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INTRODUCTION TO
WEAPONS AND WARFARE
SERIES

Weapons both fascinate and repel. They are used to kill and maim individuals and to destroy states and societies, and occasionally whole civilizations, and with these the greatest of man’s cultural and artistic accomplishments. Throughout history tools of war have been the instruments of conquest, invasion, and enslavement, but they have also been used to check evil and to maintain peace.

Weapons have evolved over time to become both more lethal and more complex. For the greater part of man’s existence, combat was fought at the length of an arm or at such short range as to represent no real difference; battle was fought within line of sight and seldom lasted more than the hours of daylight of a single day. Thus individual weapons that began with the rock and the club proceeded through the sling and boomerang, bow and arrow, sword and axe, to gunpowder weapons of the rifle and machine gun of the late nineteenth century. Study of the evolution of these weapons tell us much about human ingenuity, the technology of the time, and the societies that produced them. The greater part of technological development of weaponry has taken part in the last two centuries, especially the twentieth century. In this process, plowshares have been beaten into swords; the tank, for example, evolved from the agricultural caterpillar tractor. Occasionally, the process is reversed and military technology has impacted society in a positive way. Thus modern civilian medicine has greatly benefitted from advances to save soldiers’ lives, and weapons technology has impacted such areas as civilian transportation or atomic power.
Weapons can have a profound impact on society. Gunpowder weapons, for example, were an important factor in ending the era of the armed knight and the Feudal Age. They installed a kind of rough democracy on the battlefield, making “all men alike tall.” We can only wonder what effect weapons of mass destruction (WMD) might have on our own time and civilization.

This series will trace the evolution of a variety of key weapons systems, describe the major changes that occurred in each, and illustrate and identify the key types. Each volume begins with a description of the particular weapons system and traces its evolution, while discussing its historical, social, and political contexts. This is followed by a heavily illustrated section that is arranged more or less along chronological lines that provides more precise information on at least 80 key variants of that particular weapons system. Each volume contains a glossary of terms, a bibliography of leading books on that particular subject, and an index.

Individual volumes in the series, each written by a specialist in that particular area of expertise, are as follows:

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Military Aircraft in the Jet Age
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Air Defense
Destroyers

We hope that this series will be of wide interest to specialists, researchers, and even general readers.

Spencer C. Tucker
Series Editor
PREFACE

This work is one of the few books that chronicle the history of the capital ship from the time of the bronze-beaked galley-rams of ancient times, to the storied multidecked ship-of-the-line of the Age of Fighting Sail, to the squat, grim ironclads, and concluding with the big-gun massive dreadnought.

This is no mere antiquarian study of planks, rivets, armor thickness, gun barrels, and the like. Rather this work, in addition to dealing with the changing technical parameters of the capital ship, takes in the political decisions to build, the design constraints and controversies, and the life of the crews who served aboard these warships. It also chronicles the numerous combat actions of the capital ships, not just in the well-known clashes like Hampton Roads, Tsushima, or Jutland, but also in more obscure clashes in South America, Russia, and Japan.

The section titled “Ironclads and Battleships Through History” should prove valuable to anyone interested in capital ships. There, the reader will find the dimensions, displacement, builders and dates of construction, armor, guns, propulsion machinery, crew, and fate of selected capital ships.

A note on nomenclature: First-class warships have gone through numerous name changes. The coming of the multigun large warship in the seventeenth century produced the first term that distinguished the warship from the merchantman since the days of the galley-ram: “line of battleship” or “ship-of-the-line,” that is, powerful enough to lay in the line of battle; “first rate” referred to the largest of these warships. The ironclad steam warship rendered the line of battleship obsolete, and a nation’s naval power almost overnight came to be determined by its number of “ironclads,” the new capital ships. Late in the nineteenth century, the term “battleship” superseded “ironclad,” and with the coming of the Dreadnought to the Royal Navy (RN), its
title was applied to all first-rate warships. The successors of the dreadnought were given the unoriginal name “super-dreadnought,” although by World War II, the preferred title was once again “battleship”—the final term. The term “capital ship” was retained in somewhat more limited use from the seventeenth century on. However, the term is now occasionally used to describe the battleship’s successors—the fleet aircraft carriers and strategic nuclear submarines.

First, galleys (which were in use for far longer than their successors), then ships-of-the-line, ironclads, battleships, dreadnoughts, and super-dreadnoughts easily were the most expensive and, until the coming of the great ocean liners, the largest man-made moving objects of their times. And battleships, wooden and armor clad, share with the great rigid airships the distinction of being the only large-scale technologies now almost completely extinct. Thus it is easy to make a case for their study.

The author is indebted to Virginia Military Institute professor Spencer Tucker, John Biggs Chair in Military History Emeritus, for suggesting that I undertake this volume in the Weapons in War series, of which he is general editor. Particular thanks go also to Alicia Merritt of ABC-Clio’s editorial staff, who chivvied the author along to its completion; and to my production editor, Kay Maria.

It is unlikely that the world will ever again see the likes of the battleship, and only a few examples of ships-of-the-line, ironclads, battleships, dreadnoughts, and super-dreadnoughts remain. But this work attempts to keep alive the memory of these warships and their lost technology, which for so long dominated the world’s naval powers.
INTRODUCTION AND OVERVIEW

It can be argued that the great capital ship, along with the cathedrals and the music of Johan Sebastian Bach, are among the finest achievements of Western civilization. The major shipyards that built them were usually the largest concerns of their times, and ships-of-the-line/ironclads/capital ships/battleships also were easily the most expensive, most complex man-made moving objects. This has been true from the English Sovereign of the Seas (1637) to HMS Vanguard some three centuries later. Although it is difficult to estimate the cost of wooden warships in meaningful contemporary fiscal terms, at £40,800, Sovereign of the Seas actually cost appreciably more in equivalent twentieth-century money than did Vanguard (1946), at £9,000,000, even taking into account the much greater size and complexity of the latter. Further, one should not be misled into the vulgar misapprehension that a wooden first-rate like Sovereign of the Seas was somehow “less complex” and “simpler” than its successors. That warship was the expression of a family of cunning contemporary skills and trades (many now lost). Those who persist in a Darwinian view of history as a tale of accelerating progress from the simple to the complex (certainly a common failing of historians of technology) might ponder the fact that a twentieth-century Afghan tribesman could learn to operate the Stinger handheld missile in about six weeks and bring down helicopter gunships, but it took an Englishman his adult lifetime to master the longbow. Sovereign of the Seas was, in its way and in its time, of the same order of magnitude of complexity—and expense—as Vanguard.¹

Capital ships have exercised a hold over the imagination from the days of England’s “wooden walls” that goes well beyond an expression of national naval power; this has continued through to the twenty-first century. Well might the nineteenth-century British author John Ruskin proclaim that “taken in all, a ship-of-the line is
the most honorable thing that man as a gregarious mind has pro-
duced.”2 Of a more practical bent, the founder of the efficiency
movement, Frederick W. Taylor, asserted that the loading and firing
of a battleship’s big guns was “the finest example of scientific man-
agement I know of.”3 This author well remembers when, in 1968, as
a researcher at the Smithsonian Institution, he shipped aboard USS
New Jersey on invitational travel orders for a two-week gunnery
cruise in Chesapeake Bay. Numerous retired navy petty officers vol-
unteered to serve gratis aboard the battleship. Docking at any port
would be viewed by hundreds of civilians, and the battleship would
be escorted by dozens of pleasure boats. It might have been the an-
tique technology that drew them, but that warship was heading for
modern-day combat off Vietnam; it might have been its size, but
there were a number of far larger aircraft carriers in the vicinity.
More likely, it was the squat, brute power so obviously displayed in
its great guns; by contrast, the carriers seemed to be little more than
vast utilitarian floating platforms. Only the submarine seems to ex-
ercise a roughly similar hold on the mind.

Some uncharitable writers have asserted that it was actually this
romantic hold on the imagination, rather than any objective ration-
ale for the role of the battleship, that accounts for the retention of
the battleship in the first line of defense of a nation well after it was
obvious that the future would be the aircraft carrier. How else to ex-
plain the elation of the Japanese commanders at the results of the
Pearl Harbor attack, even when they realized that the U.S. carriers
were all absent? They had sunk the battleships! As late as 1942—
that is, after Pearl Harbor and the sinking of Prince of Wales and Re-
pulse by airpower alone—the Japanese Navy proposed two “super-
Yamato” battleships. And in 1944–1946, the Soviet Union requested
and received two elderly battleships, one as a temporary gesture of
Allied wartime goodwill, and the other as postwar reparations.

There are tangible historical reasons for the hold that the capital
ship has on the imaginations of so many. Europe’s great ships ex-
plored, colonized, defended, and exploited much of the world beyond
that continent. And this was a uniquely European phenomenon. The
Aztecs were fully as clever as the Spanish who “discovered” and sub-
dued them, yet the Aztecs did not “discover” Spain, anymore than did
the Chinese find Italy. The restlessness that sent Europeans from the
time of Leif Ericsson across vast uncharted, even terrifying, waters
had no lasting counterpart elsewhere.

At the time of the greatest European maritime expansion, the two
great powers of Asia—China and Japan—had turned resolutely inward,
despising foreigners and foreign ways. China indeed had great ships and organized navies as early as 500 B.C. (and, later, gunpowder weapons and the compass) and had dispatched expeditions as far abroad as the Indian Ocean and the shores of southern Africa. Albeit impressive, these few Chinese oceanic ventures did not “take,” even their memory being mostly lost, and they certainly did not obtain any mastery of the seas beyond China’s coasts. Japan’s maritime-imperial expansion, except for forays to Korea in the sixteenth century, had to await the late nineteenth century and the first half of the twentieth century—and abruptly ended in 1945.

The European searches for glory, for gold, for converts, and for refuge led to colonization, which required oceangoing ships to maintain commerce and communications with the European mother country, which in turn required oceangoing warships to protect that commerce and communication from other maritime powers. The largest of these warships came to be termed “capital ships.”

It is undoubtedly well to make an early note on nomenclature. This work will deal exclusively with the big-gun, front-line warship of the naval powers. “Capital ship” encompasses all such warships, be they three-gun deck wooden sailing or steamships, mid-nineteenth century armored warships, or twentieth-century all-big gun, steam-powered armored vessels.

By the eighteenth century, the term “ship-of-the-line” had become a common means to refer to the first-rate, big-gun wooden sailing capital ship of the time, with its main gun battery arranged on the broadside, usually on three decks. These behemoths alone were considered fit to lay in the “line,” that is, the line-abreast formation in which naval battles were fought during the Age of Fighting Sail. Beginning with the iron construction and armor-age naval revolution in the 1860s, “ironclad” or “armored-clad” described the first-class warship. Finally, late in that century, the term “battleship” came into everyday use. And although the term “capital ship” gained some English-language currency early in the twentieth century, “battleship” remained the preferred terminology long after such warships ceased to be built. The expense of capital ships—whether of wood, iron, or steel—dictated that only nation-states could construct such warships. Although many capital ships were built in private yards, none remained in private hands, such as privateers and pirates. The rise of the capital ship to preeminence in the world’s naval establishments thus coincided with the rise of the nation-state. Only that entity could muster the resources to build and maintain such warships. Fortunately for the maritime nation-states’
taxpayers, capital ships are extraordinary long-lived weapons. HMS Victory, launched in 1756, was considered good enough 27 years later to serve as Nelson's flagship at Trafalgar. Despite journalistic prattle about overnight obsolescence during the early twentieth century, the Royal Navy's Queen Elizabeth- and Revenge-class battleships served in both world wars, as did the U.S. Navy's New York, Texas, Arkansas, and Nevada. No tank or aircraft could make that boast. The extraordinary lifespan of the U.S. Iowa class, designed in the late 1930s and in action during the 1991 Gulf War, is unique, but it does illustrate the point.

In part because of longevity, a number of battleships have led service lives that can only be termed picaresque. For example, France's Provence had the odd distinction of being sunk and raised on three different occasions during World War II. Russia's Imperator Alexandr III was renamed Volya after the March 1917 revolution, was seized by Ukraine in April 1918, was taken over by the Germans in October 1918, and the following month was seized by the British. They, in turn, handed it over to the White Russian fleet of Baron Petr Wrangel, under whose colors it fought the Bolsheviks as General Alekseev. With the final defeat of the Whites, Imperator Alexandr/Volja/General Alekseev finally found rest in Bizerta, North Africa, where it was scrapped in the 1930s. The four Iowas fought in no less than four wars or conflicts. Although the Iowas still exist (though in retirement), they were not the last battleships to be completed. That distinction would go to the French Jean Bart, finished in 1949, five years after Missouri, the last of the Iowas, was to be completed. The Iowas can, however, by a wide margin, claim to be the last battleships to fire their guns in anger during the Gulf War.

Battleships, unique among weapons, could often be at some stage of construction and then ordered halted for fiscal or political reasons, never to be completed. Thus, the remaining two Iowas, Illinois and Kentucky, were scrapped when 22 percent and 69 percent completed, respectively. Whole classes of battleships were canceled after hardly being laid down in the post-World War I battleship reductions mandated by the Washington Treaty. Occasionally, battleships would be converted to aircraft carriers while still on the stocks, as was the case with Chilean Almirante Cochrane, converted to HMS Eagle, and the French Béarn (formerly Vendée). Generally, however, navies preferred to convert battle cruiser hulls to aircraft carrier configuration, taking advantage of the former's great speed.

Although battleships, as noted, were very expensive and complex, only one nation, Japan, ever held on to battleships taken from an
enemy. Russian war booty capital ships taken during the Russo-Japanese War (1904–1905) were retained by Japan, although some of those aged warships were, again uniquely, actually sold back to Japan’s new Russian ally during World War I.

Only the major industrial and industrializing nations of the nineteenth to twentieth centuries (France, Germany, Great Britain, Italy, Japan, the United States, Austria-Hungary, and Russia) had the resources to construct battleships entirely on their own. Even so, several battleship-building nations, such as Japan, Russia, Italy, and the United States, had to rely on Great Britain, at least initially, for such technically demanding fittings as turbines, boilers, and armor plate. Oddly, although backward czarist Russia built a wide variety of capital ships, the Soviet Union, for all its frenetic drive to industrialize and despite several fits and starts, never completed a battleship.

Most of the middle industrial/industrializing powers (Belgium, Czechoslovakia, the Netherlands, Poland, Yugoslavia, and Canada) neither built nor purchased battleships. Several did construct their own small coast-defense armored warships, usually with engines, armor, and big guns again being supplied by the major industrialized nations. Some nations with a small or nearly nonexistent or emerging industrial base (the Confederate States, Greece, Japan, Turkey, Brazil, Argentina, Chile, China, and Peru) simply purchased the capital ships they required in the free-trade warship atmosphere of the late 1800s and early 1900s.

The era of the big-gun capital ship lasted for a little less than four and a half centuries, if we assume that Great Harry (1488) was the first true multigun capital ship. As no battleships are planned by any of the navies of the twenty-first century, there can be no doubt as to when the era ended. In this regard, the history of the capital ship reads somewhat like that of the rigid lighter-than-air dirigible: Both technologies flourished (the dirigible only from around 1912 to the loss of Hindenburg in 1937), then came to a complete end. As with battleships, only a handful of industrialized nations (France, Germany, Great Britain, and the United States) could muster the resources to construct rigid heavier-than-air ships. Unlike the battleship, however, nothing remains of the brief era of the giant lighter-than-air ships in the sky.

Looking at the very exceptional deployment of battleships in World War I and their near irrelevance in World War II, it can be argued that the dreadnought battleship was easily one of the world’s most overrated weapons. Few, if any, major weapons systems have inflicted so little damage on an enemy. (No German died at the hands of any of the U.S. Navy’s mighty battleships during World War I.)
Yet no other man-made object more symbolized the nation-state than the capital ship, and the strength of a naval power could be summarized by “count[ing] up your battleships,” in the words of the jingoist early twentieth-century poet, Sir Henry Newbolt. Thus the discomfiture to so many officers of the Royal Navy and the U.S. Navy at the passing of the trident of naval supremacy from their battleships to the aircraft carrier.

Only one Royal Navy dreadnought (Audacious) was lost to enemy action in World War I, but Great Britain still came within an ace of defeat, for all of its mighty battle fleet, by the lowly German submarines’ attacks on its vital merchant fleet. The lesson was brought home far more vividly and disastrously during the next world war. To the Royal Navy’s elderly Royal Oak goes the unhappy distinction of being the first dreadnought sunk by a submarine, when the German U-47 worked its way into Scapa Flow and fired its fatal torpedoes on 14 October 1939. (The Italian Conte di Cavour was the first battleship sunk by airpower when it was struck by an aerial torpedo launched by Fairey Swordfishes from the RN carrier Illustrious on 11 November 1940.)

But defenders of the battleship argued with some plausibility that these two capital ships, and those lost in the carnage of Pearl Harbor, were obsolete, immobile, and unable effectively to defend themselves. Admiral Tom Philips, commander of Force Z, consisting of the new RN battleship Prince of Wales and the elderly battle cruiser Repulse, held such beliefs and was convinced that a well-handled modern capital ship could fight off aerial attacks. He lost his life when Japanese naval warplanes on 10 December 1941 sank both of his warships in short order.

The point was finally taken, and the U.S. Navy canceled its planned giant Montana super-Iowa class. The Royal Navy had stopped construction of its follow-on King George V class (the Lions) in 1939 and, despite a spurt of interest as late as 1943–1944, never resumed their building. Japan was the last naval power finally to give up on the battleship, again well into World War II.

The Royal Navy’s last battleship, Vanguard, was constructed to put to some use against the Japanese the four 15-inch guns and their turrets and mountings never fitted on the super battle cruisers Glorious and Courageous after their conversion into aircraft carriers in the 1920s. But Vanguard was not finished until 1946 and never fired a shot in anger. Attempts to convert uncompleted battleships to high-speed merchant ships or guided-missile monitors almost never came to fruition.
Battleships were designed primarily to fight other battleships, although they certainly gave yeoman service in shore bombardment right through to the 1991 Gulf War.

Today, only three nineteenth-century ironclads and nine twentieth-century battleships remain in existence, as museums or memorials. Battleships are now so popular that U.S. seaboard states vied even for units named after inland states. Astonishingly, Great Britain has no preserved battleships.

National symbol, complex product of the industrial revolution, yardstick of maritime power, talisman of elderly admirals, modern object of fascination by naval buffs and historians, and now serving as seaside tourist attraction, the battleship retains its hold on the public imagination well into the twenty-first century.

NOTES

1. Another note with a contemporary flavor: *Sovereign of the Seas* was estimated by its builder, Phineas Pett, to cost some £13,000; the final cost, as noted, was some three times greater.
2. Quoted in O’Connor, p. 32.
3. Ibid., p. 12.
4. There have been some attempts to extend the term “capital ship” to the successors to the battleship: the aircraft carrier and the nuclear-powered submarine.
CHAPTER ONE

Wooden Battleships
Through the Age of Fighting Sail, 2000 B.C.—1804

The first battleship (capital ship or first-class warship) was the galley-ram, an oar-powered vessel equipped with an elongated underwater snout, often bronze-tipped, and that later mounted guns as an armament secondary to the ram and to armed boarders. The age of the galley was the longest of any of the warship eras, some 2,000–4,000 years, from about 2000 B.C. to the Battle of Lepanto in A.D. 1571.

The distinction of founding the world’s first navy probably goes to the Minoans, who ruled the island of Crete from about 2000 B.C. to 1500 B.C., and they may well have developed the first standard warship, the galley, with some 50 rowers, 25 to a side. But no sea battle account has survived from before 1190 B.C., when the Egyptian fleet defeated a “Sea Peoples” flotilla, a naval victory we know about only because it was carved in detail on a temple near Thebes.

The first specific naval weapon, the ram, appeared in about 1000 B.C. No longer was the galley more or less a troop transport relying on boarders for its offensive power; the galley-ram was a specialized naval warship, and only the major naval powers had the resources to construct and man them. The next important naval weapon, the
catapult, was supposedly sent to sea by Alexander the Great, who used the device against the Phoenician city of Tyre in 307 B.C. Other naval weapons developed at about this time in the ancient world were the ballista, which threw arrows at low angles; collapsible boarding towers; and firepots.

Using all of these weapons, the bireme, a galley-ram propelled by two banks of oarsmen, became the standardized capital ship. Even after the introduction of the trireme about 500 B.C., it never entirely disappeared from the ancient world’s fleets.

The Greek triremes did supplant the bireme as the dominant warship after 500 B.C., and the Greeks even classified their warships as “selects,” “firsts,” “seconds,” and “olds,” according to age. (The warships of the time, because of their wooden construction, would last twenty years on average.)

The Romans developed a unique weapon of their own, the corvus (raven), a boarding bridge mounted on a warship’s prow that dropped to the enemy’s deck and was held there by a spike that resembled a raven’s beak—hence the name. The successful use of the corvus at the naval Battle of Mylae (260 B.C.) off the northern coast of Sicily during the First Punic War against Carthage was the first of a series of Roman victories, thanks in large measure to the corvus. (The unfortunate Carthaginian commander, after another such defeat at the hands of the Romans, was crucified by his own men.) These were no mere sea skirmishes. At Mylae, the Romans mustered some 100 warships, the Carthaginians about 150, and in the First Punic War, Rome supposedly lost some quinquiremes (despite the name, not a galley propelled by five banks of oars, but in all likelihood simply three banks) and their enemy about 500.

The naval Battle of Actium (Marc Anthony and Cleopatra versus Octavian) saw yet another ingenious new naval weapon, the harpax, an iron grapple hurled by a catapult at an enemy ship, which was then hauled in by a winch for boarding.

The last new naval weapon of antiquity was the mysterious Greek fire, the contents of which are still unknown although some authorities think that it may well have resembled the napalm of the twentieth century. Greek Fire was used by the Byzantines to defend Constantinople successfully against the Muslims, beginning in A.D. 673.

About 900 years later, the Portuguese pioneered the use of great guns at sea, and in a battle off the Malabar coast in 1501, Vasco da Gama, using line-ahead, stand-off gunfire tactics, destroyed a great Arab sailing dhow fleet using such artillery—without the loss of a single Portuguese ship.
Single line-ahead tactics eventually followed from the use of heavy
guns as the prime weapon of war at sea, for it enabled warships to
concentrate their gunfire without shooting over their consorts. Row-
ing warships began to disappear from the fleets of the naval powers,
for they were too lightly built to handle more than a couple of heavy
guns, they were unsuited for the Atlantic’s tempestuous waters, and
oarsmen could be urged to their task only for so long.

The last great galley-ram boarder battle was that of Lepanto in
1571, between the Venetians and the Turks. By the time of the
Spanish Armada in 1588, the large warship propelled by sail and
mounting heavy guns along the broadside dominated naval war-
fare. The ram had vanished and would not be resurrected for some
300 years.

But nonetheless, guns lacked the fatal destructive power of the ram.
Even in the Armada battles, the defeat of the Armada was due more to
stormy weather than to English gunnery. (Queen Elizabeth I, aware of
this natural phenomenon, ordered a medal struck to commemorate
the great victory, with the Latin inscription translated as “God Blew
and They Were Scattered.” God apparently was a Protestant.)

The principal capital ship of the sixteenth century was the galleon,
a three-masted, full-rigged ship of war, mounting its ordnance on
gun decks within the hull, firing through hinged, relatively watertight
gun ports rather than from high fore and aft platforms. The galleon
also marks a distinction between cargo ships and warships that had
been blurred since the days of the galley-ram. By this time as well,
the great naval guns had gone over to muzzle-loading for the sake of
simplicity.

The long and eventful history of the big-gun capital ship may be
said to have opened with England’s grandly named Sovereign of the
Seas, built in 1637, of 1,466 gross tons, mounting 100 guns, and
costing £40,000. It was built “to the great glory of the nation and not
to be paralleled in the whole Christian world,” in the words of a con-
temporary. (The Masters of Trinity House had earlier argued that a
three-decker was “beyond the art or wit of man to construct.” Both
quotations in Charles N. Robinson, The British Fleet: The Growth,
Achievements, and Duties of the Navy of the Empire. London: Geo.
Bell & Sons, 1894, pp. 222–223.) Sovereign of the Seas set the pat-
ttern for the wooden sailing ship for the next 200 years, with the
main armament arranged along the broadside in three (and on only
one occasion, four) decks, the heaviest guns on the lower deck, and
the smaller and lighter guns on the middle and upper decks. It was
propelled by an array of square-rigged sail paraphernalia.
Naval battles of the time were still dominated by the line-abreast chase and boarding, but the Battle of the Gabbard, sixteen years after the launching of *Sovereign of the Seas*, saw the introduction of line-ahead, broadside-to-broadside battle, which would prevail to the end of the battle fleet in the twentieth century. The minimum number of guns required to fit a warship to lay in the line grew from 30 in 1650, 50 to 74 in 1800, and finally 80 in 1840.

By the later seventeenth century, the newly centralizing nation-states of Europe had established a monopoly on organized violence, and the great warship was a tangible expression of that monopoly. (Piracy had been practically eliminated from European waters, and privateering was strictly regulated.) Not until the end of the nineteenth century would any non-European power (Japan) build great capital ships. The greatest of these “wooden walls,” the three-decker line of battleships, were hugely expensive and time consuming to construct. The Royal Navy itself could muster no more than a dozen or so at any time, even during war. At the penultimate Battle of Trafalgar (1805), of the 27 British and 33 French and Spanish ships-of-the-line, only four ships on either side mounted 100 or more guns; most ships-of-the-line were two-deckers.

*Sovereign of the Seas* was soon followed by even larger ships-of-the-line, such as *Britannia* of 1,700 tons, costing £30,000. Gradually, the term “ship-of-the-line” emerged, referring to those warships that were deemed strong enough by virtue of their up to 30 inches of planking and, of course, their thunderous gun power, to lie in the line of first-rate ships (which had to mount at least 60 guns) and endure an enemy’s broadside. The capital ship had replaced Europe’s cathedrals as the most complex and expensive construction of the time.

