and solved many problems during the course of construction.

The construction and early career of this vessel, later designated the USS *Galena*, provides the focus of this study. Unlike the other two accepted proposals in the design competition, built as the USS *Monitor* and the USS *New Ironsides*, the *Galena* earned a reputation as a

qualified failure. However, it is not enough to write her off in the brief paragraph or two she usually merits in most naval histories. The following pages explore not only the reasons for her failure as an experimental ironclad but also place her within the context of her times. The account of her construction history elucidates problems faced by the Navy Department as it rushed to harness the industrial might of the Northeast for the war effort. On a more personal level, the interaction between representatives of the Navy Department and the *Galena*'s contractors demonstrates the tensions which developed between businessmen motivated by financial gain and naval officers who wanted to quickly and efficiently introduce ironclads to the fleet. The expectations of both parties were artificially high at the start of construction, which meant each had to compromise by the end.

The early operational career of the *Galena* examines the process by which the Union determined the design of the ironclads used throughout the war from a slightly different perspective, emphasizing tactical failure and performance below expectations as a motivation for choice. However, it also demonstrates the strategic success of the *Galena* at a critical point during the war, when her psychological effect equalled or outweighed her actual physical effect. The resulting monograph should not only broaden the understanding of naval affairs in the East but also raise some interesting questions about how a nation gears up for war.

CHAPTER I NOTES

[1]Dean C. Allard, "Naval Technology During the American Civil War," *The American Neptune* 49 (Spring 1989):114-22.

[2]For a general introduction to European naval advances, see James Phinney Baxter, *The Introduction of the Ironclad Warship* (Cambridge: Harvard University Press, 1933; reprint ed., Hamden, Conn.: Archon Books, 1968), 1-210.

[3]Ibid., 41-47; U.S., Congress, Senate, *Annual Report of the Secretary of the Navy, 1841*, Senate Doc. 1, 27th Cong., 2nd sess., 1841, p. 382. The three ships were the USS *Michigan*, the USS *Allegheny*, and the USS *Water Witch*.

[4]Baxter, *Introduction of the Ironclad Warship*, 48-52; U.S., Congress, Senate, *Letter of the Secretary of the Navy, in Answer to a Resolution of the Senate of the 18th instant, in Relation to the Contracts Made with Robert L. Stevens for the Construction of a Steam Floating Battery*, Senate Doc. 34, 37th Cong., 2nd sess., 1862. See Appendix A for a schedule of payments made to Stevens. For further cost overruns see U.S., Congress, House, *Annual Report of the Secretary of the Navy, 1857*, House Exec. Doc. 2, 35th Cong., 1st sess., 1857, p. 582.

[5]U.S., Congress, Senate, Committee on Naval Affairs, *Report of the Committee on Naval Affairs, on the Construction of Naval Vessels*, Senate Rept. 363, 35th Cong., 2nd sess., 1859, p. 1.

[6]Ibid.

[7]Ibid., 2. These wooden steam ships were equal to or better than similar vessels in the navies of other nations and would be outclassed only in a battle with the French or British navies.

[8]For Davis' proclamation, see U.S., Navy Department, *Official Records of the Union and Confederate Navies in the War of the Rebellion*, 30 vols. (Washington: Government Printing Office, 1894-1922), Series II, vol. 3, pp. 96-97. (Hereinafter cited as *ORN*. Series II unless otherwise noted). The Confederate Congress did not formally authorize letters of marque until May 6, but Lincoln's response was based on Davis' public proclamation. For the Confederate Congress' authorization, see *ORN*, vol. 1, pp. 335-40.

[9]Richard S. West, Jr., *Mr. Lincoln's Navy* (New York: Longmans, Green and Company, 1957), 44-45.

[10]Ibid., 46-54; Robert Greenhalgh Albion, *Makers of Naval Policy 1798-1947* (Annapolis: Naval Institute Press, 1980), 195; James Russell Soley, "The Union and Confederate Navies," in Robert U. Johnson and C. C. Buel, eds., *Battles and Leaders of the Civil War*, 4 vols. (New York, 1887-88; reprint ed., Secaucus, N.J.: Castle, 1956), I:614-16, 623.

[11]Cited in Baxter, *Introduction of the Ironclad Warship*, 242.

[12]West, *Mr. Lincoln's Navy*, 29-31.

[13]*Report of the Committee on Naval Affairs, on the Construction of Naval Vessels*, 16-17.

[14]James M. McPherson, *Battle Cry of Freedom: The Civil War Era* (New York: Oxford University Press, 1988), 279.

[15]West, *Mr. Lincoln's Navy*, 35-38.

[16]Gideon Welles, *Diary*, edited by Howard K. Beale, assisted by Alan W. Brownsword, 3 vols. (New York: Norton, 1960), I:41. Unfortunately, Welles' diary does not begin detailed entries until the summer of 1862. The introduction, written several years after the war, remains useful for describing his impressions of the first year of the war.

[17]West, *Mr. Lincoln's Navy*, 36-43; John S. Long, "The Gosport Affair," *Journal of Southern History* 23 (May 1957):155-72.

[18]William C. Davis, *Duel Between the First Ironclads* (New York: Doubleday, 1975; reprint ed., Baton Rouge: Louisiana State University Press, 1981), 7-8. A statement from Commissioner William H. Peters to Governor John Letcher of Virginia describing the condition of the Norfolk Navy Yard after the Federal evacuation can be found in *ORN*, vol. 2, pp. 107-12. By February1862, Mallory could report to President Davis that "the construction of vessels and their equipments of gun carriages, ordnance and ordnance stores, the manufactures of steam engines and of shot and shell are all progressing satisfactorily" at

Norfolk. Mallory to Davis, February 27, 1862, *ORN*, vol. 2, pp. 153-54.

[19]*ORN*, vol. 2, p. 69.

[20]Ibid.

[21]Davis, *Duel Between the First Ironclads*, 9-13; for Brooke's testimony of events, see *ORN*, vol. 1, pp. 783-88; for Mallory's version, see *ORN*, vol. 2, pp. 174-76; see also Mallory's letter of July 18, 1861 to Jefferson Davis in *ORN*, vol. 2, pp. 76-79 describing the condition of the Norfolk yard and the status of the *Merrimack*.

[22]Frank M. Bennett, *The Steam Navy of the United States. A History of the Growth of the Steam Vessel of War in the U.S. Navy, and of the Naval Engineer Corps* (Pittsburgh: Warren, 1896; reprint ed., Westport, Conn.: Greenwood Press, 1972), 262-63.

[23]"From the Report of the Secretary of the Navy, July 4, 1861. Iron-Clad Steamers or Floating Batteries." in U.S., Secretary of the Navy, *Report of the Secretary of the Navy in Relation to Armored Vessels* (Washington: Government Printing Office, 1864), 1.

[24]Bennett, *Steam Navy of the United States*, 263; Albion, *Makers of Naval Policy 1798-1947*, p. 195.

[25]William Salter, *Life of James W. Grimes* (New York: D. Appleton and Company, 1876), 145-46, cited in Albion, *Makers of Naval Policy 1798-1947*, p. 196; Baxter, *Introduction of the Ironclad Warship*,

246.

[26]"Act of Congress Authorizing the Construction of Iron-Clad Vessels." in *Report of the Secretary of the Navy in Relation to Armored Vessels*, 1. See also Bennett, *Steam Navy of the United States*, 263. The text of this uncharacteristically short act is given in Appendix B.

[27]"Copy of Advertisement Calling for Plans and Specifications. Iron-Clad Steam Vessels." in *Report of the Secretary of the Navy in Relation to Armored Vessels*, 2.

[28]Albion, *Makers of Naval Policy 1798-1947*, p. 196; for general reaction to ironclads among naval officers and constructors see Charles B. Boynton, *The History of the Navy During the Rebellion* (New York: D. Appleton and Company, 1867), 156-57.

[29]"Order Convening a Board to Examine Plans for the Construction of Iron-Clad Vessels." in *Report of the Secretary of the Navy in Relation to Armored Vessels*, 2. James Phinney Baxter has found evidence that the board originally consisted of Smith, Paulding, and Commander John A. Dahlgren, the Navy's resident ordnance expert. The original manuscript copy of the orders has Dahlgren's name on it with Davis' name pencilled in. He claims that Dahlgren secured his removal from the board and was replaced by Davis on August 25. However, all printed copies of Welles' orders to Smith on August 8 specifically name Paulding and Davis as associate members of the board. See Baxter, *Introduction of the Ironclad Warship*, 247.

[30]"Report on Iron Clad Vessels" in U.S., Congress, Senate, *Annual Report of the Secretary of the Navy, 1861*, Senate Doc. 1/13, 37th Cong., 2nd sess., 1861, p. 152. The text of this report is given in Appendix C.

[31]Ibid.

[32]Ibid.

[33]Ibid.

[34]Ibid.

[35]Ibid., 154

[36]Ibid.

[37]Ibid.

[38]"From the Report of the Secretary of the Navy, December 2, 1861. Armored Ships." in *Report of the Secretary of the Navy in Relation to Armored Vessels*, 8.

[39]"Report on Iron Clad Vessels," 154-55.

[40]Ibid., 154.

[41]West, *Mr. Lincoln's Navy*, 104-105.

[42]"Report on Iron Clad Vessels," 155.

[43]Ibid.

[44]Ibid., 156.

[45]Contracts and Bonds 1861, Records of the Bureau of Yards and Docks, Record Group 71, Entry 48, National Archives, Washington, D.C., 249.

[46]Ibid., 249-50.

[47]Ibid., 249.

[48]Ibid., 250.

[49]Ibid., 251.

CHAPTER II

"LIKE THE LARGER END OF AN EGG"

Cornelius Bushnell held much more in his hands than a simple contract for wartime goods when he left the Navy Department. He and his brother, acting as the primary contractors, had been offered the opportunity to revolutionize the very essence of naval warfare. While the French and the British designed and built ships which might not face the test of battle for years, if ever, the Bushnells had just been given a license to create a vessel which was assured of seeing combat almost immediately after it entered service with the navy. A successful performance could mean more contracts for more ironclads, guaranteeing the brothers a comfortable future. All in all, it was an exciting proposition. Still, the government exercised a certain degree of control over the entire process, attaching several specifications to the contract. Although it was taking a risk on an untried design, the Navy Department made sure that basic requirements for a seaworthy vessel would be met.

The design of the hull was markedly different than anything yet built in the United States or overseas, but closely followed traditional construction techniques. The materials and manner of construction, with the exception of the armor, could have been accomplished by any competent shipyard. The interior and exterior fittings would not differ in any degree from the pre-war steam screw frigates built for the navy. Likewise, the vessel's power plant followed a contemporary design

already used widely in naval ships around the world. It was the *Galena*'s shape, not her substance, that explored new aspects of naval design.

The only other feature of the ship that hinted at innovative design was the armor plating. The armor scheme differed from that of other ironclads building in Europe and the United States for a number of reasons. One was, hopefully, to employ armor that would more effectively resist enemy fire, but the main reason was to accommodate limitations in the vessel's design and in capacities of the nation's industrial base. Designed as a gunboat, the *Galena* could not carry the armor load of the bigger ocean-going cruisers. Even if she could have carried that much armor, the North could not produce plates of the required thickness. Innovation guided the design, but necessity forced its adoption.

Although the Bushnells provided financial backing, the actual design of the *Galena* sprang from the mind of Naval Constructor Samuel H. Pook.[1] The potential of armored warships had occupied Pook's mind since the outbreak of hostilities. He spent the summer of 1861 in the West modifying the design of the first armored river gunboats, the "city class" vessels which played such a crucial role in campaigns in the Mississippi Valley. The exposed machinery and shallow draft of these river boats made the addition of armor plating a necessity, and Pook wrestled with the problems of weight, draft, and a means of securing armor to a vessel. Although unable to solve all of these problems before being recalled to Washington in July, the

experience gave him a solid grounding in the mechanics of ironclad design and construction.[2]

Cornelius Bushnell spent at least the latter half of the summer of 1861 in Washington, no doubt assessing his chances of landing a war-related contract. He was in close contact with Secretary Welles during the struggle to obtain funding for ironclads, and actively lobbied with a member of Congress from his home district to push for the bill's passage.[3] At some point, perhaps during the congressional deliberations, Bushnell and Pook discussed ironclad design. Pook evidently convinced Bushnell of the soundness of his design. The Connecticut industrialist agreed to supply the necessary financial backing and submit Pook's plans to the naval board for consideration. Thus, as previously described, Bushnell & Company received one of the coveted contracts.

One of the most important stipulations of the contract allowed the navy to assign a superintendent to the project who had "the right to reject any of the materials and work which shall not be of the best quality."[4] Accordingly, Commodore Joseph Smith, Chief of the the Bureau of Yards and Docks, informed the Bushnells on September 30 that "Mr. S. H. Pook will be appointed superintendent of the vessel on the part of the United States, with instructions to see that all the conditions of the contract are fulfilled."[5] Although Smith may have worried about the conflict of interest in assigning a designer to superintend his own vessel, he had little choice. Few men possessed Pook's experience in the construction of ironclad warships.

The newly appointed superintendent evidently wasted little time getting to Mystic, Connecticut, where the *Galena* would be built. Five days later Smith addressed a letter to him there, enclosing "herewith a copy of the contract and specifications with C. S. and H. S. Bushnell for an ironclad vessel, to govern you in the superintendence of the construction of said vessel."[6] The enclosed specifications, although excruciatingly detailed, were relatively straightforward. Divided into three sections, they itemized the structural requirements and construction techniques for the ship's hull, its engines, and its armor.

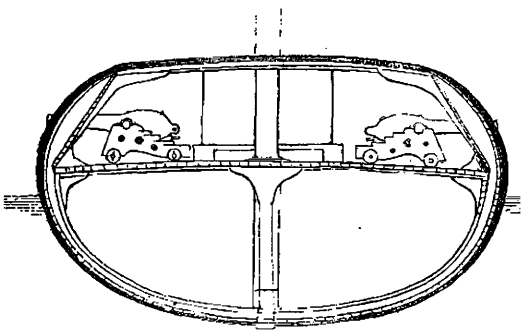
Pook's instructions stipulated a vessel one hundred and eighty feet in length and thirty six feet in breadth, with a "depth of hold from inside of floor timber to underside of main deck plank, eleven feet eight inches."[7] The hull itself followed traditional construction techniques for wooden ships, with key components fabricated from white oak. The keel was to be of "White Oak of the best quality" made of no more than five pieces "scarphed horizontally, not edgewise."[8] The bottom of the main keel was to be coppered before a two inch thick white oak shoe was put on and "fastened with 5 inch composition spikes."[9] Cast iron shoes would be secured to the keelson to support the fore and main mast.[10] The stern and deadwood were also to be of white oak and coaked to the keel, with the deadwood "strapped with galvanized iron straps on the outside as may be required to make this part of the vessel perfectly secure."[11] The rudder was "to be secured to the keel and to the stern frame above in the best and most workmanlike manner [with] the rudder head to be completely fitted so as to keep out the water."[12]

The specifications called for a "frame of white oak & white chestnut" with "fillings of yellow pine or chestnut timber." Each frame would be "bolted to the keel with one iron bolt." The filling would "be bolted to the frame and raised with it, . . . and caulked solid above and below, before the plank[s] are put on."[13] Nautical parlance refers to each line of planking as a strake, and the *Galena*'s specifications mandated distinct guidelines about the strakes on each part of the ship. The garboard strakes, among the most important, were "of white oak in thickness 6 inches fastened through the keel and each other where practicable."[14] The specifications required four inches of white oak for the actual bottom planking. The bilge strakes could be either white oak or yellow pine but must be six inches thick.[15] In the case of both the garboard and bilge strakes, the thickness of the oak decreased as it came towards the bow and the stern. The remaining strakes to the planksheer would be $3\frac{1}{2}$ inches thick.[16]

The planking in the hold could also be either white oak or yellow pine three inches thick. No planking was "required below the thick strakes forward and aft except at spaces where rooms are to be built." There, "it will be boarded with 2 inch white pine."[17] The perimeter of the hold was designed for drainage. Constructed solely of yellow pine, it was $5\frac{1}{2}$ inches thick on the edge of the deck. However, the planking was only $3\frac{1}{2}$ inches thick between the edge of the deck and the actual deck surface, creating channels which facilitated the removal of water. The gun deck was constructed solely of yellow pine, this time 4 inches thick. This deck's "top timbers and connections [had] to be made strong

enough to resist the strain consequent upon the iron top" when the armor was affixed. A system of braces, beams, and stanchions supported both decks.[18]

FIGURE 1: HULL CROSS SECTION



While the construction techniques indicated a traditional wooden hull, the design called for something completely different. Instead of relatively vertical sides, the *Galena*'s hull would have a pronounced curvature, prompting one observer to declare that the vessel looked "like the larger end of an egg." (FIGURE 1). He declared that "the advantages of this rounded form are apparent. A ball striking a flat surface at a right angle--that is, in a direct line--exerts its whole force, and either passes through, or is stopped, or rebounds. Now if it strikes

at considerably less than a right angle, it glances off in another direction."[19] Whether or not the concept would work remained to be seen, but the design represented a new approach to naval architecture.

The *Galena*'s hull specifications dealt with more than the hull itself. They also included the various accouterments which the contractors were expected to install. The contract price included a rudder, tiller, steering wheel, and capstan, all of iron, four brazed heavy copper pumps and a three hundred pound bell. The vessel was to be caulked with "oakum from new material" and all seams securely sealed with pitch. The bottom of the ship, following standard practice, was to be coppered with 24 ounce copper, "except in the vicinity of iron covering, where it will be covered with zinc" to prevent an adverse chemical reaction. The gun deck was to be fitted with $11\frac{1}{2}$ inch thick oak beds for two pivot guns and ring and eye bolts for the *Galena*'s broadside armament. To service the ordnance, the contractors had to build "Magazine and Shell rooms as [the] Ordnance Bureau may direct, fitted with lamps, cocks for flooding, [and] shelves for powder" and "all the Store rooms, chain and shot lockers necessary."[20]

Not all of the required equipment was so mechanical in nature. The creature comforts of the officers and crew also had to be attended to. First, for the captain, a cabin

> of seasoned white pine, to have state rooms, clothes lockers, berth, coat and hat hooks, pantry and water closet with fixtures complete, extension dining table of black walnut, chairs, camp stools, looking glass, wash stand, book shelves, one cot & cot hooks, hanging lamp, one table and cover, with 6 dish covers, shades for window, floor covered with Brussels carpet, cabin fitted with Venetian blinds and shades to the windows.[21]

The officers enjoyed similar accommodations. Their ward room floor was to be covered with oil cloth and supplied with an "extension dining table of black walnut" They had "rooms fitted with berths, lockers, coat & hat hooks, washstands and shelves, furnished with chair and camp stools [of] sufficient number, hanging lamp, one table cover, [and] six dish covers," along with "hammock hooks for four persons." The steerage was to be "fitted with berths, curtains, lockers, shelves, [an] extension table cherry, wash stand, two chairs and 8 camp stools." Separate water closets were to be constructed for the ward room and the steerage. The forward berth deck, where the crew would be quartered, was to be "fitted with Sail room, store rooms, mess chests 6 in number, or more if required" and "hammock hooks for as many men as can be slung." In addition to living quarters, Bushnell & Company was also to provide a dispensary closet, a general store room with an armory, arms chest and musket stands, and a galley capable of feeding 150 persons.[22]

When completed, the *Galena* was to have "3 good coats of paint complete." She would have two white pine masts, spruce or hard pine yards and top masts, wire rope rigging, and sails of the best flax canvas available. Her forward mast would be rigged as a brig and her aft mast as a schooner. She would stow four wooden boats, "completely fitted with masts, sails, oars, boat hooks and gratings . . . and arranged as life boats." These life boats could be mounted on "iron boat-davits two pair on each side [with] one set of davits at the stern." The contractors also had to supply the ship's complement of anchors, grapnels, cables, hawsers, and "all necessary fittings for promptly working anchor and

cable." As far as the rest of the hull went, "stores, ordnance and ordnance stores and equipments extra are to be furnished by the Navy Department."[23]

The specifications for the *Galena*'s engine were less exacting than those for the hull, leaving room for experimentation on the part of the builder. The contract called for "a pair of condensing steam propeller engines . . . with two horizontal cylinders--each 48 inches diameter of bore, and 36 inches stroke of piston."[24] Although an engine based on vertical cylinders would have been easier to maintain and easier to build because of the widespread use of similar designs on commercial steamers, "its height [would be] so great that it would be exposed to injury by shot."[25] The engines were to be positioned so "that when one engine is on the centre the other shall be on the half centre, or nearly so." In an apparent effort to provide a backup mechanism, "each engine [was] to be so arranged by its pumps, pipes and connections that it may be worked independently, or be used in connection with the other as a double engine."[26]

The engine was to be built of wrought iron, especially the "shafts, levers, cranks and all moving gears and connections . . . The steam opening and valves of the cylinders [were] to be of the largest proportions used for quick working engines," relying on "simple and effective valve gear" for ease of operation. Likewise, the "condensing arrangement [was] to consist of effective and perfect air pumps" with an "efficient and satisfactory apparatus for producing" surface condensation. The engine was to have two tubular boilers with "a fire surface of at least four

thousand square feet." The *Galena*'s design called for "tanks of $\frac{1}{4}$ inch iron to contain 2000 gallons of water with distillery apparatus and tank complete" to operate the steam machinery. In a manner reminiscent of the hull specifications, "the engines and boilers [were] to be provided with all the necessary iron, floorings, ladders, gratings, tools, instruments, valves & cocks, and to be completed and in perfect order for service . . . and to be provided with all the appliances for durable, safe, and economical working." The object of the engine, the propeller, was to be fashioned from brass.[27]

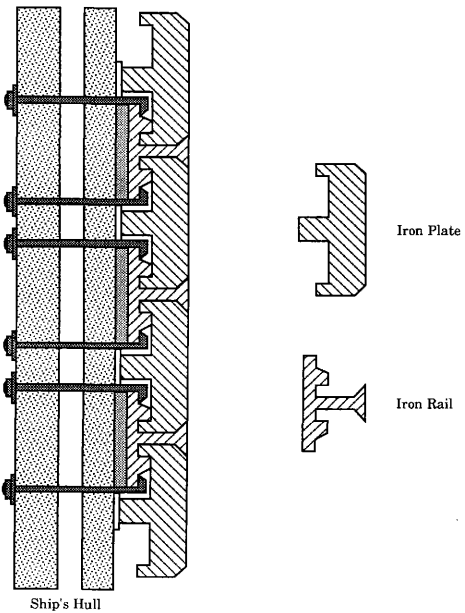
The final set of specifications dealt with the *Galena*'s armor plating. The contractors had the option of using either steel or high quality iron plates. The proposed armor consisted

> of a girder chair or rail . . . 5 $\frac{1}{2}$ inches broad by $\frac{5}{8}$ inch thick rolled . . . in suitable lengths. These chairs are placed eight inches apart from centre to centre, bent to the form and placed lengthwise with the vessel, from a point four feet below the water line at midships and terminating at the water line at stem and stern and fastened to the sides of the vessel by one inch hook-headed bolts about 12 inches apart, passing to the inside of the vessel, and there secured by nut, screw and washer. The steel or iron plates also rolled for this purpose, . . . [are] 7 $\frac{3}{8}$ inches broad, 1 $\frac{1}{4}$ inches thick and armed with flanches which interlock with corresponding projections on the girder chair. The intermediate and continuous tongue, also a rolled part of the chair or rail, is rivetted over contiguous plates, thus firmly securing the plates to the chair or rail.[28]

In order to ensure the secure attachment of the outside plates to the rails, not more than five 1 inch bolts would be countersunk to the surface of each plate and secured on the interior of the vessel by nut and screw, presenting an even surface and maintaining the integrity of the armor.

The point of juncture between plates would be cemented and caulked. (FIGURE 2).[29]

FIGURE 2: ARMOR CROSS SECTION



The armor would extend up to the edge of the woodwork above the

main deck. An arched iron roof would then be built over the gun deck on the same rail and plate principle as the sides of the ship. However, the thickness of the plates was reduced from $1\frac{1}{4}$ to $\frac{3}{4}$ inches. The design included a row of stanchions running the length of the vessel to support the roof and check any vibrations. Finally, "for the purpose of increasing the resisting power of the armor," the specifications suggested a layer of vulcanized india rubber between the hull and the iron rail $1\frac{1}{2}$ inches thick, adding $16\frac{1}{2}$ tons to the weight of the vessel.[30]

Unknown to the Bushnells, a series of experiments carried out by the French and British questioned the utility of this type of armor scheme. The French conducted a number of tests in 1856 on targets representing several different armoring techniques. These tests, which ultimately determined the type of armor used on the *Gloire*, yielded an unexpected result which was promptly incorporated into all French ironclads. The armor had been attached to its wooden backing with bolts secured with nuts. However, this "had the serious defect that frequently the bolts broke and the nuts flew off when the plate was struck by a projectile," creating potentially harmful missiles within the confines of a warship. The French solved the problem by securing their armor to its wooden backing with screws. The Bushnell proposal relied on bolts, to the detriment of the design when taken into combat.[31]

French and British ironclads, either proposed or constructed, were designed on the "belt and battery" principle, as was the *New Ironsides*, then building in Philadelphia. The armor for these ships consisted of a series of iron plates, which, on the *New Ironsides*, were

fifteen feet long, twenty-eight inches wide, and 4 $\frac{1}{2}$ inches thick. Each plate had a groove around the perimeter, on which tongue pieces of iron would be fastened to link the plates together.[32] The British Admiralty, contemplating the continued use of this design for vessels then building, tested targets during the spring of 1861. Its Special Committee on Iron issued a preliminary report in August, 1861 and a final report in March, 1862. The final report declared:

> All tonguing and grooving, or any departure from plane-edges, is a source of weakness to each particular plate; is liable to assist in destroying neighbouring plates which would not otherwise be affected by a blow, and has structural disadvantages, in preventing facility in repairing a damaged ship, or changing a damaged plate.[33]

The report and test results impressed the Admiralty enough for it to change the armor design on vessels which had not yet received their iron plating.

