THE BATTLE OF HAMPTON ROADS: A REVOLUTION IN MILITARY AFFAIRS

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ALAN J. DEOGRACIAS II, MAJOR, USA
B.A., Louisiana State University, Baton Rouge, Louisiana, 1990

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THESIS APPROVAL PAGE

Name of Candidate: Major Alan J. Deogracias II

Thesis Title: The Battle of Hampton Roads: A Revolution in Military Affairs

Approved by:

_____, Thesis Committee Chairman
LTC Mark T. Gerges, M.A.

_____, Member
William G. Robertson, Ph.D.

Accepted this 6th day of June 2003 by:

_____, Director, Graduate Degree Programs
Philip J. Brookes, Ph.D.

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ABSTRACT

THE BATTLE OF HAMPTON ROADS: A REVOLUTION IN MILITARY AFFAIRS, Major Alan J. Deogracias II, 82 pages.

This thesis examines the Battle of Hampton Roads, 8 and 9 March 1862, the first battle of ironclads, to determine if it was a Revolution in Military Affairs. This study is an analysis of naval developments prior to March 1862, the battle, and the impact the battle had on the U.S. Navy and the Royal Navy from 1862 to 1871. The battle signaled the end of the wooden warship era when the CSS *Virginia* destroyed two wooden warships on 8 March 1862. The USS *Monitor* influenced a change in naval design, which led the U.S. Navy and the Royal Navy to build turreted warships, which culminated in the launching of the first modern battleship in 1871. The transformation from sailing and steam ships with broadside armament to steam-powered turret ships led to a reduction in the size of the crews and the acceptance of engineers into the naval community. The battle led both navies to assign ironclads to their squadrons to counter ironclads of hostile nations. The battle influenced the development of tactics for fighting ironclads including ramming and coastal warfare. The Battle of Hampton Roads was a Revolution in Military Affairs and the onset of modern naval warfare.

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CHAPTER 1

INTRODUCTION

The Battle of Hampton Roads is the most famous naval battle in history of the United States Civil War. On 8 March 1862 the Confederate ironclad ram, CSS *Virginia* destroyed two wooden battleships, which signified the end of the wooden warship era. The next day a turreted ironclad ship, USS *Monitor* fought the *Virginia* to a draw proclaiming the only way to stop an ironclad was with another ironclad. Winston Churchill states in his book *The Great Democracies*, "The *Merrimac* [*Virginia*] had made the naval revolution, but the *Monitor* one day later was a whole lap ahead of her."[1] The battle symbolized a major change in naval design, organization, and tactics and had a great impact on the navies of the world.

This thesis seeks to determine if the battle of Hampton Roads was a Revolution in Military Affairs. The central question is whether the Battle of Hampton Roads was truly a Revolution in Military Affairs or merely an evolution of modern naval warfare? Subordinate questions that are related are what is the definition of a Revolution in Military Affairs? Second, what was the impact of the battle on naval organization? Third, what was the impact on naval shipbuilding? Lastly, what was the impact of the battle on naval tactics? To answer these questions this study will examine what impact the battle had on the United States Navy and the British Royal Navy from 1862 to 1871.

The thesis will be divided into five areas. First, it will define a Revolution in Military Affairs and discuss naval developments prior to the Battle of Hampton Roads. Second, this study will provide a general description of the CSS *Virginia*, the USS *Monitor*, and discuss the Battle of Hampton Roads. Third, it will examine the United

States Navy prior to the battle and then show what changes were made to fleet organization, ship construction, and tactics after the battle from 1862-1871. Fourth, it will discuss the British Royal Navy prior to the Battle of Hampton Roads and what changes were implemented after the battle. Lastly, this thesis will summarize the findings from the previous chapters, draw conclusions, and determine if the Battle of Hampton Roads and its famous warships were a Revolution in Military Affairs or an evolution of a naval warfare.

The first step in determining if the Battle of Hampton Roads was in fact revolutionary is to understand what a Revolution in Military Affairs is. A Revolution in Military Affairs as defined by the United States Department of Defense, Office of Net Assessment is:

> Military revolutions are major discontinuities in military affairs. They are brought about by changes in military relevant technologies, concepts of operation, methods of organization, and/or resources available, and are often associated with broader political, social, economic, and scientific revolutions. These periods of discontinuous change have historically advantaged the strategic/operational offense, and have provided a powerful impetus for change in the international system. They occur relatively abruptly--most typically over two-to-three decades. They render obsolete or subordinate existing means for conducting war.[2]

Prior to the Battle of Hampton Roads there were several Revolutions in Military Affairs that are generally agreed upon by military historians: the gunpowder/artillery revolution 1560-1660, social revolution epitomized by the French levée en masse in 1793, and the steam engine/railroad/telegraph revolution of the 1800s, subordinate parts of the greater industrial revolution. All of these Revolutions in Military Affairs brought about major changes in warfare. This thesis will determine if the Battle of Hampton Roads, and the ironclad warships involved meet the criteria of a Revolution in Military

Affairs or was just another technological evolution in a larger naval warfare revolution that occurred over the late nineteenth century.

In order to determine the impact the Battle of Hampton Roads had on naval warfare it is important to understand the naval developments that had occurred prior to the historic battle. The battle was the first battle of ironclad ships but not the battle of the first ironclads, as is often erroneously taught in American History. In fact, both France and Great Britain possessed ironclad ships prior to the battle. To better understand the significance of Hampton Roads requires a review of the naval innovations developed between 1815 to 1871. The fielding of the steam engine, shell gun, screw propeller, iron-hull, and armor plate set the stage for the Battle of Hampton Roads and the impact it had on naval development in its aftermath.

Most naval historians consider the steam engine the greatest revolution in naval warfare. It changed naval warfare as it negated the importance of the wind for ships in battle. Equally important it led to a change in naval logistics, as ships became dependent on coaling stations and engineers to operate. The United States invented the first steam driven warship in 1814, Robert Fulton's USS *Demologos.* She was a catamaran hull, powered by a steam engine that turned a central mounted water wheel and was fully rigged for sail. She had a speed of six knots under steam and was armed with twenty 24-pound cannons. The ship was not completed before the end of the War of 1812, but tests showed that her ability to out maneuver sailing vessels and her powerful armament would enable her to easily defeat the British sailing frigates she was designed to engage. After the war, the *Demologos* or *Fulton* was assigned as a receiving ship in Brooklyn Navy Yard until a mysterious explosion in 1829 destroyed her.[3]

The United States Navy did not develop another steam driven ship until 1836. The Secretary of the Navy and other senior leaders were reluctant to adopt steam, despite the fact that U.S. commercial shipping had embraced the concept and there were hundreds of merchant steamers in American waters. Their reluctance was due in part to the unreliability of steam engines at the time and the inability of ships to carry enough coal for long voyages.

In 1836 the U.S. Navy built its second steam warship the USS *Fulton II*. She was a side paddle wheel steamship and had a top speed of fifteen knots under steam. The *Fulton II* performance in test trails convinced the U.S. Navy of the merits of steam propulsion and several paddlewheel ships were ordered for construction. During the 1840s the U.S. Navy built two ocean going paddlewheel frigates, the USS *Missouri* and the USS *Mississippi*. These frigates were large vessels that were used to protect U.S. merchant ships overseas. These vessels were extremely large, over 220 feet long, and were armed with two 10-inch guns and 8-inch guns. Other paddlewheel warships were built and served effectively in various roles in both the Mexican War and the Civil War but the paddlewheel design was viewed dead end in naval design. The side paddlewheel, which was the preferred configuration for sea-going ships, limited the amount of guns that could be mounted on the broadsides and it was vulnerable to enemy fire. Additionally, the machinery cluttered the deck, restricted the fields of fire, and slowed the ship when under sail. The transition to the screw propeller in the 1840s quickly led to its demise. The U.S. Navy built its last paddlewheel warship in 1863.[4]

While the U.S. Navy invented the steam engine and produced only a few steam-powered ships, the strategy of the Royal Navy from 1815 to 1871 was to not invent new

naval technology and design, but to improve on the inventions of others. This period involved no major combat for the Royal Navy and the naval policy was to have enough powerful ships to deter war. Seven years after the United States Navy launched USS *Demologos*, the Royal Navy commissioned HMS *Comet*, a steam tugboat in 1821. She was a side paddlewheel ship, had a top speed of five knots and an armament of four 9-pound cannons.[5] The Admiralty was skeptical that steam propulsion could be used for warships and limited its use to a combat support role, because of the inefficiency of the engines and the large amount of coal they consumed.

> The Board deem it unnecessary to enter at present into consideration of the question as to how far the power of the steam engine may be applicable to the purposes of navigation: but . . . it would be attended with material advantages to his Majesty's service, if it could be used for the purpose of towing ships of war out of harbor.[6]

The Royal Navy, because of its worldwide commitments, maintained a sailing battlefleet from 1815 to 1850 while experimenting and testing to improve steam propulsion. The first major development of these experiments was the use of the paddlewheel.

Great Britain's paddlewheel program was fueled by its rivalry with France and fears of cross Channel invasions by a French force ferried by paddlewheel steamers. From 1830 until 1852 the Royal Navy built paddlewheel steamers to maintain its advantage over the French Navy. The Royal Navy, for the most part, viewed paddlewheels as a transitional form of propulsion, and regulated its use to tug boats and mail carriers, though some warships were built. The limitations to the paddlewheel were that it was vulnerable to cannon fire, it limited the amount of weapons along the broadsides, and reduced the speed of the ship when under sail.

Therefore, they were restricted to limited operations and did not serve in the battlefleet. Used mostly in a support role, paddlewheel ships saw service during the Crimean War, 1854 to 1856, employed to bombard shore batteries and to move sailing ships of the line. The Royal Navy built over fifty paddlewheel ships with the last one commissioned in 1852. Despite its limitations, the paddlewheel served well and proved the tactical value of a ship that could operate independent of the wind. They also foretold the end of the pure sailing ship as the paddlewheels were often used to tow sailing ships into combat. Though paddlewheel ships were rendered obsolete by the invention of the screw propeller, they continued to serve the United States Navy and the Royal Navy into the early twentieth century in various support roles.[7]

In 1836 two inventors living in England, John Ericsson and Francis Petit Smith invented the first successful screw propellers without knowledge of each other's work. Smith patented his invention in England, but it was Ericsson who conducted a successful demonstration of this new method of propulsion. The screw propeller, because of its location in the stern and under the waterline, solved the problems of the paddlewheel ships. The broadsides were no longer obstructed, so more cannons could be added to the armament and the propeller and the engine were protected from enemy fire because they were below the waterline. Additionally, the screw could be disconnected and raised when the ship was under sail, which eliminated the drag of the immovable paddlewheels. This innovation was the most important feature, since sail was still the primary means of propulsion in the 1840s.

In April 1837 Ericsson's steamship the *Francis B. Ogden,* towed the Admiralty's barge down the Thames River at a speed of ten knots. The trip was flawless, but the

Admiralty thought a ship could not be easily steered if the propulsion was in the stern and deemed the test a failure. Captain John Stockton, United States Navy, impressed with the experiment convinced Ericsson to immigrate to the United States were his work would be appreciated. In 1843 Ericsson and Stockton built the first steam screw propelled warship, USS *Princeton.*[8]

The *Princeton* was a sleek ship 164 feet long, thirty feet wide, fully rigged for sail and her top speed under steam was thirteen knots. She was the fastest steam ship in the world at that time. She was also the most modern ship of her time and had several new innovations to include blowers to force a draft in the furnace of her engines, engines that burned smokeless coal, telescopic smoke pipes, and two large wrought iron cannons, named the *Peacemaker* and the *Oregon,* that fired 225-pound cannon balls. Unfortunately, on a voyage in 1844 one of her cannons exploded during an exhibition and killed the Secretary of State, the Secretary of the Navy, and several bystanders.[9] Captain Stockton unjustly blamed Ericsson for the mishap, which soured relations between the inventor and the Navy. In 1861, the Navy and Ericsson's mutual distrust for each other would surface again during the submission of Ericsson's design for an ironclad ship.

Despite the accident, the *Princeton* was a success and served with distinction during the Mexican War, thus prompting the Navy to build more steam warships with screw propulsion. The Navy built several new wooden battleships in the 1850s to include the large steam frigates USS *Merrimac,* USS *Minnesota,* and USS *Roanoke.* Built in the American tradition of the USS *Constitution,* these warships were of greater size and armament than frigates of other navies. The *Merrimac* was 256 feet long, fifty-one feet

wide, her armament included twenty-four 9-inch cannons, with fourteen 8-inch and two 10-inch cannons mounted along her broadsides. While impressive, it was observed that the *Merrimac* was only a large sailing ship and her engines were underpowered to drive her at combat speed for any length of time. This problem would continue to plague this class of ships, which is why the *Merrimac* was in Gosport Navy Yard having her engines upgraded when the Confederates seized the navy yard in April 1861.[10]

Simultaneous to the American transition to the screw propeller, the Royal Navy was finally sold on its merits. In 1839 Francis Petit Smith conducted several demonstrations on rivers and at sea with the screw-propelled steamer *Archimedes* to convince the Admiralty of the value of screw propulsion. The clearing of the broadsides and deck of machinery and the speeds achieved with the screw propeller validated the value of this new method of propulsion. The Admiralty ordered the construction of HMS *Rattler* in 1842 and she was completed a year later becoming Great Britain's first screw powered warship. In 1845 HMS *Rattler* and the paddlewheel ship *Alecto* conducted a series of races and a tug of war, which HMS *Rattler* won quite convincingly, proving the screw propeller to be superior to the paddlewheel.[11]

The Admiralty ordered the building of new steam warships and the conversion of numerous paddlewheelers and sailing ships. As with the building of paddlewheels and sailing ships the main focus was to stay ahead of rivals, particularly France. About the same time HMS *Rattler* was built the French Navy launched *Napoleon*, and the United States commissioned the USS *Princeton*.[12] The Admiralty approved the full production of steam frigates and ships of the line with screw propulsion. Beside the British need to maintain the premiere navy in the world, the French invasion scare of the 1840s and

1850s fueled the British steam warship program.[13] While the general consensus was that steam vessels could not operate at sea without sails, it was also believed that French warships could cross the Channel under steam and reach the coast before the powerful sailing battlefleet could react. The British Prime Minister, Lord Palmerson observed, "Steam has bridged the Channel."[14]

The French Navy in 1848 built the world's first steamship of the line, *Napoleon*. She was a large ship, 234 feet long with two gun decks and an armament of ninety guns. The building of *Napoleon* set off an arms race between the two countries that spanned the 1850s. The Royal Navy launched HMS *Agamemnon*, which was equal in size and strength to *Napoleon* with an armament of two gun decks with ninety-one cannons. The building of *Agamemnon* signaled the Royal Navy's transition from a wooden sailing battlefleet to a wooden steam battlefleet.

The Royal Navy built twenty-six steamships of the line and converted fifty sailing ships to steamships of the line. The largest of these ships was HMS *Duke of Wellington*, converted in 1852. She had three gun decks and 131 cannons. Great Britain and France were the only countries in the nineteenth century that built wooden steamships of the line. Smaller navies, namely the U.S. Navy, built steam frigates. The Royal Navy also built twenty-eight steam frigates from 1840 to 1860. Their primary missions were to protect merchant shipping and intercept illegal slave traders and pirates. After the United States launched its five large frigates of the *Merrimac* class the Royal Navy, always striving to maintain its supremacy, built the *Mersey* and *Orlando*. These two ships were the largest wooden frigates built at 336 feet long, with forty guns and a top speed of thirteen knots under steam.[15]

Throughout this period the Admiralty enforced a sail-first policy for the fleet. British steam warships were sailing ships with auxiliary steam engines because of the inefficiency of steam engines at that time and the requirement for the Royal Navy to conduct operations on the open seas. Andrew Lambert states in his book *Battleships in Transition*, "British ships were designed to balance the tactical value of steam with the strategic requirement for long distance cruising under sail."[16] The steam battleship's only combat service was a limited role during the Crimean War. Like the paddlewheelers it was used to for coastal bombardment and towing sailing ships of the line. The towing of sailing ships in order to get them in battle was a clear signal that the age of sail was ending.