They were remarkably impervious. Slow-velocity cannonballs rarely penetrated such warships. Rather, the great splinters unleashed by their impact winged down the gun decks, felling gun crews at their stations but leaving hulls basically unharmed. For obvious reasons, those decks were painted red, and sand was scattered over the floors before an impending battle. On more than one occasion it was reported, quite literally, that “the scuppers ran red with blood.” As the effective range of the heaviest shipboard gun was about 100 yards, the clashing lines in a naval battle were quite close, and boarding, in which specially equipped sailors attempted to seize an enemy vessel by force, was commonly practiced. Horatio Nelson himself led a band of boarders to seize two Spanish first-rates at the Battle of Cape St. Vincent on 14 February 1797.
Unless they were set afire and their magazines exploded, these wooden warships usually survived even the most bloody of battles. Very few foundered as a result of enemy bombardment. Those that were destroyed were most often the victims of onboard conflagrations or of enemy fireships. Throughout the period, the fireship was by far the most dangerous weapon afloat, and it seems odd that more attention was not paid to these lowly but deadly weapons. (Most likely, then as now, admirals were attracted to the big ships.) Only the coming of the metal warship would usher in the modern phenomenon of the near-instantaneous destruction of a major ship of war by gunfire, torpedo, or naval mine.

But the Royal Navy, by the first years of the eighteenth century, was hobbled by the overgunning of its warships, leaving them hampered in their sailing and lying too low in the water or heeling over, unable to use the lower gun ports even in mildly rough weather. This state of affairs can be traced to the 1719 decision of the Navy Board to establish a standard scale of dimensions, officially fixing the existing tonnage for each class at the existing levels. This decision had the unfortunate effect of practically locking in ship designers to existing dimensions, regardless of the advances of other maritime nations, particularly France and Spain. By 1745, a member of the Admiralty was complaining that “our 70-gun ships are little better than their 50-gun ships,” and a Spanish officer dismissed Royal Navy as “three-deckers on the dimensions of two-deckers” (Robinson, p. 236). HMS Royal George of 1790, for example, weighed only 365 more tons than Royal William of three-quarters of a century earlier! As late as the wars with France at the end of the eighteenth century, the British learned, to their chagrin, that captured frigates were bigger and better than most smaller RN first-rates and, indeed, of some first-class rates.

Ship-of-the-line dimensions gradually increased through the eighteenth century, with Royal Navy first-rates generally topping off at 110 guns, although a few 116–120-gun warships were built. Nelson’s 104-gun Victory weighed in at 3,500–4,000 tons. But Britain’s foes were constructing still larger comparable warships. The largest sailing ship ever in the U.S. Navy, Pennsylvania, mounted 116 guns.

The French by this time were also applying some scientific precision and method to their warship design. Most eighteenth-century Royal Navy design improvements resulted from the “taking of the lines” of captured French and Spanish warships. Still, the numbers of first-class warships engaged in naval combat diminished drastically, from the hundreds involved in the great Punic Wars, to Michiel
de Ruyter’s 91 Dutch warships against 81 British in 1666, to Nelson’s 27 against 33 enemy at Trafalgar 140 years later.

The situation hardly improved, even with the coming of the ironclad steam warship. Through the nineteenth and early twentieth centuries, the limited size of British dry docks also restricted dimensions and tonnage. The British have traditionally and irritably replied that the French and the Spanish, and later the Italians, built better ships than they could fight. The Royal Navy’s near-perfect record of naval victories can be credited to its better training, seamanship, and leadership. When the British were later matched against a naval enemy that ordered these personnel matters considerably better than the French and the Spanish, the outcomes were not always so completely favorable to the Royal Navy. The British learned the mettle of American seamen in the most sanguinary ship-to-ship clash of the age of fighting sail: John Paul Jones’s cobbled-up merchantman *Bon Homme Richard* versus HMS *Serapis* (1779). The British dismissed this and the U.S. frigate victories of the War of 1812, as well as the less-remembered American fresh-water victories on Lake Erie and Lake Champlain, as extremely rare defeats of an entire Royal Navy fleet, not involving first-class ships-of-the-line. British naval battle superiority lay in its rapid and well-aimed gunnery; a Royal Navy 74 (smaller ship-of-the-line) could discharge its broadside twice as quickly and effectively as its French counterpart. Further, the less-well-trained French aimed high, for the British masts and rigging, more often than not hitting air and sky. British gun crews aimed straight for the hull.

The guns were being classified more rationally by the late seventeenth century, with the earlier hodgepodge of guns, sakers, demicannons, and culverins giving way to guns classified by the weight of shot fired, eventually settling basically on 42-pounders (i.e., the weight of the shot—only used in the largest first-rates) followed by 32-, 24-, 12-, 18-, 9-, and 6-pounders, arranged with the heavier guns on the lower decks. These first-rates had also settled into the standard classification of 90-, 80-, 70-, 60-, and 50-gun warships. They also reached their full glory by the early eighteenth century, with double or triple tiers of ornate stern galleries for the higher officers to take their leisure in relative privacy, and with carved wooden figureheads often representing the reigning monarch, surrounded with trophies, figures from nautical mythology, emblems, and the like. Circular gun ports also passed out of fashion in favor of the more practical square hull openings.

The early eighteenth century also saw the replacement of the ancient, wearying, and complex whip staff by the steering wheel.
Although the steering wheel was an enormous improvement, it still, like the whip staff, required that the helmsman turn his helm in the opposite direction that the ship was to go. In other words “Port your helm!” would send the ship to starboard. This most confusing state of affairs was not put to logical rights until the twentieth century.

The dimension shackles of 1719 were not finally loosened until 1832, with the appointment of Captain Sir William Symonds as surveyor of the Royal Navy. Symonds was able to lift all restrictions on size and armament. Although RN warships still lagged behind the French and Spanish in scientific construction, at least they enjoyed increased speed and stability, with more room below decks. Paradoxically, Symond’s reforms would become irrelevant within three decades, when iron-built ships permitted dimensions that would be limited only by Britain’s docks.

The other hobbling development was the initially realistic decision to rely on line-ahead tactics. Admiral Robert Blake formalized the line-of-battle formation during the First Anglo-Dutch War (1652–1654). The Dutch were the only naval power to challenge the Royal Navy aggressively, winning about as many naval battles as they lost. The French were much more the land power; the army absorbed far more resources than the navy, and French naval tactics consisted of shooting at the top hamper of the enemy—losing most battles in the process. Ideally, two enemy fleets would fight in parallel lines, their guns battering each other and trying to get the weather gauge (to be upwind) and then to “cross the enemy’s T,” that is, to maneuver so that one fleet’s weak and under armed bow (or, less commonly, stern) was exposed to its opponent’s broadsides. Line-ahead also gave the commanding admirals more control over their warships. But two opposing schools of thought emerged within the line-ahead concept. One stood for unwavering adherence to the line, emphasizing the lack of control that would inevitably follow a mêlée. The other, often called the mêlée school, believed basically in the line-ahead approach to the battle but then argued that ship and squadron commanders should be free to attack or pursue on their own as the clash developed and opportunities presented themselves to the adventurous. Given that signaling was primitive at best during the Age of Fighting Sail, and that the foremost proponent of the mêlée school was Horatio Nelson, it would seem that the latter school of thought had the better argument. Nonetheless, the formal line-ahead school prevailed through the late eighteenth century, becoming calcified in the Admiralty’s Fighting Instructions of 1691, which had the force of law. One who felt the full force of that law was Admiral Sir John Byng, who was actually executed by firing squad in
the wake of the Battle of Minorca for failing to depart from the tactics laid down in the Fighting Instructions. (Byng was obviously being used as a scapegoat for one of the Royal Navy’s very rare defeats in a fleet action.) The formalized line-ahead’s grip on the Royal Navy was at last broken in a series of actions by younger commanders, who brought victory with their mêlée tactics at the Glorious First of June (1794), Cape St. Vincent (1797), and, of course, Trafalgar.

Whether adhering rigidly to Fighting Instructions or breaking into a mêlée, the Royal Navy never suffered one decisive defeat at sea after the Battle of Beachy Head (1690). The Great Age of Fighting then passed its peak, and there would be only one more large sailing fleet battle, the one-sided slaughter of an Egyptian-Turkish squadron by a combined fleet composed of British, French, and Russian warships at Navarino Bay in 1827.

Nonetheless, the major maritime powers continued to build great wooden ships-of-the-line, and they grew in size and gun power, thanks in large measure, in the Royal Navy, to the Symonds construction reforms noted above. After Trafalgar, the 120-gun warship became the standard first-rate. The examples of the captured enemy warships and the frigate-to-frigate U.S. victories in the War of 1812 could no longer be ignored or explained away. It is perhaps an indication of the increased power of the new first-rates that the Royal Navy scrapped its last fireships just after Trafalgar and the last bomb ketch in 1836. Yet there was little change in the heart and purpose of the wooden sailing first-rate: its guns. The 42-pounders had been discarded toward the end of the previous century in the belief that they were harder to work than the 32-pounder and that they would strain the ship’s frame in rough weather; they now returned in the much more stoutly built post-Trafalgar capital ships, and even 48- and 68-pounders were introduced. Thus the great Marlborough carried 68-, 48-, and 32-pounders as armament. The actual firing of the guns was greatly improved by the introduction of the flintlock, detonating tube, and elevating screw.

At about this time the Royal Navy began to adopt the old Venetian method of constructing its warships under cover, finally rejecting the unexamined old adage that open-air construction somehow beneficently “aged” the timbers. Actually, timber can age about as well under cover, and construction could proceed much more quickly, unhindered by bad weather.

The methods of construction of the wooden hull were transformed by the naval constructor Sir Robert Seppings, and these methods made it possible to increase battleship dimensions by one-
quarter. Seppings, as surveyor of the Royal Navy, applied the diagonal truss system, which he had observed in contemporary bridges, to the hulls of wooden warships. The Seppings truss system helped battleship hulls to resist hogging, that is, the arching of the keel; sagging, which is just the opposite movement; and horizontal shearing, all of which put pressures on the wooden hull as it reacted to the water, only weakly resisted by the traditional system of vertical framing. Seppings’s diagonal trusses formed a network of triangles between the frames, adding considerably to hull strength and making possible much larger wooden warships. He later advocated the use of iron strapping and iron structural parts to replace those of wood. Without these construction innovations, it is difficult to see how the great wooden steam battleships could have carried their own weight. Seppings also strengthened wooden hulls against shot by his use of solid circular prows and a reinforced circular stern, following upon the Nelsonian tactic of breaking through the enemy line, exposing the vulnerable bow and stern to concentrated enemy fire. By the 1850s, John Edye had substantially advanced Seppings’s work by combining parallel frames with strong iron riders. The work of Symonds, Seppings, and Edye, however, was for the most part rule-of-thumb, and their scientific basis was not worked out until 1866 by John Rankine and Edward James Reed (later Sir Edward Reed). Even then, the Royal Navy continued to lag behind the French in methods and principles of naval architecture, and did not establish its School of Naval Architecture until 1864, well after the French. Great Britain’s undoubted naval supremacy rested upon its superior industrial base, as well as its good fortune in having men of genius at the right time administering, designing, and building its new battleships, both wooden and, later, ironclad.

What did not change appreciably was the condition and treatment of the men who crewed these wooden walls; this changed remarkably little over the centuries. The gap between seaman and officer was virtually unbridgeable (Captain James Cook was one of the very rare exceptions, rising from cabin boy to captain). Europeans passed from serfdom to peasantry, great wars of religion were fought, and nation-states arose, but the common seaman remained basically unchanged in his food, treatment, discipline, and even pay. His food was ample (a considerable attraction for the time) but monotonous and lacking in nutrition: beef, bread (usually hardtack biscuits), beer, with perhaps some cheese and peas. On a long voyage (and most were long voyages by twenty-first-century standards) the food deteriorated. The beer soured, and it was said that if one
looked at it long enough the cheese could be seen to move. The biscuits had to be tapped sharply against a hard surface to scatter the infesting weevils. And when the cooks reached the bottom of the “beef” barrels (or so it was often alleged) they might find four horseshoes. (There is one authenticated story of how a crew expressed their appreciation to a kindly captain. They presented him with a small box for cufflinks and the like. When the captain, admiring the box’s fine color and grain, inquired as to what exotic wood was used in its construction, the men replied, “Our meat, Sir.”)

Discipline was savage, and resort was made to the infamous cat ’o nine tails, a wicked device composed of nine ropes in which had been embedded pieces of metal that could, if applied in a criss-cross pattern, open a man’s back. Such a flogging could be applied for even trivial offenses, such as malingering or muttering. Even worse was keel-hauling, in which a man was bound hand and foot, a line passed under the ship, and the unfortunate drawn from one side of the vessel to the other under the hull. All that can be said in mitigation, from a twenty-first-century perspective, is that conditions were about as bad on shore; in the matter of food, conditions ashore were perhaps even worse. Nonetheless, the eminent eighteenth-century English writer, Samuel Johnson, was considered to have made a valid point when he compared life at sea to imprisonment—but at least the prisoner enjoyed the advantage of not constantly having a mere half-inch board between himself and eternity.

These conditions were brought home to the Admiralty and the British public in 1797 when, on Easter Sunday (16 April), seamen of the Channel Fleet mutinied en masse, demanding improved pay and conditions (they had not been granted such a raise since 1653), an end to the infamous press gangs, lack of shore leave (impressed men, of course, unlike volunteers, were much more likely to make such leave permanent). Eventually some 30,000 seamen refused to work 80 warships. This was mutiny during wartime—a hanging offense, of course. But Great Britain also needed those 80 warships, so the government acceded to the mutineers’ minimum demands for a wage increase. However, delays in passing the necessary legislation sparked another mutiny at the Nore anchorage on the Thames. This time, the government stood firm, refusing to negotiate or make concessions; the mutineers slipped away until only the hard-core were left. A vengeful government hanged 29 of them. Over the years, most historians played down any overt political motivation by the mutineers, but more recently, historians have noted that there were clear Jacobin (French revolutionary) sentiments among some disaf-
fected crews (especially those of Irish and Scottish background), with a few even advocating sailing to France. At its worst, the mutiny and disaffection spared few Royal Navy warships. Conditions would not begin to appreciably improve until the mid-nineteenth century and the Age of Reform. (To the end of the nineteenth century, seamen went about their business barefooted.)

The wooden sailing line-of-battleship had about reached its peak of power and size when the French, not surprisingly, constructed the world’s first purpose-built wooden steam-screw ship-of-the-line, Napoléon, launched in 1850. They also completed the last sailing battleship, Valmy, of 116 guns, in 1847. Napoléon was considered so successful that the French constructed eight more such units during the following decade.

The British were slower off the mark, not from any innate conservatism, but because the Royal Navy had also to consider its oceanic obligations, so it had to find a design combination of sailing qualities as well as steam propulsion. The first Royal Navy steam battleship was Audacious, ordered in 1846, then later renamed for the pioneer of land steam propulsion, James Watt (the only case of a Royal Navy capital ship being named for a civilian, but fittingly enough). The first such purpose-built RN warship was the 90-gun Agamemnon. Agamemnon served as the Royal Navy’s Black Sea Fleet flagship during the Crimean War, participating in the bombardment of Sevastopol and, later, of the Kinburn Forts, alongside the first of the warships that would soon replace it—the French steam ironclad batteries.

It should also be noted that France’s still relatively underdeveloped industrial plant could not keep up with the British, even when its rival started from behind. Agamemnon’s engines required only regular maintenance, whereas Napoléon’s had to have its power plant replaced, and it spent considerable time under repairs. In fact, three such French battleships had to be fitted at the time with British engines.

But both Great Britain and France realized early in the 1850s that the sailing warship had come to an end, and no more were laid down. In light of the enormous appetite for coal of the early steam machinery, the world’s navies retained sail as the primary or secondary propulsion of seagoing battleships for the next decade and even beyond.

The Royal and the French navies were the only naval services to construct fleets of steam wooden battleships, and they anticipated using them against each other on some future occasion. But such a
clash never happened, and so these giant warships have been generally ignored or deprecated in march-of-progress–type naval histories. The only wooden steam battleship to see fleet action, in fact, was the Austrian Kaiser, which, although badly damaged by shell fire, gave a good account of itself during the Austro-Sardinian Battle of Lissa in 1866. Kaiser’s hull must have been stoutly built of good timber, for it was converted to an ironclad four years later and remained in the Austrian navy, incredibly, until 1918. In addition, Austria, Denmark, Naples, Russia, and Turkey all converted at least one sailing wooden battleship to steam power, and all relied on British technology for propulsion.

Nonetheless, the steam wooden battleship pushed the limits of construction. Basically, wooden hulls are limited by the length of the tallest trees, and these warships reached those limits at a time when the British Isles were experiencing a severe shortage of timber suitable for shipbuilding. Furthermore, a timber hull, despite the undoubted valuable innovations of Seppings and Edye, could not be made strong enough to resist, at length, the heat, vibration, moisture, and strains produced by the heavy machinery and its massive foundation castings, as well as the action of the sea. Further, launching these massive battleships was a delicate business and almost always resulted in some breakage or deformation. The working of the great wooden hull at sea ensured that the critical alignment of the propeller shaft was not long preserved, resulting in increased bearing friction wear, while vibration at the stern loosened seams and required frequent recaulking. All of this was exacerbated by the expedience of the hoisting screw, intended to give a free flow of water about the stern when not under steam, but that also further weakened that part of the hull. Further, the 130-gun ship-of-the-line, in its final immensity and its increased displacement, meant that it could not operate in shallow water or on offshore blockade duty.

Yet the steam wooden battleship was not some dead end; rather, it represented a previously unimaginable combination of maneuverability, reliable propulsion, and firepower in the decade or so of its dominance. The French could also take considerable satisfaction that, for the first time in more than 100 years of Anglo-French naval rivalry, they had achieved near parity with the Royal Navy in numbers of first-rate warships: both nations had 29 steam wooden line-of-battleships, although the British were constructing or converting 21 more.

The largest and the last of the steam wooden battleships was the Royal Navy’s giant three-decker, HMS Howe, completed in 1860. Of
course, 1860 was also the year that HMS Warrior was launched as the world’s first seagoing, iron-constructed ironclad warship. That ship could have, with impunity, blasted into matchwood any individual or combination of the large, slow, wooden warships. The steam timber-built battleship was a magnificent swan song of the world’s wooden sailing capital ships. The naval powers were poised on the threshold of the greatest technological revolution in naval history: the ironclad warship.

NOTES

1. Historians and archeologists agree that probably no galleys featured more than three banks; any more seems impossible, but the arrangements of such banks are still unclear.

2. Royal Navy fleets were decisively defeated by the Americans at the Battle of Lake Erie (1813) and the Battle of Lake Champlain (1814), but neither of these engagements featured capital ships.
CHAPTER TWO

Steam Ironclads: The Industrial Revolution at Sea, 1800–1889

It has often been pointed out that Drake's sixteenth-century sea dogs could have quickly and literally learned the ropes aboard Admiral Horatio Nelson’s eighteenth-century flagship, HMS Victory. Its greater size and gun power would certainly have impressed them, but Nelson's first-rate represented more growth than innovation. Actually, warships (and commercial vessels) of the late eighteenth century would not, except for their guns, have astonished Noah, Julius Caesar, or the Apostle Paul.

The great multigun, three-decked wooden sailing warship had serenely ruled since the 1600s, facing no serious challengers from above or below the waters, and fearing only the fireship. In battle, the stout wooden sides (usually oak) resisted solid shot. Only rarely was a wooden capital ship sunk, and then almost always by fire. The near-invulnerable status of the wooden warship would begin to change only in the early 1800s, and by the middle of that century they would cease to be built.

Writers tend to concentrate less on the Ironclad Era (1860–1889) than on the Dreadnought Era (1906–1918). Yet it was the former epoch that saw the more dramatic and swift transformation of capital
ships, with the introduction of steam power, iron construction, armor protection, heavy guns, and gun turrets. In fact, the emergence of the mastless, seagoing turret warship—the essence of the twentieth-century battleship—took place during a mere seven years of that era, 1863–1870. The Ironclad Era was simply the most radical technological transformation in naval history. Paradoxically, those decades of uniquely rapid naval technological transformation were a time of relative international peace.

STEAM PROPULSION

The first hint of this transformation could be found in the small Scottish commercial vessel *Charlotte Dundas* of 1801, the world's first functioning steamship and the first ship in history to be propelled by anything other than wind or muscle. Even so, *Charlotte Dundas* was primarily an experiment. But the following year did see the first Royal Navy steam vessel, a lowly dredger. The world's first efficient, commercially successful steamship was Robert Fulton's justly famous *Clermont* (1807). To Fulton, an American, also goes the honor in 1814 of constructing the world's first steam warship, *Demologos* (Voice of the People—Fulton was a committed Jeffersonian republican). This twin-paddle, ship-rigged catamaran steam wooden warship (renamed *Fulton* after the inventor's death in February 1815) was built specifically to fight in the War of 1812. But *Demologos* was completed too late to see combat and to test whether its 58-inch wooden bulwarks were in truth as shot-proof as Fulton claimed. Merely a harbor-defense vessel, it would most likely have suffered the fate of Thomas Jefferson's coastal militia gunboats, bottled-up by seagoing enemy blockaders along the coasts and in the very harbors it was built to defend. But *Demologos* was technologically advanced for its time, with its paddlewheels protected by the twin hulls of its semicatamaran design. However, its coast-defense mission foreshadowed a fad that would absorb much of the interest and resources of the maritime powers for the rest of the century. No other steam warship would be built for the U.S. Navy for the next 22 years, however, and even that vessel, *Fulton II*, a side-paddler, was basically an experimental project.

The first Royal Navy steam warship, HMS *Comet*, was launched in 1822. Mere conservatism may not be a complete explanation of the British Admiralty's lack of haste; early steam engines actually pro-
duced less power per pound than did a sail rig. The wind was free, if erratic, whereas coal, although more reliable than wind, was expensive and was eaten up in vast quantities by the early steam engines. The Admiralty had accepted steam for tugs, but as the Admiralty wrote to an inventor in 1822, their lordships "beg[ged] at the same time to state that they [were] not at all anxious to give any encouragement to the application of steam to ships of war" (Robert Gardiner, ed., Steam, Steel, and Shellfire: The Steam Warship, 1815–1905. Annapolis, MD: U.S. Naval Institute Press, 1992, p. 17). Yet only four years later, the British-built Karteria took the distinction of being the first warship to enter combat by artificial means of propulsion during the Greek War of Independence.

The French, as the inferior naval power, were usually more open to technological innovation than were the British; by 1835, they could boast of 25 steam vessels. Seven of these pioneering warships took part in the attack on Algiers in 1830, the first fleet action using steam power.

But for all of steam's advantages in propelling a vessel against tide and wind, steam engines were still inefficient, requiring mountains of coal that took up valuable interior hull space. The situation is somewhat similar to that of the first land steam engines of a century earlier—so inefficient that the only way that they could pay their way was to locate them at the mouths of coalmines.

Further, steam paddle wheels were an unsatisfactory means of propulsion for a warship. They were obviously vulnerable, easily smashed by shot, and much of their machinery was above the waterline, exposed to enemy fire. Half of the paddles themselves would be out of the water and useless at any one time (in rough weather as much as two-thirds), and when close-heeled under sail and steam the windward paddles would lose much of their grip. The paddle wheels themselves were a hydraulic drag on the ship's hull, and the paddle boxes blocked off much of the gun deck. For all of these reasons, steam would remain an auxiliary source of power for warships until the coming of screw propulsion and improved marine engines. Furthermore, with its exposed and vulnerable machinery, no steam warship could safely approach closer than 3,000 yards to the many guns of an enemy sailing battleship. Thus, until about 1840, steam was used primarily for towing and other auxiliary duties.

The underwater screw propeller, submerged and able to work in most weather, was an obvious answer to the manifest disadvantages of the naval paddle wheel, and at least 40 inventors had worked on the problem. The honors for the first effective screw propeller are
shared by the Swedish American John Ericsson and the Englishman Francis Petit Smith. Both built successful inland waterway screw-propelled vessels in the 1830s, but Ericsson, discouraged by the Admiralty’s lack of interest, gave up and emigrated to the United States where he continued his propeller work. Smith persisted in Britain, and in 1842, the Admiralty finally purchased the screw steamer *Mermaid* (renamed *Dwarf*). In the United States, Ericsson was able to persuade the U.S. Navy to construct the screw steamer *Princeton*. (Ericsson had earlier designed the iron-hulled commercial screw steamer *Robert F. Stockton*, which had crossed the Atlantic under sail in 1839.) The French Navy soon after adopted the screw for its frigate *Ponome*. The underwater screw presented naval designers with the attractive possibility that, for the first time, the motive apparatus of a warship could be protected from enemy fire; steam screw machinery could be fitted below the waterline and with the coming of armor plate protected even further. Nonetheless, steam was still primarily an auxiliary propellant, particularly aboard the great ships-of-the-line, through the end of the 1860s.

Most navies and mercantile interests also developed a hoisting screw and often a telescopic funnel for their steam-sailing ships. As a vessel would transition to steam from sail, or vice-versa, its commander would give the intriguing order “Up Funnel, Down Screw” —or vice-versa.

It cannot be said that naval commanders welcomed steam. It was dirty, particularly during coaling, and machinery was the concern of lower-class mechanics. As late as 1869–1870, a Royal Navy detached squadron circled the globe on sail alone, with the purpose of instructing the men in seamanship—that is, in the use of sail power. The squadron’s commander, Admiral Geoffrey Phipps Hornby, wrote that “more’s the pity that it should be so rare a thing to see a ship come into harbour under sail” (Mrs. Fred Egerton, *Admiral of the Fleet Sir Geoffrey Phipps Hornby*. London: 1896, p. 120). Of course, sail advocates also argued that the wind was free—an erroneous proposition if there ever was one, as shall be seen.