Even if the Bushnells and Samuel Pook had been aware of the British and French experiments, and chances are that they were not, the *Galena*'s proposed plating probably would not have been changed for three important reasons. First, the ship was much smaller than any contemporary ironclads, with the exception of John Ericsson's *Monitor*, and could not carry as much armor as her bigger counterparts. The British *Warrior* displaced almost 9000 tons, the French *Gloire* over 5600 tons, and the *New Ironsides* over 4200 tons. In contrast, the *Galena* would displace about 950 tons when built. She was designed to serve as a coastal gunboat capable of steaming up the myriad rivers of the eastern seaboard of the United States. This mission demanded a shallow draft,

which meant she would have to carry a reduced armor load. The *Monitor*, although it too would displace less than 1000 tons, looked like nothing else built for contemporary naval warfare and did not serve as a point of comparison. Indeed, its popular moniker, "Ericsson's Folly," indicated the level of confidence placed in the vessel by an incredulous public.[34]

The second reason for continued faith in the *Galena*'s armor was the support given to the design in scientific circles. Details of the ship's construction were openly discussed and debated by the press. This was not an unusual phenomena; throughout the Civil War the technical merits and defects of weapons used by both sides were bandied about in popular publications of the day. *The Scientific American* pondered the qualities of the *Galena*'s armor in its November 2, 1861 issue. The first half of its article gave a detailed description of the armor, discussing in turn the rails, the plates, and the proposed method of fastening the armor to the hull of the vessel. The second half offered editorial opinion of the success of the design. According to the article, surface mounted bolts "have proved the weak places in the armor of the iron-clad ships in the English and French navies." The *Galena*'s design avoided this problem because the bolts holding the armor to the hull were affixed to the rails, not the plates, and therefore were not exposed. With this hindrance removed, the problem became one of thickness and not stability of armor. Then, the author asked rhetorically, "if the plates are as thick as those upon the English and French war ships, and securely fastened, why should they not be as impregnable?"[35]

Having answered its own question in the course of the article, *The Scientific American* pointed out the economic advantages of this system of armor. It noted that "twelve to fifteen cents per pound is as low as the *Warrior* style of plates can be forged in this country." After forging, "four or five cents per pound for planing, [and] tonguing and grooving" had to be added to the cost. However, the *Galena*'s armor, because it could "all be rolled and so far finished in the rolling mill that nothing is left to be done but to fit them to the sides of the ship" could be manufactured for about half the cost. Yankee ingenuity would apparently match the best Europe could offer and do it for a much cheaper price, which no doubt made Northern industry feel good about itself.[36]

Despite *The Scientific American's* optimism, the third reason for this innovative armor design was based squarely on the inability of Northern industry to produce iron plates at the beginning of the war as thick as those manufactured in Europe. British and French tests during the latter half of the 1850s came to the conclusion that only plates at least $4\frac{1}{2}$ inches thick could resist the naval ordnance of the day. However, the manufacture of plates this thick was still a relatively complicated process successfully achieved to this date only in Europe. *The Scientific American* explained the process, "a matter of greater difficulty than those unacquainted with the work would imagine," to its readers in the spring of 1862. "A pile of four plates," each $2\frac{1}{2}$ inches thick, "is heated in a special furnace . . . and is drawn out by a liberating chain . . . on to an iron carriage, which conveys the pile to the rolls . . .

As the plate passes through the rolls it is received on the other side upon a roller frame." This receiving frame was inclined, so that when the iron had gone through the rolls, the rolls could be reversed and the iron would go back through to the carriage. The carriage took the iron back to the furnace where the entire process was repeated "until the 10 inches thickness is reduced to $4\frac{1}{2}$ inches." The rolled plate was lifted off the carriage by a crane onto a slab of cast iron, where an iron cylinder weighing nine tons was rolled over it "until the curvature which the plate has acquired in the rolling is entirely removed." Finally, the crane removed the plate and put it onto a planing machine "where the final operation of planing its sides and ends is completed."[37]

The North, or the South, for that matter, did not possess a rolling mill capable of producing $4\frac{1}{2}$ inch plate. The *Galena*'s armor scheme was designed to circumvent this technical problem while providing an equivalent amount of protection. Although the *New Ironsides* would be armored with $4\frac{1}{2}$ inch plates, she would not be delivered to the Navy until September, 1862, several months after both the *Monitor* and the *Galena* joined the fleet. The resulting interval gave industry time to convert its machinery to produce plates of the required thickness.[38]

It is difficult, if not impossible, to understand the construction history of the *Galena* without placing it within the context of the industrial development of the United States. The dawn of the nineteenth century found the American iron industry in a crude state. The majority of iron was manufactured using a two-step smelting and refining process that depended on local supplies of ore and charcoal.

The predominantly agricultural economy of the time dictated the type of items produced. Most iron works catered to local needs, fabricating cast iron utensils and their principle product, the bar iron used by blacksmiths. Because of the high start up cost associated with such an enterprise, they were often owned by partnerships. Still, by 1860 ironworks "were in production for a time at least in every state east of the Mississippi, except for three in the Deep South, as well as in several states of the trans-Mississippi West."[39]

The introduction of rolling and puddling technology changed the character of the industry. While traditional ironworks continued to manufacture their wares, the cutting edge of the industry moved to more urban facilities that utilized anthracite coal for production and the developing transportation infrastructure to distribute goods. First the rolling mills and then the blast furnaces gravitated towards the cities as the scale of many operations jumped dramatically. The expense of the new technology also facilitated this shift; more investors could be found in urban areas. The addition of these investors, many of them shrewd businessmen interested in securing sources of supply for their own ventures, helped foster modernization.[40] Production figures reflected increasing technical sophistication. The scattered ironworks around the United States manufactured 113,000 tons of hammered and rolled iron goods in 1830. That figure increased to over 500,000 tons just before the outbreak of hostilities in 1861.[41]

Although eastern Pennsylvania produced significant quantities of iron, the emerging iron industry concentrated itself around the western

part of the state, which had plentiful supplies of anthracite coal and access to the network of ore-carrying steamships and railroads that linked the recently developed Lake Superior ores to the hungry mills. Between 1830 and 1840, production in Pennsylvania quintupled. By 1847, it had more than doubled again.[42] By 1860, Pennsylvania manufacture almost 60 percent of the iron ore produced in the United States, with Ohio and New York also adding sizable quantities. Allegheny County, Pennsylvania, which made more iron than any other county in the United States in 1858, produced about 90,000 tons. New York churned out 74,645 tons from fifteen furnaces in 1860, mostly located in the southern highlands and the Lake Champlain region. Significantly, Rennselaer County, New York, where the *Galena*'s iron was processed and refined, produced about 30,000 tons of iron in 1858, the second highest total in the country.[43]

The iron industry did not develop and mature in isolation. The ready availability of large quantities of iron meant that a number of related industries rose into prominence during this period. Like the iron industry, they tended to concentrate in the Middle States around Pennsylvania. The key offshoot industry related to the construction of the *Galena* was steam technology. American industry expanded too fast to continue to rely on traditional sources of power, especially water. The introduction of efficient cost-effective steam engines released manufacturers from dependence on running water to power their enterprises and allowed them to expand to potentially lucrative areas which had been closed to them for logistical reasons.[44]

The original steam engine developed in England by James Watt at the close of the eighteenth century worked on the basis of low pressure, which limited the amount of work it could perform. The Watt engine "was a heavy and complicated mechanism, costly to build and difficult to maintain and keep in repair." An American engineer named Oliver Evans, who operated two production facilities in Philadelphia and Pittsburgh, tackled the problem after the turn of the century and created an engine capable of operation at much higher pressures, thereby increasing the amount of work an engine of a given size could perform. It was simpler to build than the Watt engine, easier to maintain, lighter, and cost less. As a result, it revolutionized American industry and transportation. The most powerful engines were placed on the steamboats which plied the Atlantic coast and the inland river system. By the time of the Civil War, over 3500 steamboats had been built. Although their safety record was dubious at times, the sheer number of engines produced ensured a vibrant industry open to experimentation and continued improvement of design. The only other industry employing equally powerful engines was iron rolling.[45]

By the beginning of the Civil War, American industry had taken several important steps that foreshadowed the industrial might of the Gilded Age. A recognizable industrial base was taking shape in the Northeast in the form of iron mills, machine shops and other business endeavors. Although some aspects may not have been as refined as in Europe, especially with regard to specific products, the United States possessed a fluid and dynamic industrial base eager to accept the

challenges of innovation required by the impending conflict. As Samuel Pook pondered the rigid specifications and stipulations for the yet-unbuilt *Galena*, he could take some measure of comfort knowing the extent of the technology and vibrant imagination available to his subcontractors.

CHAPTER II NOTES

[1]Cornelius S. Bushnell to Gideon Welles, 1877, in Robert U. Johnson and C. C. Buel, eds., *Battles and Leaders of the Civil War*, 4 vols. (New York, 1887-88; reprint ed., Secaucus, N.J.: Castle, 1956), I:748.

[2]John D. Milligan, *Gunboats Down the Mississippi* (Annapolis: United States Naval Institute, 1965), 12-15; John D. Milligan, "From Theory to Application: The Emergence of the American Ironclad War Vessel," *Military Affairs* 48 (July 1984):126-27. The city class ironclads were the *St. Louis*, *Carondelet*, *Louisville*, *Pittsburg*, *Mound City*, *Cincinnati*, and *Cairo*.

[3]Cornelius S. Bushnell to Gideon Welles, 1877, in *Battles and Leaders*, I:748.

[4]Contracts and Bonds 1861, Records of the Bureau of Yards and Docks, Record Group 71, Entry 48, National Archives, Washington, D.C., 249. (Hereinafter cited as Contracts and Bonds 1861).

[5]Commodore Joseph Smith to C. S. Bushnell & Co., September 30, 1861. Subject File, U.S. Navy 1775-1910, AD - Design and General Characteristics 1860-1910, Ironclads, Correspondence relative to, between Commodore Joseph Smith & various Designers and Builders. 1861 to 1863, Record Group 45, Box 51, National Archives, Washington, D.C. (Hereinafter cited as Correspondence Relative to Ironclads).

[6]Smith to Samuel Pook, October 4, 1861. Correspondence Relative to Ironclads.

[7]Contracts and Bonds 1861, p. 253. The depth of hold listed in the specifications differed from that in the contract by one foot, and may be attributed to either a clerical error or the first among many modifications to the ship's design. The final depth of hold was around thirteen feet.

[8]Contracts and Bonds 1861, p. 253. Scarphing is "the joining of two timbers by bevelling off the edges so that the same thickness is maintained throughout the length of the joint." See illustration below. From Peter Kemp, ed., *The Oxford Companion to Ships and the Sea* (New York: Oxford University Press, 1964), 756. (Hereinafter cited as *Oxford Companion*).

[9]Contracts and Bonds 1861, p. 253. A shoe was "an additional keel secured outside the main keel of a wooden ship, usually as a protection should the ship take the ground but sometimes also to increase her draught in order to improve her sailing qualities." *Oxford Companion*, 798.

[10]The keelson was "an internal keel in the form of a stringer bolted on to the keel to provide additional strength and to support the

floors." *Oxford Companion*, 444.

[11]Contract and Bonds 1861, p. 254. Coaks were "dowels... [engaged] in corresponding holes in the beams of ships to prevent them [from] slipping." Deadwood is the "solid timbering in bow and stern of a sailing vessel just above the keel where the lines narrow down to such an extent that the separate side timbers cannot each be accommodated . . . and are firmly fixed to the keel to add strength to the ship's structure." *Oxford Companion*, 175, 235.

[12]Contracts and Bonds 1861, pp. 254-55.

[13]Ibid., 255.

[14]Ibid., 256. The garboard strake was "the first plank on the outer hull of a wooden vessel next to the keel." *Oxford Companion*, 338.

[15]Contracts and Bonds 1861, p. 257. The bilge is "that part of the floors of a ship on either side of the keel which approaches nearer to a horizontal than a vertical direction." If the ship were to ground, it would rest on its bilges, hence the extra thickness. *Oxford Companion*, 82.

[16]Contracts and Bonds 1861, p. 260. The planksheer is "the outermost deck plank covering the gunwale." *Oxford Companion*, 652.

[17]Contracts and Bonds 1861, p. 258.

[18]Ibid., 258-261, 264.

[19]"The Iron-Clad Steamer 'Galena.'," *Harper's Weekly*, 5 April 1862, p. 219. The accompanying illustration is adapted from one that appeared with the *Harper's* article.

[20]Contracts and Bonds 1861, pp. 260-62.

[21]Ibid., 262.

[22]Ibid., 262-63.

[23]Ibid., 263-64.

[24]Ibid., 265.

[25]Robert H. Thurston, *A History of the Growth of the Steam-Engine* (London: K. Paul, Trench, 1883; reprint ed., Ithaca, N.Y.: Cornell University Press, 1939), 389.

[26]Contracts and Bonds 1861, p. 265.

[27]Ibid., 263, 265.

[28]Ibid., 266. The diagram of the armor cross section is adapted from an illustration that originally appeared in *Scientific American*, new series, 5 (2 November 1861):276.

[29]Contracts and Bonds 1861, p. 266.

[30]Ibid., 266-67.

[31]James Phinney Baxter, *The Introduction of the Ironclad*

Warship (Cambridge: Harvard University Press, 1933; reprint ed., Hamden, Conn.: Archon Books, 1968), 97.

[32]William H. Roberts, "The Neglected Ironclad: A Design and Constructional Analysis of the USS New Ironsides," *Warship International* 26 (No.2 , 1989):109-34.

[33]Quoted in Baxter, *Introduction of the Ironclad Warship*, 203.

[34]For tonnage figures, see Ibid., 110, 158; Tony Gibbons, *Warships and Naval Battles of the Civil War* (New York: Gallery Books, 1989), 24, 32, 41.

[35]"Improved Armor for War Ships," *Scientific American*, new series, 5 (2 November 1861):276-77.

[36]Ibid.

[37]"Manufacture of Armor Plates," *Scientific American*, new series, 6 (12 April 1862):229.

[38]Roberts, "The Neglected Ironclad," 110, 119.

[39]Louis C. Hunter, "Heavy Industry Before 1860," in Harold F. Williamson, ed., *The Growth of the American Economy: An Introduction to the Economic History of the United States* (New York: Prentice-Hall, Inc., 1944), 211-13.

[40]Ibid., 214-16; Paul F. Paskoff, *Industrial Evolution: Organization, Structure, and Growth of the Pennsylvania Iron*

Industry, 1750-1860 (Baltimore: The Johns Hopkins University Press, 1983), 109-10. Glenn Porter and Harold C. Livesay, *Merchants and Manufacturers: Studies in the Changing Structure of Nineteenth-Century Marketing* (Baltimore: The Johns Hopkins University Press, 1971; reprint ed., Chicago: Elephant Paperbacks, 1989), 72-74.

[41]Douglas Alan Fisher, *The Epic of Steel* (New York: Harper and Row, 1963), 99.

[42]Williamson, *Growth of the American Economy*, p. 214; Paskoff, *Industrial Evolution*, 73-75.

[43]William N. Still, "Monitor Builders: A Historical Study of the Principal Firms and Individuals Involved in the Construction of USS Monitor," *The American Neptune* 48 (Spring 1988):26.

[44]Williamson, *Growth of the American Economy*, 217-18.

[45]Ibid., 218-19. For a more extended discussion of the role of steamboats see Kent T. Healy, "American Transportation Before the War Between the States," in Ibid., 172-88.

CHAPTER III

"I SHALL DEMAND HEAVY FORFEITURES FOR DELAY"

Building the *Galena* provided valuable experience that would be applied to future naval contracts as the government groped its way through the hitherto unexplored waters of large scale procurement. Transforming the specifications of the Bushnell brothers' contract with the United States government into reality presented Northern industry with a tremendous challenge. Despite the occasional work on the Stevens Battery and the few iron hulled vessels built during the previous twenty years, no discernable pool of shipwrights and contractors skilled in the art of ironclad construction existed in the Union. Fortunately for the North, its industrial base proved dynamic and responsive to wartime exigencies, adapting to the task at hand and ultimately fabricating a product which met the intent of the contract, if not most of the terms.

The construction process would not be without its pitfalls. The *Galena* would undergo design modifications, some of which met considerable resistance from the Navy Department. Not surprisingly, construction of the inner hull proceeded almost without incident because this part of the ship used traditional construction techniques. The experimental nature of the vessel allowed certain shortcuts to be taken, although not without some disagreement between the contracting parties. The primary points of contention which developed in the coming months focussed around the implementation of the new ironclad technology; the contractor and the government's

representatives debated how the ship was to be built. By the time of the ship's launching, it was still unfinished and its capabilities were still in question. Throughout the entire process, the superintending naval officer took great pains to ensure that the government received exactly what it was paying for.

Commodore Joseph Smith, chairman of the original ironclad board that recommended construction of the *Galena*, was given the responsibility of overseeing the building of each of the three ironclads. Several years after the war, Gideon Welles reminisced that Smith, "in addition to great nautical and civil experience, possessed a singularly mechanical and practical mind."[1] The efforts of the following months severely tested both the patience and limits of Smith's "practical mind." He fought to protect the interests of the government from contractors whose devotion to the cause he must have doubted at times. Despite the seemingly rigid requirements appended to the contract, specific details remained open to negotiation during the construction process as either the government or the contractors changed their minds about how the vessel should be built. Some of those changes were motivated by efforts to cut costs or ease construction while others were modifications unforeseen at the time of the contract brought about by necessity during the construction process.

Smith's first letter to the Bushnells already expressed some misgivings about the vessel's design. While informing the brothers of the appointment of Samuel Pook as the government's superintendent, he expressed the opinion that "the deck plank of your vessel [is] too thin

by an inch, but it has not been changed--the specifications are as you made them." At the same time, he asked for a deck plan, not included in the original proposal, so "that arrangements may be made for the ports so soon as the battery shall be decided on" and notified the brothers that "it will require three months to test satisfactorily the qualities specified and warranted." The commodore's letter served notice that he would not wield a rubber stamp during the construction phase.[2]

Still, Smith remained open to suggestion. In a letter to Pook five days later, he noted that "the vessel is to be wider than stated in these specifications, a modification which Mr. Bushnell thought proper to make, and one which will be very acceptable to the Department." Pook was in Mystic, Connecticut, where the ship's hull was to be crafted. Mystic had a long tradition of ship building, extending back to its first English settlement in 1650. Besides being suitably located for fishing and trading along the Atlantic coast, the Mystic River valley possessed ample timber, a number of protected anchorages, and shelving river banks ideal for building ships of all sizes. Insatiable demand for bigger vessels during the nineteenth century, especially after the discovery of gold in California, spurred expansion in Mystic. Traditional builders of small boats continued to supply local markets, while larger yards increased the size of their operations to handle the burgeoning market. A number of new yards specializing in larger vessels came into the area just before the Civil War, including Maxon, Fish and Company in 1852. The ready supply of raw materials, skilled labor, and available technology made starting such a business relatively easy if infused with

ample capital.[3]

Cornelius Bushnell approached Charles Mallory in June, 1861 about the possibility of building an ironclad gunboat in his yards, among the largest and most prosperous in Mystic. Dun & Bradstreet listed Mallory as "the wealthiest man in Mystic--the richest man in the vicinity." Mallory, thinking that Bushnell wanted to build the type of traditional gunboat for which the navy had advertised in April, offered to build it for $80,000, not realizing that Bushnell had a unique new design in mind. Bushnell turned to Mallory's Mystic competitor, Maxon, Fish and Company, who offered a better price and seemed to understand the complexities of the design.[4]

Although the hull would be built at Mystic, the vessel would be finished elsewhere. The Navy Department's four month completion deadline forced Bushnell to distribute the work among various subcontractors in the region. An acquaintance of his, John Ericsson, faced similar difficulties with his own vessel, the *Monitor*. Curiously, Bushnell had been instrumental in prodding Ericcson into submitting plans for the *Monitor* to the naval board. Concerned by predictions that the *Galena* would not be stable, he went to Ericsson at the suggestion of Cornelius Delamater so the Swedish engineer could double check Pook's calculations. Having pronounced the vessel satisfactory, Ericsson hauled out a musty box from which he pulled a scale model of a *Monitor*-style battery. Sensing a lucrative financial opportunity, Bushnell convinced him to submit the design to the naval board and interceded on Ericsson's behalf with Secretary of the Navy Gideon Welles. The design

was accepted after some wrangling and Bushnell put up part of the money for the initial investment.[5]

Bushnell and Ericcson shared a similar circle of friends and associates, many of whom became involved in the construction of both vessels, either as investors, contractors, or both. Two of the men who joined Bushnell in backing Ericsson, John A. Griswold and John F. Winslow, designed and supplied the armor for the *Galena*. Griswold worked at a number of ventures in his youth in Troy, New York, including the hardware business, bookkeeping, and a wholesale and retail drug business. He became an agent for the Rensselaer Iron Works, which he bought out a few years before the Civil War. However, Griswold's real love was politics; he served as mayor of Troy before the war and was elected to Congress in 1862, becoming an ardent champion of the Navy. Griswold left the management of the company to his friend John Winslow.[6]

Originally from Vermont, John Winslow came from a background rooted in iron manufacturing. His father was an ironmaster and, after a short stint as a clerk in a mercantile house, Winslow also entered the iron business. He spent eight years in New Jersey, the last six as the owner of a small foundry, before agreeing to become the managing partner of the Albany Iron Works. Winslow, "whose experience in the working of metals is not excelled by any one engaged in the trade," was actively involved in the technical end of things.[7]

The Rensselaer Iron Works was the parent company of the

Rensselaer Rolling Mill, where the actual metallurgy took place. Located on the south end of Troy, it devoted itself for the most part to rail production before the war. In 1856, this mill produced 12,650 tons of rails and 862 tons of merchant bar. By 1859 the mill had eighteen furnaces and four trains of steam-driven rolls. The Albany Iron Works, a more substantive establishment perched on the Hudson River, had "40 furnaces, 8 trains of rolls, 60 nail, 11 spike, 2 rivet machines, and 2 hammers for railroad axles, and a machine for wrought iron chairs" in 1859. It employed about 600 men. Together, these two companies, operating in tandem on many projects, were the largest producers of iron in the country. Their production capacity, when linked to Griswold's extensive political connections, brought in more than its fair share of government contracts during the war.[8]

Despite the array of technical expertise employed by Bushnell, Commodore Smith remained skeptical of the vessel's armor scheme. He advised Pook that "if you are to superintend the armor of the vessel, it may be necessary for you to go to Troy before the vessel goes there or the armor is put on." Articulating the fears of the other members of the ironclad selection board, Smith acknowledged that he was "very anxious about the stability of the vessel, and have doubts whether she will be able to carry her armor effectually." One week later, Smith succumbed to pessimism and notified Pook that "as it is important to have some one to superintend the iron work of the vessel, I have appointed Engineer D[aniel] P. Martin for that duty, and ordered him to Troy, N.Y." The same day, Smith wrote a letter to Martin asking him to accept an

appointment superintending the ship's armor and power plant. He offered to pay "$5 per day for your services, and your actual traveling expenses." Confident of a positive reply, which he would get, Smith enclosed the vessel's armor and engine specifications.[9]

Meanwhile, construction on the *Galena* progressed. On October 12, Smith received certificates from Pook through Bushnell verifying "that work and materials to the amount of $40,000 has been put upon the hull and machinery of your vessel." Accordingly, Smith sent bills in triplicate back to Mystic for Pook's signature. Bushnell kept one copy and the two remaining copies were then returned to the Bureau of Yards and Docks for filing. Actual payment would be made through a navy agent in New York.[10]

Ongoing construction meant reevaluating and modifying the ship's design. Pook sent Smith the requested deck plan, which so thoroughly confused the commodore that he prepared his own and sent it back to Mystic, along with the first inklings of the type of ordnance the *Galena* would carry. The Navy's ordnance experts "proposed to put on the vessel four broadside IX inch Dahlgren guns, and two rifle guns, eighty-pounders, one forward and one aft." Still, they would not make a decision until an officer had been to Mystic to "confer about her armament and its fitment."[11] The original hull plans did not include specifications for the gun ports because Pook did not know during the planning stage what the ship's armament would be. Consequently, their size and design had to be negotiated during the construction phase.

A series of drawings passed between Mystic and the Navy

Department during the first days of November. Pook's initial design dismayed Commodore Smith. He reported to Bushnell that "Mr. Pook has sent a plan with eight ports aside, over four feet in width. How he could imagine that such openings were to be left for an enemy's shot, when only four or six broadside guns were intended, I am at a loss to divine." Smith mulled over the problem and dispatched his solution back to the shipyard. He suggested six ports on a side, with each port "about two or three inches narrower outside, and three inches wider inside" so the cannon could still be aimed with a smaller opening visible to the enemy. After musing over the problem a few more days, he informed Pook that "the ports must be plated with iron, and made to shut on the inside," presenting a hull fully armored on its exposed surfaces. By November 7, Smith had changed his mind again, sending a plan with seven ports on each side for Pook's consideration. The guns would be mounted on carriages, three to each broadside, so that they could theoretically be shifted among the ports depending on the situation. In a letter to Pook written the next day, Smith commented that "as Commodore Gregory has fixed the ports, &c., under the Bureau of Ordnance, I have nothing more to say on that subject."[12] Pook must have been relieved, for now he could continue with the ship's construction.