The screw propeller also caused a reverse in naval architecture when it replaced the paddlewheel. The gun decks were cleared of machinery, which allowed for more guns along the broadsides, and brought back the two and three gun deck ships of the line. The main deck was also cleared of machinery, which allowed the pro-sail establishment to build ships with multiple mast and large sails, only prolonging the reliance on wind power. However, this revival was only temporary because the friction and vibrations of the screw propeller, stressed the wooden ships, caused leaks in the stern of the ship, and shortened the time before a ship required an overhaul. This problem was another factor that led to the end of the wooden warship.[17]

Parallel to the strides made in steam propulsion was the development of the naval shell gun. In the mid-nineteenth century the idea of an armored vessel arose from the need to protect ships from a new type of ordnance. In 1822 former French artillery officer Henri-Joseph Paixhans developed the naval shell gun. Armies had used the shell gun for

several years, but Paixhans saw the merits of mounting it on ships for horizontal fire. The shell was a hollowed-out projectile filled with a fused bursting charge, the shell was designed to penetrate its target then explode. Whereas the huge wooden walls of the capital ships could absorb numerous solid shot, the shell would burrow into the timbers and explode. This explosion usually caused huge gaping holes and set the ship on fire. During the Crimean War at the Battle of Sinope in 1853 a Russian fleet equipped with shell guns destroyed a Turkish fleet armed only with solid shot cannons. The Russians did not lose a ship, while the Turkish fleet lost all but one of its ships and almost 3,000 men. The Turkish loss sent shock waves throughout the naval world.[18]

The standard armament for Royal Navy ships from 1826 to 1862 was the 32-pounder cannon, which fired solid shot and shell, the 68-pounder cannon, which fired solid shot, the 8-inch shell gun, and the 10-inch shell gun. The British maintained a mix of solid shot and shell, with a preference for solid shot. The shell was considered overrated by many British gunnery experts because of its inconsistencies. In training and in combat during the Crimean War there were numerous shells that did not function properly or failed to achieve the desired results of creating large holes and starting fires. For many in the Royal Navy the use of hot shot, which was solid shot heated in a furnace before firing, was more effective method of setting the enemy ship on fire.

The British learned numerous lessons from the Crimean War on the use of rifling and decided to use this technology to improve naval ordnance. In 1858 the Royal Navy was the first to mount breech loaded rifled guns on warships, the Armstrong 110-pounder and 40-pounder. The breechloader was a rear-loaded gun with a removable breech that was screwed into place once the round was loaded.

Tests proved that breechloaders had improved range and accuracy over the smoothbore muzzleloaders, but lacked the impact of the smoothbore cannons. Officers and gun crews considered the guns complicated to fire, because of the numerous steps required to properly close the breech and fire the weapon. Several accidents, caused by the breech flying off during firing, led to a loss of confidence in the weapon. The Royal Navy preferred the muzzle loaded cannon for its safe and simple firing and the breechloader was discontinued in 1865 and was not reintroduced until 1880.[19]

The U.S. Navy during the 1850s developed several large bore cannons, to include the Dahlgren muzzle loaded smoothbores. Lieutenant John Dahlgren designed the first Dahlgren smoothbore cannon in 1852. The Dahlgren cannons were known for their excellent construction and safety. During a test, a prototype cannon was fired 500 times with shells and 655 times with solid shot without any sign of stress or damage. Dahlgren would produce several different caliber weapons, but the 9-inch and 11-inch cannons, which fired shot and shell, became the standard naval ordnance for the U. S. Navy prior to the Civil War.

Additionally, the U.S. Navy started arming its ships with rifled cannons. The Army and the Navy used the Parrott gun developed by Robert P. Parrott. The 8-inch muzzle loaded Parrot gun, which fired a 150-pound conical shaped projectile was standard issue on U.S. Navy ships and was generally mounted as a pivot gun, while the Dahlgren cannons were mounted in the broadsides. The U.S. Navy preferred the smoothbore cannons with round shot as the main armament because of its ability to ricochet off the water during long range firing. The shaped projectile of the rifle cannon would bury into the water losing power and direction.[20]

The importance of the shell gun meant that wood walled ships became increasingly suspect in their ability to sustain damage. Therefore, experiments with iron-hulled vessels became important. In the construction of iron-hulls, Great Britain was the innovator, with France and the United States following her lead. Britain's industrial base, which consisted of numerous iron works with the ability to produce large quantities of iron plate, was much larger than that of France or the United States. This allowed the Royal Navy to set the pace in iron-hull construction. In 1821 the British built the HMS *Aaron Manby,* the first iron steamship and the first two iron warships the HMS *Phlegeton* and HMS *Nemesis*. The two warships were iron paddlewheelers armed with four and 10 cannons respectively. They were sold to the East India Company and proved themselves in combat with China.

The Admiralty contracted for the construction of several iron-hulled ships in the 1840s. Then a series of tests on the reaction of iron-hulls to cannon shot were conducted, led to a reversal of opinion on the merits of iron-hulls. The iron barge *Ruby* was engaged with solid shot and shell in a battery of tests. The conclusions of this experiment were not favorable. J.P. Baxter states in *The Introduction to Ironclad Warships,* "the large and irregular holes that are made by shot built of 5/8 iron ribs and plates would be hard to plug and splinters produced by the shell breaking up could clear entire gun crews."[21] This problem was caused by iron becoming brittle in cold temperatures.[22] In addition, there were two other limitations. First, iron-hulls became fouled with marine life faster than wooden hulls, causing the ship to lose speed. Additionally, the iron-hulls caused magnetic compasses to give faulty readings.[23] The Admiralty declared that iron was

unsuitable for the construction of hulls for warships and that all iron ships were to be troop transports and mail carriers.[24]

The U.S. Navy also experimented with iron-hulls and built three iron-hulled steamers during the 1840s, including the paddlewheeler USS *Michigan*, which served on the Great Lakes until 1923. In 1847 the United States Congress provided funds for the building of four sea-going steam warships, but it did not specify that the ships be built of iron. A board convened by the Secretary of the Navy to oversee design of the ships voted to build them of wood. The decision was made based on the Royal Navy test that deemed iron-hulls not suitable for warships.[25] The U.S. Navy did not build another iron-hulled ship until 1861.

In Great Britain, the supporters of iron-hulls saw the merits outweighing liabilities. Iron was stronger than wood and did not suffer from stress fractures and leaks caused by the vibrations of the screw propeller. Iron-hulls proved far more stable than wooden ones with the increased weight of armored plates and large cannons. Ships could be built larger with more cargo space and iron-hulls supported the theory of watertight compartments better than wooden hulls. Further, iron-hulls required far less time in dry dock the wooden ships because they did not suffer form rot and decay. Additionally, while shells and shot could penetrate iron it did not cause it to catch fire, which was usually the demise of the wooden ships. Finally, Great Britain's timber production was in decline at the end of the 1850s because of the enormous amount of wood that was required to maintain the Navy and the cost was becoming unacceptable to Parliament. Despite reservations by the Admiralty, when the decision to construct an ironclad was made, an iron-hull was the logical choice.[26]

While the development of the iron-hull was held up by conservatism, the adoption of armor plating was hastened by war. Great Britain and France built armored floating batteries to bombard Russian coastal fortifications during the Crimean War in 1855. The batteries were large steam powered barges with 4.5-inch armor plating and fourteen to sixteen cannons. The British batteries had iron-hulls whereas the French batteries were wooden hulled. The two countries built a total of ten armored batteries, but of the ten ships only three French batteries took part in the battle of Kinburn, September 1855. The four Royal Navy armored batteries were delayed for various reasons and did not take part in the fight. The three French armored batteries were impervious to the Russian 24-pounder cannons firing a majority of shell and limited solid shot. The French gunners neutralized the guns of the fort and reduced some of the fortifications. The wooden warships of the fleet joined the fight and the overwhelming fire forced the Russians to surrender.[27] The armored batteries did not see combat again, but their immunity to cannon fire impressed both the French and the British.

The French Navy, building off the success of the armored batteries initiated the ironclad era with the building of *La Gloire* in November 1858. *La Gloire*, completed in 1860 was the world's first sea-going ironclad. Two other ironclads of similar design, *Invincible* and *Normandie*, soon followed. The French ironclads caused a general panic in Great Britain, because they English feared their wooded steam warships would be no match for the French ship. Also, invasion fears swept the country because the press and public believed the Navy would not be able to defeat an invasion force protected by an ironclad fleet. The Royal Navy policy of improving on the inventions of others to maintain the advantage was applied. Sir Baldwin Walker, Surveyor of the Navy, stated,

"France has now commenced to build frigates of great speed with their sides protected by thick metal plates and this renders it imperative for this country to do the same without a moment's delay."[28]

Parliament released funds for the building of two wooden hulled armored frigates in 1858, but the Chief Constructor of the Navy, Isaac Watts, determined that an iron-hull was the best answer for the application of armor and designed an iron-hulled armored frigate. The Admiralty accepted fifteen other designs for review, including both wooden and iron-hulled designs. Watts's design, approved in April 1859 would become the premiere iron-hulled ironclad battleship, HMS *Warrior*.[29] HMS *Warrior* was the first ship to bring all the naval innovations of the nineteenth century together on one vessel. She was the largest and most powerful ship in the world in 1860. She was 420 feet long, fifty-eight feet wide, with a draft of twenty-six feet. Her top speeds under steam were fourteen knots and under sail thirteen knots. *Warrior's* armament consisted of twenty-six 68-pound cannons, and ten Armstrong 110-pound breech-loading rifles. Her armor was 4.5 inches of rolled armor backed by eighteen inches of teakwood placed along the broadsides from the upper deck to five feet below the water line. The bow and the stern were unprotected but were constructed of watertight compartments that could be independently sealed off if ruptured.[30] HMS *Warrior* and her sister ship HMS *Black Prince*, launched in 1862 were superior to *La Gloire* in size, speed, armor, and armament.

The Royal Navy laid down sixteen ironclads from the building of *La Gloire* in 1859 to the Battle of Hampton Roads in March 1862.[31] In 1859 the Navy began construction on HMS *Defence* and HMS *Resistance*, both ships were smaller versions of the *Warrior* class, because the Admiralty wanted smaller ships for coastal defense. In an

effort to catch up with the French Navy, which had begun construction on ten more ironclads the Royal Navy in 1861 converted seven wooden hulled steamers into ironclads by applying armor plating similar to *La Gloire.*

The British ironclads took a long time to build despite Great Britain's large industrial base and the use of private yards to construct ships. In fact, of the sixteen ships that the Royal Navy began construction on from 1859 to 1861, only two, HMS *Warrior* and HMS *Defence*, were completed at the time of the Battle of Hampton Roads. While the British ironclads were innovative for applying armor to iron-hulls, their design was very conservative. HMS *Warrior* and other early British ironclads resembled large wooden sailing frigates of the mid-nineteenth century, with masts, sails, and guns mounted along the broadsides. While there was change in construction material the architecture remained the same.

April 1861 marked the end of wooden warship construction in the Royal Navy. With the rising cost of timber and with the emphasis on building iron-hulled ironclads, the House of Commons voted to end construction of wooden warships. This decision did not end the service of the wooden steam warship. Because iron-hulls fouled faster than wood it was determined that iron-hulled ironclads would serve in European waters so they would be near shipyards for cleaning and maintenance.[32] Conventional wooden steam warships and converted ironclads would serve overseas because they did not foul as fast as iron and there was less of a threat from opposing ironclad warships in other regions.[33]

The Civil War was not the first time that the United States Navy planned to build an ironclad. In 1842 Robert L. Stevens designed a ship, which came to be known as the

Stevens' Battery. The battery was to be a gigantic armored barge with sixteen guns, 420 feet long, and fifty feet wide. Stevens died before the boat could be completed. His family attempted several times to complete the project, but failed because of lack of interest and funding by the United States government. After several owners and numerous starts and stops in the construction, the Stevens's Battery was scrapped in 1874.

The five major naval innovations of the early nineteenth century led to the invention of the ironclad and set the stage for the Battle of Hampton Roads. Steam engines and screw propellers allowed ships to operate independent of the wind. The shell gun's ability to defeat the thickest wooden walls led to the application of armor to defeat its destructive qualities. The iron-hull, originally viewed as unacceptable for warships, proved to be the best platform for mounting armor plate and large guns on the ironclads of the Royal Navy. The necessities of the American Civil War would spark the development of ironclad prototypes in the Confederate States and United States of America that would radically bring all five innovations together in battle and revolutionize naval warfare.

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[1]Winston S. Churchill, *The Great Democracies* (New York: Dodd, Mead & Company, 1958), 202.

[2]CSBA, "The Revolution in Military Affairs" [article on-line]; available from http://www.csbaonline.org/2Strategic_Studies/1Revolution_in_Military_Affairs/Revolution_Military_Affairs.htm#DS; Internet: accessed on 17 October 2002.

[3]Frank Marion Bennett, *The Steam Navy of the United States* (Pittsburgh: W. T. Nicholson Press, 1896), 9-15.

[4]Kenneth J. Hagan, *In Peace and War, Interpretations of American Naval History, 1775-1978* (Westport: Greenwood Press, 1978), 65.

[5]J. R. Hill, *The Oxford Illustrated History of the Royal Navy*. (Oxford: Oxford University Press, 1995), 202.

[6]Philip Cowburn, *The Warship in History* (New York: The Macmillan Company, 1965), 189.

[7]Andrew Lambert, *Battleships in Transition* (London: Conway Maritime Press Limited, 1984), 19.

[8]Cowburn, 196.

[9]John R. Spears, *The History of Our Navy* (New York: Charles Scribner's Sons, 1897), 14.

[10]Lambert, 114.

[11]Ibid.

[12]This ship was renamed *Cosre* when the French built their first steam battleship and named it *Napoleon*.

[13]The term steam warship will be used in this chapter to identify wooden sail and steam screw propelled warships.

[14]C. I. Hamilton, Anglo-*French Rivalry, 1840-1870* (Oxford: Clarendon Press, 1993), 212.

[15]James L. George, *History of Warships* (Annapolis: Naval Institute Press, 1998), 65-66.

[16]Lambert, 11.

[17]Ibid., 55.

[18]Robert MacBride, *Civil War Ironclads* (Philadelphia: Chilton Company, 1962), 2-3.

[19]Nathaniel Barnaby, *Naval Development in the Century* (Philadelphia: The Linscott Publishing Company, 1904), 146-147; Cowburn, 209; Lambert, 121; H.W. Wilson, *Ironclads in Action* (Boston: Little, Brown and Company 1898), 246.

[20]The American Ordnance Association, *Notes on Naval Ordnance of the American Civil War, 1861-1865* (Richmond: William Byrd Press, Inc., 1960), 5-8.

[21]James Phinney Baxter, *The Introduction of the Ironclad Warship* (Cambridge: Harvard University, 1933), 38.

[22]Later test on iron-hulls concluded that the *Nemesis* and *Guadeloupe* performed well because they fought in warm waters. The *Ruby* test was conducted off the English coast in the cold waters of the North Atlantic. Iron was proven to turn brittle when subjected to cold temperatures, which caused the hull of the Ruby to produce large splinters while the Nemesis and Guadeloupe were not penetrated or had smooth holes without splintering.

[23]Royal Astronomer Sir George Airy solved the compass problem in 1838 using magnets to correct the deviation.

[24]Baxter, 39.

[25]Ibid., 40-47.

[26]Hamilton, 94-95; Lambert, 119.

[27]Baxter, 84-91.

[28]Ibid., 123.

[29]Brown, 211.

[30]HMS *Warrior*, "Facts and Figures." [database on-line], available from http://www.hmswarrior.org/facts.htm; Internet: accessed on 2 January 2003; Baxter, 158.

[31]The act of building a ship. It begins by laying down the keel.

[32]Marine life grows on the hulls of ships causing the ship to lose speed.

[33]Hamilton, 91.

CHAPTER 2

THE BATTLE OF HAMPTON ROADS

In April 1861 the Confederate States Navy had a fleet of ten vessels carrying a total of fifteen guns. Steven R. Mallory, the newly appointed Secretary of the Navy, decided the best investment for the Confederate Navy was to have a small fleet of ironclad warships to challenge the Union Naval blockade that went into operation a week after the attack on Fort Sumter.

> I regard the possession of an iron-armored ship as a matter of the first necessity. . . . If we . . . follow their [the United States Navy] . . . example and build wooden ships, we shall have to construct several at one time; for one or two ships would fall 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 iron against wood, without regard to first cost.[1]

The Confederate Navy would try unsuccessfully to buy ironclads from France and Great Britain throughout the war, but Virginia's secession from the Union would provide the Confederate Navy the opportunity to build an ironclad.

On 20 April 1861 the Confederate forces took control of the United States' Gosport Navy Yard at Norfolk, Virginia. The Union Navy's quick retreat from the port left a world-class facility with dry docks and shipbuilding slips. Additionally, over 1,200 naval cannons were captured with the yard. In an attempt to destroy the yard before the Confederates could capture it, the commander of the yard ordered that all ships in port for repairs be scuttled. One of these ships, the USS *Merrimac,* was set afire and burned down to her hull.

The Confederates inspected the *Merrimac* and determined that her engines and hull could be salvaged. Mallory formed a team consisting of John L. Porter, a naval

constructor; Lieutenant John M. Brooke, a naval officer and gun designer; and William P. Williamson, a naval engineer. The team came up with a plan, based upon a design developed by Brooke, to convert the *Merrimac* into a powerful armored warship like nothing the world had ever seen.