One of the almost completely unsung virtues of steam propulsion was that the men now had a source of hot water for washing. But it was not until the purchase of ironclad HMS *Neptune* from the effete Brazilians in 1881, that the RN began to fit actual bathrooms in its battleships. Even so, the world’s navies could not indefinitely escape the nineteenth century’s Age of Improvement and increasing humanitarianism. Flogging was abolished (although some sailors asserted that they preferred “ten of the best” to being locked up.) Food
improved, particularly with the advent of canning, although seamen throughout the nineteenth century would still consume it on the warship’s gun deck, where they also slept in hammocks. By contrast, the officers’ wardrooms remained as lavish as ever, with even the more modest of ironclads, such as the coastal Peruvian-Chilean Huascar, boasting “officers’ country” of inlaid fine woods, silver table service, and the better food and wines. The contrast is stark between the wardroom of a first-class ironclad of the age, such as HMS Warrior (now restored), and that of the more utilitarian battleships of the twentieth century.¹

Undoubtedly the greatest intangible improvement was a sailor’s newly granted right to enlist for a set number of years, rather than for just his ship’s cruise. Furthermore, in line with the reform movements of the time, he could also now substitute coffee or tea for his traditional daily grog ration.²

IRON CONSTRUCTION

Iron construction represented as much of a change as steam propulsion from the way ships had been built and powered from time immemorial, and this transformation would also come in the early 1800s. The first iron-constructed steamship, the coastal passenger vessel Aaron Manby, made its first passenger-carrying voyage in 1820, later crossed the English Channel, and was purchased by a French concern to carry excursionists along the River Seine. As with steam and the screw, the world’s navies lagged behind commercial interests in recognizing the value of iron construction with its lower maintenance, cheapness, fireproof construction watertight integrity, indefinite hull life, and lighter hull weight. (Because metal plates can be rolled much thinner than wood planks can be cut, metal hulls are actually lighter and provide more space than identical structures of wood.) With wrought-iron construction, hulls could also be built, at least in theory, to unlimited dimensions, unconfined by the length of the longest tree. Iron construction also did not require as many skilled workmen as did traditional wooden shipbuilding. Additionally, by the 1840s, the railway boom in Great Britain, France, and the United States had brought down the price of iron.

Several British shipbuilding firms took up construction in the new medium, and by 1842, some 44 iron vessels were built or under construction, almost all of them steam-propelled. But they had at
first to look elsewhere than the Royal Navy for iron warship contracts. The first iron-constructed ships for war were two armed paddlewheel steamers built by William Laird and Sons of Birkenhead for the Royal Navy in 1839. But the first actual warship built of iron, the paddle frigate *Guadalupe* (1842), also built by Lairds, was for the Mexican navy. *Guadalupe* was also the first iron warship to see action, giving a good account of itself during the Mexican War (1846–1848).

Opponents of iron construction were not merely acting from some supposed deep-seated conservatism. Iron construction, for all of its merits, had one fatal flaw from the navies' perspective: firing experiments demonstrated conclusively that iron plates could be readily penetrated by solid shot and send off even larger splinters than those that wreaked havoc on the gun decks of wooden warships. Naval constructors were in a quandary: iron hulls were obviously superior in almost every respect to those of wood, but iron could not begin to stand up to shot like wood. (Yet it is a little-known fact that *Guadalupe* withstood fire by Texas forces for some five weeks with little damage.) However, wooden walls themselves were highly vulnerable to the new horizontal-firing shell gun.

**THE COMING OF THE STEAM IRONCLADS**

Four centuries earlier, the Koreans deployed into battle a number of Kobukson “turtle ships”—oar-propelled ironclads—with great success during the Korean-Japanese Wars (1592–1593, 1597–1598). But these warships were, of course, not steam-powered. Wood was obviously no protection against horizontal shell-fire, and iron construction, if anything, was even more vulnerable. But iron armor might be an altogether different proposition. The first warship to attempt to bring together armor protection in addition to the other profound innovations of the time was the remarkable *Stevens Battery*, an ingenious American private venture iron-built armored warship of some 4,000–6,000 tons, armed with long swivel guns that could fire both elongated shells designed to explode after penetration as well as solid shot. The fragility of wrought-iron construction would not be a problem as the entire hull above the waterline was to be protected by 4.5-inch armor. The few breech-loading, rifled great guns could be aimed and loaded by steam machinery operated by a
detail safely below decks. This warship, which in view of its great size—nothing comparable would be completed in the United States until the 1890s—and armament, which could be considered truly a capital ship, albeit for coastal or harbor defense, which boasted such additional innovations as artificial ventilation, boilers adapted to burn anthracite coal to produce much less smoke, two independently acting screws, a ram bow, and eventually no masts or sails. All of this was incredibly advanced for the early 1840s, when the leading naval technology of the time was the installation of steam engines in wooden sailing ships.

Robert Livingston Stevens signed the project’s contract in 1842 and commenced work in his Hoboken, New Jersey, yard. Work proceeded on the novel ironclad until it was half-completed, when Stevens then radically redesigned his vessel, increasing its armor protection to 6.75 inches to resist John Ericsson’s 12-inch heavy guns; he enlarged displacement (and cost) to carry the weight of the increased armor. He then argued with the Bureau of Ships and later died. Not even civil war and the threat of foreign intervention could persuade the U.S. Navy authorities, drawn into the monitor mania of the time, to call upon Congress for sufficient funds for its completion. Eventually, the state of naval architecture left the Stevens Battery behind. What might have easily proven to be the most powerful warship in the world in the 1850s, an eerie echo of Robert Fulton’s Demologos, was never launched. Completely obsolete, it was sold for scrap in 1881. (Cost may have been a factor: Stevens received in total some $700,000 for work on his uncompleted battery. The roughly comparable—and completed—RN turret ship Prince Albert cost £208,300.)

A full decade after the Stevens Battery, the Russian fleet basically massacred an anchored Turkish squadron at the naval Battle of Sinope (30 November 1853) and thus demonstrated the awful power of the new exploding horizontal shells. Impelled far more by the reports from Sinope than by the Hoboken venture, the British and the French set up armor testing programs that led to the first completed iron-protected warships. These were a series of small, steam-powered floating batteries designed specifically for use against the Russians in the Crimean War of 1853–1855, which saw France, Britain, and Turkey almost inexplicably allied against Russia.

The French batteries were first into action (the British batteries were scheduled for war service in the Baltic and never saw battle), participating in the bombardment of the Russian Black Sea coastal fortifications at Kinburn on the Dnepr estuary on 17 October 1855. But the weak Russian coastal batteries (24-pounders) were considerably more
damaged by fire from allies’ mortar, gunboats, and wooden ships-of-the-line than by the ironclad batteries. Surprisingly, those batteries were the only warships in this action to suffer fatalities from Russian return fire. Two were killed on *Devastation*, and a total of 24 were wounded; these casualties resulted from two Russian hot shots entering gun ports and another gaining entrance through a defective main hatch. But the ironclads’ 4-inch armor was only dented.

The performance of the pioneering Kinburn batteries, the Emperor Napoleon III’s special project, was exaggerated in the syphantic French press. In fact, it was the allies’ ships-of-the-line that finished off the remaining forts. Nonetheless, Admiral Sir Edmund Lyons, the British commander on the scene, recognized that the Kinburn batteries were worth a closer look. The naval Crimean War also proved to be the first time in history that one belligerent power had a definite technological advantage over its opponent. The Russians, with their primitive (but expanding) industrial base, could not match the steam power, armor, and heavy artillery of their enemies. By contrast, in the Franco-British wars of the eighteenth and early nineteenth centuries, the French and the Spanish, if anything, enjoyed superiority in their warships’ designs. The disparity between the technologically advanced naval military powers and those not so fortunate would only grow in the decades to come.

After the Crimean War, the French laid down no new sailing ships-of-the-line, realizing that the day of the sailing, unarmored warship had finally ended after some 300 years. Instead, Napoleon III saw to it that France produced the world’s first seagoing ironclad, *La Gloire*. But *La Gloire*, paradoxically, actually demonstrated France’s industrial inferiority to Great Britain, an inferiority that would continue through the nineteenth century. *La Gloire* was of wooden construction and had the restricted dimensions imposed on any wooden warship. (Nonetheless, its novelty should not be ignored; the proposal for its construction came within 18 months of a proposal for no less than 41 screw wooden line-of-battleships.) Iron hulls were considerably superior to those of wood because every foot of a wooden ship needed protection against the inflammatory new shells, but an iron-built hull had only to shield its guns. Iron construction also permitted watertight subdivision and eliminated the dangerous combination of steam and wood.

Britain’s response, HMS *Warrior*, a warship superior in every way except in that it deleted *La Gloire*’s waterline armored belt in order to speed up construction, was the world’s first truly seagoing ironclad and the pioneer warship of iron construction. Its dimensions were
easily twice that of *La Gloire*, its tonnage almost twice (5,600 tons versus 9,300 tons), and it was of long-lasting wrought-iron construction (so long-lasting, in fact, that *Warrior* was never scrapped; it has been restored to its 1860s splendor and is now on public display). Indicative of France’s second-class status in the era of the industrial revolution is the fact that of its first 16 ironclads, only two were of iron construction. The black-hulled *Warrior* and its sister ship *Black Prince* were “black snakes among the rabbits” and could probably have destroyed the French ironclad fleet in detail (and the U.S. Navy armored fleet as well, for that matter). Additionally, their wrought iron structural plates were superior metallurgically to those of the French.

It can also be argued that Emperor Napoleon III, for all of his imperial bluster, recognized soon enough the Royal Navy’s newfound ironclad supremacy (which he had helped to spark) and moderated his “forward” policy toward his traditional rival across the channel. Great Britain was the first nation to pass through the industrial revolution, and its iron and marine engine industries, gun foundries, and shipbuilding yards were easily the world’s most advanced. Furthermore, the British, unlike the French, had a number of private shipyards fully capable of building ironclads for the use by the Royal Navy and for sale abroad. Furthermore, the iron-building revolution rescued the British from their perennial timber supply worries, just when the problem was becoming most acute.

Yet in some ways *Warrior* reflected an extremely conservative design, from the time-honored overhanging frigate bow (although reinforced for ramming), complete with 15-foot figurehead, adding some 40 tons of useless weight (*Warrior* and *Black Prince* were the last capital ships to sport that traditional bow), to the false windows set into the iron of its traditional stern. And Great Britain continued to lay down numerous ironclads on a traditional pattern of guns arranged along the broadside and being fitted with nearly full masts and sail rigs. The most obvious change from the wooden predecessors could be seen in the bows, which (after *Warrior* and *Black Prince*) swept downward and outward to form massive and lethal underwater rams.

The immediate ironclad successors to *La Gloire* and *Warrior* continued to arrange numerous main guns in the traditional broadside pattern. Later classes clustered a smaller number of larger guns in a short armored central box battery, with indentations in the hull, or in sponsoned (bay-window) gun platforms to permit, in theory, some ahead-fire. In fact, the whole trend of ironclad naval architecture for the remainder of the 1800s was to deal with the ever-increasing
main gun size and power by grouping fewer and fewer guns in an increasingly confined and thicker armored space, either a box battery, a barbette, or, finally, a turret.

With the exception of the coastal ironclads, all of these armored warships until the late 1870s carried full sailing rigs. The box battery and the recessed sponsoned gun platforms were supposed to give ahead-fire in conformity to the ram craze, but it could be convincingly argued that these were mere shifts and dodges to avoid giving up masts and sails on the ironclads. Given the state of marine engines and their great appetite for coal at the time, sailing paraphernalia probably could not yet be dropped, nor would it be (except for coast-defense ironclads) until the bold and pioneering design of HMS *Devastation*, the first mastless seagoing ironclad.

The follow-on ironclads to *Warrior* and *Black Prince*, *Resistance* and *Defence*, were considerably smaller. They were a foretaste of frequent attempts, mostly political, into the twentieth century to limit the size of capital ships to save money. The result, in the end, was almost always an inferior warship.

Edward James Reed, chief constructor of the Royal Navy (1863–1870), then completed plans for HMS *Bellerophon*, the next significant ironclad after the pioneer Warrior class. *Bellerophon* represented the best results that could be obtained with the broadside arrangement of big guns; its sides were recessed to give bow and stern fire within a theoretical 15 degrees off the centerline. (How the hull would have held up to the discharge of heavy naval guns so close to its side was another matter.) *Bellerophon* was also the first large warship to be designed on Reed’s bracket-frame hull construction, the first effective double-bottom for a warship. Until the turret swept aside all before it, *Bellerophon*’s main battery arrangement and its variations, such as hull sponsons and indentations, were the best methods for arranging an ironclad’s main gun battery. (It could also be argued that one of the major benefits of the large broadside ironclads was the light and airy accommodations offered in their high-sided hulls. Low-lying turret ships, particularly the U.S. monitors, were particularly hot and foul below decks, despite forced-draft ventilation.)

All of the naval powers also constructed numbers of wooden-hulled ironclads from the early to mid-1860s. The Royal Navy employed such timber-built ironclad hulls only as a temporary measure to build up its ironclad fleet numbers, as well as to use up seasoned timber, now not so much in demand, and to keep the dockyards and their skilled workmen busy during the transition from wood to iron
construction. All but three such ironclads were converted wooden first-rates already on the stocks.

Many of Britain’s ironclad rivals, with their less-developed industrial bases, used timber ironclad construction as an inexpensive means to build up their ironclad fleets. Some of the naval powers’ timber-built ironclads, like those of the Royal Navy, were constructed on the hulls of never-completed wooden broadside ships-of-the-line. One minor advantage of the timber-hulled ironclads was that antifouling copper sheathing could be nailed directly to their bottoms; on iron bottoms the galvanic action between iron and copper soon ate away the sheathing, leaving the iron hulls to blossom with so much marine growth that they were said to resemble a lawyer’s wig.

The timber-built ironclads, however, labored under severe disadvantages: They were firetraps, internal watertight integrity was impossible, wooden hulls could barely support the weight of armor plating, they had a much lower carrying capacity because of the heavier weight of wooden hulls, and their engines were already obsolete. By the 1880s, having served their limited purpose, the last timber-built ironclads had been broken up.

The coming of the steam-powered armor-clad iron big-gun warship drastically narrowed the ranks of the first-class naval powers. In the days of the wooden sailing ship-of-the-line, nations such as Portugal, Denmark, Sardinia, the Netherlands, Turkey, and Spain could build and deploy first-class warships, although in limited numbers. But the technological infrastructure needed to construct ironclads and their big guns was beyond the resources of such middle powers. The case of Spain is instructive: That power built the world’s largest wooden capital ship, Santissima Trinidad, of no less than 136 guns on four gun decks, as well as numerous other first-class wooden capital ships that were in many ways superior to those of the Royal Navy. But when Spain ordered its first ironclads, most were built by foreign yards, although some wooden-hulled ironclad warships were constructed domestically. The Spanish could forge their own heavy guns and armor, but all of the machinery had to come from abroad. Much later, when the Spanish embarked upon their own dreadnought program, they ended up constructing the world’s smallest battleships.

Some of the most modest of naval powers could buy their ironclads, usually of the coast-defense type. China bought two small German-built battleships (and eventually lost both to the Japanese). Brazil deployed a host of foreign-built riverine and coastal-type armorclads,
many of which saw action in the war with Paraguay, as well as several small battleships. Chile purchased three ironclads and one battleship. Tiny but belligerent Peru had no less than seven foreign-built armor-clads, most of which saw combat, including the U.S. Civil War–era monitor *Atahualpa* (formerly *Catawba*).

Surprisingly, even the two major naval powers, Britain and France, purchased a few ironclads for their own navies. In 1867, France bought from the United States the uncommissioned giant broadside ironclad wooden ram *Dunderberg*, which mounted a massive, solid-oak ram; it had been completed too late to see combat in the Civil War. The French renamed it *Rochambeau* in a gesture of Franco-American comity; it saw no action during the Franco-Prussian War, although it did take part in the blockade of Prussia. (Alas, *Rochambeau/Dunderberg*, a hasty wartime project, was built of green wood and was stricken from the naval list only three years later.) The French also purchased the U.S. monitor *Onondaga* (which retained its American name); it played practically no role in the Franco-Prussian War but remained in service until 1904.

The British Admiralty, fearful of being drawn into the Russo-Turkish War of 1877–1878, hastily purchased four ironclads being built in British yards for the Turks and the Brazilians in probably the worst warship deals the Royal Navy ever made. The two warships for Turkey were coastal rams of very limited range and value. The third was a rigged broadside ironclad that could not proceed under sail. The fourth purchase had been intended for Brazil and could actually be considered the worst ironclad ever to enter service in the Royal Navy. The Brazilians had called for a “rigged *Devastation*”—what they got was something more akin to the fatally flawed HMS *Captain*, encumbered with a forecastle, poop, and upperworks for the working of the full barque rig. The purchased HMS *Neptune* was a “thoroughly bad ship in most respects—unlucky full of inherent faults and small vices, and at times a danger to ... consorts” through its inherent unwieldiness (Oscar Parkes, *British Battleships*, London: Seeley Service, 1960, p. 277). The Brazilians saw to it that the Admiralty, in its haste, had to pay almost twice as much for this “rigged *Devastation*” as for the real *Devastation*. Additional costs for launching damage, replacement of the guns, and general expenses to bring it up to RN standards made *Neptune*’s cost considerably more than double that of *Devastation*. About the only positive thing that could be said about *Neptune* (formerly *Independencia*) is that it did introduce a reluctant Royal Navy to the bathtub.
THE TURRET WARSHIP

The Royal Navy got far more value for its money in the development of the turret ironclad. The turret held enormous advantages over the broadside arrangement of heavy guns. In the words of the turret’s pioneer, the commander of a turret ship could “turn the guns, not the ship.” Obviously, a gun turret could be pivoted much more easily than an entire warship could be turned. Gun turret ports were much smaller than those through which broadside guns had to be aimed and fired, thus giving turret ship gun crews greater protection from enemy shot and fragments. At any rate, gun crews could be much smaller in number, having to serve only a few heavy guns and having no longer to aim, only to load and fire the guns.

However, no way as yet had been devised to combine the turret with the sailing rigs still believed to be necessary. The sweep of the turret was not so sweeping if it was blocked by masts and rigging. This problem was the main reason, rather than any innate conservatism, that broadside (or box battery) ironclads were built long after the turret became feasible.

The credit for the invention of the most effective gun turret goes not to the famous Swedish American inventor John Ericsson, designer of USS Monitor, but to the more obscure half-pay Royal Navy captain, Cowper P. Coles. Although the two turret designs were more or less contemporary, Coles’s turret was technologically far more advanced than Ericsson’s. The Coles turret rested on rollers below the waterline on the gun deck, not on an easily jammed spindle like Ericsson’s, and it was protected with solid, not laminated, armor plating.

Captain Coles enjoyed strong support from Prince Albert, Queen Victoria’s consort, and when that royal prince died in 1861, the grieving queen was all the more determined to see that its navy gave Coles a chance to prove his invention. Further, Coles enjoyed wide public support, as expressed in the naval and general periodicals of the day. For the first time, the Admiralty found itself having to pay considerable attention to public opinion. The industrial revolution, with its steam presses, cheap paper, and swift rail transportation, had made professional, literary, and popular newspapers and journals available to an enormously increased readership, as had the government school movement. Journalists and half-pay officers, not to mention lawyers, clergymen, stockbrokers, and artisans, could now fiercely denounce or praise the most technical details of naval construction and armament for a wide audience, and most supported Coles, specifically denouncing the Admiralty’s Construction Office. The
Reform Act of 1867, giving the working classes the franchise, also widened the audience that could make known its opinions on naval matters, no matter how uninformed.

Despite the Coles turret’s superiority, the distinction for participating in the first ironclad-to-ironclad clash must go to the Ericsson turret armorclad USS Monitor, the world’s first mastless ironclad. At the Battle of Hampton Roads (8 March 1862), Monitor faced off Confederate ironclad battery CSS Virginia in one of the very few naval battles fought before a large audience, lining the Virginia shore.

It is popularly supposed that Hampton Roads demonstrated that the day of the wooden warship had ended. It did no such thing; the armored Kinburn batteries had already taken the world’s attention almost six years before, the French La Gloire had been in service for the previous two years, and the magnificent seagoing British ironclad HMS Warrior for six months; and the world’s naval powers at the time had some 20 ironclads on the stocks. It would have been a peculiarly dense naval officer or designer who did not realize by March 1862 that ironclads would dominate the world’s fleets in the very near future. The main question would be what forms those ironclad warships would take.

The historic Battle of Hampton Roads did touch off a veritable monitor mania in the Union: Of the 84 ironclads constructed in the North throughout the Civil War, no less than 64 were of the monitor or turreted types. The first class of Union monitors were the 10 Catskills: Catskill, Camanche, Lehigh, Montauk, Nahant, Nantucket, Patapsco, Passaic, Sangamon, and Weehawken. (Camanche was shipped in knocked-down form to San Francisco. But the transporting vessel sank at the pier. Camanche was later salvaged, but the war was already over. Camanche thus has the distinction of being sunk before completion.) These ironclads, the first large armored warships to have more than two units built from the same plans, were awkwardly armed with one 11-inch and one 15-inch Dahlgren smoothbore. The Passaics were followed by the nine larger Canonicus class: Canonicus, Catawba (not completed in time for Union service), Mahopac, Manayunk, Manhattan, Oneonta, Saugus, Tecumseh, and Tippecanoe, distinguishable by their armament of two matching 15-inch smoothbores and the removal of the dangerous upper-deck overhang.

The eminent engineer James Eads designed four Milwaukee-class whaleback (sloping upper deck) double-turreted monitors: Chickasaw, Kickapoo, Milwaukee, and Winnebago. (Ericsson, on the other hand, loathed multiple-turret monitors, sarcastically comparing the arrangement to “two suns in the sky.”) Eads’s unique ironclads
mounted two turrets, one of the Ericsson type (much to Ericsson’s disgust), the other of Eads’s own patented design: The guns’ recoil would actually drop the turret floor below the waterline for safe reloading; hydraulic power would then raise the floor back to the turret, wherein the guns could be run out by steam power. Eads’s two paddlewheel wooden-hull monitors, Osage and Neosho, designed for work on western rivers, were also unique. Although built to Eads’s designs, the two paddlewheel monitors mounted Ericsson turrets. All of the above monitors saw action in the U.S. Civil War. Completed too late for action were Marietta and Sandusky, iron-hulled river monitors constructed in Pittsburgh by the same firm that had built the U.S. Navy’s first iron ship, the paddle sloop USS Michigan.

Ericsson designed five supposedly oceangoing Union monitors: the iron-construction Dictator and Puritan, and the timber-built Agamenticus, Miantonomah, Monadnock, and Tonawanda.

The one-of-a-kind Union monitors were Roanoke, a cut-down wooden sloop; and Onondaga, also of timber-hull construction. Ozark, a wooden-hull light river monitor, had a higher freeboard than any Union monitor and also mounted a unique underwater gun of very questionable utility. None of the seagoing or the one-of-a-kind monitors saw combat.

Keokuk was an unlucky semimonitor (its two guns were mounted in two fixed armored towers and fired through three gun ports—a revolving turret would seem to have been an altogether simpler arrangement). The fatal flaw was in the armor, a respectable 5.75 inches, but it was alternated with wood. Participating in the U.S. Navy’s first attack on Charleston, South Carolina, Keokuk was riddled with some 90 Confederate shots and sank the next morning.

Aside from riverine/coastal ironclads, the Federals built only two broadside wooden ironclads, New Ironsides and Dunderberg (later Rochambeau, a super–New Ironsides, almost twice the former ironclad’s displacement), both with no particular design innovation. But New Ironsides could claim to be the most fired-upon ironclad during naval operations off Charleston, perhaps the most fired-upon warship of the nineteenth century, as well as the ironclad that, in turn, fired more rounds at the enemy than any other armored warship of the time. The broadside federal ironclad was formidably armed with fourteen 11-inch Dahlgren smoothbores and two 150-pound Parrott rifles, as well as a ram bow. Its standard 4.5-inch armor plate was far superior to the laminated plate of contemporary monitors. Whereas the monitors off Charleston suffered serious damage from Confederate batteries (and semimonitor Keokuk was sunk), New Ironsides could more or less
brush off enemy projectiles and was put out of action only temporarily when attacked by a Confederate spar torpedo boat. During its unmatched 16-month tour of duty off Charleston, it proved a strong deterrent to any Confederate ironclad tempted to break the Union’s wooden blockading fleet off that port city, becoming the “guardian of the blockade.” Still, naval historians have tended to ignore *New Ironsides* and its wartime contributions because of the conservative design.

In light of their technological inferiority to British turret ironclads, it is difficult to understand why the Union’s Ericsson-turret monitors were also built by other countries: Brazil, Norway, Russia, and Sweden either built their own Ericsson-style monitors or had them built in other countries. (The Swedes, naturally enough, named their initial monitor *John Ericsson.*) The Russians constructed no less than ten Bronenoseetz-class coast-defense monitors, and the Norwegians four similar Skorpionens. The Royal Navy ordered a class of four dwarf coastal ironclads that could be termed monitors, but they carried, of course, Coles turrets on breastworks well above the height at which they would have been mounted on Ericsson monitors, and they had superstructures. Furthermore, unlike the monitors, these coastal ironclads were in fact the diminutive template of the mastless turreted capital ship of the future.

The Union monitors, although an intriguing design, were in truth merely coastal and river warships; although several ventured onto the high seas, they only did so sealed up and unable to use their guns. Their extremely low freeboard (a long-armed man could have dipped his hand in the water from the deck) and tiny reserve of buoyancy made them liable to swamping, beginning with *Monitor* itself, which foundered off the North Carolina coast in December 1862. Monitor *Tecumseh* went down in less than two minutes after striking a mine at the Battle of Mobile Bay, the first instantaneous destruction of a warship, an all-too-common event in the twentieth century’s naval battles. *Tecumseh* was also the first ironclad to be sunk in battle, if one discounts two federal riverine armorclads sunk earlier at the Battle of Plumb Point Bend in May of 1862.

In fact, although the monitors might have been impervious to any Confederate gunnery, Southern mines destroyed the only three such warships sunk by the enemy: *Patapsco, Tecumseh,* and *Milwaukee.* (Monitor *Weehawken* foundered on a relatively calm sea in Charleston Harbor.)

The monitors also suffered from an extremely slow rate of fire; *Monitor* itself could get off only one shot about every seven minutes. Each shot required that the monitor’s turret revolve to where its
floor ammunition hatch matched that of the hull; when firing, the
two hatches were out of alignment to protect the magazine. And if
an enemy shot hit where the turret met the upper deck, the turret
could jam, something that apparently never happened to the many
turrets built with Coles’s system.

In 1865, the U.S. Board of Ordnance obtusely argued that warships intended for sea service would be best with no armor at all. Yet at that very moment the Royal Navy had deployed five seagoing ironclads, including the magnificent pioneering Warrior and Black Prince, both warships with truly oceanic range, not to mention Defence, Resistance, and the timber-hull Royal Oak, Prince Consort, and Hector. The French, of course, years before had commissioned the seagoing La Gloire as well as Magenta and Solferino, the latter two the only ironclads ever to mount their main battery on double gun decks. (Magenta also has the melancholy distinction of being the first of the capital ships to be destroyed by mysterious explosion, a fate followed by about a score of such warships in the succeeding decades.)