At about the same time, Pook requested permission from Smith to dispense with the India rubber underlay and replace it with a layer of thin iron, but the commodore did not approve "as one of the strongest arguments used by the contractor for the iron of your vessel was that

vulcanized rubber would be most effective in resisting shot." Still, Smith exercised some discretion, opting to wait for the results of experiments conducted by the contractor on the armor scheme before making up his mind. However, Smith cautioned the superintendent about plating the vessel before launching it, an idea broached by Bushnell possibly in an effort to save time and meet the terms of the contract. In his opinion not only would its sides settle two inches, but "she will probably roll over without anything inside as ballast" once she was launched. [13]

A more serious disagreement between Pook, Bushnell, and Smith developed over the vessel's rudder. Apparently, Pook "very improperly authorized the substitution of iron for brass in the propeller . . . the rudder and after stern post" without consulting Smith. Smith wrote a polite letter to Cornelius Bushnell pointing out the contract's explicit reference to a brass propeller "and the rudder and outer stern post, of metal, of course meaning brass as well as brass bearings." In separate letters to Bushnell, Pook, and Daniel Martin, Smith voiced several concerns about this apparently minor turn of events. First, the use of iron implements on the outer hull posed a mechanical problem. Like any other ship of the day, the "bottom of the vessel must be coppered to prevent destruction by worms." Because of the adverse chemical reaction and resulting corrosion between copper and iron, "there must be a strip of zinc to prevent contact" wherever the coppered hull approached iron accoutrements.[14] For example, such a strip was intended for placement below the iron armor, which descended beneath the waterline.

Smith also kept the financial interests of the United States in mind, a recurring theme throughout the *Galena*'s construction. Iron parts could be procured or fabricated much cheaper than comparable brass items. By substituting iron for brass, Bushnell increased his profits on the vessel. The commodore promptly warned him that "in case an iron propeller, rudder &c., is substituted for brass, the difference in cost will be deducted from the price of the vessel. He reiterated the point to Martin, under whose responsibility fell the engines and fittings, noting "the contractor will deduct the difference in cost from the price of the vessel, which is $235,250, complete and ready for sea."[15] Try as he might, Bushnell would not easily make more than his predetermined profit on the *Galena*.

Brass enjoyed widespread use in the navy because of its durability and had become standard in a service that emphasized durability in its vessels. However, Smith realized that construction of the *Galena* and the other ironclads differed markedly from his previous experiences in the Bureau of Yards and Docks. These ships were built as wartime emergency measures, much like the ninety-day gunboats building on the Mississippi River at the same time. The Union needed two things: serviceable craft capable of carrying out the immediate needs of the war and experience in building armored vessels that could be applied to the ships that must surely follow. After "scanning the specifications . . . more closely," Smith wrote "the vessel will not be very strong, or one to wear long." Still, he entreated Pook to "make her as strong as possible under the contract." In light of the realization that the *Galena* would

probably not serve the navy for an extended period, he conceded privately to Martin that "as I do not calculate this vessel will last long, and as she is an experiment, it may be perhaps as well to let the propeller, rudder, &c., be of iron."[16]

At a more fundamental level, Pook's authorization to use iron instead of brass challenged Smith's authority over the project, and Smith acted decisively to let the constructor know who ran the show. He informed Pook that he was "surprised that you should have suggested the substitution of iron for brass in the propeller, rudder, &c., before reporting to me your views." Smith proceeded to recapitulate the terms of the contract to Pook, who doubtless was all too familiar with them because he had designed the original specifications. Having put Pook in his place, the commodore informed him that "I cannot consent to the substitution of iron before I take advice on the subject."[17] As the letter to Martin shows, Smith was already disposed toward the substitution, although he would not let Bushnell or Pook know it. However, by making Pook wait for confirmation from Washington, Smith asserted his control over the project.

Smith seemingly put his foot down on the controversy a few days later. He notified Bushnell & Co. by telegraph on November 14 that "I insist on a composition rudder and stern post as specified, notwithstanding delay." He followed the telegram up with a letter written the same day, reminding Bushnell that "the contract provides for no modifications without the consent of the contracting parties. Now, I must insist on the adherence to the contract and specifications as

regards the metal or composition propeller, rudder and stern post, as well as the copper sheathing." Despite the tough talk, Smith "still [held] in abeyance the question of composition rudder, &c.," pending Martin's opinion. Martin, probably bearing in mind that this vessel would have a short life in the navy, agreed that it could get by with an iron rudder, propeller, and stern post. Smith, having received the expert opinion he desired, notified Bushnell that "I have come to the conclusion to accept your proposition to substitute iron for brass in the propeller, after stern posts, rudder, &c., for the vessel under your contract, dated September 27, 1861, you deducting, according to your proposition, the difference of cost between brass and iron for these parts." However, the commodore stood firm on the question of a copper bottom, informing Pook that "I prefer the copper sheathing to any mineral paint known."[18] Bushnell got most of his changes, but Smith, true to form, made sure the government received the requisite price adjustment.

In fairness to Bushnell, it should be pointed out that there were any number of reasons why he may have opted to substitute iron for brass in the steering and propulsion mechanism. The United States suffered from a shortage of bronze at this time. Bronze, a component of brass, was in high demand for the forging of cannon. Ordnance manufacturers in both the North and the South experimented with iron cannon out of necessity. Bushnell may have been forced to do the same, although records to indicate this are not available. Even if he could have gotten the bronze, and, by implication, the brass needed for the *Galena*, the delay may have jeapordized Bushnell's ability to meet the contract

deadline, after which he might have been financially penalized. In other words, he might have been willing to suffer a small financial loss early in the process while averting a larger one when it came time for the government to pay the balance of the contract. Finally, Bushnell may have been trying to increase his profit margin on the *Galena*. The final amount deducted from the contract price, most likely for the substitution of iron for brass, was $2677.76, a significant sum. That would have been translated into profit for Bushnell if Smith had not insisted on the adjustment of payment.[19]

Commodore Smith retained an extremely pessimistic attitude throughout the *Galena*'s construction. Even at this early stage, he candidly expressed his doubts about the ship to Cornelius Bushnell. In the midst of the squabbling over the rubber sheathing, ports, and rudder, he wrote Bushnell that he feared "in your eagerness to build an armored vessel, you did not reflect sufficiently on the many obstacles to be encountered, and which we now have to overcome as best we can." Despite his doubts, which would continue to surface until the ship was successfully launched, he refused to let Bushnell use them as an excuse to gain extra time. For example, he notified the contractors that he was pressing the Navy Department "to order a Commander to the vessel at once to see about the fitments, as in eighty days she is to be ready for sea, according to contract."[20] In his zeal to protect the interests of the government, Smith seemed determined to hold Bushnell & Co. to its obligations, no matter what difficulties arose. As construction continued and other problems materialized, he would become even more

strident, threatening financial penalties and possible abandonment of the project.

The resolution of the gunport problem and the iron vs. brass issue came just in time for a new challenge. On November 13, Smith informed Bushnell that "Messrs. Griswold & Winslow propose to dispense with the plate over the rails on the armor of the vessel under your contract . . . provided you will agree that such increase of weight which the plan they propose as a substitute . . . shall not interfere with or modify any of the other provisions or conditions of your contract." Smith himself would agree to such a change under those conditions and asked Bushnell to make a decision. Strangely enough, the commodore did not want Pook to know that he had agreed to modify the contract. In a letter to Pook written the same day, he indicated to the constructor that "Mr. Griswold is here, and wants to change the armor, but I prefer to stick to the contract, except to substitute for the rubber an additional thickness of the iron plate outside."[21] Perhaps Smith wanted to retain the image of a superior fully in control of the situation and not willing to put up with any nonsense from a subordinate whose devotion to the welfare of the government may have been in question.

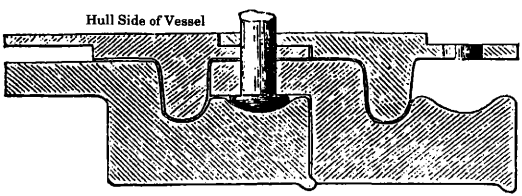
Smith's wariness did not extend past Pook. The following day he assured a still undecided Bushnell that "if the armor of the vessel is destroyed, it is not your loss or your fault." In fact, Smith liked the new armor better than the original plan. In a letter discussing obstacles to be overcome in the *Galena*'s construction, he commented to Martin that "I have agreed to modify the contract as respects the armor, if the

contractors assent to it, which will greatly increase the resistance, and of which you will be informed in due time."[22] Still, the final decision had yet to be made, pending two conditions. First, Bushnell must agree to the revisions. Second, Martin, as superintendent of the armor, needed to examine the new plans to determine their feasibility. Smith fired off a barrage of letters and telegrams to settle the question once and for all.

Having heard from Martin that Bushnell was coming to Washington, Smith telegraphed the contractor: "I will wait for you, to adjust our questions." Smith, anxious to expedite the process and come to a firm decision, sent another telegram the following day asking Bushnell "Are you coming here? I wait your decision as to whether you agree to the change of armor as stated in my letter of the thirteenth instant." The same day, Smith received the plans of the armor from Griswold in Troy and submitted them to Martin for inspection, commenting, "I think it an improvement, if the vessel will bear it." However, he was not completely sold on the idea and told Martin in a second letter that he "probably may make some change in the form of the armor." Giving form to his uncertainties, he remarked to Griswold that "I like the plan, but fear there will not be security enough in the heads of bolts as proposed." Still expecting Bushnell in Washington, Smith resolved to Griswold that "if he does not come, I shall require a categorical answer from him on this point" of armor.[23] Although flexible on an improvement that looked capable of enhancing the *Galena*'s performance, Smith was going to make sure the contractor

By November 20, the fundamentals of the design change had been settled, although specific details remained to be worked out. Bushnell sent a letter confirming his acceptance of the changes to the armor and Martin forwarded a telegram giving his approval of the design. Smith sent letters to all parties involved the next day, making the changes official. The improved armor, based on Griswold's design, would be $3\frac{1}{8}$ inches thick and composed of interlocking layers. (FIGURE 3). Construction could now go forward.[24]

FIGURE 3: REVISED ARMOR PLAN OF USS *GALENA*



Smith decided to pay a visit to Mystic to check on the construction himself. On his return, he wrote a letter to Cornelius Bushnell and expressed his satisfaction at "[finding] her well put together and generally of good materials, so far as I could see." However, the armor remained a problem. While in Mystic, Smith consulted with Pook, who said that "the $3\frac{1}{8}$ inch iron is too heavy, the vessel will not bear it." Pook had obviously given the question some thought and presented Smith

had obviously given the question some thought and presented Smith with a solution. Instead of plating the entire vessel in $3\frac{1}{8}$ inch iron, he proposed to reduce the thickness of the plating at less vital areas of the ship's hull and "reduce the weight by substituting the following: From Water line to port sill $3\frac{1}{8}$ inches to within 25 feet of ends; from port sill to rail 2 inch iron; wooden deck $2\frac{1}{2}$ inches thick covered with $\frac{1}{2}$ inch plate; for 25 feet on bow and stern covered with $\frac{1}{2}$ plate." Smith, with customary concern, agreed, "provided such modification shall not change or modify any of the covenants or provisions of the contract except that of reducing the weight of the armor, and provided also that a pro rata reduction on the estimated cost of the armor be made on the contract price of the vessel." Once again, the commodore consciously linked design modifications and financial considerations. Ever the pessimist, he closed the letter declaring "the vessel I fear will be behind time for want of the armor."[25]

A short note to Winslow in Troy from Smith notified the subcontractor of the impending change, although he left it to Bushnell to announce the details. The commodore decided to vent his concerns at the main contractor, where the most good could be accomplished. After reminding Bushnell that he "made no proposition to change the armor; it came from your sub-contractors, Messrs. Winslow & Co.," he moved to the crux of what he saw as a developing problem. The change in design meant delays. Even then, with the fundamental design decided upon, the thickness of the armor at various points of the hull remained up in the air. In a stern warning, Smith wrote Bushnell that "I hope to fix

upon something quickly as the plan, and shall demand large forfeitures for every day the vessel is short of delivery over the time stipulated in the contract." If that was not enough, he reminded the contractor that "the reduction in the weight of iron will be pro rata upon the estimated cost of the armor."[26] Clearly, Smith sought to head off the problem before it got out of hand by threatening Bushnell where it made the most difference: the pocketbook.

Not content to ensure prompt delivery of the *Galena* by pestering Bushnell, the commodore shifted his sights to the armor subcontractors, Winslow and Griswold. Two days after his note to Bushnell, he repeated his threats of financial retribution to the Troy industrialists. After noting the changes he had discussed with Pook, he observed that "a small vessel will not stand a heavy armor." The "small vessel" obviously being the *Galena*, Smith went on to repeat what he had told Bushnell: "If the thickness and weight of the armor be reduced, I shall deduct the estimated cost pro rata from the price previously agreed upon. And furthermore, I shall demand heavy forfeitures for delay in not completing the vessel within the stipulated time."[27]

The available documentation does not indicate whether or not Bushnell and Winslow discussed Smith's letters. For whatever reason, Bushnell promptly responded, assuring the commodore that the vessel would be completed in the time specified by the contract. Smith, "pleased to learn" of Bushnell's promise, nonetheless promised to "fall back on the contract if she does not come up to the requirements." In addition, he complained that Winslow had not yet submitted the revised

armor specifications. Bushnell sent another letter on December 10 promising timely delivery of the *Galena*, to which Smith responded by asking again for the final plans of the plating.[28]

In the middle of all the wrangling over the armor, Smith lost a valuable ally, Daniel Martin. The limited experience of the war already suggested that victory might depend on the ability of the navy to reduce the coastal fortifications defending key Southern cities. To do so, the navy needed a heavily armored shallow draft vessel capable of carrying a few large caliber weapons to within battering range of these forts, a task for which the *Galena* would not be suited. Secretary of the Navy Gideon Welles had been bombarded with designs for ironclads throughout the fall and winter of 1861. While most were summarily rejected or set aside pending further examination, the navy took a closer look at turreted ironclads, which seemed to meet the Union's needs. By the beginning of December, 1861, the Department of the Navy and certain members of Congress had become convinced that the navy's future rested with turreted coastal ironclads.[29]

Throughout this period, the level of debate in Congress over ironclads steadily mounted. On December 17, Congressman Charles B. Sedgewick, Chairman of the House Committee on Naval Affairs, introduced a bill appropriating ten million dollars for the construction of twenty turreted ironclads based on a budget and plans drawn up by John Lenthall, Chief of the Bureau of Construction and Repair, and Engineer-in-Chief Benjamin Isherwood. The bill passed the House on December 19 and moved to the Senate, where it encountered strong opposition, not

being passed until February 7. Anticipating the high demand for iron plate that must follow, the Navy Department recognized that American industry was still incapable of producing the volume of iron plate necessary to armor a sizeable number of ironclads. Secretary Welles therefore ordered Martin to Europe on December 21 to see if armor plate could be purchased in England, France, or Belgium.[30]

The reason for the delay between the passage of the House and Senate bills rested with Lenthall and Isherwood's design. It called for ironclads using turrets based on the design of Captain Cowper Phipps Coles of the Royal Navy, which had been published in 1860. His turret design relied on thicker armor placed in fewer layers and had a sloping armored glacis to protect the base of the turret from enemy shot. (FIGURE 4). Ericsson and his partners viewed the introduction of this design with some trepidation, for it would mean both a blow to prestige and a loss of future contracts. Using all the power at their command, they forced a compromise. Ericsson's backers used their influence in the Senate to stall passage of the bill until a deal could be worked out with Secretary Welles promising that construction of the new ironclads would not be completed until the *Monitor* had been given a chance to prove itself. The deal also pledged that some of the new vessels would follow Ericsson's design, assuring his backers of ample war profits. The bill promptly passed upon successful completion of the negotiations.[31]

FIGURE 4: COMPARISON OF TURRET DESIGNS

Coles' Turret Design

Ericsson's Turret Design

Obviously, the machinations of the fall and winter of 1861 did not bode well for the *Galena*. In effect, the vessel's design concept was being rejected before construction was ever completed. However, the situation was not as bleak as it might seem. First of all, Bushnell & Co., provided they carried out the terms of the contract and successfully delivered the vessel, still stood to make a profit on the ship. Second, the *Galena*'s investors, which included Bushnell, Griswold and Winslow, would not be cut out of future war contracts.

Thus it is important to note that the men who invested in the *Galena* were the same men who invested in the *Monitor*. From a purely financial perspective, it did not matter which ship succeeded, as long as one of them did. Having assured the prospect of more *Monitor*-inspired ironclads by their intense lobbying, the investors could finish the *Galena*, take their money, and forget that the vessel had ever existed. Future contracts could be channeled to the same subcontractors. Although gloomy predictions about the *Galena*'s future abounded, everyone involved with the vessel stood to gain.

Despite the apparent lack of commitment to the *Galena*'s design,

she had at least one redeeming quality that made her important to the Department of the Navy. Unlike the proposed ironclads, the *Galena* was partially completed and would be ready for service several months before the others. The Union would have to rely on her or the *Monitor* to counter the *Merrimack*, under construction (and surveillance) at the Gosport yard. Even if she was not all that the navy hoped, she was still an ironclad and could be expected to contribute to the war effort. Construction continued, still pushed and prodded along by Commodore Smith.

Smith appointed Pook to take Martin's place and "attend to the plating of the vessel and report progress from time to time." Reminding Pook of potential problems, Smith noted his "fear [that] Messrs. Winslow & Co. will fail in accomplishing their part of the work in the time specified." On January 2, Smith requested information from Pook about the progress of the plating. Then, apparently not satisfied to leave matters in Pook's hands, the commodore appointed M. Minthorne of New York City "superintendent of the engine, &c., as well as the plating for the ironclad vessel building at Mystic, Connecticut." Smith instructed Minthorne to journey to Mystic, examine the *Galena*, and "report progress to this Bureau." The same day, he apprised Pook of the change and expressed confidence in Minthorne's abilities, noting "he is a man of experience and knows all about the business. Confer with him; his advice will be valuable."[32]

Meanwhile, the plating of the vessel continued. Pook reported on January 6 "that there is now about 3 feet in height on both sides of the

vessel fore and aft, of the first thickness." Juan Patterson, an Englishman with a solid background in ironworking, supervised the sixty men assigned to the task by Winslow & Co. Minthorne corroborated Pook's statement two days later, noting that "the parties doing the job seem to have provided themselves with the necessary force, furnaces, tools, &c., to expedite the work." Even Bushnell got into the act, writing with some enthusiasm: "I was at Mystic attending to the progress of the plating yesterday, and am happy to assure you that it is now a fixed fact that the plan of putting the iron on is a perfect success so far as protection and appearance is concerned, but as to cost and time, there is not much to be said I fear."[33]

Smith seemingly ignored all but the last of Bushnell's letter. Responding with a less than cheerful message of his own, he cautioned Bushnell: "I would remind you that the time for completing your vessel under the contract expires on the 27th instant, after which, if she is not ready, I may demand heavy forfeitures for delay." Then, in an effort to move things along, he asked the contractor to "notify me when the vessel will be ready for the guns." The same day, he wrote Minthorne and informed him of the time obligation, remarking that "if the vessel is not completed in that time, the contractors are liable for liquidated damages, which the government may demand."[34]

Bushnell got the message. He dashed off a letter to the commodore explaining that he, Winslow and Griswold were headed to Mystic for a personal inspection of the situation and that he would forward a report of what they found as soon as they returned. In the

meantime, he appealed to Smith for understanding:

> In regard to our being a few days behind our time, which I most surely regret to say is now possible on account of delay in plating only, we can give three very good reasons why you will not be likely to demand any forfeiture, but will not now suggest them, as we are determined to do our best and have the fullest confidence that you will see that the government does right in the case.[35]

Smith was not impressed by the cryptic "three very good reasons" and sent back a typically pragmatic response. Once again, he reaffirmed the government's resolve, noting "as regards the delay in completing your vessel the Bureau has no discretion but to exact a full compliance with the terms of the contract." Probably reflecting the Navy Department's concern over the *Merrimack*, he warned that "the loss of time is a matter of serious consideration to the government."[36]

By January 16, Minthorne reported "there is on the vessel at present about forty-five tons of armor, twenty-eight tons first course and seventeen covering course. The parties say the whole amount is delivered; from the estimate I could make I should consider their estimate reliable." In his opinion, "the job cannot be finished by the twenty-seventh of January," but he thought "all possible efforts are being made to fulfill the contract." Indeed, a significant portion of the construction was finished. Pook reported on January 21 that "the carpenter's work upon the hull is about completed, with the exception of such work as may be required by the engineers." However, haunting questions remained, especially about the armor. The contractors were still not sure how much armor the ship would bear and wanted to wait until after she was launched before determining the final load. Smith

vetoed this idea, perhaps considering it a ploy to avoid paying penalties for delayed delivery, and reminded Pook that "the contractor is responsible for the completion and successful performance of the vessel, and must decide as to the weight of the armor to be put on her before launching." Furthermore, voicing his skepticism of the ship's structural stability, he told Pook to "have sights arranged along the sides of the vessel and amidship fore and aft, to ascertain how much the sides settle, if any, after the shores are knocked away, and how much her shape is changed, if any, after launching."[37]

The armor was not the only part of the vessel confounded by delays and confusion. The engines also provided their share of problems during construction. They were subcontracted to the Delamater Iron Works of New York City, the same firm responsible for building the *Monitor's* machinery. Founded in 1850 by Peter Hogg and Cornelius Delamater as Hogg & Delamater, these works made their reputation for their ability to manufacture heavy machinery and cylinders for steam engines. Hogg had retired in 1855 and Delamater bought him out, changing the name to Delamater Iron Works. Delamater proved to be a capable administrator, and the company's reputation for quality work increased even further.[38]

Delamater's success resulted from more than his administrative and mechanical prowess. His extensive network of friends included John Ericsson, whom he had known since 1839, and Cornelius Bushnell. Ericsson and Delamater were so close that "rarely . . . did either of them enter upon a business venture without consulting the

other." Delamater gave Ericsson free rein around the iron works, allowing him to try out his ideas. In return, Delamater had unrestricted access to Ericsson's designs for his own projects. Delamater had set up the initial meeting between the Swedish inventor and Bushnell when the latter was concerned about the *Galena*'s stability during the summer of 1861. Delamater's association with Bushnell and his circle of politically connected friends no doubt helped increase his chances of securing war contracts, of which he had several more than his fair share.[39]

Samuel Pook had welcomed Smith's directive appointing Minthorne as superintendent of the engines, "as that portion of the work needs driving more than any other at present." Pook had given little or no attention to their construction, for Minthorne was able to report two days later that "I have visited Mr. Dellemater's [*sic*] and seen the engines, boilers, &c. The principal parts of the engines are together and the rest in such a state of forwardness as to make all nearly ready for shipment." The only parts of the engine Minthorne did not see were the boilers, but he thought they were "well advanced and not likely to cause detention."[40]

Bushnell planned to have the engines built at Delamater and then shipped to Mystic, where they would be installed on the vessel as soon as construction permitted. Keeping Smith's admonitions in mind, this seemed to be a prudent plan for speeding up the construction process in any way possible. By January 16, Minthorne could "report that the arrival of bed plates, cylinders and portions of engines necessary to the

commencement of erection, was daily expected, and that the machinists to do the work were there." Still, the January 27 deadline for the launching of the *Galena* was rapidly approaching. Six days before the deadline, Pook could only write that "most of the engine is here upon the wharf" at Mystic, although the boilers remained unfinished in New York at the Delamater Iron Works. Obviously, the engine could not be installed until the hull was ready. By February 8, the constructor reported "the bed plates for engine is about ready for bolting to the keelsons."[41] Perhaps the pace of construction would now accelerate.

At this critical juncture, Minthorne was taken off the project because of other commitments. Smith turned over the supervision of the armor plate to Pook, asking him "to do the best you can for the interest of the government." Pook was a logical choice. Although the commodore had doubted Pook's ability to carry out this type of task earlier in the building period, the constructor was the only person capable of stepping in at this late date and understanding the complexities of the ship's construction. The need for greater urgency was obvious; the vessel should have been launched on January 27 and Smith grew restive as the first week of February passed. On February 8, Pook wrote "that the gunboat now building at this place will probably be launched on Friday, the 14th instant." Two days later he asked Smith to "give the contractors two payments upon the armor," but Smith had had enough. Having given up on remonstrances, the piqued administrator turned to the one tool of persuasion Bushnell & Co. would have no trouble comprehending: money. With what must have been some degree of

satisfaction, he replied to Pook that "the Department has decided to make no further payments to the contractors until the vessel shall have been completed and accepted."[42]

Smith later relented on part of his threat to cut off payments. Acting on Pook's suggestion to pay Griswold and Winslow "provided no other payment has been made" for the remainder of the vessel, he ordered funds released on February 15 to pay for the armor put on the vessel to date. However, the government still withheld a substantial portion of the contract price, pending successful completion and testing of the vessel. Through the end of January Bushnell & Co. had only been paid $60,000, with an additional $20,000 held back as required by the contract.[43] Thus, the government retained control of $155,250 promised to the contractors for the finished ironclad, giving it powerful leverage in this situation.

Construction continued at Mystic, spurred on by the government's withholding of funds. On February 14, Bushnell telegraphed to Smith "the ship is safely and successfully launched . . . Stability all right." He optimistically predicted to the commodore that the "ship will prove a success." Pook followed up with an equally positive assessment of the launching. The vessel, with "her armor on to the port sills" and "90 tons of machinery on board," showed "no changes which can be measured" in the shape of her hull after launching. Like Bushnell, Pook confidently declared "I have no doubt in my own mind of the eventual success of this ship."[44] The validity of this statement awaited the test of battle.

The launching of the vessel did not end Commodore Smith's problems with the contractors. Only part of the armor plating was affixed and the engines had yet to be installed. However, the ship was finally in the water, a positive step which must have been appreciated by the frustrated commodore. The last six months had required him to play a curious brand of diplomacy in which he tried to hurry along the ship's construction while protecting the interests of the government from a contractor who at times either appeared not to understand what he had gotten himself into or else seemed intent on increasing his profit margin on the *Galena*. It must be remembered that the agonies of the *Galena*'s construction process represented only one third of Smith's work load. His responsibilities also called for overseeing construction of the *Monitor* and *New Ironsides*. In each case he dealt with a similar network of contractors and subcontractors.