The design of the ironclad was a large wooden casemate, which resembled the roof of a barn, erected on top of the cut-down hull of the *Merrimac.* The casemate was made of two feet of oak, covered by two layers of two-inch armor plate. One layer was mounted vertically and the second layer was bolted on horizontally. The top of the casemate was covered with iron grating to provide ventilation, and there were three hatches. The sides of the casemate canted thirty-five degrees inward, which Brooke determined best for deflecting shot. The pilothouse was on top of the casemate above the bow protected by an iron conical shield. The armor plates extended from the casemate six inches below the water line. The bow and stern were partially submerged during movement presenting less of a target.

She was armed with six nine-inch Dahlgren smoothbores and two Brooke seven-inch rifled cannons along the broadsides and two smaller 6.4-inch rifled cannons in her bow and stern. Lastly, she was fitted with a 1,500-pound ram on her bow. She was powered by two rebuilt steam engines, with a screw propeller, and was not rigged for sailing. The *Merrimac* was 263 feet long and fifty-one feet wide and had a twenty-two foot draft. She had a top speed of seven knots and took a full thirty minutes to turn 180 degrees. She was not maneuverable, but her strength was unequaled by any ship in the Union Navy. The *Merrimac* had a crew of 19 officers and 311 men. Her commanding

officer was Captain Franklin Buchanan and her executive officer was Lieutenant Catesby ap Roger Jones.

On 17 February 1862 the rebuilt *Merrimac* was commissioned the CSS *Virginia*. Weeks later on 8 March 1862 the CSS *Virginia*, still under construction waiting for gun shutters to be installed, left on what Captain Buchanan told his crew was to be a practice run. She cruised into Hampton Roads and ended the wooden warship's dominance of the seas.

The eighth of March 1862 was just another uneventful day for Union sailors taking part in the blockade of Hampton Roads, Virginia. Yet, a dramatic change was about to take place. On the horizon was a dreadful sight, the ironclad ram CSS *Virginia (Merrimac)*, and she was coming at full steam for the USS *Cumberland*, a twenty-four gun sailing sloop. Several ships in Hampton Roads fired at the ironclad only to see their shells bounce off her iron casemate and fall harmlessly into the water.

> Shells from the *Cumberland*, the *Congress*, and the Union Army batteries at Newport News glanced harmlessly off the *Merrimac's* sloping sides, which her crew had made slippery with buckets of hot pork fat. "Those shells had no more effect," wrote a newspaper correspondent watching the attack from the shore, "than peas from a popgun."[2]

The *Virginia* began firing on the *Cumberland* when she was within one mile of the wooden vessel. Her first shot destroyed the *Cumberland's* aft pivot gun, and then she struck with her ram leaving a gapping hole in *Cumberland's* starboard side. "The noise of the crashing timbers was distinctly heard above the din of battle," wrote Executive Officer Catesby Jones. "There was no sign of the hole above water, but it must have been large, as the ship soon commenced to careen. The shock to us on striking was slight. The blow was not repeated. We lost the ram and had the bow slightly twisted."[3] The

Cumberland would continue to fight furiously and went to the bottom with her colors still flying. With only minor damage and the loss of her ram, The *Virginia* turned to attack her next victim.

The ironclad ram set course for the fifty gun sailing frigate USS *Congress*. The *Congress* attempted to lighten her load and headed for shallow water to escape the ironclad, but ran aground. *Virginia* closed in on her prey. The ironclad took a position 200 yards from the *Congress* and fired hot shot and shells destroying her within an hour. Over 120 of the 400-man crew were killed or wounded. The *Virginia*, CSS *Beaufort*, and CSS *Raleigh* attempted to evacuate the wounded from the *Congress*, but were engaged by rifle fire from Union troops along the shore. Buchanan was wounded from the attack and ordered his crew to fire hot shot and shell to until the wooden ship was on fire. The *Congress's* ammunition and powder blew up shortly after midnight, completing her destruction.[4]

By the evening of 8 March 1862 the *Virginia* had easily destroyed two of the strongest wooden ships in the Union squadron. Several times throughout the day, the *Virginia* had been fired upon by over one hundred guns from ships in Hampton Roads and batteries on the shore. *Virginia's* iron casemate was dented, but not penetrated, and no shells had hit her below the waterline. She had only superficial damage: her ram was broken off, the smokestack was riddled, two guns were disabled, and the lifeboats had been shot away. Panic raced through the Union. In Washington, Secretary of War Edwin Stanton declared, "The *Merrimac* [*Virginia*] will change the whole character of the war. She will destroy, seriatim, every naval vessel; she will lay all the cities on the seaboard under contribution."[5]

At nightfall, the *Virginia* anchored off Sewall's Point. Her crew celebrated their victory and planned to finish their rout of the Union ships in the coming morning. “The *Virginia* proved no wooden ship, no matter her strength could stand against an iron ship.”[6] With the armor and firepower of the ironclad, the era of wooden warships had ended. For one day she was the greatest innovation in naval warfare. The next day, a small strange looking ship that observers said looked like a tin can on a shingle rendered her obsolete.

With information of the Confederates building an ironclad warship on the hull of the old *Merrimac*, the United States decided that the Navy must have its own ironclad to counter this threat. In August of 1861 the Secretary of the Navy, Gideon Wells, formed an Ironclad Board to select the best possible design for an ironclad warship. There were sixteen submissions, but the board narrowed it down to two designs. The first was USS *New Ironsides*, which was built on the same design as *La Gloire* and had sixteen cannons and 4.5-inch armor bolted to fifteen inches of wood. The second entry USS *Galen*a was a wooden gunboat with six cannons and 3.5-inch armor plating on her broadsides. Both of these ships represented the conventional thinking of the Navy at the time and were viewed favorably by the board. The financial backer of the *Galena*, C. S. Bushnell, recommended that the board look at a third entry, developed by the Swedish inventor John Ericsson. It was a ship like nothing anyone had ever seen.

The vessel was built in two parts, the upper hull, and the lower hull. The upper hull was armored on the deck and had an armored belt of five inches of armor bolted to a bank of oak and pinewood around the sides to protect the ship from ramming. The upper hull also provided the platform for its most striking feature, an armored revolving turret,

protected by eight inches of iron plate. Additionally, there was a small armored pilothouse to the front of the ship. The deck was wooden covered with an inch of armor plate. Her lower hull was below the waterline protecting the crew and engines from enemy fire. Instead of a conventional broadside consisting of numerous cannons, the ship's armament consisted of only two Dahlgren smoothbore cannons, mounted side-by-side in a revolving turret.[7]

She had no rigging or sails and was driven by Ericsson's vibrating lever steam engines and a screw propeller. She had numerous inventions that were new to ship design to include an anchor system that was under the hull and could be retrieved without exposing the crew to enemy fire. The inventor's plan was a revolutionary departure from ship design of the mid-1800s, and the board let him know their skepticism about his invention. "One board member even tried to force Ericsson to add masts and sails to the design, but the inventor refused."[8] The Navy still harbored ill feelings toward Ericsson over the *Princeton*, which made the board reluctant to approve his design. He had to brief the board three times in one day, and it took the urging of President Lincoln and Secretary Wells to get a probationary approval. Only after this endorsement was the contract between the Navy and Ericsson signed on 4 October 1861. A stipulation in the contract stated that Ericsson would not be paid in full until the ship had been successfully tested.

The threat of the *Virginia* required that construction begin at once. One of the selling points of the Ericsson's ship was that it could be constructed in 100 days in accordance with the contract. She was built at the Continental Iron Works at Green Point, Brooklyn, New York. The turret was built at the Novelty Iron Works and sent to the

shipyard in pieces. She was launched on 30 January 1862 as a crowd gathered to see if she would sink upon entering the water. The turreted ironclad was a small ship for her day. She was 173 feet long and forty-one feet wide, weighed 987 tons, had a ten-foot draft, and had a top speed of eight knots. She was moved to the Brooklyn Navy Yard in February 1862 where she received two 11-inch Dahlgren cannons taken from the steam sloop USS *Dacotah*.

On 25 February 1862 she was commissioned the USS *Monitor.* The *Monitor* made two trial runs before she left on her first mission. During her first run the steam engines did not work properly and during the second trail her rudder failed. The inventor fixed both problems, and the ship prepared to depart for Hampton Roads on 6 March 1862. Commanded by Lieutenant John L. Worden, the *Monitor* had a crew of thirteen officers and thirty-six men.

The voyage to Hampton Roads was a perilous one. The *Monitor's* crew quickly discovered that she was not seaworthy and was best in shallow inland waters. Twice during the voyage, she encountered high waves and was swamped. Water poured below deck through the turret ring and hatches. The men were sea sick from the violent rolling of the ship and the carbon dioxide from the engine room after the fans failed. The engines' fires were extinguished, and she had to be towed close to the shore to dry out. On 8 March 1862 the sea was calm and the warship completed her journey to Hampton Roads. It was late evening and as she entered Hampton Roads her crew heard explosions and saw smoke and fire in the distance. She anchored next to the USS *Minnesota* and prepared for combat. The next morning she and her Confederate rival would make naval history in the first battle of iron battleships.

Around 8:00 a.m., 9 March 1862, the *Virginia* steamed back into Hampton Roads to complete the destruction of the previous day. Her target was the *Minnesota,* a forty-gun steam frigate that had run aground. Just as the *Virginia* started to attack, her crew saw a strange ship move between her and the *Minnesota*. The *Monitor* and *Virginia* passed each other and the *Virginia* fired, missing the *Monitor* but striking the *Minnesota,* which replied with a full broadside firing of her own. The *Virginia* fired again and struck the *Monitor's* turret. The shells bounced harmlessly off the heavily armored vessel. "'A look of confidence passed over the men's faces,' Lieutenant Greene, the *Monitor's* Executive Officer, remembered, 'we believed the *Merrimac* [*Virginia*] would not repeat the work she had accomplished the day before.'"[9]

The *Monitor* was smaller, more maneuverable, and the revolving turret with twin guns allowed her to fire shots at the Southern ironclads armored casemate from any position. In fact, the *Monitor* could fire in any direction but ahead, because of concern of hitting the pilothouse. The *Virginia* was less maneuverable than the smaller ship, but she had more firepower (ten guns) and could fire every five minutes compared to the *Monitor's* eight minutes. The two ships dueled for over four hours trying to find and exploit the other's weakness. They fought at distances of a few yards to 3/4 of a mile, but could not cause any damage. The *Virginia* attempted to ram the *Monitor*, but with the loss of her ram the day before and the *Monitor's* ability to maneuver, she only scored a glancing blow that had no effect on the little ironclad. Next, the *Monitor* attempted to ram the *Virginia* in her unarmored stern. "Just before reaching the Confederate ironclad, the *Monitor's* steering apparatus somehow malfunctioned, causing her to sheer off, just missing the *Virginia* by a few feet."[10]

The joust continued until the *Virginia* scored a direct hit on the pilothouse of the *Monitor.* Lieutenant Worden was blinded from the hit, and the *Monitor* drifted into the shallow water while the Lieutenant Green moved to the pilothouse to take command. The *Virginia*'s captain, Lieutenant Jones, believing that that the *Monitor* had withdrawn, turned to attack the *Minnesota.* As she moved toward the *Minnesota,* the *Virginia's* pilot told the commander that the ironclad must return to port before the tide ran out, or risk running aground. The *Monitor*, under new command, returned to fight; the *Virginia* turned toward Norfolk. The *Monitor's* crew seeing the *Virginia* steaming off to Norfolk thought that she had won the fight. It was a case of mutual misapprehension. Both ironclads felt they won the day.

The first battle of ironclads was a draw. A slight advantage went to the *Monitor*, because she had accomplished her mission of protecting the *Minnesota*. While she did not destroy the *Virginia*, she had proved that the only way to stop or defeat an ironclad was with another ironclad. What the wooden ships on 8 March 1862 failed to do, the *Monitor* had succeeded, stopping the Southern ironclad. The era of the steam driven, big gun, iron ship had begun.

In conclusion, the Battle of Hampton Roads foretold the future of naval combat in the nineteenth and twentieth century. The Confederate ironclad ram, the CSS *Virginia*, on 8 March 1862 destroyed two wooden battleships, revived the ancient tactic of ramming and signaled the end of the wooden warship era. On 9 March 1862 the ironclad turret ship, the USS *Monitor,* fought the *Virginia* to a draw demonstrating to the world that the only way to stop an ironclad was with another ironclad and proclaiming that the armored turret was the future of naval design and armament. The news of this battle quickly

traveled through America and across the Atlantic and had a great impact on the United States Navy and the European naval powers, which led to revolutionary changes in ship design, fleet organization, and tactics. The battle of Hampton Roads, Virginia, on 8-9 March 1862 was the birth of modern naval warfare.

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[1]James Phinney Baxter, *The Introduction of the Ironclad Warship* (Cambridge: Harvard University Press, 1933), 224.

[2]Time-Life Books, *The Civil War, The Blockade, Runners and Raiders* (Alexandria: Time-Life Books, 1983), 55.

[3]Catesby ap. R. Jones, "Battle of Hampton Roads." [article on-line], available from http://www.civilwarhome.com/CHMHampton%20Roads.htm; Internet: accessed on 7 December 2000.

[4]Baxter, 292.

[5]Time-Life Books, 57.

[6]William C. Davis, *Duel Between the First Ironclads* (Baton Rouge: Louisiana State University Press, 1975), 165.

[7]The Mariner's Museum, "The Design of the Monitor." [article on-line], available from http://www.mariner.org/monitorcenter/history/about.html; Internet: accessed on 21 October 2002.

[8]Angus Konstam, *Union Monitor,1862* (Oxford: Osprey Publishing, 2002), 8.

[9] Time-Life Books, 62.

[10] Davis, 131.

CHAPTER 3

IMPACT ON THE UNITED STATES NAVY, 1862-1871

When Abraham Lincoln established the blockade of Southern ports on 19 April 1861, known as the Anaconda Plan, the United States Navy found itself woefully unprepared for the task at hand. The mission was quite overwhelming; the southern coastline was over 3,000 miles long, not including the Mississippi River and her tributaries. The Navy was not organized or equipped for such a daunting task. The U.S. Navy's primary mission at the time was to protect United States merchant shipping overseas and defeating enemy ships in one on one combat. "In the naval context, when the Confederate forces fired on Fort Sumter the Navy was still cruising on station and preparing for a repeat of the War of 1812."[1]

After the blockade of the Confederacy was established, the Navy reorganized and formed four blockading squadrons in early 1862: the North Atlantic, South Atlantic, East Gulf, West Gulf, and Mississippi Squadrons. Hampton Roads was in the area of operations of the North Atlantic Blockading Squadron. In addition to the four blockading squadrons the Mississippi River flotilla was transferred to the Navy from the army in 1862.[2] After the battle of Hampton Roads it would go through more radical change to adapt to a new form of naval warfare.

Four distinct themes resulted from the Battle of Hampton Roads that changed the United States Navy. First, the *Virginia* proved that a wooden ship was no match for an ironclad. Second, the *Monitor* proved the best way to stop an ironclad was with another ironclad. Third, the *Monitor* and *Virginia* were not designed as sailing ships and fought with steam as the only source of propulsion. Finally, the *Monitor*'s turret allowed the ship

to fire in any direction and protected the crew from enemy fire. The United States was gripped with "*Monitor* Fever" after the news reports of the successful first battle of ironclads at Hampton Roads and an ironclad program to produce more monitors was born.[3] In order to build and fight the new ships the Navy instituted major organizational changes to the administration and the blockading squadrons.

On 5 July 1862 Congress reorganized the Bureaus of the Navy to effectively administer the large wartime Navy and emerging technology of the ironclads. The five bureaus were expanded into eight: recruiting, construction and repair, navigation, ordnance, provisions and clothing, yards and docks, medicine and surgery, and steam engineering. The establishment of the Bureau of Steam Engineering signaled the Navy's new reliance on steam power to operate its vessels and its new interest in technological development.[4] This new administrative organization would essentially remain intact until World War II.