In view of their design faults, plus their inferior and extremely slow firing guns and laminated armor, the monitors were a dead end in naval architecture from the start. The fact that Washington would consider the British sale of just two Coles turret rams to the Confederacy as grounds for war is a strong indication that the administration of President Abraham Lincoln realized the superiority of British-built turret ships to Union monitors.

In the meantime, the Royal Navy had constructed on Coles principles two mastless coastal turret ironclads, Royal Sovereign and Prince Albert (their very titles a reminder of Coles’s royal patronage). The former was an uncompleted steam wooden ship-of-the-line cut down to a low-freeboard turret ship, undoubtedly the ugliest capital ship ever constructed in any navy. The latter was designed from the keel up as an iron-built turret ironclad. Queen Victoria saw to it that the little Prince Albert, the Royal Navy’s first iron turret ship, remained on active service long after it had become hopelessly obsolete.

Coles did not have matters completely his own way, however. Royal Navy constructors tiresomely pointed out that the combination of masts and sails with turrets would block the all-around fire that was one of the most compelling of the theoretical arguments for the turret against the broadside. Relying on steam alone might suffice for coastal ironclads, but for the oceanic demands of the Royal Navy, masts and sails were considered essential. Edward James Reed (the British Admiralty’s chief constructor) and Admiral Sir Robert Spencer Robinson, the controller of the Royal Navy (responsible for the service’s materiel)
both mustered serious objections to Coles’s dreams of low-freeboard oceangoing masted turret ships. They designed and had constructed a high-freeboard fully-masted turret ironclad, the first seagoing turret ship, HMS *Monarch*, much to Coles’s disgust. (Coles rudely wrote that *Monarch’s* twin turrets might just as well “be mounted on the First Lord’s old hat”). At any rate, Reed and Robinson at the time still preferred the box battery type of ironclad, which permitted, in theory, fore-and-aft fire, although in reality the blast from these short-barreled, muzzle-loading guns in battle would probably have caused hull damage. However, the box battery did permit a full sailing rig, a major advantage in that day of fuel-hungry, unreliable engines.

Actually, even before the turret ship controversy became public, Reed was the object of severe denigration, with critics jibing that Reed’s first ironclad designs (*Research*, *Enterprise*, and *Favorite*) and Reed’s position itself owed less to research and enterprise and more to favoritism. But Reed’s accomplishments, starting at least with *Bellerophon*, were lasting.

Coles, with his political heft, was able to sign on to design and supervise the construction of HMS *Captain*, the antithesis of the monitor and of HMS *Monarch*. *Captain* was a fully-masted twin-turret seagoing ironclad of extraordinarily low freeboard and excess weight. Coles was no naval constructor, but the half-pay captain did believe that he had solved the problem of combining turrets and sailing rig. *Captain* carried its sailing tackle on Coles’s patented tripod masts (the forerunners of masts on twentieth-century capital ships), an arrangement that eliminated almost all standing rigging and which—again in theory—gave the turret ship optimum lateral angles of fire but still no pure fore-and-aft ranging. These heavy iron masts also added weight topside, undermining stability, a consideration that Coles blithely dismissed.

Reed and Robinson had their doubts about the stability of Coles’s turret ship, as increasing weight heightened its waterline even below its extraordinarily low freeboard. But the two Admiralty officials could do nothing to prevent its completion. On the night of 6 September 1870, only a few months after its completion, *Captain* capsized in a moderate gale off the coast of Spain in the worst naval disaster of the nineteenth century. Only 27 of the 490 aboard survived; Coles was not among them. *Captain’s* sinking was also the Royal Navy’s first ironclad loss to any cause. After the *Captain* disaster, the combination of low freeboard and full masting was never tried again by any naval power.

Well after Germany and France, the Royal Navy went over to breech-loading main guns for the first time since *Warrior*. And this decision came none too soon for, despite Great Britain’s undoubted
industrial lead, all the other major naval powers had adopted the breechloader some years earlier. Much of this reluctance to change stemmed from the fact that for the first 25 years of the ironclad era the Royal Navy labored under an impossible ordnance system in which the army's Royal Gun Factory at Woolwich supplied its guns. Woolwich was so tardy in its methods that, in some cases, RN ironclads were commissioned while still missing some of their big guns. The absurd situation was not corrected until Captain John Fisher (of later Dreadnought fame) became director of naval ordnance in 1886 and the navy, logically enough, took over the supply of its own guns.

Gun accuracy, if anything, was even worse than supply. In 1870, HMS Captain, Monarch, and Hercules fired at a ship-sized rock off Vigo, Spain, during a practice run of six minutes at a range of 1,000 yards. It was calculated that, of the twelve rounds that these three ironclads managed to get off (about one every 2.5 minutes, which was about the best rate that a well-trained gun crew of the time could achieve), one would have scored a direct hit and one an indirect hit. Had the target been a moving ship, there was a good likelihood that all of the shells would have missed altogether. And those hits might have caused little damage at any rate. Two years later, on a flat, calm sea at Portsmouth Harbor, two RN coastal ironclad rams, Glatton and Hotspur, were drawn up stationary at a 200-yard range. A new 25-ton gun on Hotspur was test-fired at Glatton, which had a bull's-eye conveniently painted on its turret. After four test shots, the fifth shell missed altogether, the sixth and seventh hit the structure but missed its target, and Glatton's turret rotated freely afterward. Not only were the gunnery tests themselves conducted under unrealistically ideal weather and sea conditions, but also the range and penetration tables of the naval powers were absurdly laid out in similar perfect conditions and used shell-striking angles that obviously could very rarely be expected in any naval action on the high seas. It would seem that, over the years, the bigger the gun, the less the accuracy and rate of fire. In light of these ordnance results, there were some powerful theoretical arguments in favor of the ram. Yet, as will be seen, the ram in battle was about as chancy as the gun.

Nonetheless, British naval guns were superior to those of its competitors, except for Germany (not a major naval power at the time). And there was progress later during the ironclad era. The most significant advance in the later half of the 1800s was the reintroduction of breech-loading guns. Early in the ironclad era, the muzzleloader offered simplicity and speed of fire compared to the breechloader. But toward the end of the 1870s, slow-burning gunpowder and then smokeless powder had finally replaced the smoky black powder. But
barrels had to be lengthened to use the new propellant to its best advantage, which in turn raised muzzle velocity and penetration power at longer ranges. These considerations, plus a disastrous gun explosion in HMS Thunderer in January 1879, when two charges were inadvertently loaded into the same barrel, at last convinced the British Admiralty to make the transition to breechloaders. After having resisted such a move for almost two decades, the Admiralty could see that an improved, gas-tight breech mechanism, mechanical ramming, and the partial use of metal cartridges made breech-loading possible and practical. The Admiralty finally decided to adapt the turret battleships Colossus and Edinburgh (completed in 1886 and 1887, respectively), already under construction, to mount the new guns.

The main gun shells also improved throughout the ironclad era. A Royal Engineers captain first topped a shell with a wrought-iron cap, which gave far greater penetrating power, but it remained for the Russian Admiral S.O. Makarov, not the British Admiralty, to take up this discovery as late as 1890. (Later, Makarov was one of the very few efficient naval commanders in the Russian Navy during the Russo-Japanese War, in which he was to lose his life when his battleship struck a mine.) And although the U.S. Navy also adopted its own capped shell, the Royal Navy did not adopt one until 1905, well after the ironclad era had passed. Armor-piercing shells were simply solid shot, as they had been during the U.S. Civil War, and were about as successful.

Although the big guns were improving range and penetrating power (although not necessarily accuracy), nineteenth-century inventors were busy developing numerous means to sink ironclads, perhaps in response to the ironclad’s seeming invulnerability to anything but the ram.

As early as 1868, the Briton Robert Whitehead had produced a torpedo that was run by compressed air (with a range of about 700 yards at 7 knots), a vast improvement on the spar torpedoes that had sunk several warships during the U.S. Civil War. Although Whitehead’s free-running torpedo would remain the standard form of such weapons until 1945, only one warship was sunk by this weapon during the ironclad era, the Blanco Encalada (described later).

THE RAM CRAZE

From the earliest days of the ironclad, naval theorists and ironclad designers, frustrated by sailing impedimenta in their attempts to ob-
tain fore-and-aft gunfire and inspired by the newfound mobility afforded by steam, looked to resurrect an ancient weapon: the ram. Throughout the nineteenth century, almost all ironclads were fitted with some sort of reinforced or ram bow.

During the U.S. Civil War, riverine battles were often fought entirely between rams, such as the Battle of Plumb Point Bend and the Battle of Memphis in the spring of 1862 (not to mention the depredations of CSS Virginia on the Union unarmored wooden blockading fleet at Hampton Roads). At Plumb Point Bend (10 May 1862), the first major fleet engagement of the Civil War, the Union river ironclads *Cincinnati* and *Mound City* were rammed and sunk, although both were quickly raised. The score was evened at the Battle of Memphis on 6 June 1862, when federal unarmored Ellet rams destroyed all but one of eight Confederate warships.

These sinkings, however, took place in confined riverine waters. Ramming was a considerably different matter on the high seas, which saw only one case of successful ramming at the Battle of Lissa (1866), the only major fleet action between the Napoleonic Wars and the Sino-Japanese War (1894–1895).

A few French and Royal Navy ironclads were actually constructed basically as rams, beginning with the aptly named HMS *Hotspur* (completed in 1871), with their guns secondary to their exaggerated rams (*Hotspur*’s snout extended a full 10 feet beyond the bow). The Royal Navy went so far as to construct two battleship-rams, *Victoria* and *Sans Pareil* (completed in 1890 and 1891, respectively), but *Victoria* suffered the ironic tragedy of being accidentally rammed, with heavy loss of life, by a consort.

The ram’s protagonists proclaimed the potency of this “ever-loaded weapon.” But it was something like a person going about with a cocked and loaded pistol in his pocket: the weapon is more likely to go off inadvertently. A series of catastrophic accidental peacetime rammings through the remainder of the nineteenth century saw to it that the ram was finally removed early in the next century. The major peacetime victims of the ram were:

1869: Russian ironclad *Kreml* rammed and sank the Russian frigate *Oleg* with the loss of 16 lives.
1871: Russian ironclad *Admiral Spiridoff* rammed the sister ship *Admiral Lazareff*, which was saved from sinking only by the speedy arrival of marine pumps.
1873: Spanish ironclad *Numancia* rammed and sank the wooden corvette *Fernando El Catolica*; all but five of the crew of the latter were lost.
1875: French ironclad *Jeanne d'Arc* rammed dispatch vessel *Forfait* without loss of life.


1877: French ironclad *Thétis* rammed French ironclad *Reine Blanche*, which was run ashore to save it from sinking.

1878: German ironclad *Koenig Wilhelm* rammed and sank German ironclad turret ship *Grosser Kurfurst*, with the loss of nearly all of the latter’s crew.

1893: Battleship HMS *Camperdown* rammed and sank HMS *Victoria*, with 358 dead.

These ironclads were all victims of ram fratricide; only *Re d’Italia* was sunk by enemy action. Three of these eight ram losses were themselves ironclads, sunk despite their underwater subdivision and watertight doors. (By contrast, it could be argued that because of the accidental nature of these peacetime rammings, watertight doors had not been closed, damage control crews were not at their stations, etc., as would have been the case in battle.)

Nonetheless, not until 1906 did a naval power launch a battleship without a ram. This was HMS *Dreadnought*. Even so, *Dreadnought* carried a forward underwater bulge, purportedly for greater buoyancy. Such vestigial snouts were not finally eliminated until after World War I, with *Nelson* and *Rodney*. And it was not until 1943 that the Royal Navy actually outlawed ramming. (The thought of, say, HMS *Prince of Wales* attempting to ram *Bismarck* beggars the imagination.

**COAST DEFENSE**

Considerable resources were also wasted by the major naval powers during the coast defense craze. Coastal defense was a new departure in naval strategy. In the preceding Age of Fighting Sail, only the United States had devoted considerable resources to defending its coastline. Thomas Jefferson’s gunboats were about as effective as his embargo against Great Britain. (In the War of 1812, few even made it into Chesapeake Bay.) But the coming of steam and armor made it possible for some maritime nations to make coastal defense their main defensive strategy. The French, Russians, and Germans realized that in any possible future conflict with Great Britain, the Royal Navy would undoubtedly clamp down a close blockade, as it had throughout the
eighteenth-century Anglo-French wars. Coastal defense seemed logical for these powers, as well as for the United States, which had just fought the bloodiest war in its history on the rivers and coastal stretches of its continent. The Civil War Battle of Mobile Bay was probably the most significant coastal naval clash of the ironclad era.

However, when a nation permits an enemy to institute a close blockade with large seagoing warships, it is difficult to see how dwarf capital ships could ever reverse the situation. Further, coastal waters are often tempestuous, so the low freeboard that distinguished coast defense warships could be a drastic hindrance. Further, the waters around major harbors that coast-defense ships were supposed to protect were usually deep enough for a seagoing capital ship to operate safely, or the port would not have been constructed in the first place. (The converse of this situation may be seen with the three units of the small coastal Russian Admiral Ushakov class: All three made the gruelling voyage halfway around the globe to the 1905 Battle of Tsushima, where the patronymic unit was sunk and the remaining two wisely surrendered.)

The French, along with the Russians, put the most resources into coastal defense, but the French had little enough to show for it at the end of the day, although if one includes France’s coastal ironclads, that nation had actually far more ironclads than did Great Britain (106 to 67). The major land war of the ironclad era, the Franco-Prussian War (1870–1871), was profoundly unaffected by naval power, and the French coastal fleet, the world’s largest, played no significant role. And what is one to make of the absurd French coastal ironclad designs of the later nineteenth century? With their low freeboards and hotel-like superstructures, and their gun barrels poking far beyond dwarf turrets, they resemble a caricature of a warship design. But then, French battleships of the time were hardly better.

Still, it can be argued that many ironclads that might superficially be termed coastal defense warships were simply small ironclads, reflecting the political demands for economy among all the naval powers at various times during the ironclad era.

Small and coastal ironclads dominated the fleets of the secondary maritime powers with no overseas interests. Russia, Norway, Denmark, Sweden, Greece, Turkey, Portugal, Brazil, Argentina, and Italy all constructed or purchased ironclads to defend their territorial waters and to venture occasionally into farther waters such as the Baltic Sea, the North Sea, and the Mediterranean Sea. Of those dwarf ironclads that fought beyond coastal areas, the Italian *Affondatore*, *Varese*, and *Palestro* saw action at the Battle of Lissa (in the Mediterranean Sea),
where *Palestro* caught fire and exploded with the loss of all aboard. *Rolf Krake* fought extensively for Denmark in the Danish-Prussian War (1863–1864) in the Baltic and suffered no losses, although it was hit twelve times on one occasion by Prussian shore batteries. The Peruvian (now Chilean) small turret ironclad fought the British and the Chileans in the Pacific off the South American coast. The Russians and Turks fought it out along the Black Sea coast with coastal or small ironclads in their war of 1877–1878. (The two circular Russian ironclads of the time, *Vice-Admiral Popov* and *Novgorod*, were not used in this conflict, possibly because they seemed more likely to spin on their axes than to progress ahead.)

The distinction must be made between coast-defense ironclads and those used in riverine and harbor warfare that sometimes engaged in coastal action. The best examples are the ironclads of the U.S. Civil War, not one of which was truly seagoing, as well as the armored warships used the South American wars, which saw river, coast, and harbor ironclad clashes during the late 1800s. A true coast-defense ironclad/battleship could be defined as an armored warship designed to defend a nation’s coasts and adjacent seas but that could not navigate upriver. Thus the Union’s USS *New Ironsides* was confined to the coasts and harbors of the eastern United States and could not have navigated the James River, where U.S. monitors could be found, although most of the monitor action was upon the harbor waters of the Confederacy. *New Ironsides* (like all federal monitors) would have been in great danger in any kind of rough weather on the high seas.

Several of the larger U.S. monitors could also be considered coast-defense armorclads. Two of these, the wooden-hulled *Monadnock* and its sister ship *Miantonomah*, did make oceanic voyages in 1865–1866, *Monadnock* to San Francisco from the East Coast via the Strait of Magellan, and *Miantonomah* across the Atlantic to Europe. But the latter was towed about halfway across, and neither warship could have fought with its guns in any kind of a seaway. In the early twentieth century, coastal defense was damned by navalists, influenced by Alfred Mahan in particular, as the weapon of the weaker powers, the losers in any real naval war. Yet coast-defense warships made a strong return in both world wars, and saw an unforeseen and mostly unreported amount of action in European waters that would have greatly surprised blue-water navalists.

The Royal Navy’s turn to coastal defense during the ironclad era is particularly baffling, but coastal ironclads were, at least marginally, an improvement on the masonry forts erected for coastal defense earlier in the century against a supposed threat from Napoleon III. Like other
naval powers, the Royal Navy constructed numerous low-freeboard ironclad-rams that could never venture on the high seas and that were at risk even in the tempestuous waters surrounding the British Isles. Their only supposed advantage was their cheap price, but it is difficult to understand how warships of little worth costing one-half or more the price of a seagoing ironclad represented value for money.

It took several decades for the French and British, and even longer for the Americans, to realize that an oceangoing warship could also defend a nation’s coastline. When the cost of the crews were taken into account, coast-defense ironclads were not such a bargain. It can also be argued that the U.S. retention of the coastal ironclad into the twentieth century was more the result of congressional parsimony and isolationism than of any thought-out doctrine.

**HMS DEVASTATION**

Breaking with the Royal Navy’s coast-defense myopia and with its conservative reliance on masts and sails, and well before the loss of HMS *Captain*, Edward Reed had initialized the final plans for a warship that would establish the basic form for battleships until they ceased to be built. HMS *Devastation*, with its complete absence of sailing paraphernalia, its turrets, and its oceanic range can indeed be termed the world’s first modern capital ship. By abolishing the ancient sailing rig, Reed not only permitted a very wide arc of firing for *Devastation*’s four heavy guns in their twin turrets, but also was able to man the warship with 358 crewmen, compared to the 633 needed for HMS *Sultan*, a fully-rigged contemporary ironclad of roughly the same size. The space for the extra men and equipment to work the sails could instead be utilized by *Devastation* in the form of more generous dimensions, heavier armor, and a coal capacity that gave oceanic range. (It could steam 5,000 miles at 10 knots, far more than any other ironclad of the time and for a decade or more to come.) Reed answered the objection that marine engines were still too unreliable by fitting his masterpiece with twin engines.

The argument that the wind is free was exposed as fatuous when it was realized that the crews of comparable sailing ironclads like *Sultan* far outnumbered those of *Devastation*. Further, the vastly more powerful *Devastation* weighed in at less than half the displacement of *Captain*; much of the greater tonnage of the latter may be attributed to the weight of the extra crew and equipment for the sailing impedimenta.
A contemporary aptly described *Devastation* as “an impregnable piece of Vauban fortification with bastions mounted upon a fighting coal mine” (in Oscar Parkes, *British Battleships*, p. 199). Reed and Robinson were among the first to realize that the masts and rigging of an ironclad ship were a permanent hindrance to progress under steam and that by twinning the engines, sailing impedimenta could safely be jettisoned. To cap it all off, *Devastation* was also a good sea boat, rolling and pitching much less than many of its contemporary and succeeding broadside ironclads, although its low freeboard forward did limit speed. *Devastation* and its two sister ships (*Thunderer* and *Dreadnought*) were superior warships in almost every way. (Even the excellent and much later RN Admiral class was cut to dimensions little greater than those of *Warrior*.)

Oddly enough, *Devastation*’s genesis lay in the little coast-defense Cerberus class (*Cerberus* and *Magdala*), diminutive low-freeboard twin-turret mastless ironclads of limited range and endurance. Reed basically took the U.S. monitor concept and on the low freeboard laid a breastwork, upon which he mounted Coles turrets. The turrets and the upperworks were thus protected from any but the most violent seas, as was proved when *Cerberus* was dispatched to Australia and *Magdala* to Bombay for coastal defense duties. (Due to their small coal capacity, both ventured out on the high seas under a temporary sail rig.) Subsequently, Reed basically had only to scale up *Cerberus*’s basic design to produce a mastless turreted seagoing war engine—the world’s first modern battleship.

Yet both Reed and Robinson had resigned (in the wake of the Captain disaster) before the completion of *Devastation*, and the pace of ironclad warship development slowed dramatically. Some lack of progress was due to a reaction against turret ships after Captain’s loss, even though the two ironclads were hardly comparable. HMS *Captain* was a disastrous dead end, but with HMS *Devastation*, Reed had taken the ironclad steamer and transformed it into the mastless seagoing turret ironclad—the template for all future capital ships.

**THE DARK AGES OF THE VICTORIAN NAVY**

The thread of ironclad development did not continue immediately after the Devastation class, and the so-called dark ages of the Royal Navy could be said to have commenced with the resignations of
Reed and Robinson from the Admiralty. No new mastless turret ironclads would be laid down by the Royal Navy for another decade, and nearly full-sail rigs actually reappeared on the world’s ironclads. Technologically, even the British began to slip somewhat, a reflection of the rising scientific and industrial power of Germany. German guns came to surpass those of the Royal Navy by the 1870s, and British naval constructors had to go to France for suitable material when the time came for the transition to steel warship building. Surprisingly, even in numbers, the Royal Navy, unprecedentedly, fell to something like qualitative and quantitative inferiority with the French from the mid-1870s to the early 1880s. Admittedly, the French designs were, like the Union monitors, another dead end in naval architecture. With exaggerated ram bows and unprotected hulls, and their emphasis on sponsoned ahead-fire, they are difficult to take seriously today. Nonetheless, the genius of Royal Navy ironclad design seems to have gone on hiatus for about 15 years with the departure of Reed and Robinson.

In all fairness, it should be pointed out that battleship designers worked under severe, politically imposed constraints on dimensions and tonnage. Even the admirable RN Admiral class was cut to dimensions little greater than those of *Warrior*. In something of a reaction to the *Captain* catastrophe, ironclad construction reverted to earlier forms, and masts and sails reappeared, with all the troublesome and basically unsatisfactory design expedients that this ancient form of propulsion imposed on any warship. Yet it should have been perfectly obvious that the loss of HMS *Captain* was in large measure due to its towering sail rig and top hamper, as well as its heavy iron tripod masts, adding weight topside and thus undermining stability—excellent arguments against sailing ironclads.

Presumably, in some spirit of compromise, HMS *Inflexible*, the Royal Navy’s last first-class sailing capital ship (completed in 1881), carried a brig training rig that could be jettisoned in wartime. Even with the return of turrets, instead of *Devastation*’s fore-and-aft turret arrangement, *Inflexible* and other contemporary ironclads sited turrets *en échelon* (off-center) amidships. This arrangement would, in theory, give some fore-and-aft fire. *Inflexible*’s two 750-ton turrets housed four great 16-inch muzzle-loading guns that were too long to load inside the turrets; consequently, the shells had to be inserted through an awkward arrangement using a deck hatch in front of each muzzle. In reality, had the guns been fired repeatedly in a combat situation, this turret arrangement would have imposed severe hull stresses and topside damage. Yet it could be argued that no one
needed to worry much about such strains for, in the best of conditions, *Inflexible*'s guns could fire only every 2.5 minutes. This freak ironclad is also notable for carrying the thickest armor plate of any British battleship ever built; later, improved armor gave the same protection with less thickness. Armor also seemed to go to extremes; *Devastation*'s armor (maximum 14 inches on the turrets) shielded everything above the waterline except the light upperworks. HMS *Inflexible*'s unmatched 2 feet of armor shielded only a central citadel, consisting of the turrets and their handling and turning works, plus an underwater deck, and all subsequent ironclads followed this example until around 1900. Nonetheless, for all its faults, *Inflexible* would have made short work of its French contemporary, *Admiral Duperré*, which was very vulnerable above the waterline.

Even when the Royal Navy finally again constructed mastless turret ironclads, and introduced breech-loading guns, steel construction, and armor in the *Inflexible* diminutives, *Colossus* and *Edinburgh* (completed in 1886 and 1887, respectively), the turrets were arranged again in the hull-straining echelon arrangement to give ahead-fire for ramming. When the Admiralty finally went over to *Devastation*-pattern fore-and-aft turrets with *Hero* and *Conqueror* (completed in 1886 and 1888, respectively), they were mounted on dwarf ironclads, still designed primarily for ramming and counter-ramming, as were the *Victoria* and *Sans Pareil* (completed in 1890 and 1891, respectively).

Steel construction resulted in a hull lighter by some 35 percent. (The all-iron hull of *Warrior* absorbed some 52 percent of its entire weight.) Steel was considerably more expensive than iron, but improved production methods made steel cost-competitive by the 1870s. Here again, the French took the technological lead, laying down the first capital ship constructed completely of steel, *Ré-doubtable*. (By contrast, wrought iron was far more long-lasting than steel, which undoubtedly accounts for the remarkable preservation of the surviving nineteenth-century ironclads more than 100 years after their completion.)

The increasing cost, size, and complexity of nineteenth-century ironclad capital ships led many naval theorists of the time to claim that the torpedo had doomed the large warship. If one small, cheap torpedo could sink a large, expensive warship, the need was for the former, not the latter. In fact, in 1886, it was announced in Parliament that, in light of the rapid developments in torpedoes and torpedo warships, the newly authorized *Nile* and *Trafalgar* would probably be the Royal Navy's last battleships. Actually, no new capital ships were
laid down in Great Britain for three years after 1886. Yet Nile and Trafalgar, with their breech-loading turret guns arranged fore and aft, were in the line of future development of capital ships, although they were hindered by their low freeboard, designed keep the heavy weights of the turrets as low as possible in the interests of stability.

It has also been argued that this erratic ironclad development and even retrogression after 1870 was more the result of severe budgetary restrictions in this time of widespread European peace after the German Wars of Unification, rather than simple-minded resistance to change. In fairness to Reed’s successor, Nathaniel Barnaby, it should be noted that much of the inadequacies of the ironclads of the dark ages of the Royal Navy were indeed due to the cost-cutting economics followed by both Liberal and Conservative governments of the time. Such economizing led to ironclad dimensions far too small for adequate armor and ordnance, which Barnaby did protest on occasion. True enough, but the argument weakens somewhat in light of the enormous sums spent uselessly on sailing tackle during those same decades. For example, in 1876, the Admiralty spent £113,000 on coal and £123,000 on raw hemp, canvas, and the like. And these figures do not count the cost of the many extra seamen needed to man sailing rigs. HMS Bellerophon, for example, required 200 of its 556-man crew for work aloft. (Sailing was also somehow supposed to build character.) Armor also seemed to go to extremes; in all, Devastation led the way until the close of the century.