No matter how frustrating Smith's job was, the realities of the developing conflict put the *Galena*'s construction into perspective and reminded the commodore of the larger end for which he must strive. Increasing concern over the renovation of the *Merrimack* and the urgent call for ironclad warships from General George Brinton McClellan during the spring of 1862 would force Smith to keep up the pressure on Bushnell & Co. Although the ship was in the water, much work remained to get her ready for combat, and though increasingly tired of the whole process, it was to this task that Smith turned in the next two months.

CHAPTER III NOTES

[1]"The First Ironclad Monitor," in *The Annals of the War* (Philadelphia: The Times Publishing Co., 1879), 17-31.

[2]Commodore Joseph Smith to C. S. Bushnell & Co., September 30, 1861. Subject File, U.S. Navy 1775-1910, AD - Design and General Characteristics 1860-1910, Ironclads, Correspondence relative to, between Commodore Joseph Smith & various Designers and Builders. 1861 to 1863, Record Group 45, Box 51, National Archives, Washington, D.C. (Hereinafter cited as Correspondence Relative to Ironclads).

[3]Smith to Samuel H. Pook, October 4, 1861. Correspondence Relative to Ironclads; James P. Baughman, *The Mallorys of Mystic: Six Generations in American Maritime Enterprise* (Middletown, Conn.: Wesleyan University Press, 1972), 13, 80.

[4]Quoted in Ibid., 100; Ibid., 111-12.

[5]John Niven, *Gideon Welles: Lincoln's Secretary of the Navy* (New York: Oxford University Press, 1973), 366-69; "Negotiations for the Building of the 'Monitor.'" in Robert U. Johnson and C. C. Buel, eds., *Battles and Leaders of the Civil War*, 4 vols. (New York: Century Co., 1887-88; reprint ed., Secaucus, N.J.: Castle, 1956), I:748-50. A map showing the locations of the *Galena*'s various contractors is given in Appendix D.

[6]*Dictionary of American Biography*, 20 vols. (New York: Charles

Scribner's Sons, 1928-1936), VIII:8-9. (Hereinafter cited as *DAB*).

[7]Samuel Rezneck, "John Flack Winslow (1810-1892), Troy Iron and Steel Master," in *Profiles Out of the Past of Troy, New York Since 1789* (Troy, N.Y., 1946), 97, quoted in William N. Still, "Monitor Builders: A Historical Study of the Principal Firms and Individuals Involved in the Construction of USS Monitor," *The American Neptune* 48 (Spring 1988):108; J. Leander Bishop, *A History of American Manufactures From 1608 to 1860*, 3rd ed., 3 vols. (Philadelphia: Edward Young & Co., 1868; reprint ed., New York: Augustus M. Kelley, 1966), III:251.

[8]J. P. Lesley, *The Iron Manufacturer's Guide to the Furnaces, Forges and Rolling Mills of the United States with Discussions of Iron as a Chemical Element, an American Ore, and a Manufactured Article, in Commerce and in History* (New York: John Wiley, 1859), 225-26; Still, "Monitor Builders," 109.

[9]Smith to Pook, October 14, 1861; Smith to Pook, October 21, 1861; Smith to Daniel P. Martin, October 21, 1861. Correspondence Relative to Ironclads.

[10]Smith to Bushnell & Co., October 17, 1861. Ibid.

[11]Smith to Pook, October 21, 1861; Smith to Pook, October 22, 1861. Ibid.

[12]Smith to C.S. Bushnell, November 2, 1861; Smith to Pook,

November 2, 1861; Smith to Pook, November 4, 1861; Smith to Bushnell, November 7, 1861; Smith to Pook, November 8, 1861. Ibid.

[13]Smith to Bushnell, November 2, 1861; Smith to Bushnell, November 7, 1861; Smith to Pook, October 21, 1861. Ibid.

[14]Smith to Daniel B. Martin, November 2, 1861; Smith to Bushnell, November 2, 1816; Smith to Pook, November 2, 1861. Ibid.

[15]Smith to Bushnell, November 2, 1861; Smith to Martin, November 2, 1861. Ibid.

[16]Smith to Pook, November 2, 1861; Smith to Martin, November 2, 1861. Ibid.

[17]Smith to Pook, November 2, 1861. Ibid.

[18]Smith to Bushnell, November 14, 1861; Smith to Bushnell, November 14, 1861; Smith to Martin, November 14, 1861; Smith to Martin, November 19, 1861; Smith to Bushnell, November 21, 1861; Smith to Pook, November 13, 1861. Ibid.

[19]Contracts and Bonds 1861, Records of the Bureau of Yards and Docks, Record Group 71, Entry 48, National Archives, Washington, D.C., 249.

[20]Smith to Bushnell, November 7, 1861; Smith to Pook, November 4, 1861. Ibid.

[21]Smith to Bushnell, November 13, 1861; Smith to Pook, November

13, 1861. Ibid.

[22]Smith to Bushnell, November 14, 1861; Smith to Martin, November 14, 1861. Ibid.

[23]Smith to Bushnell, November 18, 1861; Smith to Bushnell, November 18, 1861; Smith to Martin, November 19, 1861; Smith to Martin, November 19, 1861; Smith to Gris wold, November 19, 1861. Ibid.

[24]Smith to Bushnell, November 21, 1861; Smith to Martin, November 21, 1861; Smith to John A. Griswold, November 21, 1861; Smith to Martin, November 22, 1861. Ibid. Illustration based on one that appeared in Alexander Holley, *A Treatise on Ordnance and Armor: Embracing Descriptions, Discussions, and Professional Opinions Concerning the Material, Fabrication, Requirements, Capabilities, and Endurance of European and American Guns for Naval, Sea-Coast, and Iron-Clad Warfare. And Their Rifling, Projectiles, and Breech-Loading. Also, Results of Experiments Against Armor, From Official Records with an Appendix, Referring to Gun-Cotton, Hooped Guns, Etc., Etc.* (New York: D. Van Nostrand, 1865), 214.

[25]Smith to Bushnell, December 3, 1861. Correspondence Relative to Ironclads.

[26]Smith to Winslow & Co., December 3, 1861; Smith to Bushnell, December 5, 1861. Ibid.

[27]Smith to Winslow, December 5, 1861. Ibid.

[28]Smith to Bushnell, December 9, 1861; Smith to Bushnell, December 11, 1861. Ibid.

[29]James Phinney Baxter, *The Introduction of the Ironclad Warship* (Cambridge: Harvard University Press, 1933; reprint ed., Hamden, Conn.: Archon Books, 1968), 269-72.

[30]Ibid., 276-77.

[31]Ibid., 275-81.

[32]Smith to Pook, December 23, 1861; Smith to Pook, January 2, 1862; Smith to M. Minthorne, January 3, 1862; Smith to Pook, January 3, 1862. Correspondence Relative to Ironclads.

[33]Pook to Smith, January 6, 1862; Minthorne to Smith, January 8, 1862; Bushnell to Smith, January 9, 1862. Ibid.

[34]Smith to Bushnell, January 10, 1862; Smith to Minthorne, January 10, 1862. Ibid.

[35]Bushnell to Smith, January 14 1862. Ibid.

[36]Smith to Bushnell, January 16, 1862. Ibid.

[37]Minthorne to Smith, January 16, 1862; Pook to Smith, January 21, 1862; Smith to Pook, January 23, 1862. Ibid.

[38]Bishop, *History of American Manufactures*, III:128-29.

[39]*DAB*, V:211; William Conant Church, *The Life of John Ericsson*, 2 vols. (New York: Charles Scribner's Sons, 1911), I:226.

[40]Pook to Smith, January 6, 1862; Minthorne to Smith, January 8, 1862. Correspondence Relative to Ironclads.

[41]Bushnell to Smith, January 9, 1862; Minthorne to Smith, January 16, 1862; Pook to Smith, January 21, 1862; Pook to Smith, February 8, 1862. Ibid.

[42]Smith to Pook, February 7, 1862; Pook to Smith, February 8, 1862; Pook to Smith, February 10, 1862; Smith to Pook, February 12, 1862. Ibid.

[43]Pook to Smith, February 10, 1862; Smith to Pook, February 15, 1862. Ibid; Contract Ledger for Ironclads 1861-1862, Records of the Bureau of Yards and Docks, Record Group 71, Entry 48, National Archives, Washington, D.C., 317.

[44]Bushnell to Smith, February 14, 1862; Pook to Smith, February 14, 1862. Correspondence Relative to Ironclads.

CHAPTER IV

"I HAD BEGUN TO REGARD HER AS A MYTH"

The frustrations which had bedeviled Commodore Joseph Smith throughout the construction process did not let up once the vessel had been launched. Much work remained to be done, including the affixing of the rest of the armor and the installation of the power plant. Unfortunately, neither step would go easily, demonstrating the type of problem inherent in American ironclad construction at the time. Once again, the armor would undergo changes, although not in design this time. The engines would require more time to put in than earlier anticipated. These changes and delays resulted in a steady pushing back of the *Galena*'s delivery date to the navy, which incensed the commodore and brought dire promises of financial retribution. The navy desperately needed its ironclads; rumors of the *Merrimack's* impending launching sent nervous shivers down the spines of officers in Washington and on the blockading squadron responsible for closing off Chesapeake Bay. Even though the *Galena* missed its chance to take on the Confederate behemoth, military officers recognized the psychological effect of having another ironclad on station. From February until early April, Smith kept up pressure on the contractors until he had what he wanted: delivery of the *Galena* to the navy.

The launching of the *Galena* allowed Smith to include another oversight mechanism into the construction process. During the middle of January, he had "applied for a commander for the vessel" to take her

through the final stages of fitting out.[1] The navy assigned Commander Alfred Taylor to the task. He was a capable officer, having been in the navy since 1825. Smith sent him "a copy of the contract which you will see is complied with so far as her equipments, stores and outfits are concerned. Upon your certificate upon these points and upon her performance will depend the final payment to the contractors."[2] While maintaining the stern demeanor that typified Smith's behavior during the preceding months in his letter to Taylor, the commodore revealed his momentary relief over the vessel's launching by authorizing Samuel Pook, the naval constructor, "one week's leave of absence" as soon as his duties would permit.[3]

Meanwhile, progress continued on the *Galena*. The shipyard at Mystic installed the rest of her engine, minus the boilers, and more of the armor plating. Pook reported that "the contractors inform me that they have engaged a steamer to tow this ship to New York on Saturday next, to take on her boilers and the deck plating."[4] The unfinished vessel departed as planned, at three o'clock in the afternoon. It is doubtful whether anyone paid much attention to the movement of this partially finished experiment. National attention was riveted on Richmond, Virginia, where Jefferson Davis took the oath of office as President of the Confederate States of America. At the same time, the Union formally celebrated the birthday of George Washington.[5]

The *Galena* was destined "for Rowland's shipyard, at Green Point, L[ong] I[sland]."[6] There she would finish building, taking on her remaining machinery, armor, stores, and supplies. "Rowland's

shipyard" was actually the Continental Iron Works, owned and operated by Thomas Fitch Rowland. Located near the East River, the Continental Iron Works was "a comparatively new establishment," less than two years old. Rowland, like many of his contemporaries, started as an apprentice in a machine shop, where he learned the basics of his trade. He worked on the steamboat *Connecticut* for two years and then "obtained a job with the Allaire Works of New York, an old established engine-building concern." After working there a year, he left to become an independent designer and builder of steam engines in New York for the next six years. He founded the Continental Iron Works with Samuel Sneden in 1859, but their relationship ended one year later, with Rowland retaining control of the company.[7]

Since the outbreak of the Civil War, Rowland had been engaged in the "manufacture of Gun Carriages and Mortar Beds for the Navy Department, and fitted out most of the steamers purchased from the merchant service which took part in the capture of Port Royal, and all of the vessels composing the 'Porter Mortar Fleet.'" His Continental Iron Works was chosen by John Ericsson to build the *Monitor's* hull in October, 1861, a vessel whose construction Smith was also hurrying along in anticipation of the *Merrimack's* appearance. However, the *Monitor* had been launched almost a month earlier and had left the Continental Iron Works on February 19, allowing Rowland and his men to concentrate on the *Galena*.[8] Indeed, the navy's leadership eagerly awaited the new ironclads. Admiral Louis M. Goldsborough, commanding the North Atlantic Blockading Squadron, wrote Assistant

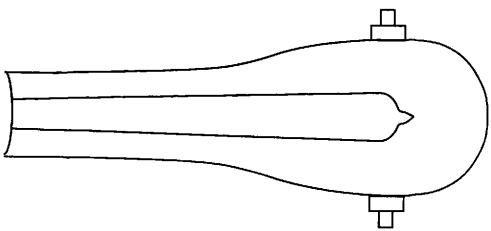
Secretary Gustavus Vasa Fox that "I hope the Dept. will be able to send the *Ericsson* soon to Hampton Roads to grapple with the *Merrimac* & lay her out as cold as a wedge. She, & another like her, would do the work well."[9]

By February 28, Pook could report progress on several key components of the *Galena*. He noted that "the deck is being plated, and that part of the work will probably be completed in ten or twelve working days," although "the plating on the sides is rapidly approaching completion." In addition, the "boilers are to be placed on board tomorrow" and "most of the machinery will be on board next week." Evidently Pook was uncertain of his ability to set up the machinery, because the constructor asked Smith to send an engineer to supervise the final installation.[10] Smith promptly responded, appointing John Farron, the navy's Chief Engineer, as "superintendent of the engine and its erection on the ironclad gunboat *Galena* now at Green Point."[11] Like his predecessors, Farron received a set of instructions from the Bureau of Yards and Docks which enclosed the original specifications and noted the modifications which had been made during the course of construction. In closing, Smith told the new engineer that "I want the vessel, and wish the workmen to work night and day."[12]

Throughout the ship's construction, the nature of her armament had been debated within the Navy Department. By early January, Smith reported to Pook that "four IX inch Dahlgren guns and two 80 lb. rifled cannon are proposed for the armament."[13] The basic arrangement had not changed by the middle of February, although it was not sure

whether there would be "four or six IX inch broadside guns" placed on board. Regardless of number, the *Galena* had more than enough ports available.[14] By the end of the month, the Department had decided on "four IX inch Dahlgren guns, and two 80 lb. rifled cannon, unless otherwise ordered."[15] After some scrambling around and desperate searching, Commander Andrew A. Harwood of the Ordnance Bureau was able to procure two of the new 100 pounder Parrott rifles and the necessary mounting carriages.

FIGURE 5: CROSS SECTION OF DAHLGREN GUN



The nine inch Dahlgren gun had been developed in 1850 by John A. Dahlgren, working in the Bureau of Ordnance. This design, shaped like a soda bottle, could contain the tremendous inner pressures required for heavy ordnance. (FIGURE 5). Manufactured in nine, eleven, fifteen, and twenty-inch sizes during the Civil War, Dahlgren's design proved more than a match for its European counterparts.[16] In the war's last year, Norman Wiard, an ordnance expert testifying before

Congress, justly claimed that "the Dahlgren gun has exhibited better endurance in proof than any other large gun" in service.[17] In response to a query asking what was "the best gun now known," Assistant Secretary Fox offered a similar opinion, declaring that "the best shell gun is Admiral Dahlgren's nine and eleven inch guns."[18]

FIGURE 6: CROSS SECTION OF PARROTT RIFLE

The Ordnance Bureau chose to put Parrott rifled cannon on board the *Galena*. Invented by Robert C. Parrott, this type of cannon was "composed of a cast-iron cylinder with a wrought-iron jacket or band shrunk upon the breech of the gun, in order to strengthen it about the seat of discharge."[19] (FIGURE 6). Although the largest sizes of this type of gun were prone to burst when fired with explosive shells, it was considered by its contemporaries to be the best rifled cannon available. According to American steel maker Alexander Holley, "the gun is cheap, and has proved very serviceable . . . It is intended, not to exhaust the capabilities of the system of initial tension, but to utilize that system as far as possible without greatly increasing the cost of the standard ordnance and without serious risk of damage by exposure and maltreatment in the hands of green artillerists."[20]

The dual armament had been chosen by the Ordnance Bureau for

very practical reasons. Each cannon had different effects at different distances. Captain Henry A. Wise explained the difference to the Committee on the Conduct of the War in 1864:

> The rifled gun has the greater range, but the ball from the smoothbore *starts* with the greater velocity. In other words, the rifled projectile retains its flight longer than the smooth-bore ball. The effect which projectiles produce is different under varying circumstances. The rifled gun, with its projectile, can cut away masonry or brick-work. The round shot has a smashing power, and at a certain range, with its high velocity, it can penetrate as well as *smash*.[21]

Captain S. V. Benét, who had carried out a number of tests at Parrott's foundry during the war, offered a similar opinion to the committee. In his opinion, at a range of 1000 yards or less, "for use against ironclads [the Dahlgren's] smashing effect would render it more effective than a rifled gun." However, the rifled cannon's greater accuracy at distances exceeding 1000 yards made the addition of such guns necessary to the existing smoothbore armament of warships like the *Galena*.[22]

Just when it seemed that the *Galena*'s construction had been brought under control, two new crises occurred, both at about the same time. The first dealt with the vessel's armor plating. Commodore Smith received an emphatic letter from John F. Winslow on March 6 requesting permission to alter the placement of armor on the ship's hull. In it, Winslow extolled the merits of the rail and plate armor which covered most of the hull, noting "where this sort of armor is on the ship it is the most beautiful and perfect that can be conceived, and affords $3\frac{1}{4}$ inch protection against shot." However, where this armor ended, "20 feet aft from the stem, and 14 feet forward of the stern post,"

$\frac{1}{2}$ inch boiler plates had been affixed to the hull. Winslow declared "that this $\frac{1}{2}$ inch iron affords precious little protection against shot, and besides is so unsightly compared with the rest of the armor that it ought not to be permitted to remain." Indeed, "you will at once perceive that if the $\frac{1}{2}$ plates are allowed to remain on the ship, that in the event of her presenting her bows to the shot of an enemy, they will be sure to be penetrated, and as the magazines are well forward, they would be greatly endangered."[23]

Noting that Pook had fifty tons displacement to spare, and that replacing the boiler plate with iron planking would only add eleven tons to the *Galena*, Winslow requested Smith's approval for the changes. Anticipating the commodore's reaction, he admitted "it is true we have incurred much of the expense of putting on the plates, but we will allow the government the weight of them against the same amount of bars, and only charge for the work already expended in fitting them, and in addition the extra weight of the bars, and putting them on the ship." Winslow justified the increased expense by noting that "this extra cost to the government will be but a trifle compared with the superior protection afforded by the bars, and their greatly improved appearance." Not only would the *Galena* fight better, but she would also look better.[24]

Commodore Smith decided to write Pook about the impending change and see if he had any objections. After referring to Winslow's proposition, Smith opined that "the Bureau prefers the change if it does not increase the displacement of the vessel beyond that provided for in the contract, the difference in cost to be settled with the contractor." He

asked the constructor for "your views on the subject."[25] At the same time, he replied to Winslow, stating that "I have no objection to continuing the bars from stem to stern if the contractors agree to it" and it did not make too great a change in the ship's displacement.[26] A telegram went out to the Bushnells two days later from the Bureau agreeing to the changes, with Smith hoping "it will not delay the vessel."[27]

As concerned as Smith might appear, the main reason for hurrying the *Galena*'s construction along had been partially alleviated. The *Merrimack* steamed out of Norfolk on March 8 and delivered a crippling blow to the wooden Union blockading vessels in Hampton Roads. She sank the *Cumberland*, blew up the *Congress*, and damaged several other warships before retreating back to the protection of Confederate batteries at Sewell's Point. Her officers planned to bring her out the next day and finish the job. However, late that night, the *Monitor* arrived, leading to the epic battle of Hampton Roads the following morning. Although neither ship won, the *Monitor* prevented the *Merrimack* from wreaking havoc on the Union fleet, breaking the blockade, and, in the minds of some government officials, threatening Washington itself. Although the menace was not removed, it was contained.[28] However, pressure on Smith to get the *Galena* ready for battle remained. A few days after the Battle of Hampton Roads, a nervous Goldsborough, concerned about the ability of the *Monitor* to withstand another foray by the *Merrimack*, wrote Fox: "Would to God we had another iron clad vessel on hand! Cannot something more be

done to hurry up the *Mystic*, or whatever her name may be?"[29]

Shortly after the *Galena*'s launching, Bushnell wrote an optimistic letter to Smith lauding the vessel's abilities. "It is very natural," he noted, "that I should be pleased with the success of our Mystic steamer in her every part. But I can assure you that every one, competent and incompetent to judge, are unanimous in their praise of her in all particulars . . . Her speed, appearance, power to punish rebels and all enemies of the country are now unquestioned."[30] Unfortunately, Bushnell's views were not shared by all. James Strong, a prominent New Yorker and volunteer officer in the Union army, visited the ship one month later. He described his reaction to Smith:

> I, with several gentlemen, went on board the ironclad gunboat *Mystic* now lying in Green Point, and in our opinion, and also the opinion of several ship builders, was that the ship was not worth the materials that were in her before she was put together. Any schooner in the port of New York is stronger than she. A 32 pound shot will smash her in. The knees are about 10 feet apart and small at that, and her timber entirely too light; she can't stand ten minutes before any vessel of ordinary strength. Appoint a proper person to examine, and you will find what I say is true and unless she is made stronger, she is worse than nothing.[31]

The reply to Strong's letter is not extant, but this report must have raised doubts in Smith's mind about the venture.

The only other change to the armament was proposed by Smith himself. The commodore wrote John Winslow on March 14 and asked about the possibility of attaching a ram to the *Galena*'s bow. The original plan carried no such provision and Smith's request can be attributed to the *Merrimack*'s effective use of her ram against the *Cumberland* at Hampton Roads on March 8. The ungainly Confederate

ironclad had easily disposed of the Union vessel, although snapping off her ram in the process. Winslow discussed Smith's query with John Ericsson and Pook. Together, they decided that the *Galena*'s bow was strong enough to serve as a ram if necessary, but "that in her present forward state toward completion, the proposed iron horn or prow cannot be put on so as to be entirely safe against breaking when used. Besides, its preparation and application would seriously delay getting her ready for sea."[32] That was enough for Smith. He informed the engineers that "the ram is abandoned" on March 21.[33]

As if the change to the armor, and the resulting delay, was not enough, the installation of the boilers became a problem. Based on information from the Continental Iron Works, probably from Pook, Smith fired off a letter to Bushnell & Co. on March 6. In it, he chastised the contractor calling "the slow progress of the *Galena* . . . unaccountable . . . The boilers were not in the vessel yesterday." Reverting to the strategy which seemed to work so well earlier, the commodore threatened that he would "claim heavy damages for this delay."[34] Bushnell quickly replied by trying to shift the blame to the whims of nature. He claimed "our engines and boilers have been ready for a long time, and the reason for the delay, as given by the Captain of the Derrick, was the impossibility of handling them safely during the continuous gale of last week." Calmer weather permitted the placing of the equipment on board two days earlier. The contractor went on to declare that "it cannot be possible that the government will add to the great loss thereby sustained, by demanding damages, especially when it

is fully known that what has caused a large part of the delay has added immensely to the real value of the steamer in general appearance, as well as power of resistance in her plating."[35] The argument did not impress Smith, who once again was growing skeptical of the changes and delays.

On March 19, Cornelius Bushnell reported back to Smith that the workers at the Continental Iron Works "are getting along as fast as I expected, taking into account the change of plate both foreward and aft." He informed the commodore that "the trial trip and day of delivery to the government is fixed unchangeably for two weeks from to-day."[36] Smith was unimpressed and impatient. Ignoring Bushnell's attempt to placate him with a delivery date, he plunged to the heart of the problem: "Please state what delays the *Galena*. Is it the engine or the plating? I would not have taken off the $\frac{1}{2}$ inch plates, if I had supposed that it would cause delay. I was informed that it was the engine which was behind hand."[37] In another letter written the same day, he chastised the contractor for the delivery date, complaining, "Now you state two weeks more are required! Why, no one can count the damage to the government for this extraordinary delay."[38] Smith was clearly getting frustrated.

During the exchange of letters, Bushnell unwittingly gave Smith a chance to score a moral victory, which the commodore promptly seized upon. On March 18, Bushnell submitted "a proposal" for another ironclad "that I trust the public exigencies will not induce you to accept, as I have care, censure, money, glory enough. But with all this, I may

have boldness and means that you can use to help save the nation; if so all, all is at your service."[39] Bushnell wanted to take another hull that he had building and turn it into an ironclad "all complete for action in sixty days." In a letter to Secretary of the Navy Gideon Welles, he suggested using the same armor plan as that used for the *Galena*, because "this mode of armor can be applied more rapidly than any other, plates or bars, and is in my opinion much superior to any that can be conceived." Anticipating questions about problems with the *Galena*'s armor, he noted that "the delay in putting it on the *Galena* arose from want of experience, which difficulty is now overcome, and the necessity of fitting the outer and inner bars."[40] He offered to build the new vessel for three hundred thousand dollars.

Welles sent the proposal to Smith, who would ultimately decide whether or not to proceed with it. Smith wrote back to Bushnell, informing him that if any vessel were built, it would have to be smaller than the industrialist's proposal. With obvious relish, he offered his opinion that "if the time consumed in building the *Galena* is an evidence of your ability and promptness, it would require near four months, instead of sixty days, to complete the vessel if your proposition were adopted."[41] Bushnell got the message, writing back to the commodore that "I am glad you did not accept my 60 days offer, but you had no right to touch on facts in regard to the time it has taken to plate the *Galena*, in consideration that it is enough to make a man sick to think of it."[42] Smith must have felt better knowing he was not the only person frustrated by the delays and changes.

Commander Taylor, on the scene at the Continental Iron Works, could only inform Smith "that it is impossible to say with certainty whether the armor or the engine will delay the *Galena*." Engineer Farron predicted "at least two weeks before the engine will be ready."[43] Although installation of the armor seemed to be proceeding satisfactorily, the contractors were encountering some problems with the weather. On this particular day, a heavy snowfall made work difficult. Meanwhile, Bushnell promised Smith two days later that "you shall have the *Galena* next week all complete." Still obviously frustrated with the whole project, he decided to go the New York himself "and see that there is no slip this time, and that everything is provided to your satisfaction."[44] This was just as well, because Farron had written Smith on the same day that "the presence of the contractor or some person to act for him, would expedite the work materially."[45] As things presently stood, Farron was not nearly as optimistic as Bushnell about the prospects of finishing the *Galena* in less than two weeks.