The success of the *Monitor* and the threat of more Confederate ironclad rams was the driving force to build more armored vessels, and a second ironclad board was established to review all previous ironclad designs submitted to the first board, accept new bids, and to oversee construction of new ironclads. The Navy lacked the equipment and facilities to build ironclads and requested help from private industry. Assistant Secretary Fox established several small committees usually led by a retired naval officer to contract civilian shipyards to build ironclad vessels for the Navy. "These offices would abruptly mushroom after the appearance of the *Monitor*, as none of the Navy Yards had the machinery to build iron-hulled vessels or Ericsson turrets. The New York Office would be dubbed the Monitor Bureau."[5] Additionally, the Navy Department created the

positions of general superintendent of ironclads and general inspector of ironclad construction to supervise the Monitor Bureau and the construction of ironclad vessels. The Monitor Bureau was independent from the Bureaus of the Navy, which often led to a lack of responsibility when a project was over cost or a failure.[6]

The *Virginia's* destruction of two wooden warships on 8 March 1862 and the *Monitor's* successful defense of the fleet on 9 March 1862 led to a change in task organization for the blockading squadrons. The strategy of the Confederate Navy was to break the blockade with ironclads, in order to counter this strategy monitors or other ironclads were assigned to each blockading squadron. *Passaic* class and *Canonicus* class served predominately with the North and South Atlantic Blockading Squadrons, while the a city class ironclads and *Milwaukee* class served with the Mississippi Flotilla and the East and West Gulf Blockading squadrons, respectively. The primary role of the monitors and other ironclads was to attack Rebel ironclads and its secondary role was to attack enemy fortifications. Ironclads were part of the task organization for several of the major naval battles of the Civil War to include at Vicksburg and Charleston in 1863, Mobile Bay August in 1864, and Fort Fisher in January 1865. Additionally, the ironclads fought numerous ship versus ship battles with Confederate ironclads and wooden warships, enforcing the blockade and protecting the fleet. After the war, the monitors that were not sold, scrapped, or placed in ordinary served in the Home Squadron as coastal defense vessels.[7]

Furthermore, the organization of the ironclads' crews was markedly different than that of a wooden steam vessel or sailing vessel, as engineers became essential members of the crew. Whereas on a wooden steam ship only a few engineers were needed to run

the auxiliary steam engines, the ironclads relied on machinery to power everything on the ship. The *Monitor* had a crew of forty-nine personnel. Of that number, seventeen were engineers responsible for the operation of all engines and all machinery, including the turret rotation system. Line officers were considered superior to engineers during this time period, but this was not an issue on the monitors. The captain and the other line officers relied on the engineers to keep the ship running and ready to fight, so for the most part they respected them.[8]

Accordingly, the changes in ship design to turreted monitors led to smaller crews for the ironclads as compared to conventional wooden warships. A good example is two ships assigned to the Western Gulf Blockading Squadron in 1864. USS *Hartford*, a steam sloop of war, commissioned in 1859 was a sailing ship with steam power, a broadside of forty-two cannons and a crew of 304 officers and men. In contrast USS *Chickasaw*, a twin turreted monitor, commissioned in 1864 mounted only four large guns in her turrets and her crew consisted of 120 officers and men. The adaptation of the turret and steam engine reduced the amount of sailors needed to man a ship.

The changes to the organization of the Navy paralleled the radical change in shipbuilding brought on by the Battle of Hampton Roads and her two revolutionary warships. Despite the inconclusive results of the battle and serious questions about the sea worthiness of the *Monitor*, Secretary of the Navy Gideon Wells and Assistant Secretary Gustavus Fox were convinced that the *Monitor* was the best ship for the Navy. Secretary Wells asked Congress for $30,000,000 to build ironclads and appointed the second ironclad board to oversee the construction.

By the end of June 1862, twenty-four monitors and three casemate ironclads were under construction, exclusive of the *Monitor, Galena,* and *New Ironsides.*[9] Furthermore, from 1862 to 1871 the Navy built a total of eighty-three ironclads of all types, and commissioned seventy-five into the fleet.[10]Seven classes of monitors were built from 1862 to 1871. This study will focus on the three classes that had the largest impact on the U. S. Navy during and after the Civil War, the single turreted *Passaic* class, and the double turreted *Milwaukee* class and *Miantonomoh* class.

The *Passaic* class was designed to correct the deficiencies of the original *Monitor.* The *Passaic* class was named after the first ship built of this model, the USS *Passaic.* Ten of these monitors were approved for construction within a week of the battle. The most noticeable change was the pilothouse, which was moved on top of the turret to give the captain better, vision and improve communications with the gun crews. This redesign also allowed the ship to fire to its front, which the *Monitor* crew would not do out of fear of hitting the pilothouse.[11]

The turret was enlarged to make room for the larger fifteen-inch Dahlgren smoothbore cannons that were to replace the 11-inch Dahlgrens in the first ship. This decision was made because the *Monitor's* eleven-inch guns failed to defeat the *Virginia's* armor. Correspondence from Assistant Secretary of the Navy Gustavus Fox to the ordnance branch stated, "the 11-inch guns were entirely inadequate. . .What was needed was a larger caliber and great initial velocity."[12] Test showed that the 11-inch guns with full charge would have pierced the Virginia's armor, but at the time the Navy thought a larger gun was the only solution. Dahlgren built the 15-inch guns specifically for the monitors, so they could breach the armor plate of the Confederate ironclads.

A shortage of the 15-inch Dahlgrens resulted because the armories could not produce them fast enough. The solution was to have a mixed armament of one fifteen-inch cannon and one 11-inch cannon. This solution, however, created problems for the gun crews, namely the need for mixed ammunition and the delay in firing time of the 15-inch cannon. The 15-inch cannon was shorter in length than the 11-inch gun and its muzzle did not clear the gunport of the turret, thus a special box was built on the turret so the muzzle flash would not hurt the crew. Additionally, the turning mechanism of the turret was improved which enhanced the crew's ability to control its movement.[13]

Improvements were also made to the hull. It was thirty feet longer than the *Monitor's* hull and the raft shape was replaced with a more traditional ship's hull to improve its stability. Also, the deck was slightly rounded to allow water to run off quickly. A permanent armored smokestack was added and blowers were installed to force air into the engine compartment. The three biggest flaws of the *Passaics,* and of all monitors, were the low freeboard still allowed the ship to be easily swamped and the cruising speed was reduced to six knots because the ship was larger than the original *Monitor*, but had the same size engines.[14]

Additionally, the *Passaic* class suffered from terrible reserve buoyancy and inefficient bilge pumps. This was highlighted, when the USS *Weehawken* sank while anchored in calm water, because she was overweight in the bow with ammunition. The bilge pumps in the stern were not strong enough to pull the water without the help of gravity. Water quickly filled the bow through the anchor hole and the ship went down killing twenty-four officers and men.[15] Lastly, all monitors were vulnerable to torpedoes, known in the Civil War as mines. While the turret and the sides of the ship were heavily

armored the hull was not armored below the waterline and consisted of half-inch iron plate. This problem coupled with the monitors' lack of reserve buoyancy resulted in the loss of four monitors during the Civil War, but torpedoes were the only effective weapon the Confederates possessed to destroy the turreted armored ships.

The *Passaic* monitors performed with mixed results in battle. The *Passaic*, *Weehawken*, and seven other ironclads to include the *New Ironsides* took part in the attack on Fort Sumter in April 5,1863. The attack was a failure and all the ironclads were damaged. The monitors received multiple hits though none were penetrated. Several of the monitors' turrets jammed when they were hit where the turret joined the hull. During repairs a protective armored ring called a glacis, was installed around the base of the turret on all monitors to prevent this problem from reoccurring.[16]

On June 1863 the *Weehawken* fought the CSS *Atlanta* near the mouth of the Wilmington River. The *Weehawken*, with her fifteen-inch Dahlgren, smashed the casemate of the southern ironclad, ruptured her armored pilothouse, and wounded over 40 members of her crew. After fifteen minutes of battle the captain of the *Atlanta* surrendered his ship while the *Weehawken* suffered no damage. The new monitors proved they were superior in battle against southern ironclads though not well suited for attacking forts. As a class the *Passaic's* were remarkably durable, and many saw continued naval service off and on during the remainder of the nineteenth century, to include duty as coast defense vessels during the Spanish-American War.

Along with improved single turret monitors the Navy wanted large double turret monitors for coastal and sea operations. Even before the Battle Hampton Roads had occurred the Navy had decided it wanted to build double turret ironclads. The Bureau of

Construction and Repair submitted plans in November 1861 to the Secretary of the Navy for a double turret vessel incorporating Coles turrets, invented by Captain Cowper Coles, a Royal Navy officer. In December 1861 Secretary of the Navy Wells requested $12,000,000 to build twenty vessels based on the Bureau of Construction and repair designs. Only $10,000,000 was approved in February 1862, and after the success of the *Monitor* at Hampton Roads all funds went to building monitors with Ericsson turrets, no further attempt was made to use Coles' turrets on American warships.[17]

Four days after the Battle of Hampton Roads the Chief of the Bureau of Construction and Repair urged Secretary Wells to order the immediate construction of a double turreted ironclad based on the plan submitted in November 1861.[18] While, this plan was not executed the Navy continued to pursue this venture. The Navy wanted twin turrets for obvious reasons. "Two guns were better than one and in this case, four guns were better than two."[19] If a turret was broken or was destroyed, the ship could continue to fight with its second turret. This fact was validated during the Battle of Mobile Bay in 1864 when the twin turret monitor USS *Winnebago* lost power in her aft turret she was still able to effectively engage the CSS *Tennessee* with her forward turret, leading to the *Tennessee's* surrender.

John Ericsson was against this concept, he believed that two turrets would not be as formidable as a single turreted monito*r* able to fire 360-degrees, and he refused the contract. However, three different classes of double turreted monitors were built. Two classes of double turret monitors were constructed by private contractors, the USS *Onondaga*, and the *Milwaukee* class. The Bureau of Construction and Repair built the third class, the *Miantonomoh* class.

James B. Eads, a shipbuilder from Saint Louis, Missouri, designed the *Milwaukee* class monitors. These ships were contracted for in May 1862 in order to meet the Navy's needs for shallow draft double turreted vessels to operate on the Mississippi River and the Gulf of Mexico. Four ships were built the USS *Milwaukee*, USS *Winnebago*, USS *Chickasaw*, and the USS *Kickapoo* and all were commissioned in the summer of 1864. They were 220 feet long, fifty-six feet wide, and had six-foot draft that allowed them to operate in shallow water. The hull was turtle backed and protected by only a .75-inch of iron plate on the deck and three inches along the sides, in order to maintain a shallow draft. The hull also incorporated watertight subdivisions, which allowed the crew to close off areas taking on water from the rest of the ship.[20] Four engines and four screw propellers that gave the *Milwaukee* class a top speed of nine knots. They were the only class of monitors to meet or exceed their planned speed.

The *Milwaukee* class had an armament of four 11-inch Dahlgren cannons, mounted in two turrets, one an Ericsson turret, the other one of Eads own design. The Eads turret differed from the Ericsson turret in that the base of the turret rotated on ball bearings instead of a central axle. The guns were mounted on a platform that also rotated and was mounted on a cylinder that lowered the guns into the hold for reloading. All of the turret mechanisms were steam powered including the gun carriages and port shutters, which open automatically when the guns moved forward and closed when the guns lowered to reload.[21] The turrets were very technical and expensive, which led to only one being mounted on three of the four vessels produced. These twin turreted monitors refuted Erricson's idea of the one turret for a 360-degree field of fire and incorporated what was to become the model for fire control on the battleships of the late nineteenth

and twentieth centuries, they had an armored tower in the center of the ship to direct fires. They were the first vessels to use the system of fore and aft gun turrets with a centrally located fire control station to command fires from both turrets simultaneously.[22]

The *Milwaukee* class had a limited record in combat but was widely considered the best monitor class built. The USS *Chickasaw* and the USS *Winnebago* took part in the battle of Mobile Bay and were instrumental in the capture of the Rebel ironclad CSS *Tennessee* and Fort Morgan.[23] The *Milwaukee* class was also very well built shown when the *Milwaukee* struck a mine in 1865, but stayed afloat for an hour, allowing her crew to escape unharmed. After the war she was raised and her iron was used to build the Eads Bridge in Saint Louis. Another example of their excellent construction, the *Chickasaw* was sold in 1874 and was converted into a ferryboat, she served in this capacity until 1944.[24]

The last class of twin turreted monitors built during the Civil War was the *Miantonomoh* class. Four ships were constructed: the USS *Monadnock*, the USS *Miantonomoh*, the USS *Agamenticus*, and the USS *Tanawanda*. This class of monitors had the distinction of being the only monitors built by the Bureaus of Construction and Repair and Steam Engineering. Furthermore, they were the only monitors built with wooden hulls, which was why the Navy was able to construct them. They were larger than the *Onondaga* measuring 257-feet long, fifty-two feet wide, with a twenty-one foot draft. They were armed with four fifteen-inch Dahlgrens in two Ericsson turrets with ten-inches of armor plating. Pilothouses were protected by eight-inches of armor. A hurricane deck was placed between the turrets. Twin engines and screw propellers powered the ironclads and they averaged a speed of seven knots[25]

The *Monadnock* was commissioned in March 1864 and was the only ship of this class to see combat, taking part in joint operations against Fort Fisher in 1864 and 1865. The other three ships were commissioned in 1865 after the war had ended. Two of the ironclads made ocean voyages in 1866 to prove the seaworthiness of the American warships. These voyages were planned by Assistant Secretary of the Navy Gustavus Fox to convince skeptics in the United States and Europe of the monitors' seaworthiness. The *Monadnock* cruised from the East Coast around South America to San Francisco. Her crew praised her for her sea worthiness and she completed the entire trip under her own power with the addition of a temporary mast and sails.[26]

The *Miantonomoh* crossed the Atlantic on a cruise to Russia. Assistant Secretary of the Navy Fox made the journey to show off this work of American ingenuity to the European governments and admiralty. The large monitor made stops Ireland, Great Britain, France, and Denmark before arriving in Russia. While in Portsmouth, England she was visited by several shipbuilding personnel of the Royal Navy. Sir Eric Reed, Chief Constructor of the Royal Navy, was greatly influenced by the original *Monitor* and the later classes of monitors went on to develop the world's first modern battleship based on an improved version of the USS *Miantonomoh.*

The large monitor also had an impact on the British Press. The *London Times* wrote after seeing the *Miantonomoh* anchored near several Royal Navy ironclads, " the wolf is in our fold, the whole flock at its mercy."[27] She was also viewed with skepticism, as another reporter wrote, "The American monitor is literally a floating gun carriage, nothing more."[28] The ironclad's European cruise also had an impact on the French. Fox had an audience with Napoleon III who showed a great interest in the twin turreted

monitor, a year later France would purchase the very similar *Onondaga* for service as a coast defense vessel. Upon reaching its final destination Russia, it also had a great impact on Tsar Alexander II and his Imperial Russian Navy. Influenced by this memorable visit the Imperial Navy would from 1867 to 1873 build a monitor fleet of ten *Passaic* class monitors and several double turret monitors.[29]

After the two historic trips, the four ships of the *Miantonomoh* class were decommissioned in 1870 and while in storage, their wooden hulls rotted. In the 1880s the double turreted monitors along with the unfinished *Puritan* were rebuilt with new iron-hulls, new engines, steel armor, and were fitted with breach loading cannons. The five ships were known as the "New Monitors" and served the country as our only modern warships until the building of our cruiser fleet in the 1890s. They were decommissioned for the last time in 1905 and sold in 1922.[30]

Simultaneous to the building of the single and double turreted monitors, several ironclads were built from other designs, showing the level of interest the Navy had for ironclad development after the Battle of Hampton Roads. For the purpose of brevity this study will focus on the USS *New Ironsides*, which represented the chief rival design, to the monitors. The USS *New Ironsides* was the other conventional vessel chosen by the first ironclad board. She was very similar in design to the French ironclad *La Gloire*, except that she was wider and had a shallower draft, so that she could work in coastal waters. Her broadsides and firing batteries were protected by four-inch thick iron plate and fifteen–inch oak backing. *New Ironsides* armament consisted of fourteen 11-inch Dahlgrens and two 150-pound rifled cannons, making her the most powerful ironclad in

the fleet. She was steam propelled and was initially rigged for sailing, but the masts were removed before her first combat and she fought most of the war in that configuration.

Commissioned in August 1862, the *New Ironsides* was assigned to South Atlantic Blockading Squadron and took part in the attacks on Charleston in 1863 and then later in the war she was with the North Atlantic Blockading Squadron and took part in the attacks on Fort Fisher in 1864/1865. She was the favorite ship of the anti-monitor contingent, which preferred her conventional shape and broadside armament to the low freeboard turret vessel. "Her key advantage over the monitors was in her number of guns and greater rate of fire."[31] Furthermore, she proved to be able to take a tremendous pounding, during the siege of Charleston she was hit hundreds of times with no serous damage or loss of life. Additionally, in October 1864 she was torpedoed and after the attack remained on duty for seven months before leaving for repairs. After the war she was decommissioned and was accidentally destroyed by fire in 1866.[32]

Along with the new warships came the development of tactics to best employ the armored vessels in combat. As the monitors counted for the majority of the ironclad fleet and impacted naval architecture more than other designs, the focus is on the tactics for that type of vessel. Additionally, the CSS *Virginia's* successful ramming of the *Cumberland* had an impact on tactics, which directly led to changes in fleets and doctrine.