Emphasis on coastal defense and on the ram inhibited tactical thought, and throughout the nineteenth century only one tactics textbook was published by a British officer. The lonely author, G.H. Noel, in the spirit of the times, argued “that the ram is fast supplanting the gun in import” (Peter Padfield, The Battleship, Edinburgh: 2000, p. 69). In fact, complex evolutions, the type that led to the Victoria ramming disaster, took the place of any serious study of battle tactics. (Still, it could be argued that in the absence of wireless, the complex maneuverings of ironclads in a fleet action would have to be worked out ahead of time and rigidly adhered to in time of battle.)

RECOVERY

Not until the laying down of HMS Collingwood (completed in 1887) did this dismal state of naval affairs weaken. The Royal Navy’s ironclads/battleships began to approach the novelty and vision of HMS
Devastation of almost two decades earlier. Collingwood, with its absence of masts and sails and its main guns arranged fore and aft, would become the prototype of the subsequent Admiral class. Still, its main 12-inch guns were mounted high and exposed on two unprotected barbettes to save top weight, and its great guns could fire only one round every 4 minutes or so, even less than the earlier average of 2.5 rounds per minute.

With two unfortunate exceptions (the battleship-rams HMS Sans Pareil and Victoria, with their two heavy guns mounted on a single turret forward, and the absurd full-rigged Imperieuse and Warspite), Collingwood and the Admirals returned to Reed’s Devastation model (except for the latter’s full-scale armor). They thus served as the pattern for all future RN battleships, as such warships were increasingly called.

The Admirals (Anson, Camperdown, Howe, and Rodney) were an answer to the charge that the Royal Navy’s ironclads had become a fleet of samples, with no more than two alike. The four Admirals were of identical design. Although a major improvement on predecessors, they suffered from a low freeboard, a reflection of the government insistence on moderate dimensions in the interests of economy. HMS Benbow was a higher-freeboard Admiral and thus an improved warship, it was also distinguished by mounting the heaviest main guns ever on a British battleship: 16.25-inch, 110-ton breechloaders mounted one each in two fore-and-aft barbettes.

The progress in battleship development accelerated, at least in the Royal Navy, with the appointment of William White as director of naval construction in 1886. The Admiralty had become alarmed at the weak state of the Royal Navy compared to the French by 1880 when, in some respects, the latter was actually superior to the former and determined to take action. Yet the French threat receded rapidly; much of its new ironclad construction was funded by loans and ended as these subventions ran out.

White’s first two battleships, Nile and Trafalgar (completed in 1891 and 1890, respectively), reverted to Reed’s Devastation design principles, except for the armor, now protecting only the turrets and an amidship’s citadel, plus an armored deck below the waterline. Yet as late as 1886–1888, that is, after the Royal Navy had laid down Collingwood, the Admiralty ordered two new ironclads, Imperieuse and Warspite, that carried full square-rig sails and mounted four inadequate 9.2-inch breech-loading guns, protected by only semicircular screens and scattered, French-style, at the four corners of the upper deck. (These two black sheep of the Victorian navy also...
supported archaic stern galleries that were even more elaborate than those set into the iron sterns of *Warrior* and *Black Prince* more than 20 years earlier.) White's advent was indeed overdue.

*Nile* and *Trafalgar* were followed by White's masterpieces, the *Royal Sovereigns* (1889–1890)—the magnificent seven that easily reestablished the Royal Navy's battleship dominance. The *Admirals* averaged 10,000 tons, whereas the *Royal Sovereigns* weighed half as much and carried their turrets on a much higher freeboard. (Even aesthetically the class stood out, in the words of one eminent authority, as “initiating a new era of Vulcanic beauty, after two decades of sullen and misshapen misfits” (Parkes, *British Battleships*, p. 316). Because of weight considerations, the *Royal Sovereigns'* guns were exposed; succeeding battleships carried a light metal shield over the main batteries for protection against splinters and high seas. As armor became tougher yet lighter, these screens could once again be armored and thus once again be called turrets.

The *Royal Sovereigns* were the direct result of the Naval Defense Act, which for the first time officially recognized that the Royal Navy must remain stronger than the combination of any of the next two strongest naval powers—the so-called Two Power Standard. Earlier in the decade, there was a feeling in Great Britain that the Royal Navy's armored warships were still fewer in numbers than those of the French. No longer so. By 1889, the Royal Navy could boast of 22 first-class ironclads to France’s 14 and Russia's 17. The Royal Navy did not yet enjoy a two-to-one superiority over France and Russia, but thanks to the Naval Defense Act, it would soon enough.

**IRONCLAD COMPETITION**

The Royal Navy indeed ruled the seas throughout the ironclad era, and its armored warships set the standard for all naval powers for the rest of the nineteenth century. But this superiority is far more evident in hindsight than it was at the time. From 1858 to 1870, France, under Napoleon III, loomed as the most serious challenger. The first two classes of French ironclads seemed, at least on paper, to be more powerful than the armored warships of the Royal Navy. However, by the end of the 1860s, the Royal Navy was ahead in quantity and quality. British shipyards could turn out ironclads one and one-half times as quickly as their French counterparts, even though the British were producing greater numbers of more complex iron hulls.
In every naval technical field, except in guns vis-à-vis the Germans, Great Britain excelled as the world’s first industrial power.

Yet the British Admiralty rarely confessed its good fortune, and its primitive methods of intelligence gathering ensured that many of its advances and advantages remained unknown. By crediting the French with anything afloat that carried a patch of armor, the First Lord of the Admiralty in 1867 insisted that Great Britain’s first-class ironclad fleet was barely the equal of France’s. Prime Minister Benjamin Disraeli had a tighter grip on reality when he denounced the prevailing Admiralty view of the French threat as “marked by the usual exaggeration and false coloring which always accompanies [sic.] their estimates” (G.E. Buckle and Wm. F. Monypenny, The Life of Benjamin Disraeli, Earl of Beaconsfield, vol. 4, London: 1916, p. 579). The French threat faded in the wake of the disastrous Franco-Prussian War, when France’s extensive ironclad fleet made little difference in the outcome of the conflict. France, of course, continued to build ironclads throughout the remainder of the nineteenth century, but for the most part the French Navy posed no serious threat. The lengthy construction time for French ironclads (again, a reflection of France’s industrial weakness compared to that of Great Britain) meant that its ironclads were more often than not obsolete when completed. For example, the small coast-defense ironclads of the Térrible class, laid down in 1870–1878, took a full decade to complete. Although France did serve throughout the ironclad era as a useful paper bogeyman to extract monies from Parliament.

As for the U.S. Civil War, CSS Virginia was nothing more than an armored box battery and had nothing with which to threaten other naval powers. But of necessity it became the model for all succeeding Confederate ironclads. (Contrary to popular opinion, the first North American ironclad was not Virginia but the federal riverine ironclad Cairo.) The Confederacy simply lacked the technological and industrial resources to build monitor and turret ironclads. Further, there was not one industrial establishment in the entire South that could construct marine engines, although some could recondition them. Confederate ironclad builders had to commandeer engines from seized or sunken Union and commercial ships; consequently, engine reliability was consistently a weakness.

Union monitor development was more noteworthy for its technological ingenuity than for any particular threat it posed to other naval powers. The main reason for the Union’s commitment to the monitor concept was urgency; it was not doing very well in an internal war. The end of the Civil War also ended the U.S. Navy’s moni-
tor program (and any other ironclad construction, for that matter), at least for two decades. No nation’s major weapons system ever arose so quickly and then faded so rapidly. However, the naval world had not seen the last of the monitor concept.

Relations between the United States and Great Britain remained tense throughout the Civil War, with the Union feeling, with some justification, that the British ruling classes favored the Confederates. On two occasions, tensions were fanned by naval crises that led to mutual bluster and threats of war. The first imbroglio was the Trent affair, in which a U.S. warship stopped a British mail steamer in November 1861 and removed by force two Confederate commissioners. Many Britons understandably considered this interception as nothing less than an act of state-sponsored piracy on the high seas: grounds for war. In his last significant public act, Prince Albert, Queen Victoria’s consort, in the early stages of the typhus that would end his life, toned down the blistering memorandum of his foreign secretary to the U.S. secretary of state, moderating Britain’s demands. The two Confederate envoys were released, and the mutual war threats subsided. (Some Americans might have argued that the United States was finally getting its own back after the Chesapeake-Leopard affair, when an unprepared U.S. frigate in time of peace, 22 June 1807, in U.S. territorial waters was fired into by a RN frigate looking for deserters.) The Monitor-Virginia clash took place soon after the Trent affair, and it is significant that the patriotic John Ericsson deliberately named his novel ironclad “monitor,” that is, “warning.” That warning was directed not to the Confederacy but to any Europeans with interventionist fancies.

The second crisis was confined to diplomatic dispatches but was no less serious than the Trent affair. It was instigated by a brace of British-built ironclads that could have destroyed every monitor in the Union fleet. When word reached the U.S. ambassador to Great Britain that the Confederates were about to take possession of the two so-called Birkenhead rams, mounting two Coles turrets each, he dropped the usual diplomatic language to warn the British foreign secretary that “this meant war.” The rams were soon after taken into the Royal Navy. (It is one of the coincidences of history that Lairds also built the Confederate raider Alabama and HMS Captain. One of the Birkenhead rams, HMS Wivern, predecessor to Captain, was also the only other ironclad mounting Coles’s patented tripod masts with their dangerously elevated weight.)

Yet surprisingly, the Admiralty seemed unaware of its own ironclad lead. In the last year of the Civil War, the first secretary of the
Admiralty warned Prime Minister Disraeli that the U.S. Navy must be considered the most dangerous of all, warnings repeated by the British ambassador to Washington, Lord Lyons, and by the veteran statesman Lord John Russell as late as 1869. By the latter date, in reality the U.S. Navy was but a shadow force, its monitors in an advanced state of decay. But let John Ericsson himself have the last word on the worth of his monitors against the Royal Navy’s newest seagoing turret war engines: “Devastation and Thunderer may steam up the Hudson in spite of our batteries and our monitors and dictate peace terms off Castle Garden” (letter from Ericsson, Engineering, 18 February 1870). No matter that Castle Garden is in New York Harbor, not up the Hudson—Ericsson had made his point. His confession and the U.S. ambassador’s threat of war in the face of two RN turret rams six years earlier are strong indications of U.S. inferiority at the time. The U.S. challenge, if it ever even existed, had come and gone; the U.S. Navy would not see better times for another two decades.

The Italian ironclad fleet, after the French, probably caused the most unease for the British Admiralty until 1866, the year of the Piedmont-Sardinian defeat at the Battle of Lissa. Piedmont-Sardinia (Italian unification would not come until 1871) could mass its entire ironclad fleet, numbering some 10 warships by the mid-1860s, in the Mediterranean, whereas the Royal Navy could muster only two. However, the crippling ineptitude displayed by the Sardinian fleet at Lissa showed that, as in the case of Russia, ironclads alone do not necessarily make effective warships or fleets.

Smarting from its defeat at Lissa, Italy constructed some of the largest, fastest, most technically interesting battleships in the world at the time. Caio Duilio and Enrico Dandolo (completed in 1880) were the first warships to be protected by all-steel armor; Italia and Lepanto (launched between 1880 and 1883) were the first all-steel battleships. These four ironclads carried no side armor; their designer, Benedetto Brin, argued that no such protection could be realistically applied against the great shells of the time. Part of the protection for Italia and Lepanto consisted of cork-filled cofferdams; the ships were designed, uniquely, to carry no less than a full infantry division. But the four guns of these great ironclads could fire one shot apiece about every 15 minutes, raising a very real question of their fighting worth. Their main guns, mounted in two en échelon turrets, gave, in theory, ahead-fire, but the real possibility of blast damage made this advantage problematical. The turrets were protected with no less than 17 inches of armor plate, some 25 percent
of the ships’ weight. Other Italian ironclads continued this pattern, but the value of all were lessened, like those of France, by their slow construction times (Duilio and Dandolo, for example, took seven years to construct) and firing rates. Further, the Italians had to buy their main guns, armor, and engines from British firms, and their iron and steel from the French. At the time, however, the two monster warships were considered the most powerful battleships in the world. Yet in the long run, the *en échelon* arrangement of the turrets was a technological impossibility, for reasons noted above. Such mountings might have provided, at least in theory, more or less fore-and-aft firing arcs for the main guns around the masts, but Brin’s battleships carried no masts and sails and were, in fact, the first oceangoing capital ships, after the Devastation class, to dispense with this impedimenta. Brin’s more lasting contribution to the Italian Navy probably lay in the spearheading of a wholly Italian industrial metallurgical and mechanical basis for future construction. It could also be argued that with their high speed and light armor protection, Brin’s creations might be termed the first battle cruisers (or perhaps battle cruiser/troop transports).

The second-ranking ironclad powers (and the U.S. Navy, in its technological senescence, was sinking well below that class) compelled the Royal Navy to station ironclads in areas that had previously required only unarmored warships. The Admiralty also feared, in its ignorance, that, given the supposedly close balance of power between Britain and France, the alliance of a minor power with France could tip the ironclad balance against the Royal Navy.

Significantly, the minor naval powers’ ironclads were most often constructed in British yards. Private shipbuilders, who were in direct competition with the Royal Dockyards for contracts, were eager for the business. Thus Brazil, Chile, Italy, the Netherlands, Peru, Russia, Spain, and Turkey all ordered their first ironclads from private British builders. Of course, the Confederacy also ordered the Birkenhead rams from Lairds. French yards also did contract work for foreign ironclad powers, including the Confederacy. Only the United States refrained from purchasing ironclads from others. Except for Brazil and Chile, most of the lesser naval powers by the end of the decade of the 1860s were constructing their own ironclad hulls, but not the engines, heavy guns, and armor plate.

The poor showing of the Russian Navy in the Crimean War provided imperial Russia an incentive to rebuild its fleet around an ironclad core. The Russians opened their ironclad era by converting wooden warships to ironclads that, in theory, could put to sea and
cause the Royal Navy some discomfiture. The first such Russian ironclad (with the Crimean War obviously in mind) was Sevastopol. But diplomatic complications resulting from the Polish insurrection of 1863 made the Russian Admiralty look to its coasts (and also to dispatch a fleet of wooden warships to the United States on a mission of friendship during the Civil War, leaving the Americans as mystified as they were gratified). From the 1860s until well after the Russo-Turkish War (1877–1878), the Russian Navy ordered no seagoing ironclads. Instead it adopted the coastal monitor for its own use, building or ordering no fewer than 10 monitors in 1863 and becoming one of the few naval powers outside the United States to adopt the Ericsson turret system. As early as 1869, the Russian Baltic Fleet included 23 ironclads, almost all of the coast-defense variety. The Russians did construct their own Devastation-type mastless turret ironclad, Petr Veliki (Peter the Great). But Petr Veliki, unlike Devastation, was a bad roller, with inefficient engines; still, it lingered on until 1922. The Russian Admiralty also took Edward Reed’s bluff designs to the extreme, producing a pair of circular coastal ironclads (Vice-Admiral Popov and Novgorod), heavily armed for their size (3,500 tons), with two 12-inch guns fitted on hydraulically disappearing mounts in an armored barbette. Unfortunately, against a downstream current, they were more likely to spin on their own axes like tops, despite their six engines and propellers. (Yet the czar ordered his new royal steam yacht to be built with a circular hull, presumably because he suffered more from seasickness than dizziness.)

The British Admiralty worried about the possibility of a Russian combination with the French, but closer study of the czar’s ironclads by RN officers in 1871 and 1873 emphasized their strictly coastal character. Only Russia’s armored cruisers, with protection confined generally to a waterline belt with patches to protect the guns, seemed to pose any threat. These unique warships are of interest in that they were superior to the highly publicized (but already obsolete) wooden U.S. Navy Wampanoag commerce raider and to similar British efforts, which resulted in simply unsatisfactory second-class dwarf capital ships, deficient in armor and speed. The Russian ironclad threat never materialized, for the country was indifferent to naval matters, stifled by centralized bureaucracy/autocracy, and usually deficient in technical application. Russian ironclads relied on foreign expertise (primarily from Britain and France) for guns, armor, and machinery.

The Netherlands made a surprisingly strong showing in the early ironclad era. After laying down several unsuccessful box battery
ironclads, the resourceful Dutch attempted another class of ironclad whose ends alone were armored: the amidships gun boxes were protected by cells filled with sand. Understandably, the naval architect involved was discharged, and the Dutch began to construct, as well as to order, ironclad rams with Coles turrets from British and French yards. The thrifty Dutch saved two such ironclads for secondary duties long after they had become obsolete. These two, Buffel (Buffalo) and Schorpioen (Scorpion), meticulously restored, may be visited today as museum ships.

**MINE AND TORPEDO**

No weapon is so neglected by navies in peacetime as the marine mine, yet no weapon wreaked as much destruction through the latter nineteenth century and into World War I. In fact, the very first ironclad to be sunk from any cause, the riverine USS Cairo, was sunk by a Confederate mine.

The earliest mines were simple yet destructive. Confederate mines (often confusingly called torpedoes at the time) consisted of little more than gunpowder-filled beer barrels with coned ends and five fuses. A passing ship would bend a projecting lead tube, rupturing a glass tube within containing sulfuric acid in a mixture of potassium chlorate and sugar. The resulting chemical reaction detonated the gunpowder in the barrel. Such infernal devices sank monitors Tecumseh, Patapsco (which sank even more quickly than Tecumseh, with the loss of 63 lives), and Milwaukee, as well as Cairo and its sister ship Baron de Kalb.3

Yet mines were not a priority with either the Royal Navy or the U.S. Navy. Submarine mines require no great resources and no particular courage to lay, and they do their dirty work long after the layers have departed. In naval services, with stirring traditions of flashing cutlass and roaring broadsides, the mine seemed an underhanded, passive, almost sneaky way of war. Yet during the early battleship era, four battleships were sunk by mines in the Russo-Japanese War (1904–1905). In World War I, a German mine sank the new dreadnought battleship Audacious, one of only five dreadnoughts to be sunk in that conflict (none to naval gunfire). Rarely has so despised a weapon so proven itself in battle.

The submarine and its torpedo weapon would not come into their own until the early twentieth century. Although the Confederates
had sunk the Union sloop-of-war *Housatonic* (February 1864) and damaged *New Ironsides* by what are often called submarines, the correct term for these vessels should rather be “semisubmersibles,” for they were small boats that could be self-sunk to the level of the conning tower (lacking a periscope) when attacking; the agent of destruction was an explosive charge on the end of a long spar. This was hardly submarine warfare as it came to be known in World War I.

Surface torpedo boats were much cheaper than large warships, however, and this was a most compelling consideration during the ironclad era. Successful surface torpedo attacks included the sinking of the Confederate ironclad *Albemarle* in October 1864. In 1877, during the Russo-Turkish War, a Russian spar torpedo boat attack sank the Turkish river monitor *Seyfi* in the Danube. As a result of the Russo-Turkish War, the Russian Empire gained a renewed interest in sea power, as seen in the 1882 naval expansion program that featured 15 battleships, later raised to 20, as well as 24 cruisers and other naval craft.

The French, lacking practical experience during naval warfare in this era, would lead the way in propounding the *jeune école* (young school—presumably its proponents would never age), which, inspired by the newly invented submarine self-propelled torpedo, could unleash a swarm of torpedo boats, Davids against Goliaths, that could whittle down the Royal Navy’s battleships, giving French battleships an opportunity to take on the enemy directly. French cruisers would then engage in commerce raiding (*guerre de course*) in the Mediterranean and the English Channel, sweeping up British merchant vessels and possibly sparking confusion and panic in the British Isles. The Jeune École, as envisioned by Admiral Théophile Aube, minister of marine for only 16 months in 1886–1887, and the journalist Gabriel Charmes, did not call for the abolition of the battleship, as popularly supposed. It did damn pro-battleship officers as despising the rough and wet torpedo boats in favor of their capital ships’ spacious, comfortable quarters (quite literally the case on the French battleships, with their hotel upperworks) and well-paid positions. Torpedo boats, although extremely uncomfortable, did offer junior officers more opportunities for command, however. Additionally, many torpedo boats could be constructed for the cost of one battleship and built much more quickly. In 1884, two French torpedo boats sank a Chinese cruiser and damaged another.

The French naval maneuvers of 1887 demonstrated the limited seaworthiness of torpedo boats and reasserted the battleship’s dominance in the French navy. But the Jeune École would later return with
a vengeance, not with the French but in the ruthless German and U.S. submarine commerce destruction in two world wars. But that development was well in the future; it is noteworthy that during the Russo-Japanese War, when fears of torpedo attacks were widespread, not one warship was sunk by torpedo. In the end, torpedo boats never reached their potential, and in the twentieth century it would be the submarine-fired torpedo that would wreak the worst havoc.

**ARMOR**

Armor protection increased in quality and decreased in quantity through the ironclad era. Here the Germans were in the lead, but Germany would make no pretensions as a major naval power until the turn of the twentieth century. Ironclad armor improved steadily over the era, as seen by the ability of several Chilean ironclads in 1877 to penetrate the armor of *Huascar*, built in 1865.

The earliest armor consisted of hammered wrought-iron plates bolted to wood. By 1865, standard armor protection was rolled iron, bolted on a double layer of wood stiffened with iron girders, and completed with a thin iron inner skin to protect against flying fragments. Sandwich armor was common by 1870, with several layers of rolled-iron plates alternating with layers of wood, plus an inner skin of two layers of sheet iron. By the end of the decade, steel-clad wrought-iron plates had been added to the earlier rolled-iron plates. Solid-steel plates would not be available until the 1890s.

Throughout the 1870s and 1880s naval architects and admiralties strongly disagreed about the distribution of ironclad armor. The increasing power of heavy naval guns made the extent of armor protection carried by earlier ironclads (the full gun deck or the turrets and a waterline strip) no longer possible. One solution was to confine armor only to a small waterline strip and the turrets and ammunition hoists, but only a few ironclad designers, mostly French, took this extreme measure. More commonly, designers clustered the vitals of an ironclad and its guns amidships, protected by an armored box, plus an armored deck below the waterline. They left the rest of the hull unprotected, although minutely subdivided to isolate any flooding. But clustering the guns amidships left little room for superstructures, so the expedient of sponsoned main guns on the upper deck was tried in the 1880s. (Again, an arrangement that, in theory, would provide fore and aft arcs of fire.) The sponsoned guns,
however, imposed heavy strains on the hull when firing, and the blast effect could damage the superstructures. Once again, the solution could be found in HMS *Devastation*’s classic design: gun turrets mounted fore and aft on the centerline and modest superstructures clustered amidships on a mastless hull, although that warship’s overall hull armor could never be repeated. Still, practically every positive design development of the ironclad era harkened back to HMS *Devastation*.

**ENGINES**

As with the general design of ironclads, the second half of the nineteenth century saw unprecedented development in engines, reflecting perhaps the most rapid advance in maritime history. The earliest classes of ironclads were propelled by simple, noncompounding, single-expansion engines in which steam was expanded into a single cylinder before exhaustion. Compounding, by contrast, passed the exhaust steam through a series of cylinders of decreasing size, making a much fuller use of its energy. The process would radically reduce coal consumption, but at the price of increasingly complex machinery that was more difficult to handle and could be unreliable. Nonetheless, advances in metallurgy and engineering, the realization that the more efficient compound engines would require smaller bunkerage, and the experience of earlier compounding in commercial vessels gradually won over the world’s admiralties. By the early 1870s, compounding had become the norm for new warship construction. Compounding required higher boiler pressures, so the older box-fire tubular boilers gave place to elliptical and then circular boilers, constructed of improved steel which could withstand the increased steam pressures. Better steels made possible high-pressure boilers, which made triple-expansion engines possible. And in turn, better armor arrangements permitted vertical engines for further savings in space. Previously, naval engines had to be configured horizontally to keep vital machinery below the waterline, but the action of the pistons wore down horizontal surfaces more quickly than if they were vertical. The first large warship to be fitted with vertical triple-compound engines was HMS *Inflexible* (completed 1881).

The great and steady improvements in warship engines also resulted in the provision of almost limitless supplies of fresh water for
boilers and crew through the development of evaporation and distillation plants. Warships could now range far greater distances without having to put in to a port to replenish the water supply.

Oddly, these propulsion advances did not result in greatly increased power or speed. The noncondensing engines of the Agincourt class (completed 1867–1868), real powerhouses for their time, could develop an average of 6,500 indicated horsepower (ihp), driving these giant ironclads at an average speed of 14-plus knots. The vertical triple-expansion engines of Dreadnought I a little more than a decade later (the third of the Devastation class), generated 8,210 ihp and a speed of about 14 knots. The main advantage of compounding lay in greatly decreased fuel consumption: of the identical wooden sailing frigates converted to steam in 1865, two were given simple expansion-type engines; they burned between 3.17 and 3.64 pounds of coal per ihp per hour. But the third, fitted with a compound engine, consumed only 2.51 pounds (from Robert Gardiner, ed., Steam, Steel, and Shellfire: The Steam Warship, 1815–1905. Conway's History of the Ship. Annapolis, MD: Naval Institute Press, 1992, p. 174.)

In fact, it could be argued that the most significant engineering innovation in increasing power and speed was forced stokehold draft. An early forced-draft system on HMS Sans Pareil and Victoria (completed 1890–1891) gave both of these ironclads an increase of about 1,500 ihp and 1 knot.

Twin screws, dating from the late 1860s, improved warship maneuverability and provided some insurance against mechanical failure. HMS Captain was the first major ironclad fitted with twin screws, one of its few points of superiority over its rival seagoing turret ship, the Admiralty-designed HMS Monarch.