Bushnell hurried to New York to oversee construction and reported that "if we do not have continuous bad weather, as we have had most of the time since our arrival, we will deliver her at the Navy Yard next Wednesday, [April 2], all but complete."[46] Bushnell then engaged in a little politicking in an effort to assuage the testy commodore:

> My prediction of some months since that you would not only save your reputation, but put posterity forever under a debt of obligation to you for your untiring efforts in the work of providing the *Monitor*, to say nothing of the *Galena*, which is destined to run down and destroy the Merrimac ere long. I now call to your mind, and you will allow me to suggest now that you have taken all said risk, and certain facts and principles are demonstrated,

> and your reward is sure. Let some one else take the risk and get the credit if there is any in some of the new 1000 inventions.[47]

Smith was not disposed to Bushnell's flattery. The same day he grumbled to Farron that "I am tired of the delay in completing this vessel."[48]

Engineer Farron talked to Samuel Pook, still engaged in working on the ship, about the delays and Smith's frustration. Pook wrote Smith and expressed regret "that it has appeared to you that I have not done my best." First, he blamed Delamater for slowing down construction by insisting that the vessel be brought to New York to receive her boilers. He also faulted Griswold and Winslow for late delivery of the iron plating, noting "I am aware that more men could have been put on the armor, but what can be done when the material is not at hand." In closing, he begged Smith to "not blame me, sir; I have done all I could from the beginning. I shall inform Mr. Bushnell to-day that the government holds him responsible for this delay, and he must see that men enough are put upon the ship immediately to finish the ship without more delay."[49]

The latest deadline for the *Galena*'s delivery came and went without word from Bushnell. On April 3, Smith dashed off a short letter to the contractor saying "I have almost abandoned the hope of receiving the *Galena*." His disgust was plainly evident, and he promised that "as to charges for extras, you will find the government's claim for damages more than an offset to the account even if the vessel shall prove satisfactory."[50] At last, Smith could take it no longer. Writing to one of Rowland's associates, Henry R. Dunham, he made it clear that "the

Galena is wanted for service immediately. She is at best only an experiment, and it is not deemed advisable to incur further expense or risk of delay preparing her for service."[51] Finally, after almost two more weeks of construction, Bushnell delivered the vessel to the navy, still unfinished, on April 15, 1862. Smith could only "rejoice to hear that the *Galena* is at last in our hands. I had begun to regard her as a myth." Somewhat facetiously, he suggested to Bushnell that "I hope you will make a trip in her."[52]

Although the vessel was not completely finished, she had been delivered to the navy, which meant she was one step closer to her ultimate test: contact with the enemy. Smith would continue to haggle with Bushnell & Co. about whether or not the terms of the contract had been fulfilled and what penalties, if any, should be exacted for construction delays and design failures. Still, despite all the bluster and remonstrances, the United States Navy now possessed its second coastal ironclad. The reputation of ironclad technology, especially after the fight at Hampton Roads, meant that the *Galena* would serve as much as a psychological weapon as she would an actual physical threat to Confederate forces. Even though she was still untested in battle, she was an ironclad, and her presence alone would bolster Union morale in the Chesapeake and cast doubts among the enemy about their ability to resist. Therefore, the navy quickly moved to prepare her for active duty.

CHAPTER IV NOTES

[1]Commodore Joseph Smith to M. Minthorne, January 17, 1862. Subject File, U.S. Navy 1775-1910, AD - Design and General Characteristics 1860-1910, Ironclads, Correspondence relative to, between Commodore Joseph Smith & various Designers and Builders. 1861 to 1863, Record Group 45, Box 51, National Archives, Washington, D.C. (Hereinafter cited as Correspondence Relative to Ironclads).

[2]Smith to Commander Alfred Taylor, February 15, 1862. Ibid.

[3]Smith to Samuel H. Pook, February 17, 1862. Ibid.

[4]Pook to Smith, February 18, 1862. Ibid. The following Saturday was February 22.

[5]Everette Beach Long, *The Civil War Day by Day: An Almanac 1861-1865* (Garden City, N.Y.: Doubleday, 1971; reprint ed., New York: Da Capo Press, 1985), 174.

[6]Pook to Smith, February 22, 1862. Correspondence Relative to Ironclads.

[7]J. Leander Bishop, *A History of American Manufactures From 1608 to 1860*, 3rd ed., 3 vols. (Philadelphia: Edward Young & Co., 1868; reprint ed., New York: Augustus M. Kelley, 1966), III:132-33; *Dictionary of American Biography*, 20 vols. (New York: Charles Scribner's Sons, 1928-1936), XVI:200.

[8]Bishop, *History of American Manufactures*, III:133; William C. Davis, *Duel Between the First Ironclads* (New York: Doubleday, 1975; reprint ed., Baton Rouge: Louisiana State University Press, 1981), 47-52.

[9]Admiral Louis M. Goldsborough to Assistant Secretary of the Navy Gustavus Vasa Fox, February 23, 1862, in Gustavus Vasa Fox, *Confidential Correspondence of Gustavus Vasa Fox, Assistant Secretary of the Navy, 1861-1865*, edited by Robert Means Thompson and Richard Wainwright. 2 vols. (New York: De Vinne Press, 1918-1919), I:244.

[10]Pook to Smith, February 28, 1862. Correspondence Relative to Ironclads.

[11]Smith to John Farron, February 28, 1862. Ibid.

[12]Smith to Farron, March 11, 1862. Ibid.

[13]Smith to Pook, January 7, 1862. Ibid.

[14]Smith to Taylor, February 15, 1862. Ibid.

[15]Smith to Captain Andrew A. Harwood, February 25, 1862. Ibid.

[16]David K. Allison, "John A. Dahlgren: Innovator in Uniform," in *Captains of the Old Steam Navy: Makers of the American Naval Tradition 1840-1880*, ed. James C. Bradford (Annapolis: Naval Institute Press, 1986), 33-35.

[17]U.S., Congress, Senate, *Letter on Heavy Guns*, Senate Misc.

Doc. 47, 38th Cong., 2nd sess., 1865, p. 3.

[18]U.S., Congress, Senate, *Character, Efficiency, Fabrication, etc. of Heavy Ordnance Now in Use*, Senate Rept. 121, 38th Cong., 2nd sess., 1864-1865, p. 170.

[19]Ibid., 2.

[20]Alexander Holley, *A Treatise on Ordnance and Armor: Embracing Descriptions, Discussions, and Professional Opinions Concerning the Material, Fabrication, Requirements, Capabilities, and Endurance of European and American Guns for Naval, Sea-Coast, and Iron-Clad Warfare. And Their Rifling, Projectiles, and Breech-Loading. Also, Results of Experiments Against Armor, From Official Records with an Appendix, Referring to Gun-Cotton, Hooped Guns, Etc., Etc.* (New York: D. Van Nostrand, 1865), 53. The "system of initial tension" referred to by Holley refers to the method of attaching the wrought-iron jacket to the barrel. The cross section of the Parrott rifled is adapted from p. 51 of Holley's text.

[21]*Character, Efficiency, Fabrication, etc. of Heavy Ordnance Now in Use*, 27.

[22]Ibid., 39.

[23]John F. Winslow to Smith, March 6, 1862. Correspondence Relative to Ironclads.

[24]Ibid.

[25]Smith to Pook, March 8, 1862. Ibid.

[26]Smith to Winslow, March 8, 1862. Ibid.

[27]Smith to C.S. Bushnell & Co., March 10, 1862. Ibid.

[28]Davis, *Duel Between the First Ironclads*, 76-137.

[29]Goldsborough to Fox, March 16, 1862, in Fox, *Confidential Correspondence of Gustavus Vasa Fox*, I:249. Smith had personal reasons for pushing the *Galena*'s completion. His son, Joseph, Jr., was killed while commanding the *Congress* against the *Merrimack*.

[30]Bushnell to Smith, February 18, 1862. Correspondence Relative to Ironclads.

[31]James Strong to Smith, March 12, 1862. Ibid.

[32]Winslow to Smith, March 18, 1862. Ibid.

[33]Smith to Taylor, March 21, 1862. Ibid.

[34]Smith to Bushnell, March 6, 1862. Ibid.

[35]Bushnell to Smith, March 8, 1862. Ibid.

[36]Bushnell to Smith, March 19, 1862. Ibid.

[37]Smith to Bushnell, March 21, 1862. Ibid.

[38]Smith to Bushnell, March 21, 1862. Ibid.

[39]Bushnell to Smith, March 18, 1862. Ibid.

[40]Bushnell to Secretary of the Navy Gideon Welles, March 18, 1862. Ibid.

[41]Smith to Bushnell, March 20, 1862. Ibid.

[42]Bushnell to Smith, March 22, 1862. Ibid.

[43]Taylor to Smith, March 22, 1862. Ibid.

[44]Bushnell to Smith, March 24, 1862. Ibid.

[45]Farron to Smith, March 24, 1862. Ibid.

[46]Bushnell to Smith, March 25, 1862. Ibid.

[47]Bushnell to Smith, March 25, 1862. Ibid.

[48]Smith to Farron, March 25, 1862. Ibid.

[49]Pook to Smith, March 27, 1862. Ibid.

[50]Smith to Bushnell, April 3, 1862. Ibid.

[51]Smith to Henry R. Dunham, April 4, 1862. Ibid.

[52]Smith to Bushnell, April 16, 1862. Ibid.

CHAPTER V

"WE DEMONSTRATED THAT SHE IS NOT SHOTPROOF"

Commodore Joseph Smith's efforts had finally borne fruit. Delivery of the *Galena* came at a critical time for the Union. Although the *Monitor* turned back the *Merrimack* at the Battle of Hampton Roads in early March, the Confederate ironclad still lurked upriver, threatening to come down and complete the destruction of the wooden blockading squadron that denied vital supplies to the Confederacy. No one knew if the *Monitor* could repeat her earlier feat, and all officers concerned eagerly awaited the new ironclad. The navy was not the only service anticipating the *Galena*'s arrival. General George Brinton McClellan, engaged in his ponderous move up the Peninsula since early April, urgently requested support from the navy in the form of the new ironclad technology. The general thought he needed an ironclad to reduce the Confederate strong point at Yorktown and ensure the success of his campaign. Although not fully cognizant of the shortcomings of such craft, McClellan understood their psychological impact on both his forces and the forces of the enemy. Indeed, would the *Galena*'s presence tip the balance for the Union's control of the Peninsula? Could she give the Union the extra edge it needed to stamp out the rebellion? Most importantly, could she assist Federal forces in their effort to capture Richmond?

The key question confronting the *Galena* was how well she would perform under fire. No doubt her designers and builders held high

hopes for their creation, but she awaited the test of battle. Commodore Smith's constant sniping during the construction and the criticism of other observers loomed large in the minds of those who built her, and they anticipated vindication. But first she would have to convince the officers of the United States Navy who would operate her. They were critical to her success; if they would not believe in her and give her a fair trial, she would not have the chance to undergo the only test capable of silencing her critics: combat. The *Galena* would come of age during the summer of 1862.

With the *Galena* in its hands, the navy rushed to finish construction and get the vessel into combat. Two days after her delivery, Commodore Smith informed Chief Engineer Joseph Farron that "Commodore Paulding will furnish the contractors all the facilities to expedite work on the *Galena*," now at the Brooklyn Navy Yard.[1] All the while, General George McClellan pressured the navy for the promised ironclad. He informed Assistant Secretary Fox that he was "fast reaching a point where the success of my operations must to a certain extent depend upon the fact of her co-operation or the reverse." He hoped that the *Galena* would "shorten my work here very much."[2] Construction continued unabated for the next week as workers and officers attended to the final details. On April 21, the navy formally put the *Galena* into commission, with the log noting "the mechanicks still at work on board." The ship's crew and the dockyard workers began loading the ordnance and supplies, taking on "47 tanks of powder" and securing the guns.[3]

The following day, the *Galena* left New York under tow of the steamer *Baltic* and headed for "Hampton Roads direct."[4] During the next few days, the crew began to familiarize themselves with the ship, putting the *Galena* through her paces and working the bugs out of her machinery. The journey was not uneventful. On the second day out, a member of the crew fell overboard. The engines were started so the ship could maneuver to pick him up, but the propeller fouled the tow line, forcing the crew to stop the engine and slip the line, freeing them from the *Baltic*. The *Galena* started drifting towards shore, unable to restart her engines, and had to drop anchor. Meanwhile, the *Baltic* ran aground. The ironclad's engines sputtered to life long enough to raise the anchor, but promptly broke down again. Once again an anchor was dropped, and the engineers sat down to figure out how to fix the machinery. Needless to say, the officers and crew were probably not impressed by their introduction to the new vessel.[5]

The rest of the journey passed without incident, and on April 24, the *Galena* anchored off Fortress Monroe with a broken shaft in one of her engines, her guns loaded with shot in case of emergency. The crew could see the *Monitor* lying at anchor not far away, her turret pocked with indentations from her recent battle with the *Merrimack*. Commander Alfred Taylor, who oversaw the final construction and fitting out of the *Galena* since the middle of February, now came to the end of his responsibilities. Combat command of the vessel had been given to Commander John Rodgers, who boarded the ship at two o'clock that afternoon. Taylor left three hours later, his job finished. That same

afternoon, the commander of the blockading squadron, Flag Officer Louis M. Goldsborough, "inspected the ship and ordered the spars cut away," recognizing that the ship would have little use for them on this station.[6]

Commander John Rodgers, son of the hero of the War of 1812 of the same name, had spent the first part of the war with the South Atlantic Blockading Squadron. After bringing back the *Flag* to Baltimore for engine repairs he found himself attached to General McClellan's Army of the Potomac "for temporary special duty."[7] He engaged in bridge building and troop transport for McClellan's Peninsula campaign. Finally, on April 22, he received orders to proceed to Fortress Monroe and "await arrival of *Galena*; your orders to command her are with Flag Officer Goldsborough."[8] Commander Taylor, who assumed that he would command the *Galena*, quietly left, no doubt satisfied with the generous price Rodgers paid for his cabin stores. Meanwhile, Rodgers took stock of his new command.[9]

After spending a few days on board, he wrote his wife, Anne, about his assessment of the *Galena*: "I do not think she fully comes up to the idea of an iron-plated craft — but then she is very much safer than any ordinary vessel."[10] Acting Paymaster William Frederick Keeler of the *Monitor* thought her totaly [*sic*] unable to cope with the *Merrimac*."[11] Goldsborough was even less impressed. Even before the *Galena*'s arrival, he had been cautious about what the vessel might accomplish, telling Assistant Secretary Fox that "until I see the *Galena* I cannot speak with any confidence as to the part she may be able to

play."[12] The admiral's expectations plummeted after he paid his visit. He dourly informed Fox that "she is, in my judgement, a most miserable contrivance — entirely beneath Naval criticism."[13] Four days later he wrote Fox that "she is a sad affair. Her projectors & builders ought to be ashamed of her."[14]

Word of Goldsborough's critique reached Commodore Smith in Washington. A "mortified" Smith sat down and wrote a private letter to Rodgers about the *Galena*, explaining that he wished the commander to "please tell me what you think of her." By way of apology, he told the commander that "I could not attend to the vessel myself & had to trust to others." Smith encouraged Rodgers to be honest in his assessment, noting "we do not expect perfection." Specifically, he was "anxious" to have the armor scheme tested in combat, perhaps against the Yorktown forts currently blocking the passage of McClellan's army up the Peninsula and preventing the capture of Richmond.[15]

Interservice rivalry reared its ugly head soon after the *Galena* reached Fortress Monroe. Goldsborough told Rodgers that "Genl McClellan seems to take it for granted you are to act under his orders, which may not be the case."[16] Indeed, McClellan had written his wife that "the *Galena*, under Rodgers, will be here the day after tomorrow — in a day or two after she arrives you will hear of a blow struck that will surprise secesh & delight the country — I *may* delay it for a few days if I meet with any delays in my preparations."[17] Extremely arduous geography hampered any advance up the Peninsula. Terrain alternated between dense woods and marshy areas, with few roads and no railroad

lines to facilitate the logistics and communications requirements of an attacking army. The general's plan called for an advance up the Peninsula across its entire width, with the final goal being Richmond. Gunboats would cover the army's flanks on the York and James rivers. Control of the rivers meant that McClellan could be supplied by water with relative ease. The inclusion of ironclads into the naval support group would help keep these rivers open to Union forces.[18]

Goldsborough opposed McClellan's plans, especially the part calling for a naval attack by ironclads against Yorktown and other targets on the James and York rivers because such operations would take the *Monitor* and the *Galena* upriver where neither could prevent the *Merrimack* from leaving Gosport and running amuck through the Union blockaders.[19] McClellan relented only when Goldsborough pointed out that a successful foray by the *Merrimack* would cut the army's lines of communications, jeapordizing the entire campaign. Therefore, McClellan altered his original plan and shifted to an advance up the York River, leaving the ironclads to keep the *Merrimack* away from his army. He attacked Yorktown with wooden navy gunboats providing fire support. When the city fell on May 4, the general proposed another plan. He wanted to send an ironclad up the James River to interrupt the flow of Confederate supplies. Rodgers, aching for action, heartily agreed, but could do nothing in the face of Goldsborough's opposition.[20]

May 4, besides bringing the Union advance into Yorktown,

provided some excitement for the *Galena*. Assistant Secretary Fox visited the vessel that morning, but otherwise it seemed to be a normal day. Then, at quarter past one, the *Merrimack* rounded a distant point, evidently offering battle. The *Galena*'s log reported that her crew "beat to Quarters and loaded small arms and got everything ready for immediate action but [the *Merrimack*] made no attempt to attack us and at $3\frac{3}{4}$ p.m. she steamed up towards Norfolk out of site [*sic*]."[21] Rodgers, frustrated by his inability to get the *Galena* into combat, resorted to a time-honored stratagem: going over the head of his superior officer.

While dining at Fortress Monroe on May 6, Rodgers heard a rumor that President Lincoln had come down from Washington to check out the situation. Rodgers made his way to the President, where he presented McClellan's plan of moving up the James River. Lincoln initially rejected the idea on Goldsborough's advice, but changed his mind the next day after a tour of the *Galena* and a telegram from McClellan. Consequently, Rodgers was assigned two wooden gunboats, the *Aroostook* and the *Port Royal*, to assist him. Goldsborough's objection that three gunboats were not up to the task was cast aside in the general excitement over the army's success on the Peninsula as the navy yearned for a chance to prove itself.[22]

Rodgers' orders commanded him to "do all that may be within your power to assist the army under the command of Major-General McClellan, and endeavor to harass the retreat of the rebels wherever they can be reached."[23] In effect, this order authorized him to proceed as far up the James River as possible, striking beyond Union lines to

create confusion in the Confederate rear. The three gunboats departed shortly after 6 o'clock on the morning of May 8. By 8:30, they reached an enemy battery of eleven guns at Day's Point, which the *Galena* promptly put out of commission and set on fire after four passes in front of it. Two rebel gunboats, the *Jamestown* and the *Patrick Henry*, were spotted, but they got up steam and wisely retreated up the river ahead of the more powerful Federal force. The three Federal gunboats encountered a second rebel battery at Harden's Bluff of approximately twelve guns around one o'clock the same afternoon. This time it took seven passes before the battery was reduced, with the exception of one stubborn gun. Rodgers attacked the second battery by himself, ordering the *Aroostook* and the *Port Royal* to lie out of range for most of the attack, and then to run by the battery after several of its guns had been silenced.[24]

Two batteries taken care of, the gunboats proceeded up the river, where the *Galena* ran aground on a sandbar just off Hog's Island. Because the injection water for her boilers was taken in near the keel, the *Galena* could not use her own engines; the pipes were rapidly clogged with sand and river debris. She remained stuck on the sandbar for thirty-six hours until the *Aroostook* and the *Port Royal* could haul her off. Once again, the gunboats proceeded up the river, until they came to another bar which was obviously too shallow for the *Galena* to attempt passage. Therefore, Rodgers withdrew, requesting additional gunboats to provide fire support while the *Galena* attempted to cross the shoal. He was also low on ammunition, having expended forty shells on the first battery and 123 shells on the second.[25]

In these actions, the *Galena* aptly demonstrated her worth as a floating battery. Her Dahlgren smoothbores and Parrott rifles proved a deadly combination when unleashed on the Confederate shore batteries. However, the two engagements had not fully tested her capabilities as an ironclad. The accurate fire of the *Galena*'s crew "disconcerted the aim of the Rebel artillerists" so much that Rodgers was able to report to Goldsborough that "our boats escaped a shot." However, this was not the case. The *Galena*'s log records two hits, one on the *Aroostook*, and one on the *Galena* herself, "on our Port Quarter doing very little injury." For whatever reason, Rodgers chose not to report these hits. Regardless, the batteries were not able to bring any significant firepower to bear on the ironclad, delaying her true trial by fire.[26]

The thrust up the James River had a more lasting effect which Rodgers and his superiors were not aware of as the three gunboats retired to Jamestown Island for resupply. The Confederates recognized that their existing defenses would not impede the *Galena*'s passage up the river, leaving Richmond open to attack. Therefore, they did whatever they could in the short time left to them to prepare for the ironclad's expected advance. The existing defenses at Drewry's Bluff were manned by an artillery company of local soldiers commanded by Captain Augustus H. Drewry, on whose land the batteries stood. Commander J. R. Tucker of the Confederate Navy recommended strengthening these batteries and sinking obstructions in the river at the same point, it "being the only efficient mode of defending Richmond."[27] Lieutenant J. N. Barney agreed in a dispatch to "the commanding

officer or engineer in charge at Drewry's Bluff." He suggested "the necessity of completing your arrangements for blockading the river as soon as possible, leaving an opening for the passage of vessels."[28]

Rodgers' call for reinforcements brought greater results than he could ever have hoped for. Confederate forces evacuated Norfolk on May 10, leaving the *Merrimack* without a base. The vessel's commander, Josiah Tatnall, attempted to take her up the James to Richmond, but her draft was too deep and the Confederates beached and burned her on May 11.[29] This freed the *Monitor*, which Goldsborough had been holding back to counter the *Merrimack*, for service with Rodgers. McClellan was ecstatic. He quickly telegraphed Secretary of War Stanton and "most earnestly [urged] that our gun boats & the iron clad boats be sent as far as possible up the James River without delay." Such a move would "enable me to make our movements [against Richmond] much more decisive."[30] That same day, Welles ordered Goldsborough to "push all the boats up the James River, even to Richmond."[31] Accordingly, the *Monitor* was sent to join the Union squadron, accompanied by the steamer *Naugatuck*.[32]

Destruction of the *Merrimack* did not take her complement of sailors out of action; Confederate leadership quickly found a task for the trained gun crews of the defunct ironclad. "The officers and crew of the *Virginia [Merrimack]*, except the engineer officers" were ordered to proceed to a point $1\frac{1}{2}$ miles below Drewry's Bluff to establish a battery there. However, upon reconsideration, they were told to report to the positions already prepared and were employed in strengthening them in

anticipation of the *Galena*'s approach.[33] For two days Drewry's company and the sailors struggled to mount ordnance stripped from Confederate gunboats, working without shelter, exposed to steady rain and fighting off hunger because of a lack of rations. Their efforts resulted in the emplacement of five more cannon, some of which proved critical in the coming battle.[34]

Although the army had overall command of the defenses to the approaches to Richmond, the sailors were placed in charge of Drewry's Bluff. Secretary of the Navy Stephen Mallory informed the new commander of the naval contingent, Captain Sydney Smith Lee, that "the naval force is expected to fight all the batteries, complete the obstructions, and mount additional guns where you may deem them necessary." Lee was ordered to "defend the river to the last extremity."[35] If the Union naval vessels reached Drewry's Bluff, they would find a well trained enemy capable of using all means at their disposal to defend the passage to Richmond.

The *Monitor* and the *Naugatuck* reached Jamestown Island and the *Galena* on May 12 and prepared to advance further up the James River. One Confederate battery remained on the river below the naval vessels. The *Monitor* had attempted to silence it during its passage up the river, but could not elevate her guns at a close enough range to fire effectively. Therefore, Rodgers recommended that "a small landing party of marines and sailors" be sent to take the battery, opening the James River and allowing the naval vessels to be readily resupplied.[36] Goldsborough promptly took action, dispatching two gunboats whose

ordnance could reach the troublesome battery, along with a supply vessel.[37] However, the incident portended things to come. The *Monitor's* inability to elevate her guns would prove disastrous for the *Galena* in the coming days.