Tactics for fighting monitors focused on two types of missions, attacking enemy ironclads, and fortifications. Attacking ships and fortification were not new missions for warships, but the all around fire provided by the monitors turret and the vessels perceived invulnerability led to different tactics than employed by wooden battleships. The

doctrinal manuals of the time provided no instruction to the best employment of ironclads so squadron commanders and monitor captains studied the Battle of Hampton Roads and developed their own tactics to best employ the ironclads. Tactics for fighting monitors, because of there lack of seaworthiness, emphasized coastal and river operations. However, the tactic of ramming was the focus of fleet tactics because of the *Virginia's* successful joust and the wide spread belief that the gun had been rendered ineffective by armor plating.

The primary mission of the *Monitor*, and all subsequent monitors was to attack and defeat enemy ironclads. After the Battle of Hampton Roads the capabilities of the monitors improved due to the industrial and technological advantage the United States had over the Confederacy. Second generation monitors improved in armor, lethality, and maneuverability, while the Southern casemate ironclads were essentially all copies of the *Virginia*. In battle, monitor captains used their superior maneuverability, firepower, and the ability to fire in any direction to attack the enemy ironclads from positions that prevented the Confederates rams from firing their broadsides. In all engagements after Hampton Roads it was a mismatch favoring the monitors.

This mismatch was best illustrated by the battle between the USS *Weehawken* and the CSS *Atlanta*. The *Weehawken* was able to take up a position to the front of the *Atlanta* after the *Atlanta* ran aground on a sandbar. *Weehawken* closed to within 300 yards of the Southern ship and fired four times with her eleven-inch and fifteen-inch Dahlgrens shattering the Atlanta's iron plate. The Atlanta's captain hauled up the white flag and the battle was over in fifteen minutes. John Rogers, Captain of the *Weehawken* reported after the battle,

> On examination it was found that the enemy had been struck four times, first on the incline side by a XV-inch cored shot, which although fired at an angle of fifty degrees with her keel, broke in the armor and wood backing, strewing the deck with splinters, prostrating about forty men. . . . The third shot XV-inch cored, struck the top of the pilothouse, knocking it off, wounding two pilots, and stunning the men at the wheel.[33]

A year later, during the battle of Mobile Bay, the USS *Chickasaw*, USS *Manhattan*, and USS *Winnebago* were able to envelop the ironclad CSS *Tennessee* and attack her from fifty yards after other Union warships had boxed in the Confederate ram. This action occurred after the monitors had survived heavy fire passing the Confederates at Fort Morgan, in which the *Winnebago* lost power to her rear turret and a torpedo [mine] sank the USS *Tecumseh.* The monitors' superior armor and firepower allowed them to quickly overpower the *Tennessee.* The Rebel vessel's steering chains were broken and the monitors' fifteen and eleven-inch guns breached her armor, wounding several sailors. The captain of the *Tennessee*, wounded during the attack, surrendered the ship.[34]

While the monitor's were effective in ship versus ship actions, monitor tactics for attacking fortifications were not as successful. Due to the fact that the ironclads were believed to be impervious to cannon fire, the squadron commanders determined they could be used to reduce fortifications from close range. The tactic was for a group of ironclads to maneuver into position to mass fires against a specific fortification, using the large guns of the ironclads to rubble the fort's masonry walls, which would lead to surrender or destruction of the target.

In the battle of Fort Sumter four *Passaic* class monitors plus the USS *Keokuk*, and the USS *New Ironsides* advanced in a line to attack the fort's northwest face. As soon as they moved into position, Fort Sumter and several other shore fortifications engaged the

ironclad fleet in a crossfire. The fortifications fired over 2,200 rounds to the ironclads 139 rounds. After an hour Admiral Du Pont, the squadron commander, called off the attack. Several ironclads had been hit more than fifty times. The *Keokuk* was hit ninety times by cannon fire from the fort and sank the next morning. All the ships received damage but no monitors were sunk and the only one monitor crewmember was killed. The primary reason for the defeat was the slow rate of fire from the monitors. The monitors' 15-inch guns, with 440-pound cannon balls, took seven minutes to fire. Furthermore, the 11-inch gun could not be loaded or fired at the same time as the larger gun further slowing down the process. Of the 139 shots fired by the ironclads, no more than twenty-five were fired by any one vessel. Additionally, the *Passaic* class monitors' weak engines and fouled iron-hulls made the ships slow and hard to maneuver in the currents of Charleston Harbor, this factor plus torpedoes [mines] around the fort made the monitors easy targets for the Rebel artillery. Admiral DuPont who did not favor monitors, stated in a letter to Secretary Wells,

> I remind the department that the ability to endure is not a sufficient element wherewith to gain victories, that endurance must be accompanied with a corresponding power to inflict injury upon the enemy. . . . That the weakness of the monitor class of vessels is fatal to their attempts against fortifications before which they must receive much more than they can return.[35]

The end result of this battle was the firing of DuPont for failing to take Charleston and not resuming the attack the next day. In the end Charleston was never taken by naval attack. All the fortifications were eventually destroyed, but it took a joint operation in 1865 to capture the city. The only bright spot in this dismal operation for the U.S. Navy was that subsequent classes of monitors were improved based on the equipment failures

of the *Passaic* monitors during this fight and better tactics for attacking fortifications were implemented.

In January 1865 the monitors redeemed themselves in a supporting the attack on Fort Fisher, near Wilmington, North Carolina. The four monitors and *New Ironsides* were part of a fifty-nine-ship flotilla, which attacked Fort Fisher in a joint operation to capture Wilmington. During the attack the monitors moved to within 800 yards of the fort and fired at individual gun emplacements instead of the fortifications. The monitors took numerous hits, but provided deadly accurate fire. Consequently, almost every gun on the fort was destroyed or separated from its mount during the intense three-day fight.[36] The commander of the ironclad division during the battle stated,

> When the enemy came out of their bombproofs to defend the fort against the storming party, I used my battery with great success against them every shell bursting apparently in the right place. At 5:20pm we ceased firing by orders of the flagship, nearly every gun on the fort facing us having been disabled in the first two days' action.[37]

The use of the monitors in conjunction with a larger fleet was effective because the Confederates could not concentrate their fire on the ironclads and the heavy guns of the monitors were able to destroy numerous enemy gun emplacements with one shot. Along with the development of ship engagements with monitors, another tactic, ramming became the predominate focus of U. S. Navy leaders and doctrine writers for the remainder of the war and into the twentieth century. The Battle of Hampton Roads revived the tactic of ramming after the *CSS Virginia* successfully rammed and sunk the USS *Cumberland.* The ram advocates failed to take into effect that the *Cumberland* was grounded and that the *Virginia* almost sunk when she could not break away from the

sinking ship. Nevertheless soon after the battle several ironclads and wooden gunboats were fitted with rams or had reinforced bows designed for ramming.

After the battle of Hampton Roads several naval officers were convinced that ramming was the best tactic for naval victory. Rear Admiral Goldsborough, commander of The North Atlantic Blockading squadron, 1861-1862 stated in a report to the Secretary of the Navy,

> The value of rams, at this very moment, cannot be overestimated. With a few of them in each of our prominent commercial ports, none scarcely of more than half the displacement or weight of the *Dictator*, no enemy, I care not how powerful, could blockade those ports successfully . . . . Even the *Warrior*, although a vessel of vast size and enormous strength could be crushed by a ramming blow from the *Dictator*, as though she were nothing more than an immense egg.[38]

The creation of a ramming fleet on the Mississippi River to counter Confederate ironclad rams was a direct result of the battle. The Army established the Ellet Ram Fleet in October 1862 under the command of Colonel Charles Ellet. Secretary of War, Edwin Stanton, sent the following message to Colonel Ellet, "You will please proceed immediately to Pittsburgh, Cincinnati, and New Albany and take measures to provide steam rams for defense against ironclad vessels on the Western waters."[39] The fleet consisted of nine steam rams and its mission was to destroy Confederate warships on the Mississippi River. In the battle of Memphis in June 1862 the fleet rammed and sunk several rebel ships during the capture of the city. Interestingly, during the Battle of Mobile Bay several wooden steamers with reinforced bows rammed the Southern ironclad *Tennessee*, but were not able to cause any damage to the heavily armored vessel. The wooden ships caused some damage to their own hulls, but were able to cutoff the Confederate ship unable to maneuver freely, the monitors joined the fight pounding the *Tennessee* to submission.

Although the *Virginia's* ramming of the *Cumberland* led to a great revival of this tactic in the United States and abroad it was not formally published in U. S. Navy tactical manuals until after the war. The Battle of Lissa in 1866, in which an inferior Austrian fleet rammed and sunk two ironclads of the Italian Fleet, furthered the interest of ramming as a tactic of war and seemed to validate the American experience. The first official Navy publications that give instructions on ramming was *An Introduction to the United States Signal Code*, published in 1867, which refers to dashing the enemy's line and *Fleet Tactics Under Steam*, published in 1869, which advocates,

> Attacks should be led by a vessel of great artillery and ramming power and should have abreast of it the most formidable ram or torpedo vessel in the fleet, which should strike, at full speed, one of the enemy's vessels, thereby sinking or disabling it and opening a passage ahead of the engaged vessel for the attacking columns.[40]

Subsequently, tactical manuals and other books to include the Navy's *Tactical Signal Book* of 1873 and Commander W.M. Bainbridge-Hoff's, *Modern Naval Tactics*, published in 1884, provide detailed instruction and illustrations on fleet formations and actions for ramming. Ramming remained a doctrinal tactic of the U. S. Navy for the remainder of the nineteenth century and up until World War I.[41]

The Battle of Hampton Roads, and the USS *Monitor*, and CSS *Virginia* influenced the United States Navy in five ways. The first was the reorganization of the Bureaus of the Navy to effectively administer the large wartime Navy and emerging technology of the ironclads. In addition the Monitor Bureau was created to contract private shipyards and oversee the construction of ironclads, as the Navy lacked the facilities and equipment to build ironclad vessels. The second was the stationing of ironclads in blockading squadrons to counter Confederate ironclads threatening the

blockade. The third was the reorganization of ships' crews. The replacement of broadside sailing/steam ships of the line with steam driven turret ironclads led to a reduction of the number of personnel required for operating a battleship. The Engineer Corps became accepted members of the naval community because the new ships were dependent on engineers to maintain and operate the machinery.

The fourth impact was the success of *Monitor* that led to the building of seven classes of monitors to include improved single turret monitors, seagoing monitors, shallow draft monitors, and double turreted monitors. In addition to the single and double turret monitors, five ironclads were built from alternative designs, as the Navy looked for the best solution to the Confederate ironclad threat. Furthermore, the *Monitor* design and the European cruise of the double turret monitor, *Miantonomoh* in 1866 had great influence on warship design in Great Britain, France, and Russia. Lastly, the battle led to the development of tactics for fighting monitors against enemy ironclads and fortifications, and it revived ramming as a tactic of naval warfare.

At the end of the Civil War the United States Navy was the largest, most modern naval force in the world. The fleet totaled 641 ships to include over eighty ironclads in service or under construction. With the war over the United States turned its attention to westward expansion and the need for a large navy fell out of favor with Congress. The Navy sold or scrapped the majority of it ships and returned to its roots, a small cruising navy, as it was prior to the war.

The monitors were sold or broken up except for fifteen single turret monitors of various classes and the four double turret monitors of the *Miantonomoh* class. Until the rebuilding of the Navy in the 1890s these few ships, which were mostly kept in storage,

were the only resemblance of a modern navy the country had during the late nineteenth century. Rebuilt and modernized with stronger armor, new engines, and breech loaded cannons in time of emergency, the monitors served long after they were obsolete, the last ones being sold in the 1920s. Finally, the lasting legacy of this famous battle and its combatants was the revolving turret became the predominate method of mounting guns on battleships into the twentieth century.

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[1]Donald L. Canney, *Lincoln's Navy* (Annapolis: Naval Institute Press, 1998), 1.

[2]Clark G. Reynolds, *Navies in History* (Annapolis: Naval Institute Press, 1998), 123-125.

[3]Angus Konstam, *Union Monitor, 1861-1865*. (Oxford: Osprey Publishing, 2002), 8.

[4]Canney, *Lincoln's Navy*, 29.

[5]Ibid., 25.

[6]Canney, *The Old Steam Navy*, vol. 2, *The Ironclads 1842-1885* (Annapolis: Naval Institute Press, 1998), 85.

[7]A ship placed in ordinary was placed in storage or mothballed.

[8]Konstam, 33-34.

[9]James Phinney Baxter, *The Introduction of the Ironclad Warship* (Cambridge: Harvard University Press, 1933), 303-304.

[10]Canney, *The Old Steam Navy*, vol. 2, *The Ironclads, 1842-1885*, 137-139.

[11]MacBride, 23.

[12]Canney, *The Old Steam Navy*, vol. 2, *The Ironclads 1842-1885*, 77.

[13]MacBride, 23-24.

[14]Ibid., 25.

[15]Alvah Folsom Hunter, *A Year on a Monitor and the Destruction of Fort Sumter* (Columbia: University of South Carolina, 1987), 169.

[16]MacBride, 27-31.

[17]Baxter, 275; Canney, *The Old Steam Navy*, vol. 2, *The Ironclads, 1842-1885*, 57-59.

[18]Baxter, 305.

[19]MacBride, 34.

[20]Canney, *The Old Steam Navy*, vol. 2, *The Ironclads, 1842-1885*, 114-119.

[21]Ibid.

[22]MacBride, 61.

[23]Konstam, 23.

[24]Canney, *The Old Steam Navy*, vol. 2, *The Ironclads, 1842-1885*, 119.

[25]Ibid., 66.

[26]Ibid., 67.

[27]James A. Knowles Jr. " Blue Water Monitor," in *U. S. Naval Institute Proceedings*. (March 1973), 85.

[28]Ibid.

[29]Paul H. Paist, "Monitors-Ships that Changed War," in *U. S. Naval Institute Proceedings*. (June 1961), 83.

[30]Canney, *The Old Steam Navy*, vol. 2, *The Ironclads, 1842-1885*, 135.

[31]Ibid.,19.

[32]Ibid.

[33]United States Naval War Records Office, *Official Records of the Union and Confederate Navies in the War of the Rebellion*, Series I, vol.14 (Washington: Government printing Office, 1908), 266. Hereafter sited as ORN.

[34]MacBride, 115,123.

[35]William N. Still, "Technology Afloat" in *Raiders & Blockaders* (Washington DC: Brassey's, 1998), 44.

[36]Canney, *Lincoln's Navy*, 197-198.

[37] ORN, Series I, vol.11, 462.

[38] MacBride, 149,153.

[39] ORN, Series I, vol. 22, 680.

[40] Robinson, 678.

[41] Ibid., 679.

CHAPTER 4

IMPACT ON THE ROYAL NAVY, 1862-1871

The Royal Navy was the premiere naval fighting force in the world during the nineteenth century. Its ability to power-project around the world made Great Britain the world's first superpower. She was unmatched by any country in the amount of warships she owned and the amount of territory they patrolled.[1] The need of Great Britain to have a naval quantitative and qualitative advantage over its main rival, France and, to a lesser degree Russia and the United States fueled a naval technological race from 1815 to 1871. Great Britain developed a naval doctrine known as the "two power standard." The Royal Navy would maintain more ships than the French and Russian navies combined, and thereby have the ability to defeat both of them.

Changes to organization, shipbuilding, and tactics were spurned on by innovations of French and American ingenuity. Each time a new technology emerged that might give another country an advantage, the Royal Navy attempted to improve on the invention and relied on Great Britain's manufacturing base to out-build any threat.[2] Two significant events occurred during the mid-nineteenth century that would fuel the change of the Royal Navy from the world's best wooden sailing fleet to the world's best iron/steel steam fleet. First, the French built the world's first seagoing ironclad warship, *La Gloire*, in 1859, leading Great Britain to start its own ironclad program with the building of HMS *Warrior* in 1860. Second, the Battle of Hampton Roads, 8 and 9 March 1862, clearly signaled the end of the wooden warship era and led Britain to produce turreted, steam driven warships culminating with the launching of HMS *Devastation* in 1871.

As an island nation and a maritime power both economically and militarily Great Britain required a naval strategy that would preserve her position. The British naval strategy in wartime was to defend the British Isles from invasion, protect lines of communication, defend the merchant fleet, and defeat the enemy by attacking his merchant fleet and coastline. During peacetime the strategy was to prevent war by projecting overwhelming force and providing protection for the merchant fleet and oceanic trade routes.[3]

In order to implement Great Britain's naval strategy, the battlefleet was divided into fleets and squadrons with different geographical areas of responsibility. Fleets and squadrons varied in size from two to thirty ships with a combination of pure sailing ships and sail/steam hybrids. The two permanent fleets were the Home or Channel Squadron and the Mediterranean Fleet. The Home or Channel Squadron was responsible for defense of the British Isles, primarily from invasion from France, and for containing the Russian fleet in the Baltic Sea. The Mediterranean fleet was responsible for protecting British merchant shipping, countering the French Fleet, protecting Turkey from Russia, and ensuring overall stability in the region. It was the largest of the British fleets and considered the most important during this time period because of the region's large impact on maritime trade and Great Britain's economy.