IRONCLADS IN ACTION

It has often been argued that ironclad design was basically affected by the limited experience of ironclad battle throughout the nineteenth century; in the absence of combat experience, most ironclad design was heavily based on theory. Indeed, there were only two significant ironclad fleet actions during the ironclad era, the Battle of Lissa (1866), and the Battle of Angamos (1879). But individual ironclads clashed with each other and engaged unarmored warships, far more than is generally supposed, and bombarded shore fortifications.
As noted, the first ironclads to see action were the French batteries used against the Russians in the Crimean War. But a little-noted action on 10 October 1861 saw the first use of an ironclad against another warship: at the mouth of the Mississippi River, the lightly plated Confederate ram CSS *Manassas* forced its iron snout into the large wooden Union steam sloop *Richmond*; this was the first use of the ram since ancient times. Little *Manassas* was also the first ironclad to see battle in North America. The shock of the impact knocked down one of the ram’s two funnels, disabled one of its engines, and broke off its ram bow, putting it out of action. *Richmond*, by contrast, suffered but one small hole in the side below the waterline and was quickly repaired. The historic *Manassas* finally ended its embattled career on 24 April 1862, when it unsuccessfully contested Admiral David Glasgow Farragut’s assault on New Orleans. *Manassas* then compiled its last first: the first ironclad to be sunk in action. As was so typical of Confederate ironclads, *Manassas* was not destroyed by enemy fire but by its own crew as its worn-out engines prevented escape from the advancing Union naval forces.

Ironclad-to-ironclad combat opened at Hampton Roads, perhaps the most famous naval clash in history. The cobbled-together broadside ironclad *Virginia* (constructed atop the ruin of the frigate USS *Merrimack*, scuttled by the Union upon the fall of the Norfolk Navy Yard) bulled through the blockading Union fleet off Hampton Roads, fatally ramming the sloop *Cumberland* and then compelling the surrender of the frigate *Congress*. The Union fleet flagship, *Minnesota*, trying to bring its own broadsides to bear on *Virginia*, then ran aground. All three Union warships were wooden sailing vessels. *Virginia* retired at dusk, prepared to return the next day to finish off the federals and scatter the Union transports supporting General George McClellan’s Peninsula Campaign. The Confederate ironclad had already inflicted what would remain the worst defeat of the U.S. Navy until the Japanese attack on Pearl Harbor. (That service’s worst non-fatal disaster had occurred less than a year earlier on 21 April 1861, when the panicky Union commander of the Norfolk Navy Yard ordered the yard and all ships based in it destroyed to prevent its loss to the Confederates. All of the Union warships at the base were burned to the waterline, including USS *Merrimack*. The Confederacy salvaged some 1,195 heavy guns alone.)

But when *Virginia* returned the next morning, it found, in a development worthy of a Hollywood epic (including crowds of spectators on shore), the USS *Monitor*, a mastless, low-lying, turret ironclad—more like a collection of geometrical shapes than any recognizable
type—positioned in front of the grounded Minnesota. For the next four hours the two pioneer ironclads fought to a draw, their shots mutually caroming harmlessly off armor. When a shot from Virginia hit Monitor’s conning tower and temporarily blinded its commander, the Union turret ship drifted away. Just before Virginia’s lucky shot, its commander called out boarders among his stout-hearted crew, although the ironclads had drifted apart before this Nelsonian touch could have been carried out. But Virginia, plagued with engines that were unreliable after immersion in saltwater, never returned to the battle and was blown up by its own crew a year later.

Minnesota and the Union transports supporting McClellan’s Peninsula Campaign were saved, and John Ericsson, Monitor’s designer, was the hero of the day. In the longer run, the timely arrival of Monitor prevented Virginia from breaking the Union blockade, which would have, in turn, provided an incentive for Confederate-favoring governing circles in France and Britain to ignore the blockade, which might well have forced the Union to the negotiating table.

The next use of an ironclad in combat again took place on the Mississippi River during Admiral Farragut’s New Orleans campaign in April 1862. The little veteran ironclad ram Manassas returned to contest Farragut’s push past the New Orleans forts, delivering a glancing blow to the large paddlewheel frigate USS Mississippi, causing a 7-foot gash in the Union warship’s flank. Manassas then turned on the large Union screw sloop Brooklyn but, in the words of Brooklyn’s captain, his ship was but “feebly butted.” Manassas, more persistent than effective, then followed several Union gunboats up the Mississippi. It endured a broadside from USS Mississippi that inflicted little damage. With its engines now disabled, its crew was forced to torch the plucky ram, a fate that would befall most Confederate ironclads.

If Virginia’s victory over the wooden Union warships at Hampton Roads were not lesson enough, two additional home-built Confederate ironclads, Chicora and Palmetto State, underscored the point on 30 January 1863 when they rampaged through an unarmored Union blockading fleet in Charleston Harbor, forcing two blockaders to surrender. The Confederate ironclads’ weak engines once again allowed several other Union blockaders to escape. This was the only time that Confederate ironclads engaged the enemy in more open waters. However, the Union blockade remained—and became all the tighter over the months ahead.

After two unsuccessful attacks on Fort McAllister, Georgia, in February and March 1863, by first one and then by three Union
monitors of the new Passaic class, the Union Navy attacked the
citadel of the Confederacy, Fort Sumter. The Federals now had, in
addition to nine Passaics, the giant *New Ironsides* and the problem-
atic ironclad *Keokuk* in the assaulting squadron, led by a reluctant
Admiral Samuel F. Dupont. On 7 April 1863, in the greatest iron-
clad engagement of the era, Dupont’s ironclads began a slow bom-
bardment at a range of 600–800 yards from the fort. Fort Sumter
replied vigorously; monitor *Weehawken* was hit perhaps 53 times
and *New Ironsides* 50 times. Monitor *Nahant* was struck 36 times in
40 minutes but fired off only 15 shots during the entire day (a moni-
tor’s 15-inch gun took about five minutes to reload and fire). But if
the Union monitors were slow-firing and unwieldy, they were also
nearly impervious, and for all of their hits taken, only one man
(*Nahant*’s quartermaster) was killed throughout the squadron in the
attack. The exception to the Union ironclads’ powers of resistance
was the peculiar nonturreted ironclad *Keokuk*. This warship’s ar-
moring system proved a complete failure, taking 90 hits from Con-
federate batteries and giving only three in reply. It sank in shallow
water the following day after its first test in battle. Despite assur-
ances from Union engineers that the task was impossible, *Keokuk*’s
guns were stealthily removed by the Confederates to reinforce
Charleston’s defenses; adding insult to injury, the commander of the
Charleston garrison cheerfully reported that the wreck had also
yielded “two abolitionist ensigns.” Charleston Harbor remains the
gate for the Union ironclads *Weehawken* and *Keokuk* and the Con-
federate submarine *Hunley*, not to mention *Hunley*’s victim, the un-
armored sloop *Housatonic*. No other body of water would see so
much naval and ironclad action, and none would hold the remains
of so many warships until the destruction of Spanish warships at the
Battle of Santiago Bay 35 years later.

The second of only three ironclad-to-ironclad clashes of the U.S.
Civil War after Hampton Roads took place several months after the
Charleston failure, on Wassaw Sound, Georgia. On 17 June 1863,
*CSS Atlanta* rashly engaged two Union Passaic-class monitors, *Wee-
hawken* and *Nahant*. *Weehawken* worked its way to within 300 yards
of *Atlanta* and, with four hits within 15 minutes, forced its surren-
der. *Atlanta* was soon after taken into Union service and used in op-
erations against the Confederacy, one of the very few cases of a war-
ship being put into active service by an enemy.

The Federals returned for a second assault on the Charleston de-
fenses, this time on Fort Wagner, beginning in early July. The crews
in the monitors suffered terribly from the heat (and were given a
special ration of ice), and the ventilation system seemed to distribute more smoke than fresh air throughout the baking metal warships. On 18 July, Union ironclads *New Ironsides* and Passaic-class monitors *Montauk* (flagship, with Admiral John A. Dahlgren, the navy’s ordnance expert, aboard), *Catskill, Nantucket, Weehawken*, and *Patapsco* returned to the attack. *New Ironsides*, with ten times the rate of fire of the monitors, got off far more shots. Again, the ironclads seemed to shake off the hail of returning fire from the Confederate positions. The only exception was a 10-inch shot that struck *Catskill’s* turret, killing the captain and paymaster. For three months, Dahlgren kept up his naval bombardment on both Sumter and Wagner, in cooperation with Union troops at Wagner. After repulsing several assaults, the Confederates abandoned Fort Wagner on 16 September, diminishing Charleston’s allure for blockade runners. The city would fall to General William Tecumseh Sherman’s army in 1865.

The small Confederate ironclad *Albemarle* posed a threat to Union forces in the North Carolina coastal sounds in 1864, sinking one unarmored Union warship, driving off another, and, with its bombardment, helped to force the surrender of the Union position at Plymouth. The alarmed Federals dispatched naval reinforcements—but no ironclad. On 5 May, *Albemarle* joined battle with the unprotected Union fleet. USS *Sassacus* bravely rammed the ironclad, driving it forward for some 10 minutes with its engines at full power, while the rest of the Union fleet bombarded the Confederate’s plated casemate to practically no avail. But *Albemarle’s* commander ordered retreat, his coal supply was running low and his men, bleeding from their eyes and noses, exhausted.

The sequel of this battle was one of the most intrepid actions of the war. Union Commander William B. Cushing, on the evening of 27 October, took a steam launch armed with a spar torpedo, accompanied by another launch and a total of 28 volunteers, quietly upriver through enemy territory to the *Albemarle*. The *Albemarle’s* crew, alerted by a barking dog, poured a hail of small-arms fire into the Federals, but Cushing, after firing a burst of canister from his boat howitzer, drew up to the log boom protecting the ironclad. Coolly, he prepared the spar torpedo while he could hear *Albemarle’s* crew loading a Parrot rifled cannon with a charge of grapeshot directed at the interloper. At the last possible second, Cushing pulled the torpedo lanyard and heard two explosions. One was the Parrot, its murderous shot passing harmlessly over him and his crew. The other was the torpedo charge, blowing a hole in the
ironclad’s bottom “big enough to drive a wagon through” and permanently removing that Confederate threat. *Albemarle* was the only Confederate ironclad to be sunk by enemy action during the Civil War; the remainder were captured or scuttled to prevent capture.

Mobile, Alabama, was the next blockade-runner haven to be sealed. On 5 August, Admiral Farragut led his fleet of 18 warships, including four monitors, into action against the Confederate forts screening Mobile. Monitors *Winnebago* and *Chickasaw* were of the older Passaic class, *Tecumseh* and *Manhattan* of the succeeding Canonicus class, armed with two 15-inch smoothbore Dahlgrens. *Chickasaw* and *Winnebago* were units of James Eads’s Milwaukee class, armed with two 11-inch Dahlgrens. Although Farragut’s fleet succeeded in running the gauntlet of fire from Fort Morgan, disaster struck early. In his eagerness to get to the giant Confederate ironclad *Tennessee*, Captain Tunis A.M. Craven, commander of *Tecumseh*, had ordered his monitor directly over an enemy minefield. An explosion erupted under *Tecumseh*, and it sank in less than one minute, the first example in history of the instantaneous destruction of a warship. Of its crew of 122, only 20 survived; Captain Craven was not among them.4 A general melee, including ramming and counter-ramming maneuvering, ensued between Farragut’s unarmored warships and *Tennessee*, with little significant damage inflicted by either side.

After breaking off the battle, *Tennessee* ventured out again to attack the Union monitors. Again, ramming and counter-ramming led to no serious damage, and broadsides caromed off *Tennessee*’s iron sides. But *Chickasaw* stayed on the Confederate ironclad, firing 52 shots, and its solid bolts began to take effect. The Eads turrets in the Milwaukee class were not only the safer design; they also permitted much faster firing. Under this pounding, one of *Tennessee*’s gun port shutters jammed. Two of the four crewmen sent to repair it were killed when a *Chickasaw* shot hit the Confederate’s plated casemate and wounded its commander, Admiral Franklin Buchanan, in the leg. *Chickasaw*’s pounding hit *Tennessee* in the exposed steering chains, its most vulnerable spot. Unable to maneuver, *Tennessee* became a bull’s-eye and was forced to surrender. With one monitor lost and 145 dead (most from *Tecumseh*), the opening of Mobile Bay was the hardest-fought naval engagement of the war. Blockade running had practically been ended in the Gulf of Mexico.

Then Wilmington, North Carolina, was bombarded by Union ironclads in January 1865. The final naval assault, under Admiral David Dixon Porter, involved some 50 Union ships, the largest U.S.
Navy squadron assembled to that time. The veteran *New Ironsides* led the attack, followed by *Canonicus*, *Mahopac* (both of the Canonicus class), and the powerful new (but wooden-hulled) *Monadnock*, which mounted four 15-inch Dahlgrens in twin turrets. After some initial navy overshooting, a well-executed amphibious assault took Fort Fisher and sealed off the last main blockade-runner port.

The James River was the site of the third and final ironclad-to-ironclad clash of the war, on 24 January 1865. *CSS Virginia II*, the South’s largest ironclad, descended the river from Richmond, accompanied by unarmored Confederate warships, to raid the Union supply base at City Point, Virginia. *Virginia II*, however, ran aground, and soon after *USS Onondaga*, a twin-turret monitor armed with two 15-inch Dahlgrens and two 150-pounder rifles, came on the scene. *Onondaga* fired but seven times, hitting *Virginia II* twice. One 15-inch bolt bounced off the Confederate’s plating, but the other penetrated its casemate, sending a shower of splinters and iron fragments along the gun deck that killed one and wounded two. *Virginia II*, finally floated off by the incoming tide, pulled away, and when Union shore batteries opened fire it retreated upriver to Richmond, to be destroyed just before the fall of that city. (*Virginia II*’s fatality, plus the two fatalities at Mobile Bay and the three who died in the Charleston assaults, were likely the only persons killed behind armor throughout the Civil War. But had 15-inch guns and rifles been used earlier by either side, the tally would most likely have been much grimmer.)

The land battles of the U.S. Civil War receive the most attention from historians and the general public, and indeed they were the greatest spectacles of the nineteenth century after the end of the Napoleonic Wars. But it was the slow and silent blockade that eventually strangled the Confederacy. In addition, it can be argued that by saving the blockade, the Union ironclads saved the Union.

Ironclads also clashed outside the waters of the United States. In the Prusso-Austrian-Danish War of 1864, the small Glasgow-built twin-turret Danish ironclad *Rolf Krake* seemed to range everywhere in the Baltic, bombarding Prussian shore positions and harassing their landings. Another Danish ironclad, the wooden-hulled, single-gun *Dannebrog*, converted from a cut-down two-deck ship-of-the-line, was also in action once, against unarmored Prussian warships. Although the Danes were superior at sea and the Prussians had no ironclads (their Austrian allies had four), the two Danish ironclads seemed to have made little difference in the course of the war, and the Danes were soon forced to capitulate.
The only high-seas fleet action of the ironclad era was the Battle of Lissa fought between the Piedmont/Italian and Austrian navies on 20 July 1866. The opposing fleet commanders were two very different personalities. The Austrian admiral, Wilhelm von Tegetthoff, upon the declaration of war, immediately made for the Italian port of Ancona and challenged the Italian fleet to battle. For various unconvincing reasons, the Italian commander, Count Carlo Persano, refused to come out. Persano was the type of officer often highly praised in peacetime for his organizational ability, which usually consists of reorganizing the previous reorganization. Persano hoped to win by his material preponderance, which was, in all truth, his only advantage. His fleet could boast of 11 ironclads (soon to be increased to 12) compared to Tegetthoff’s technologically inferior seven. But Tegetthoff had already won a moral advantage off Ancona. He also drilled his crews constantly while Persano idled his time, conducted a useless bombardment of the Austrian island of Lissa, and continued to complain that the odds were still not in his favor.

On 20 July, Tegetthoff’s fleet appeared in the Adriatic mist in a ramming formation something like a flying wedge, and his captains had their straightforward orders: “Armored ships charge the enemy and sink him.” Tegetthoff knew that he had to get in close to the Italians to negate their superior rifled gun range with his own concentrated fire and his ram bows. Persano’s exhausted command was confused, scattered, and unready. Persano added to their trials by a series of complex and conflicting orders, particularly when he discovered that his fleet faced the wrong direction. Then Persano decided to transfer his command to the newly arrived ironclad ram Affondatore (Sink) but neglected to inform his captains. As it was, Affondatore failed to touch any of its enemies with its truly de Bergrac snout, although its rifled guns wrought sad execution at pistol-shot range on the timber upperworks of several Austrian ironclads.

A point-blank melee followed, with the ironclads ramming and maneuvering to avoid the ram—mostly the latter. (The Italian wooden warship contingent, for unexplained reasons, remained aloof from the battle.) The Austrian Kaiser (the only ship-of-the-line ever to fight ironclads) scraped by the Italian Re di Portugallo, broadside flaming, leaving its bow sculpture on the Italian’s deck. Yet very little damage was inflicted on either side, as the ironclads mutually avoided or harmlessly bumped into each other and their broadside discharges bounced off armor plating. The misnamed Italian ironclads Terrible and Formidable proved useless—the former loitering with the spectator wooden ship squadron, while the latter left for
Ancona to repair what its captain claimed was serious damage from the Lissa Island bombardment. Meanwhile, Persano dashed about in 
Affondatore, incognito, turning away from several ramming opportunities, although the ram did fire some three shots at the Don Juan de Austria, breaking off some armor plates.

The battle turned decidedly more deadly when the Austrian flagship Ferdinand Max suddenly rammed the putative Italian flagship Re d’Italia, which heaved on its beam ends and sank like a stone. For decades following, the example of the Italian warship would be held up as a prime example of the awful power of the ram. Actually, Re d’Italia was almost dead in the water at the moment of its ramming. Still, considering the weakness of the guns of that era against armor plate, and the technical inferiority of Tegetthoff’s warships, ramming was probably his most promising tactic.

Lissa’s immediate aftermath for the Italians was almost as grim as the battle itself. The ironclad Palestro, set afire during the battle, soon after exploded with all hands. Affondatore later foundered, not from battle damage but from stormy seas. When the wretched Persano inquired as to the whereabouts of his cherished ram, the reply was perhaps unintentionally ironic: affondato (sunk). The real tragedy of Lissa is that it was unnecessary; the Austrians had already agreed to an armistice and to hand over Venetia (the bone of contention) by way of France, but the Italian leadership vaingloriously felt that they had to appear to win the province and city by their own efforts.

The Franco-Prussian War, which erupted four years after Lissa, found the French fleet, for decades considered by many as the mortal peril to Great Britain, strangely inactive. The French ironclad fleet, after all, vastly outnumbered that of Prussia. But not one French ironclad was fit for work in shallow waters and, although the French could blockade Prussia, their fleet became an irrelevance as the French armies lost the decisive land battles of the war. Of course, the outcome of the Franco-Prussian War provided yet another argument for the advocates of ironclad coast-defense warships.

Meanwhile, minor ironclad clashes took place in widely spread sections of the globe. The War of the Triple Alliance (1864–1869, Argentina, Brazil, and Uruguay versus Paraguay) mustered a surprisingly large number of ironclads for nations so industrially underdeveloped. By the end of the war, Brazil could boast of 16 ironclads. (In 1866 the new Brazilian ironclad Rio de Janeiro had been sunk by Paraguayan gunnery and mines while bombarding fortifications at Curuzu.) On 15 August 1867, the Brazilians passed the main Paraguayan fort at Curupaiti with four more ironclads than Farragut
had deployed at Mobile Bay. Unlike Farragut’s experience, the Brazilian ironclads’ armor did not prove impenetrable; monitor *Alagoas*’s 4.5-inch hull plates were pierced 12 times and its 6-inch turret armor twice, and several additional Brazilian ironclads were roughly handled by Paraguayan batteries. But the forts were passed and the Paraguayans eventually defeated. In many ways this riverine war (with forts, ironclads, and much ramming and maneuvering) was reminiscent of the U.S. Civil War, and in fact, several Brazilian commanders consciously tried to emulate Farragut. The extensive use of fierce boarding by the out-gunned and outnumbered Paraguayans, however, was distinctly different from anything seen in the U.S. conflict.

In another naval clash in South America in March 1866, the French-built Spanish ironclad *Numancia* bombarded Valparaiso, Chile, in the presence of the warships of several nations including the U.S. “seagoing” monitor *Monadnock*. *Numancia* then went on to bombard the Peruvian port of Callao on 2 May 1866. The fighting Peruvians brought up two home-built ironclads, the *Virginia*-style casemated *Loa* and *Victoria*, which was purportedly a monitor-type ironclad powered by a locomotive engine. However, it is doubtful that the Peruvians, ingenious as they were, could manufacture a revolving-turret ironclad with their resources. More effective were the Peruvian turret shore batteries, whose return fire killed 43 Spaniards, compared to 200 Peruvian dead. Yet the Spanish, low on ammunition, did withdraw. Both sides claimed victory, with the Peruvians celebrating the holiday of Dos de Mayo (May 2) to this day. (Another newly purchased Peruvian ironclad, *Independencia*, also built in Britain, resembled *New Ironsides*. *Numancia* returned to Spain across the Pacific, the first ironclad to circumnavigate the globe.)

The U.S. Civil War had another distant echo when the ironclad ram *Stonewall*, built for the Confederates by the French and purchased by the Danes (but too late to help them in their war with Prussia) was again sold, this time to Japan, and renamed *Kotetsu*. There it fought in the civil war of 1869 in two engagements off the northern coast of Honshu. The rammer itself was rammed by the unarmored rebel warship *Kaiten* but to no apparent effect, and the rebel forces retreated. On 11 May 1869, *Kotetsu* had its revenge, sinking *Kaiten* and going on to bombard rebel positions. The rebel cause collapsed soon after.

In Spain, during the Cartagena Revolt (July 1873), revolting Cantonists seized the naval base, taking control of globe-circling ironclad frigate *Numancia*, as well as *Vitoria*, *Tetuan*, and the ironclad...
corvette *Mendez Nunez*. The Spanish government, now bereft of most of its navy, hit upon the idea of declaring the insurgents pirates. Thus when the Cantonists threatened to bombard Almiera if a ransom were not paid, the German turret ironclad *Friedrich Karl* and the British box battery ironclad *Swiftsure* seized two insurgent unarmored warships and returned *Vitoria* to the Madrid government. *Vitoria* then clashed with the insurgent-held *Tetuan*. Badly damaged in the encounter, *Tetuan* was blown up in Cartagena harbor by the rebels to avoid capture. That October, the entire rebel ironclad fleet put to sea to engage the government squadron, which now included its one remaining ironclad, *Vitoria*. That single government ironclad apparently was enough to beat off the rebel fleet in an ironclad naval battle almost lost to history. After some coastal bombardments by government ironclads and unarmored warships, the civil war finally ended in May 1876.

Much better known is the Peruvian ironclad *Huascar*, designed by Captain Coles, built in Great Britain, and mounting two 12-ton, 10-inch rifles in a single turret. By 1877, *Huascar* had fallen into Peruvian rebel hands and began to bombard coastal towns and interfere with British shipping. The large unarmored RN cruiser HMS *Shah* and its small, unarmored consort *Amythest* were ordered to halt *Huascar*’s depredations. *Shah* fired 280 rounds from its two 9-inch and 16 5-inch, 6.5-ton rifles at *Huascar*; one round penetrated the Peruvian ironclad’s thin hull armor and killed one crewman. The other shot embedded in *Huascar*’s 5.5-inch turret armor. The British cruiser also unleashed a Whitehead torpedo at *Huascar* that missed, but it was the first-ever firing of a motor torpedo in action. (The *Shah*’s busy commander also ordered two spar torpedo attacks on *Huascar*; the boats’ crews could not even find the fugitive Peruvian.) *Huascar* then missed all its shots and attempted, also unsuccessfully, to ram. With the light fading fast, the British commander ordered his two warships to cease firing. But *Huascar* soon after surrendered to the Peruvian government.

Hardly a glorious passage of arms, the *Huascar-Shah* clash, the last action by a Royal Navy warship against an armored enemy until 1914, can be seen as demonstrating the resisting power of the armor plate of the time, or as demonstrating the era’s abysmal gunnery accuracy. (In fairness, it should be noted that the two unprotected RN warships had to maneuver smartly to dodge *Huascar*’s shells and ram bow, as well as to avoid hitting a nearby Peruvian coastal town before which the Peruvian rebel turret ship had inconveniently drawn up.) The deficiencies of the broadside arrangement of heavy guns
was also evident in this clash, as Shah’s crews sweated to manhandle heavy guns from one gun port to the other to follow Huascar’s maneuverings.

Two years later, Huascar would be involved in a far more sanguinary clash, this time with two Chilean broadside ironclads, during the War of the Pacific (1879–1883). The Chilean Blanco Encalada and Almirante Cochrane were Reed-designed box battery ironclads, armed with six British-built Armstrong 9-inch, 12-ton main guns, protected by a maximum 8 inches of wrought iron. The Peruvians, in addition to Huascar, had two former Union monitors of the Canonicus class that they wisely avoided risking against the Chilean navy’s British-built guns, which would have easily penetrated the ironclads’ laminated armor. (Ever ingenious, the Peruvians also cobbled together a 48-foot-long submersible designed by a locomotive engineer, but it simply could not maneuver quickly enough to get within torpedoing distance of the Chilean ironclads.)

The Peruvian-Chilean naval clash off Iquique (21 May 1879) saw two unsuccessful ramming attempts by Huascar and three more by the Huascar’s companion, the broadside ironclad Independencia. Huascar did succeed in ramming the halted unarmored Chilean corvette Esmeralda, sending it to the bottom.

Independencia, pursuing the unarmored Chilean corvette Covadonga, repeatedly trying to ram, lost control when its helmsman was killed by a Chilean sharpshooter, causing the Peruvian ironclad to ground on a reef and heel over almost on its beam ends. The pursued became the pursuer, as Covadonga came up under Independencia and pounded its vulnerable stern. Independencia ran up the white flag. Covadonga then fled as Huascar came upon the scene. Nonetheless, the Chilean warship had the distinction of being the only unarmored warship ever to force the surrender of an ironclad.

Belligerent Huascar then raided up and down the Chilean coast and encountered a Chilean squadron off Point Angamos on 8 October 1879, composed of the Reed-designed broadside ironclads Blanco Encalada and Almirante Cochrane, purchased from Great Britain, plus four unarmored warships. Outgunned, Huascar again tried to ram, but the twin screws of its opposing ironclads easily outmaneuvered the obsolete single-screw turret ship. Chilean shot penetrated the Peruvian ironclad’s stack, and its upperworks were riddled. One shot penetrated the turret, killing everyone inside. Huascar’s commander was killed, as were the four officers who succeeded him. The survivors (32 of a crew of about 200) hauled down the flag and attempted to scuttle the warship, but they were thwarted...
by a boarding party of Chileans, pistols in hand. The two Chilean ironclads had fired 76 9-inch projectiles at a range of 500 feet in dead-calm weather, scoring 20 hits on Huascar, 13 of which penetrated armor. Huascar itself had replied with 40 shells, all of which hit Cochrane, causing little damage but killing or wounding 12 men. The hastily repaired Huascar was taken into Chilean service. In the bombardments of Arica (27 February and 11 December 1880), Huascar inconclusively exchanged fire with the Peruvian monitors Manco Capac (former USS Oneonta) and Atahualpa (former monitor USS Catawba) in the only known clashes between Ericsson- and Coles-type turreted ironclads. Not surprisingly, the Chileans to this day have retained as a museum ship the fighting Huascar, which would run New Ironsides a close second as the most-firing and fired-upon ironclad of the era. (The preserved Dutch coastal turret ships Schorpioen and Buffel are near sisters of Huascar.)