The disparate little squadron weighed anchor and proceeded up the James River on May 13, expecting to find trouble at Drewry's Bluff, also known as Ward's Hill. Escaped slaves had warned the navy of Confederate preparations, although it was difficult to assess the strength of the position based on their reports. The gunboats cautiously steamed up the river, occasionally taking sniper fire from the wooded banks. The further up the river they went, the narrower the banks became, increasing the danger of injury to the ship's crews. The captains of the gunboats became even more cautious on the morning of May 14. They expected to fight the batteries, all that stood between them and Richmond, later that day. Meanwhile, "all suspicious looking clumps of tree & bushes along the shore" which might conceal sharpshooters were "probed" by canister from the gunboats. The *Galena*, which had the deepest draft and therefore led the procession, ran aground after steaming only a few miles. The ships had to wait for the ebb tide to get her off. By the time she was freed, it was too late to proceed any further, so the "expectation of an exchange of compliments with the batteries on Ward's hill" was delayed for yet another day.[38]

The night passed quietly, marred only by a light rain. The *Galena*'s crew was roused at 4:00 a.m. and began to prepare the ship for combat. One hour later, the captains of the *Monitor*, *Port Royal*,

Aroostook, and *Naugatuck* reported to Commander Rodgers for final instructions. Once again, the *Galena* would take the lead. The squadron weighed anchor at 6:00 a.m. and proceeded up the river. The previous day's observations hinted at what they might find. Assistant Paymaster Keeler recorded that "the river has been covered all the afternoon with Sawdust, chips, logs of wood, lumber, tops of piles, charred fragments of steam & Sailing vessels, indicating that the rebels were busy filling the river with obstructions." Sure enough, the Confederates had been building an obstruction in depth, consisting of at least two and probably three layers of sunken ships, rocks and various debris, with a narrow channel to permit passage of friendly vessels. However, they had been unable to finish their work before the Federals arrived, forcing them to sink several canalboats filled with stone and two steamers alongside pilings already in place. As a final measure, the commander of the *Jamestown* scuttled his vessel, blocking the channel.[39]

Rebel sharpshooters along the banks made it extremely hazardous for any man to show himself on the journey upriver; a bluejacket taking soundings on the *Galena* was mortally wounded. As a precaution, Rodgers ordered his crew to stand to quarters at 7:00 a.m. One half hour later, the Confederate batteries came into view off the port bow. The *Galena*, still at the head of the column, moved to the attack, along with the *Monitor* and the *Naugatuck*, whose protection consisted of twenty inches of white cedar and the ability to flood ballast tanks, taking her hull below the surface of the water. The remaining two

gunboats were ordered to the protection of a sheltered bank. By 7:45, the *Galena* reached a position six hundred yards below the Confederate batteries on Drewry's Bluff, where she dropped anchor. The shore batteries fired first. Two shots hit the port bow, "going quite through and slightly wounding two men," an inauspicious beginning for the experimental ironclad.[40]

The immediate problem was to bring the *Galena*'s ordnance to bear. Using a spring mechanism to pull the vessel around on her anchor cable, the crew presented her broadside to the Confederate gunners and prepared to deliver the lethal load. Rodgers elected to use shells against the enemy positions; solid shot would have little effect on earthworks. The attack would be made all the more difficult by the presence of a number of rifle pits dug along the shore of the river. Confederate sharpshooters made short work of any man foolish enough to expose himself. They also fired into the ports of the attacking vessels when possible, making life miserable for the crews servicing the guns. To make matters worse, it was a warm, muggy day, and the sailors, now forcibly encased in their iron homes, would get no relief.[41]

The three gunboats commenced firing, but only the *Galena* had a significant effect early in the engagement. Her broadsides raked the shoreline and bluff, often driving the enemy gunners from their posts and disrupting counterfire. The *Naugatuck*, armed with a 100-pounder Parrott rifle and several howitzers, was effectively taken out of the action by the bursting of the Parrott rifle early in the engagement. Thereafter, she could only use her howitzers against the sharpshooters on shore.

The *Monitor*, which stood below the *Galena*, was too far away from the Confederate batteries to accurately disrupt their fire. Lieutenant William N. Jeffers, commanding Ericsson's ironclad, noticed that the bulk of the enemy fire was aimed at the *Galena*. Therefore, at 9:00, he passed above the *Galena* in an attempt to bring the *Monitor's* massive 11-inch Dahlgrens to bear. Unfortunately, the vessel's design did not permit her guns to be elevated enough to fire on the Confederate batteries, so Jeffers dropped back down to a point where he was in line with the *Galena* and continued to fire from there.[42]

Notwithstanding the casualties from the sharpshooters, the battle had gone well for the Union up to this point. The *Galena* had "nearly silenced the battery when we found our shells all expended."[43] Rodgers was forced to switch to less effective solid shot, and the course of the battle dramatically changed. The Confederate gunners, able to stay in their works and man their cannon, deftly concentrated fire on the *Galena*. For the first time, she found herself in a situation to test the capabilities of her armor. Rodgers noted she "was fully tried, oblique shot, direct shot, deck shot."[44] This hail of fire soon became a nightmare.

The ship's log noted that "the battery soon opened upon us with terrible effect – – every shot taking effect going through the iron armor." Tragically, the ship's armor was weak enough to allow Confederate shot to pierce it and enter the interior. Even the shot that did not physically enter the interior had a destructive effect. A number of them hit the armor and lodged in the hull. However, they did enough damage to the

armor to send splinters of wood and iron flying through the gun deck, causing numerous casualties. The plunging fire of the Confederate batteries also caused a great deal of damage to the weakly armored deck, creating a similar effect as men died both from enemy shot and fragments of the *Galena*'s own iron.[45]

Then, at 11:05, tragedy struck. A Confederate shell either pierced the *Galena*'s armor or came in through one of the gun ports. It exploded, setting off a cartridge next to one of the guns. Three men were instantly killed, several wounded, and the ship filled with smoke.[46] Acting Paymaster Keeler described the scene from the *Monitor*:

> Suddenly volumes of smoke were seen issuing from the *Galena*'s ports & hatches & the cry went through us that she was on fire, or a shot had penetrated her boiler – – her men poured out of her open ports on the side opposite the batteries, clinging to the anchor, to loose ropes, and dropping into the boats. We at once raised our anchor to go to her assistance but found she did not need it.[47]

The *Galena* required no aid because Rodgers decided to withdraw from the engagement. Rodgers justified his retreat for the extremely practical reason that he was dangerously low on ammunition. The battle nearly exhausted his store of solid shot. He had six shells left for his Parrott rifles and no shells for the 9-inch Dahlgrens. The battered squadron silently slipped down the James River to a safe anchorage off Kingsland Creek. The damaged but triumphant Confederate batteries gave three rousing cheers to the battered vessels, confident that Richmond remained secure from Federal assault. The works at Drewry's Bluff, now named Fort Darling, stayed in place until the end of the war. No Union vessel ever got past them to threaten the Confederate

capital.[48]

The following days were filled with the writing up of official reports and private letters home. Keeler went on board the *Galena* soon after the battle and painted a vivid picture of the scene in a graphic letter to his wife:

> Here was a body with the head, one arm & part of the breast torn off by a bursting shell – – another with the top of his head taken off the brains still steaming on the deck, partly across him lay one with both legs taken off at the hips & at a little distance was another completely disemboweled. The sides & ceiling overhead, the ropes & guns were spattered with blood & brains & lumps of flesh while the decks were covered with large pools of half coagulated blood & strewn with portions of skulls, fragments of shells, arms, legs, hands, pieces of flesh & iron, splinters of wood & broken weapons were mixed in one confused horrible mass.[49]

The scene described by Keeler, terrible though it was, was seen after the *Galena*'s crew had made some effort to clean up the ship. Until called into action to replace an injured loader, one marine corporal had been sweeping the debris off the deck so the ship's crew could service their guns. Efforts to clean up probably continued after withdrawal from battle, before Keeler came on board.[50]

The *Monitor*'s paymaster was not the only person deeply affected by the *Galena*'s experience. Commander Rodgers also wrote his wife the day after the battle. The opening of his letter, "Dear Anne — I have seen the elephant in the fighting line," gave way to description of the rampant destruction he had so recently witnessed. He had several brushes with death that morning. In one case, an officer stopped him to ask a question. Halting momentarily, Rodgers moved on. A shell exploded a couple of feet in front of him, at the point where he would

have been had he kept walking. In another instance, he was next to the gun crew that lost three of its members. The shell that devastated the gun deck of his ship almost did in the commander himself. Luckily, he only received a scratch on the face in the resulting explosion. He described the physical damage to the ship in some detail, but aptly synopsized the day's encounter by noting "the rebels demonstrated most fully that she is penetrable – – they killed 13 men and wounded some 11 – – the doctor had more than he could attend to – – what with amputations and bandages." It had not been an easy day for this naval veteran.[51]

His personal letter written, Rodgers sat down to the grim task of writing his official report, collecting the reports of subordinates, and gathering them together for delivery to his superiors. In the personal report, Rodgers wryly observed that "we demonstrated that she is not shot proof." After briefly describing the damage, he advised that the *Galena* be repaired at Washington before again going to sea. He suggested repairs in Washington "since so many people there have an interest in iron plating, and she so well shows the effect of various shot." Whether or not he intended this last statement to be facetious is not known, but the Navy Department could not have missed the irony. The ironclad which some had condemned and others had placed great hopes in would come back from her first real encounter with combat bearing every conceivable type of damage she could possibly sustain.[52]

Rodgers' executive officer, Lieutenant L. Howard Newman, was responsible for assessing the *Galena*'s damage. He submitted three

reports describing, in detail, the carnage wrought by the Confederate batteries. Newman counted forty-three hits on the *Galena*. Some of them glanced off, either because their velocity was too low or because they hit the vessel at a bad angle. If for the latter reason, then the severe tumble home design of the ship's hull was successful. However, the number of penetrating hits far outnumbered those that glanced off. Thirty-seven of the forty-three shots counted by Newman did some tangible damage to the vessel. Even some of the glancing shots broke the armor before bounding off. A brief list assessing the injury inflicted by each enemy shot was almost two pages long when printed up. No area of the ship escaped notice. Newman catalogued broken armor, gaping holes in the deck, broken timbers, shattered planking, damaged bulkheads, and a number of shots still lodged in the hull. In short, the *Galena* suffered massive damage. All parts of the vessel were affected; she had not been forced to withdraw because of one or two lucky hits.[53]

The official report of the *Monitor* serves as a useful counterpoint to Newman's damage report. Jeffers' account of the *Monitor*'s role in the attack on Drewry's Bluff mentions that the ironclad was hit three times by Confederate cannon. One shot hit "squarely on the turret," doing no damage, while the other two hit "the side armor forward of the pilot house; neither caused any damage beyond bending the plates." Although the rebel gunners concentrated on the *Galena*, a fact acknowledged by Jeffers, and the *Monitor* was just below the *Galena*, the lack of damage is interesting for two reasons. First, the shots that did strike the *Monitor* only dented the plates and bounded off. No shots

penetrated her armor or lodged in her hull, as was the case with the *Galena*. Consequently, her crew suffered no casualties. Second, the *Monitor*'s basic design may have hampered Confederate aim. Her turret and extremely low freeboard minimized the target the enemy had to shoot at, whereas the *Galena*, built on more traditional lines, offered a much broader silhouette. She had to present her broadside to deliver her ordnance. All things considered, on the basis of the Battle of Hampton Roads and the Battle of Drewry's Bluff, the *Monitor* appeared to be the better ship.[54]

Reaction to the repulse at Drewry's Bluff varied. Union commanders recognized that the Confederate obstructions could not have been passed by the Union flotilla, but not everyone understood that the battle had been the decisive test of the *Galena*'s design. General George McClellan, "after a careful consideration of the meager accounts" received by his headquarters, concluded that "their repulse will prove to be due to the fact that they were subjected to a close musketry fire they could not reply to."[55] McClellan had good reason for projecting optimism. Still mired down in his creeping advance up the Peninsula, he needed gunboats to protect his flanks, secure his communications, and harass the Confederate rear. Thus, he remained under the spell of the ironclad panacea, failing to recognize that all ironclads were not alike.

The psychological effect of these new weapons had not yet worn off either in the North or the South. Like many of his contemporaries, McClellan overlooked the technological limitations of the ironclads and

placed great hope in their ability to perform as advertised. Northern poets, journalists, and songwriters extolled the virtues and capabilities of the new technology, creating a myth of their invincibility that endured long after the war was over. Southerners, especially those in the West where ironclads played a key role in opening the Mississippi River to Union domination, also bought into the myth. Even though several ironclads would be sunk or heavily damaged during the war, the impact of the new technology was so great that it altered perceptions of reality in contemporary minds. By the end of the war, many observers had adopted a more pragmatic view of the iron behemoths, but their estimations often exceeded actual performance.[56]

The *New York Times* made a point of comparing the damage sustained by each ship at Drury's Bluff. Its report of the action against Fort Darling noted:

> Of twenty-eight shots that struck the *Galena*, eighteen penetrated her armor. *Not one of those striking the Monitor, however, did her any damage whatever*, all glancing off. It seems the armor of the *Galena* was not designed to resist heavy shot of the description fired at her from the fort, at so great an angle of elevation. Thus is the fact that her armor proved inefficient on this occasion accounted for.[57]

The next day, the *Times* reprinted the opinion of the *Philadelphia Inquirer*. In that paper's opinion, "the *Galena* suffered severely," while "the *Monitor* . . . maintained her superior strength and invulnerability."[58] These assessments differed markedly from the *Times'* earlier optimism of May 19. Having received early reports of the battle, an article opined "that any armament [Fort Darling] mounted was able to 'repel,' sink or seriously damage our iron-clad gunboats, we

shall be very slow to believe." Like many of the public, the *Times* expected "that the delay will be no longer than to allow the removal of the obstructions, when our iron-clad gunboats will move on to the rebel capital" and force its surrender.[59]

Reaction in naval circles was not nearly as optimistic, but it bowed to circumstances. Rodgers submitted a report on May 20 informing his immediate superior that the *Galena* was leaking badly, taking on $2\frac{1}{2}$ inches of water an hour. He also noted that "her port side is much shattered by cannon shot." This report made its way to Flag Officer Goldsborough, who, while recognizing that the vessel needed repair, ordered her to remain on station because of circumstances. He thought it "really terrible if she should have to leave the James River at this time." Realistically, he could not allow the *Galena* to leave and considered her leak "comparatively, of no serious moment." McClellan's push up the Peninsula demanded every available resource, and Goldsborough was not about to let one of his two ironclads go as long as it remained functional.[60]

Nobody recognized this more than Rodgers. In a letter to Goldsborough, he hoped the admiral would "not send the *Galena* away from James River while there is any chance of her being of more service than an ordinary gunboat." Despite the damage suffered at the hands of the Confederate batteries, Rodgers was still of the opinion that "the shots we received at our water line, and which we are still able to receive, would sink a wooden vessel." Still, he knew that his ship had taken a beating, and recommended that she not "be sent to sea in her present

condition."[61]

The navy was planning an attack against Wilmington, North Carolina, and Secretary Welles had been pushing Goldsborough to attach the *Monitor* and the *Galena* to the expedition. Goldsborough did not think the *Galena* was up to the task, and appointed a board of officers to examine her and report her condition, the final report to be forwarded to Welles. The board "held a strict and careful survey upon the condition of this vessel," and came to the same conclusions expressed earlier by Rodgers. Not only had the armor been badly damaged, but the structural integrity of the frame was in doubt and they did not think she should be exposed to the rigors of an ocean passage. They recommended "that the *Galena* be sent, so soon as the pressing exigencies of service will admit, to some port inside the cape for thorough examination and repairs." Upon receipt of the board's report, which included a detailed list of the vessel's injuries, Welles admitted that "she certainly cannot be repaired in time to be of service" and dropped the matter of her inclusion in the expedition to Wilmington. However, she was to remain on station until she could be augmented by ironclads then building. The psychological impact of her presence still outweighed her actual capabilities.[62]

While the officers at the scene assessed the *Galena*'s combat readiness, Commodore Joseph Smith haggled with C. S. Bushnell & Company over the final payment for the vessel. Initially, he decided to suspend all payments and wait for "the report of the test of the *Galena*," after which "the Bureau will present its claim for damage in not

complying with your contract." Smith sent a note to Rodgers asking him to conduct a series of trials "for twelve consecutive hours in smooth water" to determine whether or not the terms of the contract had been met. These conditions implied an ocean test, for which the *Galena* was clearly not suited at this time. Smith did not know the extent of the damage at the time of his request, but when he found out he assured her builder that he was "mortified" at the outcome of the duel with the batteries. Although unsure about what course of action he would pursue in light of her combat failure, he was sure that the government would find it necessary to withhold any further payments.[63]

Unfortunately, Smith found himself in a race with time. The agreement with Bushnell & Company stipulated that the government had ninety days from time of delivery to conduct the trials set out in the contract:

> That she shall when loaded for sea, make a speed under steam of twelve knots, or sea miles, per hour, in smooth water, and carry coal in the bunker for ten days consumption at that speed. That her frost sills amidships shall float seven feet above the water when the vessel is down to her load water-line, and that she shall have stability to carry said armament, armor, boats, provisions, stores and outfits of all kinds with 2500 gallons of water in tanks, and a crew of 130 persons, with all sails set, safely at sea as a cruising vessel.[64]

The *Galena* had been delivered to the government on April 15. Ninety days gave the navy until the middle of July to conduct its trials and determine whether or not the vessel was deficient. Smith was confident that the report "will no doubt be received, and acted upon before the ninety days provided for the trial of the vessel expires." Still, he wrote Goldsborough and asked him to push along the trials. He gave up on the

idea of an ocean test, asking instead that she conduct a day's run down the James River.[65]

For a variety of reasons, Smith's request could not be accommodated by the officers in the combat zone. Rumors of another Confederate ironclad at Richmond had reached the Union navy on the James River, and Commodore Charles Wilkes, the commander of the James River Flotilla, was not about to let the *Galena* go. Even though she was damaged, she was still useful, if only for her ordnance. He would have allowed her to make a run down the river, but that was impossible "owing to shoal water and narrow passages." On July 16, he promised to send her down to the bay "as soon as circumstances permit" for trials, but by this time it was too late. The deadline had passed, and it was Smith, ironically, who fell victim to the terms of the contract. Reluctantly, he informed Bushnell that "the time having expired within which tests of her performance should have been made, the Secretary of the Navy will not, under all the circumstances, enforce a claim for damage for non-compliance of contract in regard to time of completion." Given the tenor of his letters to Bushnell in the preceding eight months, this must have been particularly painful to write.[66]

Interest in the *Galena*'s failure extended beyond official circles. One of the most prolific writers on technical affairs of the day, Alexander Lyman Holley, addressed the *Galena*'s deficiencies in a series of articles and a book on the status of the steel industry, ordnance, armor, and ironclads. Holley set out the basic premise of the failure of the vessel's armor in two articles in 1863. He recognized that armor

derived much of its strength from the whole, not just the individual plates or bars. The ship's frame and the method by which the individual plates were joined together were as important as the structure of the plates themselves, if not more so. He classified the *Galena*'s armor as "very defective, as each bar, deriving little strength from those adjacent, offers only the resistance of its own small section." In his opinion, navies had to make a choice between less expensive armor, like the *Galena*'s, or armor that would withstand the battering blows of enemy ordnance in close quarters.[67]

Holley expounded on the effects of shot against the *Galena*'s armor in an important work published in 1865. Moving beyond his earlier work describing why the armor itself was deficient, he addressed what happened to the armor once it was hit. Armored ships were especially dangerous to their own crews.

> The armor, it is true, is only punched by a swift shot; but the part punched out is generally broken to pieces, and the shot is broken to pieces, and the backing and skin are torn to splinters, every one of which is a missile of sufficient power to put *men*, if not machinery, *hors de combat*. This was actually the case in the thinly-clad *Galena*, when pierced by the fire of Fort Darling, on the James River. The debris of the armor spread on all sides of the line of the shot, in the form of a cone. Although the shot-hole may be little larger than the projectile, in the front of the plate, it is invariably much larger in the rear.[68]

It should be noted that Holley was in a perfect position to make judgements about the *Galena*'s armor. From 1863 to 1866 he was the chief engineer at the Rensselaer and Albany Iron Works, owned by John Griswold and John Winslow, the designers of the armor. Their expertise, opinions, and plans were readily available as Holley put

together his massive work.

The *Galena* spent the remainder of 1862 and early 1863 in the James River Flotilla and North Atlantic Blockading Squadron. The navy made what repairs it could, but she was never in the same condition as before the Battle of Drewry's Bluff. Still commanded by John Rodgers, she spent the summer of 1862 supporting McClellan's laborious movement up and down the Peninsula, providing fire support, covering troop movements, and harassing the enemy whenever possible. Her log recorded several brushes with small rebel detachments, especially cavalry sent to disrupt McClellan's communications. Often her crew did not even see the enemy, as was the case on June 26, when they were ordered up the Appamattox River to bombard a wooded area suspected of harboring a rebel troop concentration.[69]

As the Army of the Potomac retreated down the Peninsula during the final days of June and the beginning of July, the gunboats became increasingly important. On June 30, Rodgers reported much of the army had found refuge on the banks of the James River under the protection of the navy's guns, including the *Galena*. One day later he reported to Goldsborough that "we need in this vicinity all the gunboats we can get as soon as possible. Yesterday, I hear, we did good service in shelling the rebel army." McClellan confirmed this assessment that same day in a dispatch to Goldsborough requesting "that every gunboat or other armed vessel suitable for action in the James River be sent at once to this vicinity, and placed under the orders of Commander Rodgers, for the purpose of covering the camps and communications of

this army." The navy quickly responded to McClellan's plea, and by July 4, Goldsborough could report seventeen gunboats "at the scene of action."[70]

The presence of the Union gunboats had a definite impact on the actions of the Confederate leaders. General Robert E. Lee, who commanded the rebel thrust pushing McClellan down the Peninsula, recognized the impact of the gunboats. He explained the situation to Jefferson Davis on July 4:

> The enemy's batteries occupy the ridge along which the Charles City road runs, north of the creek, and his gunboats lying below the mouth of the creek sweep the ground in front of his batteries. Above his encampments which lie on the river, his gunboats also extend, where the ground is more favorable to be searched by their cannon. As far as I can now see, there is no way to attack him to advantage, nor do I wish to expose the men to the destructive missiles of his gunboats . . . I fear he is too secure under cover of his boats to be driven from his position.[71]

Davis accepted Lee's explanation, noting that while "it is a hard necessity to be compelled to allow him time to recover from his discomfiture and to receive re-enforcements . . . I fully concur with you as to the impropriety of exposing our brave and battle-thinned troops to the fire of the gunboats."[72] McClellan would hold these positions until the end of August, when the bulk of his army withdrew to Washington. The gunboats, led by the *Galena*, would continue to support the army until the final withdrawal as they had before the retreat.

Events briefly thrust the *Galena* into the limelight when McClellan used her as his headquarters during the Battle of Malvern Hill, the final engagement in the Seven Days Campaign, while ignoring the real fighting at Glendale. A widely circulated (but erroneous)

Currier and Ives cartoon during the presidential campaign of 1864 pictured McClellan in a saddle on the spanker boom of the *Galena* watching his troops from the safety of the gunboat. Other than that, she performed admirable service, but was no more important to the Union efforts than any other gunboat. Of course, this assessment does not take her psychological impact into account, which is impossible to judge. The Confederates could not accurately assess her capabilities, which made her presence important and justified the navy's reluctance to send her to a proper navy yard for repairs. In the end, this may have been the *Galena*'s most significant contribution. She held the line while the Union built more *Monitor*-style ironclads, not due for delivery until the fall of 1862.[73]

The confidence of a ship's commander provides the best gauge of her capabilities. Commander Rodgers' actions during the fall of 1862 demonstrate that he knew he had gotten all possible value out of this experimental ironclad. Being aware of the new ironclads building in Northern shipyards, Rodgers knew that his future lay with the next generation of ironclad warships. He wrote to Secretary of the Navy Welles in October asking for command of one of the new vessels. Welles at first declined, because "in view of the responsibilities of your present position, the Department does not feel justified in granting your request." However, the Secretary promised "that a suitable command will be conferred upon you when the exigencies of the service will admit of it." Rodgers chafed, not quite sure what was so important about "the responsibilities of [his] present position," but he eventually got his

request and was assigned to command of the new monitor *Weehawken*, with which he forced the Confederate ram *Atlanta* to surrender outside of Charleston the following summer.[74]

After duty with the North Atlantic Blockading Squadron, the *Galena* was ordered to Philadelphia for repairs. Having seen that her armor was not "shotproof," and probably unwilling to get replacement armor rolled for her, the Navy Department authorized the removal of her armor on May 13, 1863 and refitted her as a wooden gunboat. She was recommissioned on February 15, 1864 and sent to join the West Gulf Blockading Squadron. On August 5, she participated in the Battle of Mobile Bay, lashed to the steam sloop *Oneida* for protection from the fire of shore batteries. After another refit from November 23, 1864 to March 29, 1865, she rejoined the fleet and served as a blockader until the fall of the Confederacy in April. She was decommissioned on June 17, 1865, condemned by survey in 1870, and broken up at the Norfolk Navy Yard in 1872.[75]

CHAPTER V NOTES

[1]Commodore Joseph Smith to Chief Engineer John Farron, April 17, 1862. Subject File, U.S. Navy 1775-1910, AD - Design and General Characteristics 1860-1910, Ironclads, Correspondence relative to, between Commodore Joseph Smith & various Designers and Builders. 1861 to 1863, Record Group 45, Box 51, National Archives, Washington, D.C. (Hereinafter cited as Correspondence Relative to Ironclads).

[2]General George Brinton McClellan to Assistant Secretary of the Navy Gustavus V. Fox, April 20, 1862, in War Department, *War of the Rebellion: Official Records of the Union and Confederate Armies* 128 Parts in 70 Volumes. (Washington: Government Printing Office, 1880-1901), series I, vol. 11, part 3, p. 115. (Hereinafter cited as *ORA*. Series I unless otherwise noted).

[3]Entry for April 21, 1862. Log USS *Galena*. April 21, 1862 to May 9, 1863, February 15, 1864 to November 22, 1864, March 29, 1865 to June 17, 1865, Record Group 24, National Archives, Washington D.C. (Hereinafter cited as Log USS *Galena*).

[4]Fox to McClellan, April 22, 1862. *ORA*, vol. 11, part 1, p. 119.

[5]Entry for April 23, 1862. Log USS *Galena*.

[6]Entry for April 24, 1862. Ibid.

[7]Secretary of the Navy Gideon Welles to Commander John Rodgers, March 19, 1862. Papers of the Rodgers Family/John Rodgers

(1812-1882), Library of Congress, Manuscript Division, Washington D.C. (Hereinafter cited as Rodgers Papers).

[8]Rodgers to Anne Rodgers, April 22, 1862. Rodgers Papers.

[9]Robert Erwin Johnson, *Rear Admiral John Rodgers 1812-1882* (Annapolis: United States Naval Institute, 1967), 191-94.

[10]Rodgers to Anne, April 25, 1862. Rodgers Papers.