The first ironclads HMS *Warrior*, HMS *Defence*, were stationed with the Home/Channel Squadron in 1861 to counter the French Navy after the launching of *La Gloire*. Because of the Civil War in the United States, the Royal Navy assigned its ironclad fleet to Lisbon, Portugal in 1862 where it could react to any emergency in North America and protect the British Isles from any French invasion attempts.[4] From 1861 to

1865 of the ten ironclads in the Royal Navy, no more than two were assigned overseas and they were both in the Mediterranean Fleet.[5]

The Royal Navy had eight overseas stations from 1815 to 1862: South America, North America/West Indies, Cape of Good Hope, West Coast of Africa, East Indies, Pacific, Australia, and China.[6] Other fleets/squadrons were formed during times of emergency to conduct operations, such as the Baltic Sea Fleet and the Black Sea Fleet, organized during the Crimean War 1854-1856 to defeat the Russian Navy. During the American Civil War, the North American/West Indies Squadron patrolled the coast of the United States and in the Caribbean from 1861-1864 to observe the naval operations of the Union and Confederacy and to protect British merchant shipping. The commander of this squadron gathered intelligence for Great Britain on the Battle of Hampton Roads and the ironclad programs of the Union and Confederacy.

The news of the Battle of Hampton Roads was a shock. The fact that the Americans built ironclad warships believed to be superior to the Royal Navy's was an outrage. The *London Times* stated,

> Whereas we had available for immediate purposes one hundred and forty nine first class warships, we have now two, these two being the *Warrior* and her sister ironside [HMS *Defence*]. There is not now a ship in the English navy apart from these two that it would not be madness to trust to an engagement with that little *Monitor.*[7]

Parliament, equally disturbed, held hearings to determine what Great Britain would do to answer this perceived new threat to British Naval supremacy. Several Members of Parliament had serious doubts about Britain's naval dominance. Member of Parliament George Bentinick stated, "We have learned that the boasted navy of Great Britain, when opposed to iron vessels, is useless as a fighting navy."[8]

The Admiralty was not as surprised as the public. They exclaimed that the battle had only proven what was already known, that an armored ship would destroy a wooden ship in battle. " The Duke of Somerset, First Lord of Admiralty stated, in April 1862, 'it was already the undivided opinion of all experienced men that where wooden ships met iron ships the former could not live'."[9] The Admiralty continued to downplay the significance of the ironclad battle, while quietly instituting numerous changes to upgrade what privately was perceived as a vulnerable battlefleet. The commander of the North American/West Indies Squadron was ordered to gather as much information as possible on the Union and Confederate ironclad programs to prevent wasteful experiments.[10]

The Battle of Hampton Roads would ultimately influence the Royal Navy to station ironclads on foreign stations to protect its wooden ships. Further, it led to the transformation from ships with broadside armament to turreted warships, mounting only a few large caliber guns, which in turn led to a reorganization of ships' crews. Lastly, the battle influenced the development of tactics for all-around fire, coastal warfare, and ramming.

Before the Battle of Hampton Roads, all of the ironclad warships were stationed in the Home Squadron to counter the French armored fleet, with wooden warships patrolling foreign waters. The battle, and the construction of ironclads by the United States and the Confederate States, changed this strategy. The First Lord of Admiralty stated, "Now, if other nations in distant seas were to follow the American example, Great Britain must be prepared to send her armored ships to all quarters of the globe."[11] In 1861, there were no ironclads assigned overseas. In 1865, two ironclads were assigned to the Mediterranean Fleet and, in 1870, there were nine ironclads overseas.

Armored warships were assigned to the Mediterranean to deter the French Fleet, to the North America/West Indies Squadron to counter the United States Navy, to the Pacific Squadron to counter Chile and Peru, and to the China Station to deter France, Russia, and Japan. Additionally, coastal monitors were assigned to Australia and India.[12] The Admiralty assigned no more than one to two ironclads to an overseas squadron, minus the Mediterranean, which had five. Though limited in number, they served as a powerful deterrent and, except for the minor engagement with the Peruvian ironclad *Huascar* in 1877, the overseas squadrons saw no combat.

Furthermore, The *Monitor* and the *Virginia* influenced the Royal Navy to build shallow draft vessels for use as coastal defense ships for the protection of British coastal waters. The Admiralty, while not impressed with the American ironclads as seagoing vessels, thought the United States ironclad fleet a formidable force in its home waters.

> The Controller, however, had no wish to disparage the skill and industry displayed in their construction, or to under value the "enormous defensive power which has thus been developed," a power which he believed rendered the Americans "practically unassailable in their own waters."[13]

The French Invasion scares of the 1860s led to a defensive strategy for the battlefleet to protect the British Isles. This change in strategy, and Parliament's directive to the navy to designate ships for coastal defense, led the Admiralty to build ships of the monitor design for this mission.

> The shift from "blue water" to "coastal defense" had several factors propelling it. Most compelling, at least from a purely naval standpoint, ships built specifically for operations in coastal waters fulfilled a real want of the service, that being of armorclads of shallow draft.[14]

A total of thirteen coastal monitors were built for harbor and coastal defense in the 1860s and 1870s. One was stationed in Australia, two in India, and ten were with the Channel Squadron for defense of the British coastline and major ports.

The changes to the organization of the squadrons to incorporate ironclads paralleled the change to crew organization initiated by the transformation to steam driven turreted battleships. The decision by the Royal Navy to replace broadside armament with turrets and to rely solely on steam engines to power ships was influenced by the Battle of Hampton Roads and the USS *Monitor.* These changes in ship design led to a reorganization of crews on British warships. The adaptation of the turret reduced the amount of gun crews needed to man a ship. In addition, the improvement in steam technology led to steam becoming the primary source of power reducing the amount of sailors needed, but increasing the amount of engineers required.

Within nine years of the Battle of Hampton Roads, ships were being built without sails and mounting two to four large guns in turrets. HMS *Victoria,* a steam battleship launched in 1859, was a sailing ship with auxiliary steam power and a broadside of 121 cannons. Her crew numbered 1000 officers and men. Twelve years later, in 1871, HMS *Devastation,* the first ocean going mastless battleship, armed with four large bore cannons mounted in turrets, was manned by only 358 officers and men.

The breastwork monitors influenced by the USS *Monitor* design were dependent on engineers to maintain and operate the machinery. A crew of seventy-seven officers and men manned HMVS *Cerberus,* a breastwork monitor. Of this number, nineteen were engineers responsible for the twenty engines powering the ship. The typical workweek for the ship's engineers consisted of performing inspections and maintenance on the ships

main engine, auxiliary engine, watertight doors, hull, boilers, turret engine, turret gears, and the dynamo machine that produced the ship's electricity.[15] The steam powered turreted warships of the 1860s-1870s justified the Engineer Corps existence in the Royal Navy.

These changes in organization occurred following the radical change in shipbuilding influenced by the battle and the *Monitor* design. Many navies were building prototype ironclads and conducting experiments, however the significance was the Americans were testing their ships in battle.[16] While the Admiralty downplayed the battle to the government and public, the shipbuilding programs after March 1862 included coastal turreted ships, seagoing turreted ships, breastwork monitors, and the first modern battleship.

The Royal Navy ship designers, differing from Ericsson, preferred multi turreted vessels. Of the seventeen turreted ironclads built, only three were single turret monitors. Furthermore, the CSS *Virginia* sent a powerful message with the destruction of two wooden warships. In 1861, the construction of wooden steam battleships was suspended. After Hampton Roads worked stopped on all wooden ships, except those being converted to ironclads.[17] Additionally, *Virginia's* ramming of the USS *Cumberland* led to ships built with rams or hardened bows designed for ramming.

In April 1862 following the news of the Battle of Hampton Roads the Admiralty ordered the construction of Britain's first turreted warship, HMS *Royal Sovereign.* Both the *Monitor*, and the *Virginia* influenced her design. Sir Isaac Watts' design called for the cutting down of the wooden steam battleship *Royal Sovereign* to her gun deck, and applying armored plate of four and half-inches to her sides, similar to the *Virginia*. The

next step was to mount four turrets and five guns. One turret was designated to have two guns. The turrets had ten inches of armor to the front and five inches to the back. Her armament consisted of five 9-inch guns. She was completed in 1864, and assigned as a coastal defense ship.[18]

The Royal Navy did not use John Ericsson's turret design for their ships, instead they relied on turrets designed by Captain Cowper Coles, a Royal Navy officer. In 1859, Coles patented in Great Britain a design for his armored shield mounted on a turntable, large enough to mount two cannons for use against ships or fortifications. This work was done without knowledge of John Ericsson's plans. The shield rested on a ring of ball bearings and was turned by a manual hand wheel or steam power. The base of the turret was placed several feet below the deck, protecting the turning mechanism. This turret differed from the Ericsson design, in which the turret rotated on a central mounted spindle and sat flush on the deck.

He submitted the plans for placing several of his "shot proof hemispherical screens" on an ironclad to the Chief Constructor, but it was rejected because the Constructor thought that the ship would have to be very large to mount the turrets. Additionally, he stated that the turret and gun would be slower to operate than the cannon by itself.[19] The plans were also submitted to Prince Albert, who, upon review, ordered the construction of one of the designs. Prince Albert stated "…should Captain Coles' plan succeed, his ships will be vastly superior to those we are now building. . . ."[20]

In 1861, an experimental turret, cylindrical shaped with 4.5 inches of armor and an Armstrong 40-pound breech loading gun was mounted on the armored battery *Trusty* for a series of test. The tests were designed to measure the ability of the turret to resist

cannon fire and to determine the time to traverse the turret and fire its gun. The tests were very successful. A 68-pound cannon, a 40-pound gun, and a 110–pound gun fired at the turret over thirty times without damaging the turret. The turret and gun combination was also judged to be faster at engaging targets, because of the turret's ability to traverse and the quick firing breech loaded gun.[21]

The Admiralty in January 1862 approved the construction of an ironclad armed with Coles' turrets to be used for coastal defense. While this approval occurred before Hampton Roads, it was three months after the United States Navy approved the building of the *Monitor* in October 1861. The Admiralty knew the United States was building a turreted ironclad before the Battle of Hampton Roads occurred.[22] Additionally, the United States Navy knew of the Coles' turrets: "The Bureau of Construction and Repair proposed in November 1861, to build twenty wooden ironclads each mounting two Coles turrets."[23]

HMS *Prince Albert*, designed by Isaac Watts was the turret ship approved for construction in January 1862, but no date was given to start her construction. As a result of Hampton Roads, her construction was contracted to a private shipyard and began in April 1862. She was the Royal Navy's first vessel constructed specifically as a turreted war ship. The *Prince Albert* was built with an iron-hull with armor plating 5.5 inches thick, yet different from the *Monitor* and the *Virginia* she had a high freeboard. Her armament was the same as the *Royal Sovereign*, except with four guns instead of five. The *Prince Albert* was a steam-powered ship, and did not have masts and rigging. Upon her commissioning in 1866, she was assigned to coastal defense duty in the Home

Squadron.[24] Captain Coles, objecting to the coastal defense role of the turret ships wanted his turrets proven at sea.

Captain Coles had lobbied the Admiralty to mount his turrets on a seagoing warship. Yielding to political and public pressure, the Admiralty ordered Reed to design a seagoing warship mounting Coles' turrets. Construction began on HMS *Monarch* in 1866, and she was commissioned in 1869. The *Monarch* was built with an iron-hull, with a fourteen-foot freeboard and two armored turrets mounting twin 12-inch cannons in each turret. The Royal Navy considered the *Monarch* to be a very good ship, but tests proved that the turrets could not achieve all around fire because of her masts and rigging. Thus 7-inch pivot guns were added to the bow and stern. Nevertheless, she proved a most dependable ship and served into the twentieth century.[25]

Captain Coles considered the *Monarch* a failure, because the turrets' fields of fire were restricted. So he petitioned the Admiralty through the newspapers and Members of Parliament, to allow him to build a seagoing turret ship of his own ideas. Construction began on HMS *Captain* in 1867 and she was commissioned in 1870. Coles' design was not radically different from HMS *Monarch* except for one feature. The *Captain* had a low eight-foot freeboard. Despite Coles' complaints about the construction of HMS *Monarch*, the *Captain* suffered the same limitations. She was fully rigged for sail and had a forecastle on the bow and a poop deck on the stern, which meant her turrets' fields of fire were restricted. In addition to these problems, the Chief Constructor, Reed, was concerned that the combination of low freeboard, turrets, and sails would give her a high center of gravity, which in a high wind or storm would cause the ship to capsize.

On the night of 6 September 1870, HMS *Captain* was caught in a storm near the Bay of Biscay while under sail. The wind tipped her over and she immediately capsized killing 473 men, including Captain Coles. The court marshal findings determined what Reed had predicted, that the use of a low free board, turrets, and sails had caused the *Captain* to capsize. The Royal Navy did not build anymore turret ships with masts and sails.[26]

The *Monarch's* inability to achieve all around fire due to her mast and rigging, and the loss of the *Captain*, influenced Reed to build a turreted battleship that did not require sails to operate at sea. He stated, " my clear and strong conviction at the moment of writing these lines is that no satisfactory designed turret ship with rigging has yet been built or even laid down…."[27] His plan was to design a ship using new more efficient steam engines and a large coal storing capacity. The visit of an U. S. Navy, double turreted monitor would greatly influence his design.

The 1866, tour of the USS *Miantonomoh* with Assistant Secretary of the United impressed the European navies. Sir Edward Reed was fascinated by the design of the original *Monitor* and the large double turret *Miantonomoh*, and decided to improve upon their designs to make a seagoing mastless warship.

> There can be no doubt whatever that from the *Monitor* and her successors European constructors and naval officers derived some extremely valuable suggestions. . . . But the service rendered to Europe was not confined to the construction and exploits of the *Monitor* itself. The coasting passages, and later on, the sea voyages of other vessels of the monitor type, but of larger size, were watched with intense interest, and gave to the naval world instructive experiences which could in no other way have been acquired.[28]

In 1866, the Colony of Victoria (Australia) requested a coastal defense ship to protect Melbourne Bay from hostile naval forces. Reed took the twin turreted monitor

model and added an armored superstructure between the turrets called a breastwork. The ship, HMVS *Cerberus*, was the first of seven ships of the breastwork monitor class. Construction on the *Cerberus* began in 1867, and was completed in 1870 arriving for duty in Melbourne Bay in 1871.

The *Cerberus* was comparable in size to the large twin turreted monitors of the United States Navy. Her armament consisted of two turrets with ten inches of armor and four 10-inch muzzle loaded rifled guns and four 1-inch machine guns.[29] What set her apart from earlier monitors and made her more seaworthy was the breastwork. The breastwork stood six feet above the deck and had eight to nine inches of armor plating. It housed the engines for the turrets, the cooking ranges, a steering wheel, and the hatchways to the lower hull. The pilothouse mounted on top of the breastwork was also protected by eight to nine inches of armor. Finally, two steam engines, and twin screw propellers, a first in the Royal Navy, powered the *Cerberus.* She had a top speed of nine knots.[30]

While the *Cerberus* is categorized a steam powered ship, for her voyage from England to Australia she was fitted with temporary mast and sails due to her limited coal capacity. Also, temporary sides were mounted to her hull to increase the height of the freeboard. These modifications were made because of the loss of HMS *Captain.* Upon arrival in Melbourne Bay, her crew removed the masts, rigging, and sidewalls returning the *Cerberus* to her original configuration.[31]

HMVS *Cerberus* had an uneventful career in Melbourne Bay, but served until 1924 when she was sold to a salvage company. Seven other ships of this class were built. Two served in India, and the other five as coastal defense in Great Britain. This class of

coastal monitors formed the important link between the Civil War monitors and the modern battleship. Reed's addition of the breastwork made the low freeboard monitors seaworthy vessels. Furthermore, the breastwork monitors signaled a major change in naval architecture in the Royal Navy, as it transitioned from ships built from eighteenth century design to ships that heralded the navy of the twentieth century.