The Chileans, at least, were not yet done with naval warfare, and in their civil war of 1891 the party of President José Balmeceda and Congress squared off on 23 April, presidential torpedo boats versus Congressist ironclads. Congressist Blanco Encalada, torpedoed amidships, sank within five minutes.

Later in 1880, the French bombarded the port of Sfax, in the Barbary state of Tunis, with a total of 11 ironclads, basically using the town for target practice for two days. After an amphibious assault and house-to-house fighting in the town, Tunis was incorporated into the French Empire.

Egyptian nationalists put up a somewhat better resistance during the British bombardment of Alexandria in July 1882. The eight RN ironclads and five unarmored gunboats opened fire at a range of 1,000–3,700 yards. This was the first time that British armored warships fired a shot in anger and the Royal Navy's only ironclad combat experience.

It was an indication of the execrable Egyptian gunfire that the ironclads were permitted to anchor and set their own ranges. Like the Royal Navy itself, the bombarding squadron was a fleet of samples: no two ironclads were alike. The ironclads suffered almost as much damage from the blast effect of their own guns than from return fire, although the central battery ironclad Alexandra was hit 60 times. British casualties totaled 6 killed and 27 wounded, while Egyptian losses were estimated at 150 dead. Yet fully half of the British shells were duds or split in half due to poor fuses, and only 10 of the 42 modern Egyptian guns had been disabled. The bombardment of Alexandria was the last Royal Navy fleet action using
muzzle-loading guns and the first fought behind armor. In all, the British shooting was considered by British and foreign expert observers to be good, although the shells, as noted, especially the fuses, proved very ineffective. The ironclads received high marks for the armor (although hardly tested by the Egyptians’ poor gunnery) and the efficiency of the engines in fierce heat. Egyptian forces had been driven from their fortifications, one of the very few examples of ships getting the better of forts, but they were regrouping in the countryside, and the British had quickly to muster naval brigades to hold the city until the arrival of regular troops. This later development, plus the repulse of the Union ironclads before Charleston in 1863, strengthened the conclusion that ships alone cannot take forts, a lesson that was relearned the hard way at the disastrous failure of the Dardanelles amphibious operation early in World War I.

CONCLUSION

The decades of the ironclad era saw the greatest technological transformation in naval history, as the naval powers incorporated the innovations of the Industrial Revolution to their fleets. By the end of the 1880s, even the nomenclature had changed. The term “ironclad” seemed inadequate for a warship that was now the capital ship of navies. Gradually, the term “battleship” came into use and, along with “capital ship” to a lesser extent, persisted until the end of the armored warship.

The world’s navies had passed through the dark ages of the 1870s and 1880s, and the mastless, seagoing armored turret (or barbette) warship, with its heavy guns mounted fore and aft, once again became the dominant, and eventually the only, design for all capital ships. Naval architects, probably without realizing it, had reverted to the pioneering Devastation pattern.

In all, the maritime powers had completed 401 ironclads. Thirty-four ironclads were lost to misadventure. Of the remaining 367 ironclads, only the pioneering HMS Warrior, plus the Dutch coastal ironclads Buffel and Schorpioen of the 1860s and the Peruvian (later Chilean) turret coastal ironclad Huascar, survive into the twenty-first century. All four are British-built. These historic ironclads have been restored and today serve as museum sites in their respective nations. The remains of the U.S. river ironclad Cairo was raised in the 1960s and somewhat restored, and the wrecks of the
monitors Monitor and Tecumseh were charted and dived on in recent decades; Monitor’s turret was raised in 2002.

In its time, the ironclad was the most complicated, most expensive artifact of the industrial powers of the nineteenth century, a tradition that would be carried on by the battleship and the dreadnought until World War II. Yet aside from a few museum reminders of what had been, all armored warships of the Ironclad Era have passed into history.

NOTES

1. The same holds true for buildings of the nineteenth and twentieth centuries: money that was put into fine wood and stonework in the former time was replaced by that given over to heating and air-conditioning.

2. Only men could serve in the navies and merchant marine of the world. Some women did manage to enlist, disguised as males.

3. Another sister ship, Cincinnati, holds the distinction of being sunk twice in battle, being rammed and sunk at Fort Pillow (May 1862), then sunk a second time at Vicksburg in 1863. It must have been habit-forming; Cincinnati, after its sale out of the navy, sank at its moorings for a third and last time.

4. According to some sources, Captain Craven and Tecumseh’s pilot sprang for the only ladder that would permit them to escape. Craven stepped aside and, with a courteous “After you, pilot,” allowed the pilot to go first and exit the rapidly foundering ironclad.

5. The Austrians must have built their wooden warships of extraordinarily well-seasoned timber; Ferdinand Max was not scrapped until 1916, its sister ship Habsburg in 1899-1900.
CHAPTER THREE

The Early Battleship Era, 1889–1905

Beginning with the Naval Defense Act of 1889, the Early Battleship Era would end with the ascendance of the dreadnought in 1906. By the 1890s, the battleship, following the Devastation pattern, had developed into a mastless, turreted warship with multiple screws, breech-loading guns, fore-and-aft main turrets, and a moderately high freeboard.

Certainly in Great Britain, the dark ages of the Victorian navy had ended, and battleship construction was becoming a topic of heated public debate in the 1880s. The new imperialism of the later nineteenth century accelerated the debate: Colonies needed sea lanes of communication and trade with the mother country, and those lanes, as well as coaling stations and strategic posts, had to be protected by seagoing capital ships.

The naval powers also began to move away from the fleet of samples, often used to describe ironclad squadrons from the 1860s through most of the 1880s. In fact, as a result of the Naval Defense Act, the Royal Navy laid down more battleships of a single class, the Royal Sovereigns (1889–1891), than had ever been constructed to that date: Empress of India, Ramillies, Repulse, Resolution, Revenge, Royal Oak, and Royal Sovereign. These were also the most powerful battleships of the time. This era was a time of near-furious battleship construction, and it was just as well that the designers and constructors could not see into the future to witness the overnight obsolescence of the fruit of their efforts with the coming of HMS Dreadnought in 1906.
The follow-on to the Naval Defense Act battleships were the nine Majestics of the Spencer program of 1893, the largest single class of battleships ever constructed to one design: Majestic, Magnificent, Prince George, Mars, Jupiter, Hannibal, Victorious, Caesar, and Illustrious. The gun-loading arrangements were such an improvement over any previous designs that these battleships could get off nearly two rounds per minute, as opposed to the best of the past—2.5 minutes per round. Like the Royal Sovereigns, the Majestics were the best-designed battleships of their time. All survived to engage in secondary active-duty service in World War I. They continued the Royal Sovereigns’ basic design principles of center-line heavy guns and a respectable freeboard, the main difference being that the latter class protected its main guns in lightly armored structures. (Two of the class had no protection for the main battery, just sheet steel structures to keep out spray and splinters.) These two classes of battleships reverted to Devastation principles (except for the lack of armored turrets), reestablishing a battleship design that would prevail until battleships ceased to be built.

The French resisted this design trend, favoring their exaggerated fierce face, piled-on appearance, with high freeboard, enormous unprotected superstructures, deep tumble-home to achieve end-on fire (still thinking of ramming), along with single guns poking out of tiny turrets and exaggerated ram bows (probably as much for buoyancy as for ramming, considering the extremely short French forecastles). More tangibly, these battleships were almost unarmored above the waterline, except for their turrets, barbettes, and a waterline belt. The tumble-home reduced stability, and the large superstructures presented vulnerable targets and raised the center of gravity of the warships. The reasons for such bizarre designs are unclear, although they undoubtedly had much to do with the ram. The French themselves finally realized that these steel fantasies were a dead end, as seen in later French battleship designs that gradually moved closer to Royal Navy models. However, the French were never able to build their warships as quickly or as cheaply as the British, although their material quality was high.

The Naval Law of 1891 was France’s last attempt to challenge British battleship domination and was foredoomed by France’s lesser industrial development; French battleships themselves seemed destined to overall design inferiority. They usually turned out to be above their design weight, as compared to Royal Navy capital ships, which held to the strict controls introduced by Sir William White. French battleship construction was also hampered
by inefficient shipyards, as well as financial restraints that only became worse as the French army was expanded to counter Germany’s post-Bismarck belligerency. French naval policy vacillated between challenging the Royal Navy with an oceangoing fleet or with a guerre de course based on torpedo boats and cruisers; or withdrawing into coastal defense with its dwarf armorclads and, again, torpedo boats. Neither they nor the Russians ever completed a battleship construction program before fiscal and technological realities caught up to them. Finally, after their defeat in the Franco-Prussian War in 1871, the French felt compelled to build up the army at the expense of the navy. (It didn’t help matters that there were 31 different ministers of marine in the three decades after 1870.) The French were equivalent to or ahead of the Royal Navy, however, in two important areas: heavy guns and their mountings, and water-tube boilers.

All nations’ battleships grew steadily in size and complexity, despite efforts to revert to moderate dimensions in the interests of economy. This was not mindless growth for growth’s sake; guns grew progressively heavier to secure greater range and penetration power, and so mountings and turrets grew accordingly, necessitating growth in hull sizes. The Battle of the Yalu and the Battle of Tsushima demonstrated the value of speed, which required larger and more powerful engines in larger hull space. Also, the new emphasis upon imperialism meant that warships would also need larger hulls for the greater coal bunkerage to sail and fight across the globe.

In fact, the coast-defense craze finally died out in the Royal Navy at this time. Although the French and the Russians still completed a handful of small battleships for coastal and inland sea work, and the concept found continuing favor, understandably, with such secondary maritime nations as Sweden, Norway, Denmark, and the Netherlands.

Naval ordnance made great strides in the early battleship era. Until 1895, armor-piercing projectiles were solid, just as they had been back during the U.S. Civil War—and with about as little success. But in that year and in 1903, both a British as well as a U.S. company introduced versions of an explosive-filled projectile able to pass through its own caliber steel armor. New fillers, like trinitrotoluene (TNT), also reduced the possibility of these shells exploding when fired and increased the shells’ explosive effect. The various new propellants went under the name of smokeless powder, but they were more smokeless than smokeless.

Gunnery itself had finally begun to emerge from its prevailing primitive inaccuracy. As late as 1900, RN warships had difficulty in
hitting a target a little over a mile distant. At Tsushima five years later, the Japanese could engage their enemy at 2.5 miles range—and were proud of it. Generally, although the big naval guns were capable of hitting a target at 6,000 yards, they rarely hit one at 1,500 yards, even in practice. By Jutland, hits were scored at 5 miles or more, but nonetheless, hits on both sides averaged an unimpressive 0.33 percent to 4 percent.

Greater improvement was essential if the big guns of the new dreadnoughts were to have any meaning, and it came about due to the efforts first of Admiral Sir Percy Scott in the Royal Navy, and then of Captain (later Admiral) Bradley Fiske and Admiral William S. Sims in the U.S. Navy. More accurate rangefinders, telescopic sights, continuous aiming, salvo firing, analog computer aiming systems, trigometric slide rule, range clocks, and director firing all contributed to this vast naval gunnery transformation. Director firing, the work of Scott in 1905, concentrated control in one man, high on the foremast, who provided firing data for the individual turrets. Nonetheless, the British Admiralty resisted this innovation until 1912, when a director-equipped dreadnought, HMS Thunderer, achieved a hit ratio six times better than that of HMS Orion, the latter using the old individual gun-laying technique. Even then, on the eve of World War I, only eight (or one-third) of the Royal Navy’s dreadnoughts were equipped with director firing. The Germans, by contrast, had fitted their own, albeit inferior, director system on all of their High Seas Fleet dreadnoughts. Widening ranges also called for higher elevations, and Royal Navy battleships’ big-gun elevation increased gradually from 13.5 degrees in the first decade of the twentieth century to 30 degrees by World War I.

The Royal Navy could pride itself on vastly increasing its dreadnought firing range and accuracy, from 3,000–4,000 yards in 1904 to no less than 16,000 yards plus if called for. British firing should have been the world’s best. But the effective fire control table in the transmitting station developed by the civilian Arthur H. Pollen was plagiarized and bastardized by a naval officer who was a close associate of both Admiral John Fisher and the RN fleet commander, John Jellicoe. The result was a distinctly inferior mechanism. But the firing information did come from a single master sight in a revolving director tower high on the foremast (which was by then a tripod for greater stability and was also pioneered by Dreadnought), which followed the target and sent bearings to the fire control table, which, in turn, fed the information to the turrets. The exact moment of fire was determined by the director in the foretop, who waited for the
roll of the ship to bring the heavy guns to the correct bearing, then fired all of the guns himself.

There is a myth, carefully reinforced by the Germans, that the British Barr & Stroud range-finding optics were inferior to those of the German Navy. Although the German Zeiss rangefinders could more easily range than their British counterparts, they required more specialized operators, were more affected by temperature and vibration, and their range findings deteriorated in combat.

The naval powers finally began to envision more rational operations of their battleships, and this new sense of reality led, in turn, to new designs. The growing awareness of the torpedo forced commanders to space their battleships farther apart,reviving the traditional line-ahead formation for capital ships—thus reviving the broadside. Increased range also led to a demand for more powerful guns, and so the big-gun broadside also returned.

Yet for all of this technical progress, the world’s navies were still decidedly on a leisurely peacetime routine; smartness in appearance and drill was more valued than gunnery excellence. In fact, the new battleships were decorated more flamboyantly than their predecessors. The Black Battle Fleet of the Royal Navy’s Ironclad Era gave place to the yellow funnels, white upperworks, and black hulls of the early battleships. The U.S. Navy went from the obscure lilac-gray or black of its Civil War monitors to the most attractive white hulls and buff upperworks of the turn-of-the-century “new U.S. Navy.” All naval services greatly increased their gold-leaf gilt work around the hulls and put increased emphasis upon polishing the metal work, even below decks. All of that would change, however, in the first decade of the twentieth century.

The late 1800s saw the emergence of three new naval powers, Germany, Japan, and the United States, the latter two of whom at the time proved their naval might in battle, albeit against weak opponents. For all three, battleships were to be the major measurement of their naval power. (Germany and the United States shared the distinction of losing only one battleship each, Pommern and Maine, respectively, before World War II.)

The United States was in basically the same geostrategic position as was Great Britain. The British Isles had no land borders to defend and could thus pour most of its defense funding into its navy. The United States had only two very weak military powers along its two land borders and could thus embark on a great naval construction program, centered on battleships, and relegate its army over the years to something about the size of Romania’s.
Yet of all the naval powers, the United States held on most tenaciously to the coast-defense idea. The armored warships of the new navy, in fact, commenced with the construction of no less than ten big-gun coast-defense monitors. The first five of these were virtually Civil War-era near-derelicts supposedly repaired but actually newly constructed in order to circumvent congressional refusal to allot monies for any new warships. (The fiscal situation was so dire that several Civil War monitors were given to shipbuilders as partial payment for the new monitors.) The remaining five new monitors were actually constructed openly as new warships, as Congress voted funds for the new navy. These bizarre warships were armed with 10-inch and 12-inch guns and were heavily armored. They would participate in the bombardment of Puerto Rico and in blockade duty during the Spanish-American War, fairly well fulfilling their coastal purpose. Within a few years, they were universally denounced in the service as practically useless; their one virtue in later years was that their very low freeboard made them excellent submarine tenders. (One unimpressed contemporary U.S. naval officer described monitor Monterey as “a double-acting, high-uffen-buffen, double-turreted, back-acting submarine war junk. . . .,” drawing “fourteen feet of mud forward and 16 feet 6 inches of slime aft, and had three feet of discolored water over the main deck in fair weather” (Padfield, 129). The French and the Russians also built coastal minibattleships, in limited numbers, but no new monitors. The Royal Navy and the Italian Navy also built monitors, but these warships were primarily ad hoc expedients to mount heavy guns from uncompleted battleships.

Actually, coast defense did not end with the new monitors; the first class of U.S. Navy battleships were the Indianas (Indiana, Massachusetts, and Oregon, laid down beginning in 1891) and were specified by Congress to be “seagoing coast defense battleships,” presumably warships that could venture on the high seas but probably could not work their guns there. The Indianas displaced 10,200 tons and mounted two 13-inch main battery guns and four 8-inch secondary guns. Iowa (laid down in 1892) was an improved Indiana with a higher freeboard but only 12-inch guns to save weight, plus the same four 8-inch secondary battery. The contemporary Royal Sovereigns, by contrast, displaced 15,500 tons, mounted 13.5-inch guns, and, with refueling, could venture to any ocean. It was indeed fortunate that the first naval engagement of the new navy was against the feeble Spanish. The U.S. public was considered to be still anti-imperialist, so the Navy had to tread softly, calling for new
battleships and cruisers—but nothing that could be interpreted as entangling the United States in major overseas ventures.

The U.S. Navy had earlier constructed two dwarf turret ships that might be termed battleships, *Texas* (to a British design) and *Maine* (laid down in 1888 and 1889, respectively). *Texas* displaced only 6,650 tons and mounted only two 12-inch main battery guns. *Maine*, even less promising at 6,315 tons, mounted four 10-inch main guns and was actually originally designed to carry a small spread of sail. Both battleships carried their main armament in the now-discredited echelon sponsoned arrangement to give ahead-fire—again, presumably for ramming.

The Indianas and *Iowa* (but not the new monitors) fought in the Battle of Santiago during the Spanish-American War. The mysterious destruction of *Maine* in Havana Harbor was the precipitating event of that conflict.

Such unpromising beginnings notwithstanding, a U.S. naval renaissance began based on strong theoretical foundations: The U.S. Naval Institute and the Naval War College provided means for thoughtful officers to ponder and discuss the issues of the day, and the writings of Admiral Alfred Mahan gave a theoretical rationale for an expansionist blue-water navy. Gradually, the coast-defense mentality and commerce-raiding concept (the latter having served the U.S. Navy quite well in earlier maritime conflicts) were discredited, and the emphasis turned to seagoing battleships. The victorious Spanish-American War and the achievement of a global empire seemed emphatically to validate Mahan’s theories of the necessity for a blue-water navy and colonies. (Mahan’s primary theory, which influenced generations of naval strategists, held that a decisive battle on the high seas was to be sought out and fought with big guns.)

Actually, the trend toward seagoing U.S. Navy battleships preceded the Spanish-American War. But the *Kearsarge* and *Kentucky* (both laid down in 1896; *Kearsarge*, by congressional direction, commemorated the Union naval victory over the Confederate commerce raider *Alabama* and was the only U.S. battleship not named for a state); the Illinois class (*Illinois, Alabama, and Wisconsin*, laid down 1896–1897); and the Maine II class (*Maine, Missouri, and Ohio*, laid down 1899–1900) were all too far advanced in design or construction to take advantage of any of the lessons of that conflict. The first U.S. battleships so advantaged were the five ships of the Virginia class (*Virginia, Nebraska, Georgia, New Jersey, and Rhode Island*, laid down 1901–1902); at nearly 15,000 tons with a high freeboard and the new generation of quick-firing 12-inch, caliber .45 guns employing
smokeless powder, they were the first U.S. battleships that could stand up to their contemporaries in the other major navies. (Also at the time, U.S. Navy capital ships lost their distinctive paint scheme of white hulls, gold-leaf filigree, buff upperworks, and national shield mounted at the bow, which made them easily the most handsome warships afloat at the time. They, with the other warships of the world, ever since have remained cloaked in varying shades of utilitarian gray.)

The two Connecticuts (Connecticut and Louisiana, 1903) and the four Vermonts (Vermont, Kansas, Minnesota, and New Hampshire) improved on the Virginias and showed that the United States could also build battleships in quantity to match the Royal Navy. In fact, the U.S. Navy sought to deploy a fleet second only to that of Great Britain by 1919 (and did).

The U.S. Navy’s last pre-dreadnoughts, Mississippi and Idaho, were actually retrograde specimens, resulting from the cry for economy from Congress and a feeling in some naval quarters that battleships were getting too big. The call for moderate dimensions has invariably resulted in inferior warships, and Mississippi and Idaho served only six years in the U.S. Navy before being sold to Greece (where they were quickly sunk by German dive-bombers in 1941).

All-big gun battleship design ideas were current in the United States, encouraged by President Theodore Roosevelt, and discussed in the U.S. Naval Institute Proceedings. Thus, plans for such battleships, South Carolina and Michigan, were actually drawn up before those for HMS Dreadnought, although the U.S. warships took much longer to construct. By then, the U.S. Navy had achieved qualitative equality with the Royal Navy.

As long as Chancellor Otto von Bismarck remained in power, the German Navy was distinctly subordinate to the German army in the counsels of government, and the navy was relegated basically to a coast-defense mission. (Until 1888, the year of Kaiser Wilhelm II’s accession, the navy had actually been run by an officer in the army!) The Germans remembered how the greatly superior French fleet could not affect the outcome of the Franco-Prussian War. But William II dismissed his Iron Chancellor and began to dream of Germany finding its “place in the sun.” That demanded coaling stations, and coaling stations demanded colonies, and colonies demanded maritime power—and that demanded battleships to protect lines of communication and to fight it out with other powers on the high seas. (No one seemed to take note of Belgium and Holland, each of which managed to exploit one very profitable colony with modest naval power in the case of Holland and practically none in the case
of Belgium.) More rationally, Kaiser Wilhelm worried about the vulnerability of merchant shipping transporting the food and raw materials essential for Germany’s existence as an industrial power.

The Kaiser found his answers in the works of U.S. Admiral Alfred Mahan (1840–1914). Mahan gave the kaiser the rationale for his navalist beliefs. (The kaiser even ordered that a copy of Mahan’s 1890 book *The Influence of Sea Power upon History* be placed in the wardroom of every German warship.) Closer to home, Kaiser Wilhelm relied upon Admiral Alfred von Tirpitz (1849–1930), who was appointed secretary of state for the navy in 1897. Tirpitz was an admirable administrator and propagandist. Primarily due to his efforts, and to pressures from the kaiser, Germany’s First Navy Law was passed in 1898, providing for the construction of a modest 19 battleships over six years; two years later, the program was expanded to an incredible 38 battleships (plus 48 cruisers), all to be completed by 1920. With Germanic thoroughness, the First Navy Law provided for the automatic scrapping of each battleship when it had reached the age of 25 years. Such a program was all the more impressive in a nation that already possessed the world’s largest standing army. U.S. navalists had a much easier time, as the nation’s regular army at the time was little more than a frontier constabulary.

Even with these impressive numbers, German naval planners did not seek to challenge the Royal Navy directly. Rather, they followed Tirpitz’s *risk theory*, that the German Navy would be powerful enough to inflict such serious damage on the RN that it could be open to attack by France and Russia as well as by Germany. Thus the Royal Navy would be deterred from any anti-German adventures. Yet the German battleship fleet, despite the protestations of Kaiser Wilhelm and Admiral von Tirpitz to the contrary, was indeed designed to go directly against Great Britain. In the Kaiser’s words, “Our fleet must be so constructed that it can unfold its greatest military potential between Heligoland and the Thames” (Padfield, p. 200). The two German navalists drove Britain into a rapprochement with its traditional enemy, France; the British Navy could then leave policing of the Mediterranean to its new French ally. A treaty with Japan in 1902 similarly permitted the Royal Navy to withdraw its main naval forces from the Pacific and face Germany directly. Further, Russia, badly defeated by Japan in 1904–1905, ceased to be a major player on the high seas. For all its thoroughness, rarely has a theoretical construction proved so disastrous in practice as Germany’s maritime policy, and Tirpitz lived long enough to see his program quite literally sunk.
Germany's first true pre-dreadnoughts, the undergunned and underprotected Kaiser class, first laid down in 1896, did not compare well with Royal Navy contemporaries. They indicated that the Germans, like the Americans, had much to learn about contemporary battleship design. Although both mighty industrial powers would learn soon enough.

The succeeding Wittlesbach class, the first to be constructed under the First Naval Law, and the following Braunschweig (launched in 1902–1903) and Deutschland classes, of five each, continued a gradual improving trend, although they still did not match their British contemporaries. Braunschweig carried four 11-inch main guns and 14 6.7-inch guns on a 14,167-ton displacement. The Germans accepted smaller main battery guns because of their belief that it was more advantageous to spray the enemy with accurate fire, something more likely with faster-firing, lighter heavy guns. However, throughout the early battleship era, the German challenge was more threat than substance.

The third new naval power, Japan, was just a few decades past feudalism when it embarked on a large naval construction program. Unlike the Americans and the Germans, the Japanese had to call upon British technology during this era. The Japanese therefore got off to a better start technologically than the other two naval upstarts. The first two Japanese battleships (Fuji and Yashima), ordered in 1893, were improved Royal Sovereign types built in the UK. They were thus superior to the relatively pioneering (albeit unsatisfactory) U.S. and German battleships. (These first two Japanese battleships did not arrive in time for the Sino-Japanese War of 1894–1895.) The follow-on Shikishima, Hatsuse, Asahi, and Mikasa battleships, considerably larger than Fuji and Yashima, were also built in Great Britain, this time as improved Majestics. Qualitatively, Japan, like the United States and Germany, would eventually achieve parity with the Great Britain's naval forces.