[11]Acting Paymaster William Frederick Keeler to Anna Keeler, April 25, 1862, in Robert W. Daly, ed. *Aboard the USS Monitor: 1862. The Letters of Acting Paymaster William Frederick Keeler, U.S. Navy to his Wife, Anna* (Annapolis: United States Naval Institute, 1964), 87.

[12]Goldsborough to Fox, April 21, 1862, in Gustavus Vasa Fox, *Confidential Correspondence of Gustavus Vasa Fox, Assistant Secretary of the Navy, 1861-1865*, edited by Robert Means Thompson and Richard Wainwright. 2 vols. (New York: De Vinne Press, 1918-1919), I:261.

[13]Goldsborough to Fox, April 24, 1862. Ibid., I:263.

[14]Goldsborough to Fox, April 28, 1862. Ibid., I:265.

[15]Smith to Rodgers, May 3, 1862. Rodgers Papers.

[16]Goldsborough to Rodgers, April 26, 1862. Ibid.

[17]McClellan to Mary Ellen McClellan, April 23, 1862 in George Brinton McClellan, *The Civil War Papers of George B. McClellan:*

Selected Correspondence, 1860-1865 (New York: Ticknor & Fields, 1989), 245.

[18]William M. Robinson, Jr., "Drewry's Bluff: Naval Defense of Richmond, 1862," *Civil War History* 7 (June 1961):169; Stephen W. Sears, *George B. McClellan: The Young Napoleon* (New York: Ticknor & Fields, 1988), 172-73. A map of the Peninsula can be found in Appendix E.

[19]McClellan to Rodgers, April 26, 1862. Rodgers Papers.

[20]Johnson, *Rear Admiral John Rodgers*, 196. For McClellan's request, see Col. J. J. Astor to Goldsborough, May 4, 1862, in U.S., Navy Department, *Official Records of the Union and Confederate Navies in the War of the Rebellion*, 30 vols. (Washington: Government Printing Office, 1894-1922), series I, vol. 7, p. 309. (Hereinafter cited as *ORN*. Series I unless otherwise noted).

[21]Entry for May 4, 1862. Log USS *Galena*.

[22]Johnson, *Rear Admiral John Rodgers*, 196-98. For Lincoln's order, see Lincoln to Goldsborough, May 7, 1862. *ORN*, vol. 7, p. 326.

[23]Goldsborough to Rodgers, May 7, 1862. *ORN*, vol. 7, p. 327. For the order notifying McClellan of the *Galena*'s orders to cooperate with the army, see Stanton to McClellan, May 7, 1862. *ORA*, vol. 11, part 1, p. 147.

[24]Entry for May 8, 1862. Log USS *Galena*. The first battery had ten

guns, consisting of 32-pounders and 42-pounders. The second battery had thirteen guns, not twelve, consisting of a 10-inch columbiad, four 9-inch Dahlgrens, two 8-inch columbiads, and six 32-pounders. See Captain Alfred L. Rives, CS Army, to Secretary of War Judah P. Benjamin, March 12, 1862. *ORN*, vol. 7, p. 742. For the report of the commander of the *Patrick Henry*, see Commander J. R. Tucker to Secretary of the Navy Stephen Mallory, May 8, 1862. Ibid., 786.

[25]Ibid. For Rodgers' report of the expedition, see Rodgers to Goldsborough, May 11, 1862. *ORN*, vol. 7, p. 329. For Rodgers' report to the army, see Rodgers to McClellan, May 9, 1862. *ORA*, vol. 11, part 1, p. 156.

[26]Rodgers to Goldsborough, May 11, 1862. *ORN*, vol. 7, p. 329; Entry for May 8, 1862. Log USS *Galena*.

[27]Augustus H. Drewry, "Drewry's Bluff Fight," *Southern Historical Society Papers* 29 (1901):284-85; Tucker to Mallory, May 8, 1862. *ORN*, vol. 7, p. 786.

[28]Lieutenant J. N. Barney to Commanding Officer at Drewry's Bluff, May 8, 1862. Ibid., 787.

[29]The complete story of the Merrimack's destruction is found in the text of her officers' general court martial. Ibid., 790-99.

[30]McClellan to Secretary of War Edwin W. Stanton, May 11, 1862, *Civil War Papers of George B. McClellan*, 263.

[31]Welles to Goldsborough, May 11, 1862. *ORN*, vol. 7, p. 341.

[32]Johnson, *Rear Admiral John Rodgers*, 200. This sequence of events does not seem to support William M. Robinson, Jr.'s contention that Goldsborough was trying to restore the navy's prestige by beating the army to Richmond. Clearly, the impetus for action came from McClellan, not Goldsborough. See Robinson, "Drewry's Bluff," 172-73, 175.

[33]Mallory to Lieutenant Catesby ap R. Jones, May 12, 1862. *ORN*, vol. 7, p. 799.

[34]John D. Hayes, "Ships Versus Forts," *Civil War Times* 3 (May 1961):6.

[35]Mallory to Captain Sydney Smith Lee, May 15, 1862. *ORN*, vol. 7, p. 800.

[36]Rodgers to Goldsborough, May 12, 1862. Ibid., 345-46.

[37]Goldsborough to Rodgers, May 15, 1862. Ibid., 354-55.

[38]Frederick Keeler to Anna, May 14, 1862, *Aboard the USS Monitor*, 124; Johnson, *Rear Admiral John Rodgers*, 201.

[39]Entry for May 15, 1862. Log USS *Galena*; Frederick Keeler to Anna, May 14, 1862, *Aboard the USS Monitor*, 125.

[40]Report of Lieutenant Morris, U.S. Navy, commanding USS *Port*

Royal, May 16, 1862. *ORN*, vol. 7, p. 363; Entry for May 15, 1862. Log USS *Galena*; Frederick Keeler to Anna, May 15, 1862, *Aboard the USS Monitor*, 126; Rodgers to Goldsborough, May 16, 1862. *ORN*, vol. 7, p. 357.

[41]Entry for May 15, 1862. Log USS *Galena*; Rodgers to Goldsborough, May 16, 1862. *ORN*, vol. 7, p. 357; Frederick Keeler to Anna, May 15, 1862, *Aboard the USS Monitor*, 126; Rodgers to Anne, May 16, 1862. Rodgers Papers; Chief Clerk William Faxon to Fox, May 17, 1862. *ORA*, vol. 11, part 3, p. 178; Johnson, *Rear Admiral John Rodgers*, 203.

[42]Report of Lieutenant Constable, U.S. Revenue Marine, commanding U.S. revenue steamer *E. A. Stevens* (*Naugatuck*), May 16, 1862. *ORN*, vol. 7, pp. 363-64; Colonel David Campbell to Stanton, May 17, 1862. *ORA*, vol. 11, part 3, p. 177; Report of Lieutenant Jeffers, U.S. Navy, commanding USS *Monitor*, May 16, 1862. *ORN*, vol. 7, p. 362.

[43]Entry for May 15, 1862. Log USS *Galena*.

[44]Rodgers to Anne, May 16, 1862. Rodgers Papers.

[45]Entry for May 15, 1862. Log USS *Galena*; Rodgers to Goldsborough, May 16, 1862. *ORN*, vol. 7, p. 357.

[46]Entry for May 15, 1862. Log USS *Galena*.

[47]Frederick Keeler to Anna, May 15, 1862, *Aboard the USS*

Monitor, 128.

[48]Entry for May 15, 1862. Log USS *Galena*; Rodgers to Goldsborough, May 16, 1862. *ORN*, vol. 7, p. 357; Johnson, *Rear Admiral John Rodgers*, 204. For the Confederate version of the attack, see Report of Commander Farrand, C.S. Navy, May 15, 1862; Additional Report of Commander Farrand, C.S. Navy, May 15, 1862. *ORN*, vol. 7, pp. 369-70. The Confederate commander listed his casualties as seven killed and eight wounded.

[49]Frederick Keeler to Anna, May 16, 1862, *Aboard the USS Monitor*, 130.

[50]Marine Corporal John Mackie to Rodgers, May 15, 1862. Rodgers Papers. This does not minimize Mackie's role in the battle. He received a Medal of Honor for his actions that day, the first given to a Marine in the Civil War. He served as a sharpshooter, removed wounded to safer quarters, cleared the deck, and finally served as a loader until the end of the battle.

[51]Rodgers to Anne, May 16, 1862. Ibid. A list of the killed and wounded is given in the Report of Assistant Surgeon [Ransford E.] Van Gieson, of Casualties, May 16, 1862. *ORN*, vol. 7, pp. 358-59. Two of the wounded later died of their injuries.

[52]Rodgers to Goldsborough, May 16, 1862. Ibid., 357-58.

[53]Report of Lieutenant Newman, U.S. Navy, Executive Officer of

USS *Galena*, May 16, 1862; Additional Report of Lieutenant Newman, U.S. Navy, Executive Officer of USS *Galena*, May 16, 1862; Additional Report of Lieutenant Newman, U.S. Navy, Executive Officer of USS *Galena*, May 18, 1862. Ibid., 359-62.

[54]Report of Lieutenant Jeffers, U.S. Navy, Commanding USS *Monitor*, May 16, 1862. Ibid., 362.

[55]McClellan to Stanton, May 17, 1862, *Civil War Papers of George B. McClellan*, 268.

[56]For an interesting discussion of this phenomena in the Eastern theater and a comparison to reactions in the West, see Earl J. Hess, "Northern Response to the Ironclad: A Prospect for the Study of Military Technology," *Civil War History* 31 (June 1985):126-43.

[57]"Operations on the James River," *New York Times*, 20 May 1862, p. 1. Italics in original.

[58]"The Action on the James River," *New York Times*, 21 May 1862, p. 1.

[59]"The Reported Naval Repulse near Richmond – Beauties of Official Dispatches," *New York Times*, 19 May 1862, p. 4.

[60]Rodgers to Commander William Smith, May 20, 1862; Goldsborough to Smith, May 21, 1862. *ORN*, vol. 7, p. 405.

[61]Rodgers to Goldsborough, May 25, 1862. Ibid., 426.

[62]Goldsborough to Welles, June 6, 1862; Smith to Lieutenant Thomas H. Stevens, Lieutenant William N. Jeffers, Acting Master William Watson, and First Assistant Engineer William H. King, May 24, 1862; Stevens, Jeffers, Watson, and King to Goldsborough, May 24, 1862; Welles to Goldsborough, June 7, 1862. Ibid., 456-57, 459-60.

[63]Smith to Bushnell, May 17, 1862; Smith to Rodgers, May 21, 1862; Smith to Bushnell, May 22, 1862. Correspondence Relative to Ironclads.

[64]Contracts and Bonds 1861, Records of the Bureau of Yards and Docks, Record Group 71, Entry 48, National Archives, Washington, D.C., 249.

[65]Smith to Bushnell, June 2, 1862; Smith to Goldsborough, June 6, 1862. Correspondence Relative to Ironclads.

[66]Commodore Charles Wilkes to Welles, July 16, 1862. *ORN*, vol. 7, p. 576; Smith to Bushnell, August 1, 1862. Correspondence Relative to Ironclads.

[67]Alexander Lyman Holley, "Iron-Clad Ships and Heavy Ordnance," *Atlantic Monthly* 11 (January 1863):87. See also Alexander Lyman Holley, "Iron-Clad War-Vessels," in *National Almanac and Annual Record for the Year 1863* (Philadelphia: George W. Childs, 1863), 61-66. For a brief biography of Holley and his importance to the American steel industry, see Paul F. Paskoff, ed., *Iron and Steel in the Nineteenth Century* (New York: Facts on File, 1989), 161-72.

[68]Alexander Lyman Holley, *A Treatise on Ordnance and Armor: Embracing Descriptions, Discussions, and Professional Opinions Concerning the Material, Fabrication, Requirements, Capabilities, and Endurance of European and American Guns for Naval, Sea-Coast, and Iron-Clad Warfare. And Their Rifling, Projectiles, and Breech-Loading. Also, Results of Experiments Against Armor, From Official Records with an Appendix, Referring to Gun-Cotton, Hooped Guns, Etc., Etc.* (New York: D. Van Nostrand, 1865), 213-14.

[69]Entry for June 26, 1862, Log USS *Galena*.

[70]Rodgers to Goldsborough, June 30, 1862; Rodgers to Goldsborough, July 1, 1862; McClellan to Goldsborough, July 1, 1862. Goldsborugh to Welles, July 4, 1862. *ORN*, vol. 7, pp. 529, 532, 541.

[71]Robert E. Lee to Jefferson Davis, July 4, 1862. In Robert E. Lee, *The Wartime Papers of R. E. Lee*, ed. Clifford Dowdey and Louis H. Manarin (Boston: Little, Brown, 1961; reprint ed., New York: Bramhall House, 1961), 208.

[72]Davis to Lee, July 5, 1862. *ORA*, vol. 11, part 3, p. 631.

[73]For a more detailed discussion of the *Galena*'s role during the summer of 1862, see Johnson, *Rear Admiral John Rodgers*, 206-21; Sears, *George B. McClellan*, 218-21. Actually, McClellan had been on the *Galena* the day before the Battle of Malvern Hill, but the cartoon got the point across — he should have been with his troops.

[74]Welles to Rodgers, October 27, 1862. Rodgers Papers; Johnson, *Rear Admiral John Rodgers*, 220-59.

[75] Papers of Stuart Farrar Smith, Library of Congress, Manuscript Division, Washington D.C.; Log USS *Galena*; For an account of the Battle of Mobile Bay from the *Oneida*, including a description of the *Galena*'s role, see the Kellogg Collection/Papers of Edward N. Kellogg, Library of Congress, Manuscript Division, Washington D.C.; U.S., Naval History Division, *Dictionary of American Naval Fighting Ships*, 8 vols. (Washington: Government Printing Office, 1959-1981), III:6-7. There are unsubstantiated stories floating around that the navy used the *Galena* to build a ship of the same name in the late 1870's, during the navy's lean years. According to this scenario, the navy submitted requests to Congress for repairs to existing ships, but broke up those ships and used the money to finance new vessels. A second *Galena* was in fact launched in 1880, but this deception cannot be documented.

CHAPTER VI

CONCLUSION

The *Galena*'s checkered career consistently points to failure. Her construction was marred by delays and incessant bickering between her contractors and the Federal government. Once taken into combat, she performed below expectations when challenged by a well-prepared and determined foe. As an ironclad warship, she failed to meet the standards of effectiveness that contemporary warships set. Unlike the *Monitor*, she proved incapable of resisting the concentrated fire of shore batteries, for which she had not been designed but which appeared to be increasingly important as the character of the operations in the war became manifest. On the other hand, for a more comprehensive understanding of her significance to Civil War and American naval history, the *Galena* needs to be placed in the context of her time. Although a failure, she was an important participant in the hit or miss process of determining American ironclad design in the early days of the war. The fact that no more ironclad gunboats were built on her design means that the navy learned from the inadequacies of her design. Thus, she is more notable as a valuable test case than as a combatant.

Early initiative in ironclad construction rested not with the United States, but with England and France. While the Americans had undertaken a few scattered tests and built one or two experimental ships before the Civil War, the British and French had devoted much study to

the problems and theory of ironclad construction. Clearly, they led the field. The pride of the United States Navy on the eve of the Civil War was the wooden steam ships of war built during the previous decade. The exigencies of war changed conventional American thinking. The Confederacy, hoping to dramatically alter the existing balance of power and break the blockade, pushed ahead with the conversion of the hull of the *Merrimack* into an ironclad ram. Rumors of the rebel efforts galvanized a skeptical United States Navy Department into action.

The call for ironclads and the subsequent winnowing process produced three disparate designs. This was not the result of stupidity or confusion. The intent of the naval board that recommended the three designs was to build three experimental vessels the navy could assess and use to determine the direction of future construction. Simply put, no one knew what would work and what would fail. As a result, the board cast a wide net, hoping to discover a successful design that would adequately serve the Union's needs in the looming conflict.

Each design offered its own advantages and disadvantages. The *Galena* was relatively cheap to build, could carry a heavy broadside, and was especially suited for riverine operations. She offered a new hull design which, if successful, would significantly reduce damage from enemy ordnance. Her armor scheme was also radically different from either of her competitors, or European vessels for that matter. Because she was a gunboat, the *Galena* could not carry the armor load of the bigger ocean-going cruisers like the *Gloire*, *Warrior*, or *New Ironsides*. Her plate and rail armor was designed to overcome this obstacle while

still providing superior protection and could be manufactured more cheaply than the $4\frac{1}{2}$ inch plates used on larger vessels. Necessity forced the search for alternative armor schemes; rolling mills in the United States were as yet incapable of producing those thick plates. Until industry adapted, as it did in the case of the *New Ironsides*, American inventors would try to circumvent convention with technical expertise. They succeeded with the *Monitor*, but failed with the *Galena*.

It was one thing to authorize the three ironclads, but quite another to actually build them. The construction of the *Galena* provides an excellent example of the confusion and myriad delays encountered by the government and its contractors as they struggled to transform hopes into reality. Not surprisingly, the parts of the ship that relied on traditional construction techniques were quickly and efficiently built. However, the incorporation of new technologies into the process created bottlenecks and design problems from the start. Although there were some difficulties with the engines and the steering system, the armor proved to be the most troublesome aspect of the *Galena*'s construction. First the physical design was changed and then the plan for attaching it to the ship's hull was altered near the end of the construction process.

The delays point out the fallibility of the men assigned to put the *Galena* in the water. Commodore Joseph Smith, the government's watchdog over the construction of all three ironclads, gradually became disillusioned with almost everything about the *Galena*. Used to dealing with a naval bureaucracy where rank and influence carried weight, Smith quickly learned that recalcitrant contractors best understood the

power of the purse. His correspondence with C. S. Bushnell & Company shows a distinct evolution during the construction process. At the beginning, Smith projected optimism about the project. As construction went on and delays started to mount, he wrote cajoling letters designed to spur the builders on. Finally, as it became apparent that the ship would not be built in time to be even close to the deadline, he turned to financial penalties, cutting off payments to subcontractors until the vessel was in the hands of the government and had completed her trials. Ironically, Smith had to pay the final sums of the contract to Bushnell & Company when the government could not meet the terms of the contract which he had tried to enforce so rigidly. The delays and bureaucratic sniping were not exclusive to the *Galena*. Both the *Monitor* and the *New Ironsides* encountered similar difficulties, and while the cases differ in specifics, the examination of the *Galena* illustrates the problems encountered by the government as it tried to mobilize and utilize Northern industry for the war effort.

Once the *Galena* was delivered to the navy and sent into combat, she proved a dismal tactical failure. Her first serious encounter with the enemy was also her last, at least as an ironclad. She could not withstand the concentrated fire of a determined opponent and became a death trap for several of her crew. However, no matter how poorly she performed in battle, she was of great strategic importance to the Union. Despite the extensive damage inflicted on her, she would not be taken off station and sent to a navy yard for repairs until almost a year after the Battle of Drewry's Bluff. There are several reasons for her strategic

importance.

First, the *Galena* gave Union forces in the James River a psychological edge. She was still an ironclad, and both the Union and Confederate forces knew it. Despite the punishment she had taken from the rebel artillerists, she was still an intimidating vessel. The Confederates could not be sure of her defensive capabilities, and ironclad technology was still new enough so that they usually erred on the side of conservatism. The duels between the *Merrimack* and the *Congress* and *Cumberland* had decisively shown that ironclads were the way of the future. Therefore, neither side actively discounted the *Galena*'s presence. She also provided a psychological boost to the Union soldiers she supported in the Peninsula Campaign. The popular press, especially in the Eastern theater, magnified the capabilities of the new technology to the point of distortion. The troops knew they had two of these ironclads (the *Galena* and the *Monitor*) to support their flanks, while the enemy had none, which must have been reassuring.

In addition to her psychological effect, the *Galena* had a proven physical impact on her theater of operations. She had been designed and built as a gunboat and was well suited to riverine operations. Her armament, six 9-inch Dahlgren smoothbores and two 100-pounder Parrott rifles, was imposing if not extremely formidable. During May and June of 1862, she provided critical fire support for General McClellan's men as they moved up the Peninsula towards Richmond. Her ability to bring her battery to bear at any point on the James River was a vital part of McClellan's campaign strategy. She could be in

position with her heavy guns far faster than an artillery battery. McClellan, always hesitant to risk his men in battle, counted on gunboat support during the early summer months to inflict damage on the enemy.

The *Galena* was more important to McClellan during the retreat back down the Peninsula. As flagship of the James River Flotilla, she covered the retreat of the army after the Seven Days. Along with other gunboats under Commander Rodgers' command, she created a safe haven for Union troops along the banks of the James River which the Confederates would not dare attack. These gunboats, providing covering fire on the army's flanks, stabilized a critical situation and allowed McClellan to regroup. The *Galena*, because of her psychological value as an ironclad, found herself stationed at the most critical points during the retreat and eventual halt.

Finally, the *Galena* was strategically important as a stop-gap measure. Even before she had finished building, the Navy Department had decided to make *Monitor*-style ironclads the focus of its construction program. However, the Department faced a delay of several months until the first of these turreted ironclads could be delivered to the navy and sent to their stations. Until they reached the fleet, the *Galena* was critically important because she was one of only three ironclads (the *New Ironsides* was delivered in September, 1862) in service on the Eastern seaboard. The navy was well aware of her limitations and tried to work around them whenever possible, but she was still among the best they had. The practical realities of the situation dominated

whatever obvious shortcomings she demonstrated. Of course, once the new monitors arrived, she was sent back to a navy yard, where her armor was stripped and she was refitted to rejoin the fleet as a wooden gunboat.

In the final analysis, the *Galena* was not important for any sterling achievements as a warship. Without a doubt she was a failure, and that is why historians have ignored her, concentrating on her more famous sisters, the *Monitor* and the *New Ironsides*. But failure does not translate into unimportance. The story of the construction and early operational history of the *Galena* provides a fresh perspective on the obstacles encountered by the Navy Department as it pondered the uses of new technology. The ironclad fleet which propelled the United States to the pinnacle of the world's navies for a short time during and immediately after the Civil War had an awkward and often forgotten beginning. The *Galena*, shortcomings aside, was an important part of that beginning.

BIBLIOGRAPHY

Primary Sources

Government Documents

U.S. Congress. House. *Annual Report of the Secretary of the Navy, 1857.* House Exec. Doc. 2, 35th Cong., 1st sess., 1857.

U.S. Congress. Senate. *Annual Report of the Secretary of the Navy, 1841.* Senate Doc. 1, 27th Cong., 2nd sess., 1841.

U.S. Congress. Senate. *Annual Report of the Secretary of the Navy, 1861.* Senate Doc. 1/13, 37th Cong., 2nd sess., 1861.

U.S. Congress. Senate. *Character, Efficiency, Fabrication, etc. of Heavy Ordnance Now in Use.* Senate Rept. 121, 38th Cong., 2nd sess., 1864-1865.

U.S. Congress. Senate. Committee on Naval Affairs. *Report of the Committee on Naval Affairs, on the Construction of Naval Vessels.* Senate Rept. 363, 35th Cong., 2nd sess., 1859.

U.S. Congress. Senate. *Letter of the Secretary of the Navy, in Answer to a Resolution of the Senate of the 18th instant, in Relation to the Contracts Made with Robert L. Stevens for the Construction of a Steam Floating Battery.* Senate Doc. 34, 37th Cong., 2nd sess., 1862.

U.S. Congress. Senate. *Letter on Heavy Guns.* Senate Misc. Doc. 47, 38th Cong., 2nd sess., 1865.

U.S. Navy Department. *Official Records of the Union and Confederate Navies in the War of the Rebellion.* 30 vols. Washington: Government Printing Office, 1894-1922.

U.S. Secretary of the Navy. *Report of the Secretary of the Navy in Relation to Armored Vessels.* Washington: Government Printing Office, 1864.

War Department. *War of the Rebellion: Official Records of the Union and Confederate Armies.* 128 Parts in 70 Volumes. Washington: Government Printing Office, 1880-1901.

Library of Congress

Washington D.C. Library of Congress. Manuscript Division. Kellogg Collection/Papers of Edward N. Kellogg.

Washington D.C. Library of Congress. Manuscript Division. Papers of the Rodgers Family/John Rodgers (1812-1882). Boxes 9, 21, 30.

Washington D.C. Library of Congress. Manuscript Division. Papers of Stuart Farrar Smith.

National Archives

Washington D.C. National Archives. Record Group 24. Log USS *Galena.* 3 vols. April 21, 1862 to May 9, 1863; February 15, 1864 to November 22, 1864; March 29, 1865 to June 17, 1865.

Washington D.C. National Archives. Record Group 45. Subject File, U.S. Navy 1775-1910, AD - Design and General Characteristics 1860-1910, Ironclads, Correspondence Relative to, Between Commodore Joseph Smith & Various Designers and Builders. 1861 to 1863. Box 51.

Washington D.C. National Archives. Record Group 71. Records of the Bureau of Yards and Docks. Entry 42. Contracts and Bonds 1861.

Washington D.C. National Archives. Record Group 71. Records of the Bureau of Yards and Docks. Entry 48. Contract Ledger for Iron Clads 1861-1862.

Periodicals

"The Action on the James River," *New York Times,* 21 May 1862, p. 1.

Holley, Alexander Lyman. "Iron-Clad Ships and Heavy Ordnance." *Atlantic Monthly* 11 (January 1863):85-94.

Holley, Alexander Lyman. "Iron-Clad War-Vessels." In *National Almanac and Annual Record for the Year 1863*. Philadelphia: George W. Childs, 1863.

"Improved Armor for War Ships." *Scientific American*, new series, 5 (2 November 1861):276-77.

"The Iron-Clad Steamer 'Galena.'" *Harper's Weekly*, 5 April 1862, p. 219.

"Manufacture of Armor Plates." *Scientific American*, new series, 6 (12 April 1862):229.

"Operations on the James River." *New York Times*, 20 May 1862, p. 1.

"The Reported Naval Repulse near Richmond – Beauties of Official Dispatches." *New York Times*, 19 May 1862, p. 4.