In 1869, Reed used the breastwork monitor design to build the first mastless seagoing battleship, HMS *Devastation*. HMS *Devastation* was laid down in 1869 and completed in 1871. Her design was a complete break from the wooden steam battleships and the steam/sail ironclads of the early 1860s. H.W. Wilson, in his book *Ironclads in Action*, referred to the *Devastation* and her sister ships, as "the ultimate development of the low freeboard turret ship which Ericsson and Coles had devised."[32]

As with the building of *Cerebus*, Reed was greatly influenced by the *Monitor* design, and the later class double turret monitors when designing the *Devastation*. Reed stated in his book,

> It is not possible to dwell at length upon the means by which the *Monitor* influence took effect in the navies of Europe, but it may be doubted whether ships like *Devastation*, *Thunderer*, and *Dreadnought*, which naval officers declare to be today the most formidable of all British warships would have found their way so readily into existence if the monitors of America had not encouraged such a large departure from Old World ideas. In this sense the *Times* correctly stated some years ago the American monitors were certainly progenitors of our *Devastation* type.[33]

Following the monitor design, she was built with a low freeboard iron-hull, protected by twelve inches of armor, with her turrets and breastwork protected by fourteen and twelve inches of armor respectively. *Devastation's* armament consisted of four 12-inch muzzle loaded rifled guns that fired 700 pound shells. Her deck was clear of masts and rigging, except for a signal mast on top of the bridge. The most important

features were her two steam engines powering twin screw propellers and a coal capacity of 1800 tons, which was double the capacity of all other battleships at that time. Her top speed was fourteen knots. In the 1880s, she was refitted with improved steam engines and was able to cross the Atlantic Ocean and return without coaling. [34]

The *Devastation* was 285 feet long, sixty-two feet wide, and weighed 9,180 tons, until the launching of her sister ships, HMS *Thunderer* and HMS *Dreadnought* she was the largest ship in the Royal Navy. Due to the loss of the *Captain*, and her low freeboard design, the *Devastation* was tested by a committee of engineers and naval officers to determine her seaworthiness. She was determined to be safe, and served a long career with the Channel Squadron and the Mediterranean Fleet. She was decommissioned and sold for scrap in 1908. Considered by many as the first modern battleship, she was also the pinnacle in monitor design.

The *Monitor* design not only influenced the development of the first modern battle ship, it also led to a change in the armament of warships in the Royal Navy. "The introduction of the armored turret in the *Monitor* influenced all the future of armed ships and in the form of turret or barbette the revolving gun behind armor survives in all navies."[35] Broadsides of sixty to a hundred cannons were replaced with armored turrets mounting two to four large caliber guns. Reed's breastwork monitor design perfected the use of the turret and rendered the broadside obsolete in the Royal Navy. In 1868, the Royal Navy launched its last broadside ship, HMS *Northumberland.*

The turret also proved to be the best platform for mounting weapons of extremely large caliber and size. This trend started with Dahlgren building 15-inch cannons specifically for monitor turrets. The British followed this plan and mounted their large

muzzle loaded rifled guns in their turrets. “By the use of armored turrets, originated in the United States, and developed by Captain Coles in England, it was possible to increase the weight and power of the gun….[36] In addition, every time a new ironclad was produced its armor was thicker than on previous ships, and larger guns were produced, to defeat the heavier armor. This race culminated with the 16.5-inch guns of HMS *Benbow*, in 1885.[37]

A good example of the change brought on by the transformation to the turret is to compare HMS *Warrior* to HMS *Devastation*. The *Warrior*, built in 1860, had 4.5 inches armor and mounted twenty-six 8-inch guns firing, 68-pound projectiles, and ten 7-inch breechloaded rifled cannons firing 110-pound projectiles. By comparison, the *Devastation*, launched in 1871, was protected by fourteen inches of armor and was armed with four 12-inch muzzle loaded rifles firing 700-pound projectiles. The *Warrior* was obsolete ten years after her commissioning.

Along with the building of new warships and the adoption of the turret came the development of tactics to best employ the turreted ironclads in combat. The Battle of Hampton Roads influenced the Royal Navy to develop tactics for ships with all around fire and for coastal warfare. Additionally, The *Virginia's* successful ramming of a wooden warship had a large impact on the development of fleet tactics.

News that the *Virginia* sunk the *Cumberland* by ramming revived interest in this tactic with the Royal Navy and all navies. What tacticians and naval officers failed to recognize was that battle was fought in shallow coastal waters and the *Cumberland*, which had run aground, was stationary when it was rammed. The *Virginia's* ram stuck in the *Cumberland* and she almost sank with the stricken ship until the ram broke off, freeing her from her victim. Numerous other attempts at ramming made during the Civil

War failed when attempted against a moving target and were often more dangerous to the attacker, causing serious damage to the bow of the ship. Then, in 1866, the Austrian Fleet successfully rammed and sunk an Italian ironclad in the Battle of Lissa. Again, the ship destroyed was stationary, providing an easy target for the attacker. Nevertheless, the Royal Navy developed fleet tactics that centered on ramming the opposing fleet in battle.

The Admiralty believed that armor had nullified the gun as a decisive weapon and that ramming was the only effective way to sink an ironclad vessel. This idea led to several tactical manuals and essays published on ram tactics. In 1865, Admiral P. H. Colomb, Royal Navy, an avid support of the ram tactics, published several papers listing tactics, techniques and procedures for single ship battles and fleet actions. He believed a single ship had the ability to ram another ship and that gunfire could not prevent the attacker from succeeding. He concluded the ship with the smallest turning radius would win the fight, because she could ram the larger ship by getting inside the larger ship's turning circle.[38]

However, in fleet action, a battle fleet could defeat another fleet attempting to ram by maintaining its line abreast or column formation, and engaging the enemy with guns as the fleets passed each other. Colomb based his theory on the fact that ships would not attempt to ram head on and that, as the fleets passed, they would fire into the enemy's broadsides. He concluded the ram had no advantage in fleet tactics and the best defense against it was a tight formation of columns.[39] Despite the fact that in several wars, fast moving squadrons employing heavy guns, defeated fleets attempting ram tactics, ramming would remain a viable tactic in the Royal Navy until after World War I.

On the second day of the battle of Hampton Roads, the *Monitor's* turret proved the tactical value of all around fire was as important as ramming. The *Monitor's* crew did not have to maneuver the ship to aim her heavy guns at the *Virginia*. The Royal Navy, impressed with the turret's performance in battle, eventually mounted them on mastless ships that could achieve all-around fire and modified old sailing tactics to employ turret mounted weapons. Once the two fleets joined in a melee, or in single ship combat, the all around fire of the turrets gave the battleship the advantage of firing in any direction without repositioning.

> You may put an ironclad in any position you please, and if she is attacked by three unarmored vessels [cruisers] she will make a run at one vessel or the other and attack with her guns. . . .The two other vessels, you say, will follow and disturb the action of the ironclad; but it must be recollected that the ironclad will always be firing at them, one gun at least…destroying the fighting power of the cruise.[40]

Lastly, the *Monitor* and the *Virginia* gave great impetus to the use of shallow draft armor vessels for coastal warfare. The shallow draft armorclads had two primary missions: to protect coastal waters and ports, and to attack enemy fortifications and ships protecting ports. The *Virginia* had successfully raided and destroyed two ships in an enemy harbor on the first day of battle. On the second day, the *Monitor* successfully defended the ships in Hampton Roads from the Confederate ironclad.

Later in the war, the monitor class vessels were used to attack fortified harbors with mixed results. The Southern *Virginia* class ironclads were all used to attack blockading Union warships and protect harbors and ports. Most were successful until bested by a superior Union ironclad. The Admiralty, despite their reservations about the monitors after the failed attack at Charleston and their suspect seaworthiness was still

convinced that a shallow draft ironclad was the best weapon for attacking enemy ports and harbor defense.

> Two guns in a ship that cannot be sunk [from shell fire] and where the battery is protected will prove more than a match for twenty in an ordinary wooden ship . . . twenty additional vessels of this class might be converted into formidable defenses for the Channel, or equally formidable engines of offense against neighboring ports.[41]

The Royal Navy throughout the late nineteenth century, and into the twentieth century would train on coastal attack and coastal defense tactics. HMVS *Cerberus* trained on coastal attack and defense throughout her service. She conducted training on the attack of coastal fortifications, enemy ships, and the defense of Melbourne Harbor. Monitors assigned to the Channel Squadron practiced similar tactics to prepare for battle on the English and French coast, if war commenced with France.

The defense strategy of the Royal Navy in the 1860s and 1870s led to the development of monitors and tactics for coastal warfare. The Admiralty used the Battle of Hampton Roads and other naval battles of the Civil War as a guide for developing coastal warfare tactics. Finally, the Royal Navy continued to develop coastal defense doctrine into the twentieth century and had a class of ships known as monitors in service during World War II.[42]

The Royal Navy was the premiere naval fighting force in the world during the nineteenth century. Its ability to power-project around the world made Great Britain the world's first super power. The need of Great Britain to have a naval quantitative and qualitative advantage over its main rival, France and, to a lesser degree Russia and the United States fueled a naval technological race from 1815 to 1871. Great Britain developed a naval doctrine known as the "two power standard." The Royal Navy would

maintain more ships than the French and Russian navies combined, and, thereby, have the ability to defeat both of them.

Changes to organization, shipbuilding, and tactics were spurned on by innovations of French and American ingenuity. Each time a new technology emerged that might give another country an advantage, the Royal Navy attempted to improve on the invention and relied on Great Britain's manufacturing base to out-build any threat.[43] The Battle of Hampton Roads, the *Monitor*, and the *Virginia* influenced the Royal Navy in several ways. First, it caused the stationing of ironclads in overseas squadrons to counter foreign ironclads outside of European waters. The building of the *Monitor* and the *Virginia*, and the battle, convinced the Admiralty that other small navies would follow the Americans lead and build ironclads. These few armored vessels could threaten Royal Navy squadrons posted to foreign stations that did not have ironclads. The second was the reorganization of ships' crews. The replacement of broadside sailing/steam ships of the line with steam driven turret battleships led to a reduction of the number of personnel required for operating a battleship. The Engineer Corps became more accepted as members of the Royal Navy because the new ships were dependent on engineers to maintain and operate the machinery.

Additionally, the *Monitor's* armored turret and large caliber cannons led to a change in the armament of warships in the Royal Navy. Broadsides of sixty to a hundred cannons were replaced with armored turrets mounting two large caliber guns. Furthermore, naval designs affected by the USS *Monitor* and later class twin turreted monitors influenced the building of the breastwork monitors and the first modern battleship HMS *Devastation*. Lastly, the battle influenced the development of tactics for

ramming, turret ships, and coastal warfare. The Royal Navy downplayed the significance of the first ironclad battle, while quietly instituting numerous changes to upgrade its battlefleet and maintain its position as the most powerful navy in the world.

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[1]In 1815 Great Britain owned 214 ships and possessed territories in every hemisphere.

[2]David K. Brown, "Wood, Sail, and Cannon Balls To Steel, Steam, and Shells, 1815-1895" in *The Oxford Illustrated History of the Royal Navy,* ed. J. R. Hill (Oxford: Oxford University Press, 1995), 163.

[3]Andrew Lambert, *The Last Sailing Battlefleet* (London: Conway Maritime Press, 1991),1.

[4]Andrew Lambert, *Battleships in Transition* (London: Conway Maritime Press, 1984), 85.

[5]John F. Beeler, *British Naval Policy in the Gladstone-Desraeli Era, 1866-1870* (Stanford: Stanford University Press, 1997), 27; HMS *Warrior*, "Facts and Figures." [database on-line], available from http://www.hmswarrior.org/facts.htm; Internet: accessed on 26 December 2002.

[6]Beeler, 26.

[7]William Still Jr., John M. Taylor, Norman C. Delaney, "The Historical Importance of the USS Monitor" in *Raiders and Blockaders, The American Civil War Afloat* (Washington DC: Brassey's, 1998), 15.

[8]James, Phinney Baxter III, *Introduction of the Ironclad Warship* (Cambridge: Harvard University Press, 1933), 312.

[9]Ibid., 314.

[10]Regis A. Courtemanche, *No Need for Glory, The British Navy in American Waters 1860-1864* (Annapolis: Naval Institute Press), 156.

[11]Ibid.

[12]Beeler, 24.

[13]Baxter, 317.

[14]Beeler, 20.

[15]Dennis Cahill, "The Ironclad *Cerberus*." [article on-line], available from http://www.vicnet.net.au/~cerberus.html: Internet: accessed on 10 January 2003.

[16]Courtemanche, 169.

[17]Baxter, 316.

[18]H.W. Wilson, *Ironclads in Action*, Vol. 1&2 (Boston: Little, Brown and Company, 1898), 224.

[19]Ibid., 188.

[20]Ibid., 190.

[21]Ibid., 191

[22]Newspapers, including the *London Times* covered the building of the *Monitor.* Additionally, British representatives to both the Union and Confederacy submitted reports. The Admiralty knew that both the North and South were constructing ironclads prior to Hampton Roads as agents of both countries solicited British shipyards to build ironclads and ironworks to produce rolled iron plate.

[23]Baxter, 238.

[24]Brown, 214.

[25]Barnaby, 73; Cowburn, 220; George, 72; Hill , 214.

[26]Brown, 214-215; Baxter, 329; Cowburn, 220; Wilson, 225.

[27]R.J. Herd, "HMVS *Cerberus*, Battleship to Breakwater." [article on-line], available from http://www.vicnet.net.au/~cerberus.html: Internet: accessed on 12 January 2003.

[28]Sir Edward James Reed and Edward Simpson, *Modern Ships of War* (New York: Harper & Brothers, 1888), 14-15.

[29]The 10-inch muzzle loaded guns were 15" long and weighed 18 tons. The projectile weighed 400 1bs.

[30]Ibid., 4-6.

[31]Ibid., 6-9.

[32]Wilson, 226.

[33]Reed, 15.

[34]Philip Cowburn, *The Warship in History* (New York: The Macmillan Company, 1965), 221.

[35]Nathaniel Barnaby, *Naval Development in the Century* (Philadelphia: The Linscott Publishing Company, 1904), 106.

[36]Ibid., 73.

[37]Arthur J. Marder, *The Anatomy of British Sea Power* (New York: Alfred A. Knopf, 1940), 5.

[38]S.S. Robinson, *A History of Naval Tactics from 1530 to 1930* (Annapolis: The United States Naval Institute, 1942), 687.

[39]Ibid., 688

[40]W.M Bainbridge-Hoff, *Modern Naval Tactics* (Washington: Government Printing Office,1884), 20.

[41]Baxter, 315.

[42]Paul H. Paist. "Monitors Ships that Changed War," United States Naval Proceedings (June 1961): 76.

[43]David K. Brown, "Wood, Sail, and Cannon Balls To Steel, Steam, and Shells, 1815-1895" in *The Oxford Illustrated History of the Royal Navy,* ed. J.R. Hill (Oxford: Oxford University Press, 1995),163.

CHAPTER 5

CONCLUSION

The Battle of Hampton Roads was the most famous naval battle of the American Civil War. While it contributed very little to the eventual Union victory in 1865, it did have a great affect on direction of naval warfare in the late nineteenth century. The CSS *Virginia* and the USS *Monito*r were not the first ironclads in the world, but their combat at Hampton Roads was the first fight of armored vessels. The two prototype warships built out of wartime necessity by the Confederacy and the Union, incorporated all the naval innovations of the nineteenth century: the steam engine, the screw propeller, the shell gun, the iron-hull, armored plate, and, in the case of the *Monitor*, the revolving armored turret. This thesis determined that the Battle of Hampton Roads was a Revolution in Military Affairs that resulted in major changes in naval organization, warship design, and tactics in the late nineteenth century.

First, the battle led to changes in organization. The impact of this battle on the organization of the United States Navy began long before the combat of 8-9 March 1862. The reports that the Confederates were building an armored vessel to break the blockade led the Navy to build an ironclad of its own to counter this emerging threat. Upon commissioning the USS *Monitor* was hastily ordered to Hampton Roads, to protect the James River Flotilla. The CSS *Virginia's* destruction of two wooden warships on 8 March 1862, and the *Monitor's* saving of the fleet on the next day, convinced the U. S. Navy to assign ironclads to all of its blockading squadrons. Monitors, and other classes of ironclads, served with the fleet until the end of the war. After the war, as the Navy conducted a reduction in forces, the monitors that were not sold or scrapped were

assigned to the home squadron to protect coastal waters. Further, the Navy Department reorganized the Bureaus of the Navy, in 1862 to effectively administer the large wartime Navy, and the emerging technology of the ironclads. In addition, the Monitor Bureau was created separate, from the Bureaus of the Navy, to contract private shipyards and oversee the construction of ironclads, as the Navy lacked the facilities and equipment to build ironclad vessels.

Subsequently, the Royal Navy implemented changes to the organization of its battlefleet after learning of the battle. Prior to Hampton Roads, all Royal Navy ironclads were assigned to the Channel squadron to defend against the French ironclad fleet. The fact that two small American navies built ironclads, and effectively employed them in combat influenced the Admiralty to implement changes to the fleet organization. Overseas squadrons, made up of wooden vessels, were perceived to be vulnerable to lesser navies that followed the American model and built ironclads. The Royal Navy placed at least one ironclad in every squadron to defend their wooden warships. Additionally, the British developed a strategy of coastal defense during the late 1860s and assigned several monitors to the Channel squadron to protect the British Isles and attack French ports, if war ever broke out.