Miscellaneous

The Annals of the War. Philadelphia: The Times Publishing Co., 1879.

Daly, Robert W., ed. *Aboard the USS Monitor: 1862. The Letters of Acting Paymaster William Frederick Keeler, U.S. Navy to his Wife, Anna*. Annapolis: United States Naval Institute, 1964.

Drewry, Augustus H. "Drewry's Bluff Fight." *Southern Historical Society Papers* 29 (1901):284-85.

Fox, Gustavus Vasa. *Confidential Correspondence of Gustavus Vasa Fox, Assistant Secretary of the Navy, 1861-1865*. Edited by Robert Means Thompson and Richard Wainwright. 2 vols. New York: De Vinne Press, 1918-1919.

Holley, Alexander Lyman. *A Treatise on Ordnance and Armor: Embracing Descriptions, Discussions, and Professional Opinions Concerning the Material, Fabrication, Requirements, Capabilities, and Endurance of European and American Guns for Naval, Sea-Coast, and Iron-Clad Warfare. And Their Rifling, Projectiles, and Breech-Loading. Also, Results of Experiments Against Armor, From Official Records with an Appendix, Referring to Gun-Cotton, Hooped Guns, Etc., Etc.* New York: D. Van Nostrand, 1865.

Johnson, Robert U. and C. C. Buel, eds. *Battles and Leaders of the Civil War*. 4 vols. New York: Century Co., 1887-88; reprint ed., Secaucus, N.J.: Castle, 1956.

Lee, Robert E. *The Wartime Papers of R. E. Lee*. Edited by Clifford Dowdey and Louis H. Manarin. Boston: Little, Brown, 1961; reprint ed., New York: Bramhall House, 1961.

Lesley, J. P. *The Iron Manufacturer's Guide to the Furnaces, Forges and Rolling Mills of the United States with Discussions of Iron as a Chemical Element, an American Ore, and a Manufactured Article, in Commerce and in History*. New York: John Wiley, 1859.

McClellan, George Brinton. *The Civil War Papers of George B. McClellan: Selected Correspondence, 1860-1865*. Edited by Stephen W. Sears. New York: Ticknor & Fields, 1989.

Welles, Gideon. *Diary*. Edited by Howard K. Beale, assisted by Alan W. Brownsword. 3 vols. New York: Norton, 1960.

Secondary Sources

Albion, Robert Greenhalgh. *Makers of Naval Policy 1798-1947*. Annapolis: Naval Institute Press, 1980.

Allison, David K. "John A. Dahlgren: Innovator in Uniform." In *Captains of the Old Steam Navy: Makers of the American Naval Tradition 1840-1880*, pp. 26-45. Edited by James C. Bradford. Annapolis: Naval Institute Press, 1986.

Baughman, James P. *The Mallorys of Mystic: Six Generations in American Maritime Enterprise*. Middletown, Conn.: Wesleyan University Press, 1972.

Baxter, James Phinney. *The Introduction of the Ironclad Warship*. Cambridge: Harvard University Press, 1933; reprint ed., Hamden, Conn.: Archon Books, 1968.

Bennett, Frank M. *The Steam Navy of the United States. A History of the Growth of the Steam Vessel of War in the U.S. Navy, and of the Naval Engineer Corps*. Pittsburgh: Warren, 1896; reprint ed., Westport, Conn.: Greenwood Press, 1972.

Bishop, J. Leander. *A History of American Manufactures From 1608 to 1860*. 3rd ed. 3 vols. Philadelphia: Edward Young & Co., 1868; reprint ed., New York: Augustus M. Kelley, 1966.

Boynton, Charles B. *The History of the Navy During the Rebellion*. New York: D. Appleton and Company, 1867.

Church, William Conant. *The Life of John Ericsson*. 2 vols. New York: Charles Scribner's Sons, 1911.

Davis, William C. *Duel Between the First Ironclads*. New York: Doubleday, 1975; reprint ed., Baton Rouge: Louisiana State University Press, 1981.

Dictionary of American Biography. 20 vols. New York: Charles Scribner's Sons, 1928-1936.

Fisher, Douglas Alan. *The Epic of Steel*. New York: Harper and Row, 1963.

Gibbons, Tony. *Warships and Naval Battles of the Civil War*. New York: Gallery Books, 1989.

Johnson, Robert Erwin. *Rear Admiral John Rodgers 1812-1882*. Annapolis: United States Naval Institute, 1967.

Kemp, Peter, ed. *The Oxford Companion to Ships and the Sea*. New York: Oxford University Press, 1964.

Long, Everette Beach. *The Civil War Day by Day: An Almanac 1861-1865*. Garden City, N.Y.: Doubleday, 1971; reprint ed., New York: Da Capo Press, 1985.

McPherson, James M. *Battle Cry of Freedom: The Civil War Era*. New York: Oxford University Press, 1988.

Milligan, John D. *Gunboats Down the Mississippi*. Annapolis, Maryland: United States Naval Institute, 1965.

Niven, John. *Gideon Welles: Lincoln's Secretary of the Navy*. New York: Oxford University Press, 1973.

Paskoff, Paul F. *Industrial Evolution: Organization, Structure, and Growth of the Pennsylvania Iron Industry, 1750-1860*. Baltimore: The Johns Hopkins University Press, 1983.

Paskoff, Paul F., ed. *Iron and Steel in the Nineteenth Century*. New York: Facts on File, 1989.

Porter, Glenn, and Livesay, Harold C. *Merchants and Manufacturers: Studies in the Changing Structure of Nineteenth-Century Marketing*. Baltimore: The Johns Hopkins University Press, 1971; reprint ed., Chicago: Elephant Paperbacks, 1989.

Sears, Stephen W. *George B. McClellan: The Young Napoleon*. New York: Ticknor & Fields, 1988.

Thurston, Robert H. *A History of the Growth of the Steam-Engine*. London: K. Paul, Trench, 1883; reprint ed., Ithaca, N.Y.: Cornell University Press, 1939.

U.S. Naval History Division. *Dictionary of American Naval Fighting Ships*. 8 vols. Washington: Government Printing Office, 1959-1981.

Warren, Kenneth. *The American Steel Industry 1850-1970: A Geographical Interpretation*. Oxford: Clarendon Press, 1973.

West, Richard S., Jr. *Mr. Lincoln's Navy*. New York: Longmans, Green and Company, 1957.

Williamson, Harold F., ed. *The Growth of the American Economy: An Introduction to the Economic History of the United States*. New York: Prentice-Hall, Inc., 1944.

Periodicals

Allard, Dean C. "Naval Technology During the American Civil War." *The American Neptune* 49 (Spring 1989):114-22.

Hayes, John D. "Ships Versus Forts." *Civil War Times* 3 (May 1961):4-6, 24.

Hess, Earl J. "Northern Response to the Ironclad: A Prospect for the Study of Military Technology." *Civil War History* 31 (June 1985):126-43.

Long, John S. "The Gosport Affair." *Journal of Southern History* 23 (May 1957):155-72.

Milligan, John D. "From Theory to Application: The Emergence of the American Ironclad War Vessel." *Military Affairs* 48 (July 1984):126-32.

Roberts, William H. "The Neglected Ironclad: A Design and Constructional Analysis of the USS New Ironsides." *Warship International* 26 (No.2, 1989):109-134.

Robinson, William M., Jr. "Drewry's Bluff: Naval Defense of Richmond, 1862." *Civil War History* 7 (June 1961):167-75.

Still, William N. "Monitor Builders: A Historical Study of the Principal Firms and Individuals Involved in the Construction of USS Monitor." *The American Neptune* 48 (Spring 1988):106-29.

APPENDIX A

BILLS PAID TOWARDS THE STEVENS WAR STEAMER

First appropriation of $250,000:

Date Approved	Amount
January 5, 1845	11,282.99
August 22, 1845	19,760.67
February 13, 1848	2,361.20
February 13, 1849	249.56
February 13, 1849	5,061.84
February 13, 1849	6,052.95
February 13, 1849	18,694.46
July 25, 1849	12,225.37
April 6, 1853	9,614.59
April 6, 1853	12,954.08
March 3, 1854	8,258.03
March 3, 1854	6,618.97
September 20, 1854	36,012.30
September 20, 1854	38,511.81
October 18, 1854	58,876.88

Second appropriation of $250,000:

Date Approved	Amount
March 19, 1855	20,776.79
March 19, 1855	68,920.82
April 11, 1855	12,131.81
May 22, 1855	15,448.36
July 17, 1855	50,603.43
August 30, 1855	45,943.45
September 13, 1855	32,533.00
December 14, 1855	7,106.64

APPENDIX B

An act to provide for the construction of one or more armored ships and floating batteries, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Secretary of the Navy be, and is hereby authorized and directed to appoint a board of three skilful naval officers to investigate the plans and specifications that may be submitted for the construction or completing of iron or steel-clad steamships or steam batteries, and, on their report, should it be favorable, the Secretary of the Navy will cause one or more armored or iron and steel-clad steamships or floating steam batteries to be built; and there is hereby appropriated, out of any money in the treasury not otherwise appropriated, the sum of one million five hundred thousand dollars.

SEC. 2. *And be it further enacted*, That in case of a vacancy in the office of engineer-in-chief of the navy the appointment thereto shall be made from the list of chief engineers.

APPENDIX C

REPORT ON IRON CLAD VESSELS

NAVY DEPARTMENT,
Bureau of Yards and Docks September 16, 1861

SIR: The undersigned, constituting a board appointed by your order of the 8th ultimo, proceeded to the duty assigned to them, in accordance with the first section of an act of Congress, approved 3d of August 1861, directing the Secretary of the Navy "to appoint a board of three skilful naval officers to investigate the plans and specifications that may be submitted for the constuction or completing of iron-clad or steel clad steamships or floating steam batteries to be built; and there is hereby apporpriated, the sum of one million five hundred thousand dollars."

Distrustful of our ability to discharge this duty, which the law requires should be performed by three skilful naval officers, we approach the subject with diffidence, having no experience and but scanty knowledge in this branch of naval architecture.

The plans submitted are so various, and in many respects so entirely dissimilar, that without a more thorough knowledge of this mode of construction and the resisting properties of iron than we possess, it is very likely that some of our conclusions may prove erroneous.

Application was made to the Department for a naval constructor, to be placed under our orders, with whom we might consult; but it

appears that they are all so employed on important service that none could be assigned to this duty.

The construction of iron clad steamships of war is now zealously claiming the attention of foreign naval powers. France led; England followed, and is now somewhat extensively engaged in the system; and other powers seem to emulate their example, though on a smaller scale.

Opinions differ amongst naval and scientific men as to the policy of adopting the iron armature for ships-of-war. For coast and harbor defence they are undoubtedly formidable adjuncts to fortifications on land. As cruising vessels, however, we are skeptical as to their advantage and ultimate adoption. But whilst other nations are endeavoring to perfect them, we must not remain idle.

The enormous load of iron, as so much additional weight to the vessel; the great breadth of beam necessary to give her stability; the short supply of coal she will be able to stow in bunkers; the greater power required to propel her; and the largely increased cost of construction, are objections to this class of vessels as cruisers, which we believe is difficult successfully to overcome. For river and harbor service we consider iron-clad vessels of light draught, or floating batteries thus shielded, as very important; and we feel at this moment the necessity of them on some of our rivers and inlets to enforce obedience to the laws. We however do not hesistate to express the opinion, notwithstanding all we have heard or seen written on the subject, that no ship or floating battery, however heavily she may be plated, can cope with a properly constructed fortification of masonry. The one is fixed and immovable

and though constructed of a material which may be shattered by shot, can be covered if need be, by the same or much heavier armor than a floating vessel can bear, whilst the other is subject to disturbances by winds and waves, and to the powerful effects of tides and currents.

Armored ships or batteries may be employed advantageously to pass fortifications on land for ulterior objects of attack, to run a blockade, or to reduce temporary batteries on the shores of rivers and the approaches to our harbors.

From what we know of the comparative advantages and disadvantages of ships constructed of wood over those of iron, we are clearly of opinion that no iron-clad vessel of equal displacement can be made to obtain the same speed as one not thus encumbered, because her form would be better adapted to speed. Her form and dimensions, the unyielding nature of the shield, detract materially in a heavy sea from the life, bouyancy and spring which a ship built of wood possesses.

Wooden ships may be said to be but coffins for their crews when brought into conflict with iron-clad vessels; but the speed of the former, we take for granted, being greater than that of the latter, they can readily choose their position and keep out of harm's way entirely.

Recent improvements in the form and preparations of projectiles, and their increased capacity for destruction, have elicited a large amount of ingenuity and skill to devise means for resisting them in the construction of ships-of-war. As yet we know of nothing superior to the large and heavy spherical shot in its destructive effects on vessels, whether plated or not.

Rifled guns have greater range, but the conical shot does not produce the *crushing* effect of spherical shot.

It is assumed that $4\frac{1}{2}$ - inch plates are the heaviest armor a sea-going vessel can safely carry. These plates should be of tough iron, and rolled in large, long pieces. This thickness of armor, it is believed, will resist all projectiles now in general use at a distance of 500 yards, especially if the ship's sides are angular.

Plates hammered in large masses are less fibrous and tough when rolled. The question whether wooden backing, or any elastic substance behind the iron plating will tend to relieve at all the frame of the ships from the crushing effect of a heavy projectile, is not yet decided. Major Barnard says, "to put an elastic material behind the iron is to insure its destruction." With all deference to such creditable authority, we may suggest that it is possible a backing of some elastic substance (soft wood, perhaps, is the best) might relieve the frame of the ship somewhat from the terrible shock of a heavy projectile, though the plate should not be fractured.

With respect to a comparison between ships of iron and those of wood, without plating, high authorities in England differ as to which is the best. The tops of ships built of iron, we are told, wear out three bottoms; whilst the bottoms of those built of wood will outwear three tops. In deciding upon the relative merits of iron and wooden-framed vessels, for each of which we have offers, the board is of the opinion that it would be well to try a specimen of each, as both have distinguished advocates. One strong objection to iron vessels, which, so far as we know, has not

yet been overcome, is the oxidation or rust in salt water, and their liability of becoming foul under water by the attachment of sea grass and animaleules to their bottoms. The best preventive we know of is a coating of pure zinc paint, which, so long as it lasts, is believed to be an antidote to this cause of evil.

After these brief remarks on the subject generally, we proceed to notice the plans and offers referred to us for the construction of plated vessels and floating batteries.

It has been suggested that the most ready mode of obtaining an iron-clad ship-of-war would be to contract with responsible parties in England for its complete construction; and we are assured that parties there are ready to engage in such an enterprise on terms more reasonable, perhaps, than such vessels could be built in this country, having much greater experience and facilities than we possess. Indeed, we are informed there are no mills and machinery in this country capable of rolling iron $4\frac{1}{2}$ inches thick, though plates might be hammered to that thickness in many of our workshops. As before observed, rolled iron is considered much the best, and the difficulty of rolling it increases rapidly with the thickness. It has, however, occurred to us that a difficulty might arise with the British government in case we should undertake to construct ships-of-war in that country, which might complicate their delivery; and, moreover, we are of the opinion that every people or nation who can maintain a navy should be capable of constructing it themselves.

Our immediate demands seem to require, first, so far as

practicable, vessels invulnerable to shot, of light draught of water, to penetrate our shoal harbors, rivers, and bayous. We, therfore, favor the construction of this class of vessels before going into the more perfect system of large iron-clad sea-going vessels of war. We are here met with the difficulty of encumbering small vessels with armor, which, from their size, there are unable to bear. We, nevertheless, recommend that contracts be made with responsible parties for the construction of one or more iron-clad vessels or batteries of as light a draught of water as practicable consistent with their weight of armor. Meanwhile, availing of the experience thus obtained, and the improvements which we believe are yet to be made by other naval powers in building iron-clad ships, we would advise the construction, in our own dock-yards, of one or more of these vessels upon a large and more perfect scale, when Congress shall see fit to authorize it. The amount now appropriated is not sufficient to built both classes of vessels to any great extent.

We have made a synopsis of the propositions and specifications submitted, which we annex, and now proceed to state, in brief, the result of our decisions upon the offers presented to us.

J. Ericsson, New York, page 19. – This plan of a floating battery is novel, but seems to be based upon a plan which will render the battery shot and shell proof. We are somewhat apprehensive that her properties for sea are not such as a sea-going vessel should possess. But she may be moved from one place to another on the coast in smooth water. We recommend that an experiment be made with one battery of this

description on the terms proposed, with a guarantee and forfeiture in case of failure in any of the properties and points of the vessel as proposed.

Price: $275,000; length of vessel, 172 feet; breadth of beam, 41 feet; depth of hold, 11 $\frac{1}{2}$ feet; time, 100 days; draught of water, 10 feet, displacement, 1,255 tons; speed per hour, nine statute miles.

John W. Nystrom, Philadelphia, 1216 *Chestnut Stree, page* 1. – The plan of (quadruple) guns is not known, and cannot be considered. The dimensions would not float the vessel without the guards, which we are not satisfied would repel shot. We do not recommend the plan.

Price, about $175,000; length of vessel, 175 feet; breadth of beam, 27 feet; depth of hold, 13 feet; time, four months; draught of water, 10 feet; displacement, 875 tons; speed per hour, 12 knots.

William Perine, New York, 2777 *post office box*, presents three plans. The specifications and drawings are not full. The last proposal (No. 3, page 2) for the heavy plating is the only one we have considered, but there is neither drawing nor model, and the capacity of the vessel, we think, will not bear the armor and armament proposed.

Price, $621,000; length of vessel, 225 feet; breadth of beam, 45 $\frac{1}{2}$ feet; depth of hold, 15 $\frac{1}{3}$ feet; time, 9 months; draught of water, 13 feet; displacement, 2,454 tons; speed per hour, 10 knots.

John C. Le Ferre, Boston, page 9. – Description deficient. Not

recommended. Sent a model, but neither price, time, nor dimensions stated.

E. S. Renwick, New York, 335 *Broadway*, presents drawings, specification, and model of an iron-clad vessel of large capacity and powerful engines, with great speed, capable of carrying a heavy battery, and stated to be shotproof and a good sea-boat. The form and manner of construction and proportions of this vessel are novel, and will attract the attention of scientific and practical men. She is of very light draught of water, and on the question of whether she will prove to be a safe and comfortable sea-boat we do not express a decided opinion. Vessels of somewhat similar form, in that part of the vessel which is immersed, of light draught of water on our western lakes,have, we believe, proved entirely satisfactory in all weathers. To counteract the effect of the waves, when disturbed by the winds, by producing a jerk, or sudden rolling motion of flat, shoal vessels, it is proposed to carry a sufficient weight above the center of gravity to counterpoise the heavy weight below, which is done in this ship by the immense iron armor. If, after a full discussion and examination by experts of this plan, it should be decided that she is a safe vessel for sea service, we would recommend the construction upon it of one ship at one of our dock yards.

The estimate cost of this ship, $1,500,000 precludes action upon the plan until further appropriations shall be made by Congress for such objects.

Time not stated; length of vessel, 400 feet; breadth of beam, 60 feet,

depth of hold, 33 feet; draught of water, 16 feet; displacement, 6,520 tons; speed per hour, at least 18 miles.

Whitney & Rowland, Brooklyn, Greenpoint, page 13, propose an iron gunboat, armor of bars of iron and thin plate over it. *No price* stated. Dimensions of vessel, we think, will not bear the weight and possess stability. Time, 5 months. Not recommended.

Length of vessel, 140 feet; breadth of beam, 28 feet; depth of hold, $13\frac{1}{2}$ feet; draught of water, 8 feet.

Donald McKay, Boston, page 16. – Vessel, in general dimensions and armor, approved. The speed estimated slow. The cost precludes the consideration of construction by the board.

Price, $1,000,000; length of vessel, 227 feet; breadth of beam, 50 feet; depth of hold, $26\frac{1}{2}$ feet; time, 9 to 10 months; draught of water, 14 feet; displacement, 3,100 tons; speed per hour, 6 to 7 knots.

William H. Wood, Jersey City, N.J., page 14. – Dimensions will not float the guns high enough; not recommended.

Price, $255,000; length of vessel, 160 feet; breadth of beam, 34 feet; depth of hold, 22 feet; time, 4 months; draught of water, 13 feet; displacement, 1,215 tons; speed, not stated.

Merrick & Sons, Philadelphia, pages 7 and 8. – Vessel of wood and iron combined. This proposition we consider the most practicable

one for heavy armor. We recommend that a contract be made with that party, under a guarantee, with forfeiture in case of failure to comply with the specifications; and that the contract require the plates to be 15 feet long and 36 inches wide, with a reservation of some modifications, which may occur as the work progresses, not to affect the cost.

Price, $780,000; length of vessel, 220 feet; breadth of beam, 60 feet; depth of hold, 23 feet; time, 9 months; draught of water, 13 feet; displacement, 3,296 tons; speed per hour, 9 $\frac{1}{2}$ knots.

Benjamin Rathburn, ———, page 20. – We do not recommend the plan for adoption.

Price not stated; length of vessel not stated; breadth of beam, 80 feet; depth of hold, 74 feet; time not stated; draught of water, 25 feet; displacement, 15,000 tons; speed, not stated. Specification incomplete.

Henry R. Dunham, New York, page 11. – Vessel too costly for the appropriation; no drawings or specifications; not recommended.

Price, $1,200,000; length of vessel, 325 feet; breadth of beam, 60 feet; depth of hold not stated; time, 15 to 18 months; draught of water, 16 feet; displacement not stated; speed per hour, 12 miles.

C. S. Bushnell & Co., New Haven, Conn., page 121, propose a vessel to be iron-clad, on the rail and plate principal, and to obtain high speed. The objection to this vessel is the fear that she will not float her armor and load sufficiently high, and have stability enough for a sea

vessel. With a guarantee that she shall do these, we recommend on that basis a contract.

Price, $235,000; length of vessel, 180 feet; breadth of beam, – feet; depth of hold, $12\frac{2}{3}$ feet; time, 4 months; draught of water, 10 feet; displacement, – tons; speed per hour, 12 knots.

John Westwood, Cincinnati, Ohio, page 17. – Vessel of wood, with iron armor; plan good enough, but the breadth not enough to bear the armor. No detailed specification; *no price or time* stated; only a general drawing. Not recommended.

Neafie & Levy, Philadelphia, page 5. – No plans or drawings, therefore not considered. Neither *price nor time* stated.

Length of vessel, 200 feet; breadth of beam, 10 feet; depth of hold, 15 feet; draught of water, 13 feet; displacement, 1,718 tons; speed per hour, 10 knots.

Wm. Norris, New York, 26 *Cedar street, page* 6. – Iron boat without armor. Too small, and not received.

Price, $32,000; length of vessel, 83 feet; breadth of beam, 25 feet; depth of hold, 14 feet; time, 60 to 75 days; draught of water, 3 feet; displacement, 90 tons; speed not stated.

Wm. Kingsley, Washington, D. C., page 10, proposes a *rubber-clad* vessel, which we cannot recommend. No price or dimension

stated.

A. Beebe, New York, 82 Broadway, page 18. – Specification and sketch defective. Plan not approved.

Price, $50,000; length of vessel, 120 feet; breadth of beam, 55 feet; depth not stated; time, 100 days; draught of water, 6 feet; displacement, 1,000 tons; speed per hour, 8 knots.

These three propositions recommended, viz: Bushnell & Co., New Haven, Connecticut; Merrick & Sons, Philadelphia, and J. Ericsson, New York, will absorb $1,290,250 of the appropriation of $1,500,000, leaving $209,750 yet unexpended.

The board recommends that armor with heavy guns be placed on one of our river craft, or, if none will bear it, to construct a scow, which will answer to plate and shield the guns, for the river service on the Potomac, to be constructed or prepared by the government at the navy yard here for immediate use.

We would further recommend that the department ask of Congress, at its next session, an appropriation, for experimenting on iron plates of different kinds, of $10,000.

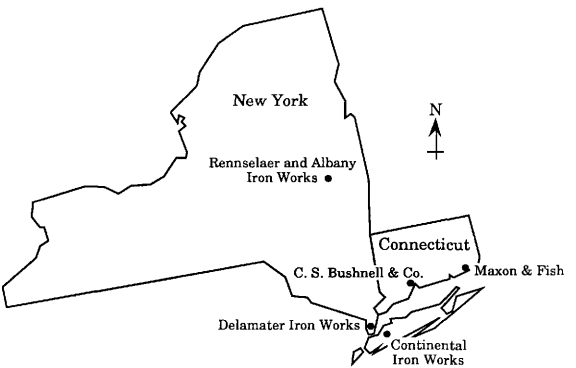
All of which is respectfully submitted.

JOSEPH SMITH.
H. PAULDING.
C. H. DAVIS

Hon. Gideon Welles
Secretary of the Navy.

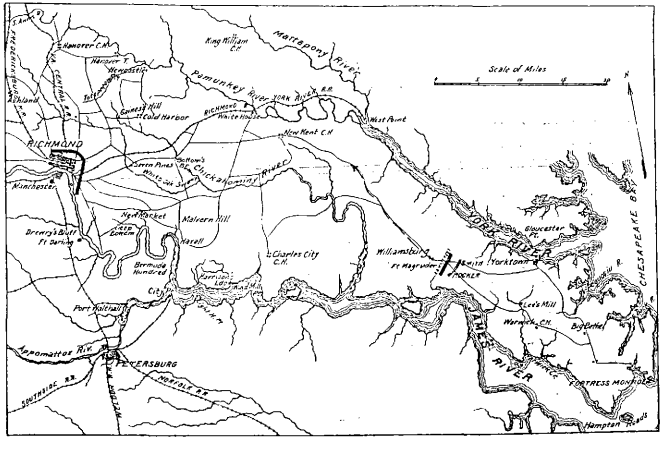
APPENDIX D

GEOGRAPHIC LOCATION OF THE *GALENA*'S SUBCONTRACTORS



APPENDIX E

THE VIRGINIA PENINSULA



VITA

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