Along with the change to fleet organization, the demographics and size of ships' crews changed because of the adoption of the monitor style ships and the armored turret. The wooden battleships were sailing vessels with auxiliary steam engines and broadside armament, which required large crews of up to a thousand men to work the sails and batteries of sixty to a hundred guns. The transformation to steam powered turreted ships led to a reduction in the size of the crew. The American monitors' crews were normally

between fifty to 120 officers and men, and the crews of the British turreted battleships numbered 300. Additionally, due to a new dependence on machinery, the engineer corps, never considered part of the naval community, became accepted members of the crew.

Further, the battle led to a radical change in naval construction. The *Monitor* and the revolving turret's future were determined by the combat on 9 March 1862. The U.S. Navy, in 1861 had contracted John Ericsson to build his armored floating battery and had developed plans for a double turreted ironclad mounting, Coles' turrets. If the *Monitor* had been defeated or had it failed to prevent the *Virginia* from accomplishing its mission, the *Monitor* program would have ended and the armored turret experiments would have suffered a severe setback in the United States. Ironclads of conventional design, such as the USS *New Ironsides,* would have been championed as the best solution, prolonging the age of Nelson several more years.

Instead, the *Monitor's* successful defense of the USS *Minnesota* in the presence of a captive audience, which included the Assistant Secretary of the Navy, Gustavus Fox, led to the U.S. Navy building seven classes of monitor vessels. The assembling of monitors became the focus of naval construction, as the amount of monitors built was greater than any other type of vessel, wooden, or iron, during the Civil War. The U.S. Navy constructed improved versions of the original *Monitor,* and several classes of double turreted monitors.

The monitors' performance during the war was mixed. It proved decisive in combat against enemy ships, though mostly ineffective against fortifications, because of their slow rate of fire. And it was restricted to coastal waters due to a lack of seaworthiness. The twin turret monitors fought late in the war and are better known for

several cruises designed to prove their seaworthiness and impress European navies. After the Civil War, the United States turned its attention to westward expansion, and sold or scrapped its monitor fleet, except for a handful of single and double turreted monitors. These armored vessels were the only resemblance of a modern navy the United States had until the building of its cruiser fleet in the 1890s. Rebuilt and modernized with stronger armor, new engines, and breech loaded cannons in time of emergency, the monitors served long after they were obsolete, the last ones being sold in the 1920s.

Moreover, the Battle of Hampton Roads, and the USS *Monitor*, had great influence on shipbuilding in the Royal Navy. Captain Coles' ideas of a revolving turret were validated in the ultimate test, namely combat. The Royal Navy built multi-turreted vessels for coastal defense and two sea-going turret ships that combined the turret with masts and rigging. This idea proved to be a failure, as the turrets' fields of fire were obstructed by the masts and rigging. Additionally, the turret, low freeboard, and sails proved to be a fatal combination, causing one of the seagoing turret ships to capsize and sink.

Sir Eric Reed, the Chief Constructor during the 1860s decided to build a mastless seagoing battleship. The original *Monitor* and the European cruise of the double turret monitor, USS *Miantonomoh*, in 1866, had great influence on his designs. Reed developed an improved monitor by building a breastwork above the deck to raise all the openings to the low freeboard hull safely above the waterline. His first breastwork monitors were used for coastal defense. Expanding on the breastwork monitor plan, Reed designed the battleship, HMS *Devastation*. Launched in 1871, she was constructed with fuel-efficient steam engines and a large coal storage capacity. She was the first sea-going warship that

did not require sails for blue water operations. The *Devastation* and other ships of this class represent the high water mark of monitor development and are considered the first modern battleships.

Finally, the Battle of Hampton Roads impacted the development of naval tactics in the late nineteenth century. The *Virginia's* successful ramming and destruction of the USS *Cumberland* led to a revival of ramming as a tactic of naval warfare in the U.S. Navy. During the Civil War, warships were built with rams, or reinforced bows, and special ram fleets were organized. Ramming was attempted in numerous combats, often resulting in failure or damage to the attacker, except for the notable success of Ellet's Ram Fleet during the battle of Memphis in June 1862. After the war, the U.S. Navy published instructions for ramming in signal books and several tactical manuals. Ramming remained a doctrinal tactic of the U.S. Navy for the remainder of the nineteenth century and the early twentieth century.

Simultaneously, the U.S. developed tactics for fighting monitors. The primary mission of the *Monitor*, and all subsequent monitors, was to attack and defeat enemy ironclads. In battle, monitor captains used their superior maneuverability, firepower, and the ability to fire in any direction to attack the enemy ironclads from positions, which prevented the Confederates rams from firing their broadsides. In all engagements after Hampton Roads, it was a mismatch favoring the monitors.

While the monitor's were great at ship versus ship actions, monitor tactics for attacking fortifications were not as successful. Due to the fact that the ironclads were believed to be impervious to cannon fire, the squadron commanders determined they could be used to reduce fortifications from close range. The tactic was for a group of

ironclads to maneuver into position to mass fires against a specific fortification, using the large guns of the ironclads to rubble the fort's masonry walls, which would lead to surrender or destruction of the target. In the Battle of Charleston, 1863, the guns of the coastal fortifications turned the monitors back. The primary reason for the failure was the slow rate of fire from the monitors, compared to the massive bombardment they received from the forts. Later in the war, the monitors proved effective in a support by fire role at Fort Fisher, 1865, were they were part of a larger fleet and used to destroy gun emplacements.

Moreover, the Battle of Hampton Roads stimulated a change in tactics in the Royal Navy. Ram tactics were the order of the day, after the news of the *Virginia's* successful attack. Coupled with the belief that armor negated the cannon as a decisive weapon, the Admiralty perceived that ramming was the most effective way to sink an enemy ship. Tactical manuals, fighting instructions, and tactical maxims were published for single ship combat and fleet action that instructed how to maneuver ships for successful ramming. As was the case with the U.S. Navy, ramming would remain a doctrinal tactic until after World War I.

Further, the Monitor's successful employment of her turret in battle led the British to build turreted ships and modify tactics for all-around fire. The line formation, a holdover from the sailing days proved the best way to employ bow, stern, and broadside fire. Once the fleet closed with the enemy vessels, the ships could fire in any direction without repositioning the ship. The Royal Navy published tactical manuals and conducted training on employing turret ships, but would not see combat until World War I.

Lastly, the Royal Navy was influenced by the battle of Hampton Roads and the *Monitor* to develop a tactical doctrine for coastal warfare. Breastwork monitors trained on coastal defense and coastal attack tactics. Training focused on single ship engagements, attacking fortifications, and harbor defense.

In conclusion, the Battle of Hampton Roads was a Revolution in Military Affairs, which led to changes in naval organization, shipbuilding, and tactics. The CSS *Virginia* on 8 March 1862 destroyed two wooden battleships signaling the end of the wooden warship era. On 9 March 1862 the USS *Monitor,* fought the CSS *Virginia* to a draw, demonstrating to the world that the only way to stop an ironclad was with another ironclad and proclaiming that the turreted warship was the future of naval design. The Battle of Hampton was a major discontinuity in naval warfare brought about by the employment of new technologies, the ironclad, and the revolving turret, in combat. The battle was a powerful impetus for change in the U.S. Navy and the British Royal Navy, from 1862 to 1871, and into the twentieth century. It clearly signaled the end of the age of wooden warships and the onset of the modern naval warfare.

SELECTED BIBLIOGRAPHY

Books

Addington, Larry H. *The Patterns of War Since the Eighteenth Century*. Bloomington, IN: Indiana University Press, 1994.

The American Ordnance Association. *Notes on Naval Ordnance of the American Civil War, 1861-1865*. Richmond VA: William Byrd Press, Inc., 1960.

Bainbridge-Hoff, W. M. *Modern Naval Tactics.* Washington DC: Government Printing Office, 1884.

Barnaby, Nathaniel. *Naval Development in the Century*. Philadelphia, PA: The Linscott Publishing Company, 1904.

Baxter, James, Phinney III. *Introduction of the Ironclad Warship*. Cambridge, MA: Harvard University, 1933. Reprint, Hamden, CT: Archon Book, 1968.

Beeler, John F. *British Naval Policy in the Gladstone-Disraeli Era, 1866-1880.* Stanford, CA: Stanford University Press, 1997.

Belknap, George E. *The Old Navy.* Boston, MA: Griffith-Stillings Press, 1902.

Bennett, Frank M. *The Steam Navy of the United States.* Pittsburgh, PA: W. T. Nicholson Press, 1896. Reprint, Westport, CT: Greenwood Press, Publishers, 1974.

Brodie, Bernard. *Sea Power in the Machine Age*. Princeton, NJ: Princeton University Press, 1941.

Burcham, William Richard. *Delay in the Evolution of Tactics Following the Introduction of New Technology Products in the United States Navy.* Ann Arbor, MI: University Microfilms International, 1992.

Cable, James. *The Political Influence of Naval Force in History*. New York, NY: St. Martin's Press, Inc., 1998.

Canney Donald L. *The Old Steam Navy*. Vol. 2. Annapolis, MD: Naval Institute Press, 1993.

_____. *Lincoln's Navy.* Annapolis, MD: Naval Institute Press, 1998.

Churchill, Winston S. *The Great Democracies*. New York, NY: Dodd, Mead and Company, 1958.

Cooling, Benjamin Franklin. *Gray Steel and Blue Water Navy.* Hamden, CT: Archon Books, 1979.

Cowburn, Philip. *The Warship in History.* New York, NY: The Macmillan Company, 1965.

Courtemanche, Regis A. *No Need of Glory.* Annapolis, MD: Naval Institute Press, 1977.

Davis, William C. *Duel Between the First Ironclads.* Baton Rouge, LA: Louisiana State University Press, 1975.

Daveluy, Rene. *The Genius of Naval Warfare, Tactics.* Vol. 2. Translated by Philip R. Alger. Annapolis, MD: United States Naval Institute, 1911.

Field, Cyril. *The Mastery of the Sea.* London, UK: Blackie and Son Limited, 1930.

Fioravanzo, Giuseppe. *A History of Naval Tactical Thought.* Translated by Arthur W. Holst. Annapolis, MD: Naval Institute Press, 1979.

Gardiner, Robert. *Steam, Steel, & Shellfire.* Edited by Dr. Andrew Lambert. Annapolis, MD: Naval Institute Press, 1992.

George, James L. *History of Warships.* Annapolis, MD: Naval Institute Press, 1998.

Hagan, Kenneth J. *In War and Peace.* Westport, CT: Greenwood Press, 1978.

Hamilton, C. I. *Anglo-French Naval Rivalry, 1840-1870.* Oxford, UK: Clarendon Press, 1993.

Hill, J. R. *The Oxford Illustrated History of the Royal Navy.* Oxford, UK: Oxford University Press, 1995.

Hoehling, A. A. *Thunder at Hampton Roads.* New York, New York: Da Capo Press,1993.

Hughes, Wayne P., Jr. *Fleet Tactics and Coastal Combat.* 2d. ed. Annapolis, MD: Naval Institute Press, 2000.

Hunter, Alvah Folsom. *A Year on a Monitor and the Destruction of Fort Sumter.* Edited by Craig L. Symonds. Columbia, SC: University of South Carolina Press, 1987.

Keeler, William F. *Aboard the USS Monitor1862.* Annapolis, MD: United States Naval Institute, 1964.

Kennedy, Greg and Keith Neilson. *Far-Flung Lines, Essays on Imperial Defence in Honour of Donald Mackenzie Schurman.* Portland, OR: Frank Cass, 1996.

Konstam, Angus. *Hampton Roads, 1862.* Oxford, UK: Osprey Publishing, 2002.

_____. *Union Monitor, 1861-1865.* Oxford, UK: Osprey Publishing, 2002.

Lambert, Andrew. *Battleships in Transition.* London, UK: Conway Maritime Press Ltd., 1984.

_____. *The Last Sailing Battlefleet.* London, UK: Conway Maritime Press Ltd., 1991.

Marder, Arthur, J. *The Anatomy of British Sea Power.* New York, NY: Alfred A. Knopf, 1940.

Macbride, Robert. *Civil War Ironclads.* Philadelphia, PA: Chilton Company, 1962.

Mahan, Alfred Thayer. *From Sail to Steam.* New York, NY: Da Capo Press, 1968.

Mindell, David A. *War Technology, and Experience Aboard the USS Monitor.* Baltimore, MD: The John Hopkins University Press, 2000.

Mokin, Arthur. *Ironclad.* Navato, CA: Presidio Press, 1991.

Reed, Edward J. and Edward Simpson. *Modern Ships of War.* New York, NY: Harper and Brothers, 1888.

Reynolds, Clark G. *Navies in History,* Annapolis, MD: Naval Institute Press, 1998.

Robinson, S. S. and Mary L. Robinson. *A History of Naval Tactics from 1530 to 1930.* Annapolis, MD: The United States Naval Institute, 1942.

Ropp, Theodore. *The Development of a Modern Navy.* Edited by Stephen S. Roberts. Annapolis, MD: Naval Institute Press, 1987.

Smith, Gene A. *Iron and Heavy Guns.* Abilene, TX: McWhiney Foundation Press, 1998.

Spears, John R. *The History of Our Navy.* New York, NY: Charles Scribner's Sons, 1897.

Still, William. *Iron Afloat.* Columbia, SC: University of South Carolina Press, 1985.

Still, William, John M. Taylor, and Norman C. Delaney. *Raiders & Blockaders.* Washington DC: Brassey's Inc., 1998.

Tertius de Kay, James. *Monitor.* New York, NY: Walker Publishing Company, 1997.

Time-Life Books. *The Civil War, The Blockade, Runners, and Raiders.* Alexandria, VA: Time-Life Books, 1983.

United States Naval War Records Office. *Official Records of the Union and Confederate Navies in the War of Rebellion*, Series I vol. 11, 14, and 22. Washington DC: Government Printing Office, 1908.

White, Ruth and W. C. White. *Tin Can on a Shingle*. New York, NY: E. P. Dutton and Company, 1957.

Wilson, H. W. *Ironclads in Action.* Vol. 1 and 2. Boston, MA: Little, Brown and Company, 1898.

Periodicals

Knowles, James A.. "Blue Water Monitor," in *Proceedings.* (March 1973): 79-89.

Paist, Paul H. " Monitors-Ships that Changed War." in *Proceedings.* (June 1961): 76-87.

Electronic Documents

Cahill, Dennis. "The Ironclad *Cerberus*." article on-line, available from http://www.vicnet.net.au/~cerberus.html; Internet. accessed on 12 January 2003.

Contemporary Reports. "The Attack by the *Cerberus*." article on-line, available from http://www.vicnet.net.au/~cerberus/contemporary2.html; Internet. accessed on 12 January 2003.

Devastation Class. "Devastation Class." article on-line, available from http://www.battleships-crusiers.co.uk/devastation_class.htm: Internet. accessed on 10 January 2003.

Greene, S.Dana. "In The Monitor Turret." article on-line, available from http://www.civilwarhome.com/monitorturret.htm: Internet. accessed on 7 December 2000.

Herd, R.J. "HMVS *Cerberus*, Battleship to Breakwater." article on-line, available from http://www.vicnet.net.au/~cerberus.html: Internet. accessed on 12 January 2003.

Jones, Catesby ap. R. "Battle of Hampton Roads." article on-line, available from http://www.cvilwarhome.com/CHMHampton%20Roads.htm: Internet. accessed on 7 December 2000.

The Mariners' Museum – *Monitor*: History and Legacy. "Later Classes of Monitors." article on-line, available from http://www.mariner.org/monitor/08_legacy/intro_monitor.html: Internet. accessed on 12 November 2002.

USS *Monitor* History. " Why the *Monitor* Matters." article on-line, available from http://www.mariner.org/monitorcenter/history/why.html: Internet. accessed on 1 November 2002.

Samply, Ted. "Civil War Ironclad Duel Forever Changed Naval Warfare." article on-line available from http://www.geocities.com/Heartland/Park/2207/css.htm: Internet. accessed on 7 December 2000.

Still, William. "Prelude to a Duel." article on-line, available from http://thehistorynet.com/CivilWarTimes/articles/1997/0697_text.htm: Internet. accessed on 7 December 2000.

Wood John Taylor. "The First Fight of Ironclads." (*The Century Magazine Vol. XXIX*, March 1985). article on-line, available from http://www.rugreview.com/cw/cwj1.htm: Internet. accessed on 7 December 2000.

HMS *Warrior*. " Facts and Figures." database on-line, available from http://www.hmswarrior.org/facts.htm: Internet. accessed on 27 December 2002.

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