The French, the Russians, and the Italians had passed their apogees as main players in the battleship game. France leisurely built its first pre-dreadnought battleship, Brennus, between 1889 and 1896. Brennus mounted a mere three 13.4-inch guns on 11,000 tons, but those guns were arranged in the modern center-line mode, and the warship had no ram bow. The following Jauréguiberry class (Jauréguiberry, Charles Martel, Carnot, Bouvet, and Masséna, laid down between 1890 and 1892) was something of a throwback to the excesses of earlier French ironclad design, with their low displace-
ment, fierce face, exaggerated tumble-home on lofty, relatively un-
protected hulls, cluttered, unprotected upperworks, and single guns
in tiny turrets. Their main battery was a mixed bag of two 12-inch
and two 10.8-inch guns, the latter sponsoned over the hull tumble-
home, presumably to give ahead-fire, even though the naval powers
were going over to line-ahead capital ship formations that empha-
sized broadside fire. Bouvet and Masséna, however, should be cred-
ited for pioneering the triple shaft-engine arrangement for battleships. Only with the Charlemagne class (Charlemagne, St. Louis, and Gaulois, laid down 1894–1896) did French battleship design seem to
come to terms with the new long-range, line-ahead demands of big-
gun naval battle. Yet they still retained the tumble-home, confused
and vulnerable upperworks, and turrets that seemed too small for
their guns. The Charlemagnes took some four to five years to com-
plete (and the Brennus seven), while the contemporaneous Majestics
were completed in an average of two and a half years. Not until Re-
publique and Patrie (laid down 1901–1902) were French battleships
given sufficiently generous dimensions to achieve speed, armament,
and protection roughly comparable to contemporary Royal Navy bat-
tleships. Their similar successors, Démocracy, Justice, Liberté, and
Vérité (laid down 1902–1903) were fine monuments to the lofty civic
virtues they commemorated but were soon rendered obsolete by the
Royal Navy’s Dreadnought.

Russian battleship designs, which had in earlier decades followed
British concepts, began to display more French influence by the
1890s—worse luck for them. The first Russian pre-dreadnoughts
were the three unlucky Petropavlovskys (Petropavlovsk, Poltava, and
Sevastopol, completed in 1903–1905—all three would be lost at
Tsushima). The last pre-dreadnought Russian battleships were the
Imperator Pavel class (Imperator Pavel and Andrei Pervossmani, both
completed in 1910). Although the Russian ironclad/battleship fleet
was sometimes used as a bogeyman by the Royal Navy to extract
more funds from Parliament, Russian capital ships remained gener-
ally inferior to their British counterparts. Their disastrous perfor-
mance at Tsushima revealed the hollowness of the Russian naval
threat. Nonetheless, the Russians were perhaps more quick than any
other naval power to adopt technological innovations. For example,
Sinope pioneered triple-expansion engines, and Georgi Pobiedonosetz
was the first to carry electrically worked turrets and hoists. (A few
Russian battleships were the only non–U.S. Navy warships to mount
the U.S.-style cage masts.)
BATTLESHIPS IN ACTION

The capital ships of this era fought in three fleet actions: the Battle of the Yalu (17 September 1894), the Battle of Santiago (3 July 1898), and the Battle of Tsushima (27 May 1905). In the first two clashes, the combatants were considerably unequal, and only one side deployed battleships. Oddly, in the Battle of the Yalu, the losing side had the battleships; in the Battle of Santiago they were with the winner.

The Yalu clash showed that the remarkable resisting powers of armor plate, demonstrated during the U.S. Civil War and in subsequent clashes, had not diminished. The better-trained and -led Japanese squadron of modern and well-protected cruisers could do no real damage to two newer German-built Chinese battleships (*Ting Yuen* and *Chen Yuen*), although five unarmored Chinese ships were sunk soon enough. The Japanese commander, with the Chinese battleships intact, had to leave the scene in some disgust, although the Japanese did retain control over local waters. Regardless of their imperviousness, the Chinese battleships, with their slow-firing guns, could not affect the course of the war and remained blockaded in Port Arthur, where one was subsequently sunk and the other captured by the persistent Japanese.

The Battle of Santiago during the Spanish-American War was even more one-sided: The five U.S. Navy battleships and one armored cruiser, products of the U.S. naval revival during the late 1800s, sank or ran aground the four modern Spanish armored cruisers that were present. Only one American had died during the battle. Closer investigation showed that U.S. gunnery had been poor; yet the Spaniards’ had been even worse. It was small comfort that during that same year, Royal Navy battleships had fired 200 rounds at a stationary target 200 yards distant and scored just two hits! Obviously the victors at Yalu and Santiago owed their successes more to superior leadership and training than to their gun laying.

The Russo-Japanese War at sea began disastrously for both sides off Port Arthur. First, the modern Russian battleship *Petropavlovsk* struck a mine on 13 April 1904 and sank. This was a double-disaster, for the stricken battleship carried down with it Russia’s best admiral, Stephan Makarov. And the mine had not yet finished its deadly work: Little more than a month later, two relatively new Japanese battleships, *Hatsuse* and *Yashima*, also struck mines off Port Arthur on the same day and sank with heavy loss of life.

In August, the Russian fleet finally sortied from besieged Port Arthur, the command devolved to Admiral Vilgelm Vitegift, who did
not live long enough to demonstrate his abilities. Admiral Hei-
hachiro Togo, despite his four-to-six inferiority in battleships and his
awareness that, unlike the Russians, he was commanding Japan’s
only battle fleet, did not hesitate to close with the enemy.

The Russians were actually giving a good account of themselves
with accurate gunfire when fate entered the battle: A 12-inch Japa-
nese shell ricocheted off the sea and plunged through the roof of
battleship Tsarevitch’s armored conning tower, where it exploded.
The errant shell wreaked havoc among the crowded Russian offi-
cers, killing Vitegift and wounding many others. The battleship’s
steering engine then failed, and Tsarevitch began to circle toward
the Japanese line. Lacking orders, the Russian fleet broke up in dis-
array, the fleet second-in-command signaled to follow, and the Rus-
sians retreated back to Port Arthur. Togo was frustrated by gathering
dusk from following up his lucky shot. Later, Japanese shore batter-
ies at Port Arthur finished off the battleships Poltava, Retvisan,
Peresviet, and Pobeda. Sevastopol was scuttled in deep water outside
the port, and Tsarevitch sought internment at Tsingtao, China. Port
Arthur had become a battleship graveyard.

Moscow then dispatched the 2nd Pacific Squadron, commanded
by Admiral Zinovi Petrovich Rohdzvenski, from the Baltic to the Pa-
cific, halfway around the world, to salvage the desperate situation in
the Pacific. Rohdzvenski’s main units numbered eight battleships,
three armored cruisers, and three hopelessly obsolete armored
cost-defense warships. The core of the Russian fleet was repre-
sented by the four new battleships of the Borodino class (Borodino,
Alexander III, Orel, and Kniaz Suvarov). The Russians again ap-
peared to have a strong edge in numbers, but they were, in truth, in-
ferior in just about every other way, particularly guns, armor, and
speed. And Rohdzvenski’s fleet was also outclassed in the intangi-
bles that really counted: leadership, morale, and training. By the
time it met the Japanese, the Russian fleet was completing a debili-
tating seven-month epic of endurance. Instead of training, the crews
had exhausted themselves in repeated coaling stops and were suffer-
ing from low morale and heat exhaustion.

The Japanese squadron numbered only four battleships and eight
armored cruisers, but this was a homogenous fleet, with higher
speed and morale, and was led by one of the great fighting com-
manders of the age, Admiral Togo, in his flagship Mikasa. Mikasa
had been constructed in Britain, and all of Togo’s warships were for-
eign-built. On the other side, and unfortunately for them, the Rus-
sians’ battleships had been constructed on the usual bizarre French
design pattern and were top-heavy and outclassed by Togo’s capital ships.

Although Admiral Rohdzvenski had hoped to make for the Russian naval port of Vladivostok, Togo cut him off, forcing the Russian fleet to battle. From the start, Togo outfought the Russians. The Japanese fleet dumped coal to tackle their opponents more quickly, whereas the Russians were encumbered by bags of coal everywhere, endangering stability. While the Japanese communicated by radio (this being the first naval battle in history in which radio was used), the Russians relied on signal flags, despite the smoke and haze (Rohdzvenski feared that his radio messages could be intercepted).

On the afternoon of 27 May 1905, Togo, after sighting his prey, made a daring move to the northeast to cut off the Russians from Vladivostok and to enable him to cross the T. The move also exposed his fleet to Russian broadsides during the long turn. But Russian gunnery was poor (something Togo might well have suspected), and the Japanese were able to make their line-ahead formation unhindered, parallel to the Russians. Now Japanese superior speed and gunnery began to tell, although neither side could gain a complete view. By nightfall, the Japanese had practically destroyed Rohdzvenski’s fleet; Togo carried on the fight into the night with torpedo-boat attacks.

Dawn revealed that eight of the twelve Russian capital ships in the line had been sunk, including three of the new Borodinos, and the other four captured. (Four cruisers were sunk and one scuttled.) The Japanese lost three torpedo boats. Comparative human casualties also indicate the extent of the Russian disaster: 4,830 Russians killed and a little less than 7,000 captured, as compared to 110 Japanese fatalities. As noted, Tsushima was the first naval battle in which radio was employed, but it was also the last in which underwater torpedoes and aerial weapons did not count. Finally, all attention was focused on the gunfire losses of the Russians, and the three battleships sunk by mines were practically ignored.

Overnight, Russia had ceased to be a Pacific power, replaced by a victorious Japan, which would continue to expand its power in Asia and the Pacific until the conclusion of its disastrous war with the United States. It would be difficult to imagine more convincing proof that Mahan’s great-gun high-seas naval battle could decide the course of empires.

Of the three early battleship era naval battles, only Tsushima repaid detailed studying; the other two were so one-sided that little could be learned except that armor, training, and leadership still mattered. Tsushima was indeed perused in detail by naval architects.
and officers. All the intricate theories, war-gaming, and writings on
the future of naval warfare had been put into practice almost to per-
fection. Admiral Togo became such a hero that babies in the United
States and Great Britain were named for him. Yet Togo’s Mikasa,
considered at the time the world’s most powerful warship, would
soon be rendered obsolete by Dreadnought.
CHAPTER FOUR

HMS *Dreadnought* and the Battleship During World War I, 1906–1914

The naval powers that entered World War I in 1914 compared the strength of their fleets (even national power) based on the number of dreadnoughts they could deploy. These powers were following the precepts laid down by an American admiral, Alfred Mahan (1831–1914), and a Briton, Sir Philip Colomb (1831–1899), both publishing similar works within a year of each other. (Colomb was one of the earliest critics of the ram, beginning as early as 1887.) Mahan’s enormously popular *The Influence of Sea Power upon History* (1890) overshadowed Colomb’s more extensive and detailed *Naval Warfare: Its Ruling Principles and Practice Historically Treated* (1891).

Actually, both Colomb and Mahan were in a sense preaching to the choir: Great Britain, Germany, Japan, and the United States were already expanding and believed that only battleships could protect their empires. (The French and the Russians were as expansive and imperialistic as any other Great Power, but they still leaned to *guerre de course* and commerce-raiding cruiser warfare.) Both Colomb and Mahan argued that all commercial powers needed fleets to protect the sea routes and that, in the words of Mahan, “the fleet is built around battleships, the basic force” (O’Connell, p. 80). And only battleships could fight other battleships. Indeed, the fate of nations would hinge on the clash of great battleships, probably in one penultimate high-seas battle, as at Tsushima—a high-seas, battleship-dominated clash
that basically destroyed Russia’s sea power in Asia and brought the Russo-Japanese War to a conclusion. For such a dénouement, great fleets of oceangoing capital ships operating in squadrons were needed. High-seas naval battles were studied for their current applicability, and Colomb and Mahan (along with the Briton John Knox Laughton) can be said to have founded the discipline of naval history. Armed with historical knowledge, as well as theories for the new age, officers played out war games in naval colleges. These tactics were not that different from the Age of Fighting Sail (mid–eighteenth century to the early nineteenth century). Tsushima, still fresh in the minds of theorists, had demonstrated the value of high speeds (the Japanese battleships had outmaneuvered the enemy by their celerity), professional skills, and big guns.

Theodore Roosevelt and his distant cousin, Franklin Roosevelt, were disciples of Mahan. Both men served as assistant secretary of the navy and as president of the United States, and so they were in a position to act on their dedication to Mahan’s concepts. Between them, they laid down no less than 16 dreadnoughts, all but two of which (Illinois and Kentucky of the Iowa class) were seen through to completion. Oddly, the pacifistic president, Woodrow Wilson, also presided over the laying down of 16 U.S. dreadnoughts, seven of which were not completed. Under Wilson, battleship construction seemed to take on a mindless momentum of its own; the canceled giant South Dakota class, with its main battery of twelve 16-inch guns and 40,000 tons (compared to the immediately preceding Colorado class’s nine 16-inch heavy guns and 32,600-ton displacement) was begun well after the end of World War I. (Considering the names of the twin battle cruisers Lexington and Saratoga, converted while on the stocks to aircraft carriers, one might conclude that the U.S. Navy, with the defeat of Germany, saw Great Britain once again as its main enemy.)

The naval theorists of the late 1800s and early 1900s did not ignore maritime commerce, however. Mahan argued that there had never been a great commercial power without a great navy to protect commerce. (Yet even in Mahan’s prime, the United States presented the peculiar spectacle of vast commercial wealth and great naval power—and a miniscule merchant marine.) But he also denigrated the anticommerce warfare that had served his country so well in the past. Control of the seas was what mattered, and that took big-gun fleets of battleships, not commerce raiders, the weapon of the inferior naval power.
THE DREADNOUGHTS

These thoughts came together in HMS Dreadnought (completed in 1906), the world’s first all–big gun, turbine-powered capital ship. Paradoxically, although Sir John Fisher, the Admiralty’s First Sea Lord, has always been associated with Dreadnought, he actually opposed the warship’s construction. Dreadnought, rather, was basically a project of the British Admiralty. Nonetheless, Fisher threw himself into its construction with his usual manic energy, completing the great ship in an astounding 14 months; the immediately preceding Nelson class had taken three years from laying down to completion. (Actually, much of Dreadnought’s materials had been assembled ahead of time, and some were even taken from other warships under construction, so its speedy construction time may be considered as something of a stunt.)

Actually, Fisher’s favorite warship design concept was not of a battleship at all but rather of a fast (and therefore lightly protected) big-gun cruiser, known later as the battle cruiser. According to Fisher, speed was armor. He saw the battle cruiser as the answer to the submarine and to the new and more effective armor-piercing shells. The battle cruiser’s high speed gave it greater protection against submarines than the lumbering battleships, and it could swiftly respond to any threat. Its battleship-scale guns made it superior to any warship it would encounter, except for battleships themselves. The battle cruiser would also save money by combining the unsatisfactory armored cruiser’s speed and the dreadnought’s power. But in reality, battle cruisers found themselves ranged against enemy battleships in wartime. The results, at least for the Royal Navy, were calamitous. In the words of Fisher, “Hence what is the use of battleships as we have hitherto known them? None! No one would seriously consider building battleships merely to fight other battleships” (Padfield, p. 188). Of course, battleships were always constructed to fight against other battleships.

Mahan and like-minded navalists had also called, logically enough, for homogeneous capital ship classes, denouncing previous policies as producing little more rather than a fleet of samples. This charge was taken to heart, and very few singular battleships were constructed during the twentieth century. Oddly, Dreadnought itself was one of a kind.

The Royal Navy had to accelerate Dreadnought’s construction, knowing full well that the other major naval powers had their own
dreadnought-type battleships on the drawing boards. In fact, the Japanese Satsuma class (laid down in 1903, completed in 1909) should be credited as the world’s first all-big gun battleships laid down. Plans for the U.S. Navy’s dreadnought-type battleships, the South Carolina class (laid down in 1905, completed in 1910) had also been drawn up before *Dreadnought*. The naval powers had come to realize that smaller-caliber guns on battleships led to confusion in gunnery spotting during battle, that mixed-caliber projectiles complicated handling, and that a single heavy gun size would simplify matters across the board. In sum, *Dreadnought* set the pattern for the 177 dreadnought-type warships subsequently laid down by the world’s navies between 1905 and 1941 (this figure includes uncompleted battleships).

*Dreadnought* embodied several significant technological advantages already enjoyed by the Royal Navy. The first was its heavy 12-inch and later 13.5-inch and 15-inch guns, with their greater hitting power and their flatter trajectories—that is, when their shells performed as designed. The second was *Dreadnought*’s faster turn of speed.

The greatest single undisputed Royal Navy superiority lay in its dreadnoughts’ turbines, pioneered by *Dreadnought* itself. At the time, no large steam turbine–powered ship had even been laid down, and the first RN turbine-propelled destroyers had been at sea only for four years. Turbines, lighter and more compact than reciprocating engines, gave *Dreadnought* a 2-knot advantage over its closest contemporaries; they were also more durable. Great Britain was so far ahead in turbine manufacturing, in fact, that for years afterward even advanced maritime powers such as the United States, Italy, Japan, and Germany had to build turbines under licenses from British firms. The United States did not go over to its own domestic turbines (Curtis) until the Nevadas (laid down in 1912). The Italians installed the Parsons turbine drive for their first dreadnought (*Dante Alighieri*, laid down in 1909) and did not install a domestically manufactured turbine (from Bulluzo) until the Littorio class (laid down in 1934–1938). The French stuck with Parsons turbines (with one mixed-drive exception) through to the end of their battleship construction. The first German turbine-powered battleships, the Kaiser class, were not even laid down until almost five years after *Dreadnought*. (This fact alone should invalidate much of the popular assertions of German technological superiority, spread as much by British journalists as by the Germans.)

At a single stroke, for better or worse, *Dreadnought* had made obsolete all other capital ships—including those of the Royal Navy,
and there were those who had used exactly this argument against the novel battleship. For example, *Mikasa* (Admiral Togo’s British-built flagship at Tsushima), with its mixed main battery of four 12-inch, 14 6-inch, and 20 3-inch guns, was considered the most powerful warship in the world. Yet it was asserted convincingly that *Dreadnought*’s 10 12-inch guns were worth 2.5 *Mikasa*s and, with centralized gunnery fire, perhaps even four or five. All other naval powers hurriedly drew up plans for their own dreadnoughts or pushed their existing dreadnought plans into reality. After all, a dreadnought cost only one-quarter more than the newest (and inferior) pre-dreadnought. But replacing pre-dreadnoughts with dreadnoughts was a daunting task. The world’s maritime powers had devoted the previous two decades to constructing battleships—the main measure of their might. No less than 201 first- and second-class ironclads had been constructed between 1890 and 1905 by the major naval powers, and most were still in service. More capital ships existed then than at any other time in history (see table, Number of Battleships).

For all its innovation, *Dreadnought* had its faults, mostly due to hurried design and construction. Its wing turrets were masked for more than half of their firing arcs, underwater protection was very poor, and the fire-control platform position was positioned directly abaft the forward funnel (reflecting a surprising lack of understanding that the coal smoke generated by battleships at high speeds would obscure long-range gunnery). This design error carried through the Colossus and Orion dreadnought classes and the Lion battle cruiser classes. France, in its first dreadnought class (*Courbet*) was the only other naval power to make this mistake. The foremost of these battleships were positioned abaft two funnels! One has but to look at photos of coal-fired capital ships working up to speed, or of their blackened forelegs, to see just how obvious this blunder was. But opposition did not focus on such tangible shortcomings in *Dreadnought*. Rather, the main criticism was that all the naval powers would start from scratch, i.e., from a position of battleship equality. Also, critics maintained that the British Admiralty was putting too many eggs in one basket. Mahan obscurely argued that long-range fire, as in *Dreadnought*’s all-big gun battery, somehow destroyed the offensive mentality that had given the Royal Navy such an advantage over its adversaries. Mahan, of all people, should have known that victory at sea had always gone to the side with the longer-range guns. At any rate, the validity—and inevitability—of the Dreadnought principle was seen in the simple
fact that after *Dreadnought*, no naval power ever built a battleship of the pre-dreadnought type.

There were no occasions for dreadnoughts to go into action until World War I began in 1914. However, from December 1907 to February 1909, the 16 battleships of the U.S. Navy’s Atlantic Fleet circumnavigated the globe. Not until the warships reached the Caribbean Sea were the crews notified by wireless that they were to circle the oceans, not just head for San Francisco by way of the Strait of Magellan. (The Panama Canal was still under construction.) President Theodore Roosevelt, a Big Navy advocate if there ever was one, had determined to impress the world that the United States had passed well out of its post-Civil War naval torpor and was now a global maritime power. He also wanted to demonstrate U.S. battleship strength to the Japanese, in the wake of deteriorating Japan-U.S. relations stemming from anti-Japanese riots on the Pacific Coast. The ships, with their white hulls and buff upperworks, were known ever after as the Great White Fleet. Their 45,000-mile voyage was a logistical, technical, and diplomatic triumph, particularly during the Mediterranean leg of the voyage, when some of its elements carried out humanitarian relief work after the great Messina earthquake. But it was also noted that the ships had to put in to foreign ports for supplies and coaling, and subsequent Senate hearings focused on the location of the ammunition magazines, which were directly below the gun turrets. Increasing world tensions led to a sober professionalism in the U.S. Navy, and it was finally realized that white ships made good targets; the entire U.S. fleet (and all others) was repainted in an obscure gray. (The land armies of the major belligerents of World War I experienced a similar enlightenment; all of them, even the romantic French after 1916, went over to somber shades of gray, brown, or blue uniform colors.)

In 1914, the Royal Navy could boast 20 completed dreadnoughts, Germany 13, the United States 10. The combined battleship fleet in service of the Allied Powers numbered some 49 compared to 32 for Austria-Hungary and Germany. Italy had one dreadnought (with three more on the way). The Russian Navy could deploy four dreadnought-type capital ships, all in its Baltic Fleet. Japan, which would soon join the Western allies, had four remarkable battle cruisers/fast battleships, the Kongos. Thus, the Triple Entente powers (Great Britain, France, and Russia) seemed to have a great advantage in modern capital ships. However, Germany had passed France as the second naval power, although the United States, which had no battleships in commission before 1890, was fast moving up. (It is a
common mistake to attribute the coming of World War I to a naval armaments race between Germany and Great Britain. In reality, earlier diplomatic crises notwithstanding, German-British relations were fairly good in 1914, and a cordial atmosphere prevailed between the two nations' fleets. The main German worry was the Russian army, allied with the revanche-minded French.)

When the United States entered the war in 1917 its navy could deploy some 14 excellent dreadnoughts. Yet it actually contributed only five, under the command of Admiral William S. Sims. Due to the British fuel oil shortage, they were all older coal-burners.

Dreadnought battleships were extremely expensive and typically consumed years in construction. With only two exceptions (Japan's *Ise* and *Hyuga*), no dreadnought under construction during World War I was completed in time for that conflict. USS *Tennessee*, for example, was laid down in May 1917 but was not completed until June 1920. And, of course, the designs for the two Japanese exceptions predated the hostilities by several years.

However, the belligerents' relative strength was considerably closer if one looks beyond numbers. Royal Navy ships were narrower in the beam than German ships, so as to fit into the British dockyards. (The Germans saw that the dock should be built for the ship, rather than vice-versa.) The greater beam of the German dreadnoughts meant that they could devote more space to watertight integrity. (In fact, no German dreadnought would be lost until World War II.) Further, even more space could be devoted to watertight subdivision because short-service German Navy crews lived in barracks ashore and thus did not require the greater habitability needed in British warships with worldwide commitments. (The British scoffed that the Germans were mere “soldiers at sea.”) Although earlier German capital ships could also devote more tonnage to armor protection, on the eve of war the armored proportions of both nations' dreadnoughts were almost identical.

Although the British docks could have been enlarged at great expense, their location could hardly be changed. These Royal Navy sites had been established during the Age of Fighting Sail, when France, Spain, and Holland were the main enemies—Germany as such did not yet exist. Only the gigantic fleet anchorage at Scapa Flow in the far North Orkneys could position the Grand Fleet to command the North Sea. (The Grand Fleet contained the Royal Navy's dreadnoughts, the Channel Fleet its pre-dreadnoughts.) But Scapa Flow was completely undefended in 1914. The French Navy found itself in roughly the same position; after battleship *Jean Bart* was torpedoed
(but not sunk), the French blockade of Austria-Hungary was removed first to Malta and then to the island of Cephalonia.

The German situation was just the opposite; two of their main naval bases were on the North Sea, and the third, Kiel, was accessible through the Kiel Canal, widened and deepened to take dreadnoughts by 1914. In fact, all the major German naval bases were connected by rivers and canals, and all the German coastal naval bases were heavily fortified.

The British were well behind in metallurgy. The RN had opted for wire-wound guns, a bad proposition from the start because the barrels tended to droop after only a few rounds were fired, leading to a consequent loss of accuracy. The Germans relied on built-up ordnance, with greater endurance, but then again the smaller-caliber German guns tended to jam more frequently. Still, the Royal Navy’s armor-piercing shells, filled with the unstable lyddite as a burster, tended to break up if they landed obliquely, rather than penetrating and bursting inside. (British seamen would cheer as they saw their shells burst against German flanks, not realizing that the explosions were often little more than fireworks displays.)

British cordite propellant tended to be unstable, as seen in the destruction of the pre-dreadnought Bulwark and dreadnought Vanguard by internal explosions during World War I. No German battleship suffered such a fate. (Neither did any U.S. battleship, unless one accepts the theory that an internal explosion, and not sabotage, destroyed Maine in Havana Harbor.)

Perhaps more significant was the Royal Navy’s emphasis on rapid fire: Projectiles and cordite propellant charges were carelessly left laying about as gun crews concentrated on pumping out shells. This habit made for impressive peacetime blanketing of the target, but it turned the lightly protected battle cruisers into death traps in the real world of naval combat.

British dreadnoughts overall were no less resistant to shell fire. For example, the super-dreadnought Warspite took 13 heavy hits and the battle cruiser Tiger 17 at the Battle of Jutland and both suffered only moderate damage. British mines, however, dismissed as the resort of weaker powers, were definitely inferior.

The Royal Navy also had much to learn about damage control, as demonstrated in the loss of the brand-new dreadnought Audacious, which foundered, despite prodigious efforts to save it, after striking a German mine and suffering relatively light damage in October 1914. Many supposedly watertight compartments proved to be anything but.\(^1\)
A significant cause for these significant qualitative differences in naval technology can be seen in the educational systems of the two powers. The Germans trained for the trades, the British for the professions. There were very few British captains of industry carrying doctorates, as was often the case with Germans. The Eton-Oxford graduate who could elegantly parse classical Greek hexameters was valued by the British middle- and upper-class education system far more than the grubby metallurgist and chemist (who were to remain “on tap, not on top”). More tangibly, it might also be that the Germans, with fewer battleships than the British, were simply more concerned about the safety of individual ships. Through World War I, they had lost only one, and that an elderly pre-dreadnought, at Jutland.

Knowledge of the shortcomings of Royal Navy battleships and equipment had not seeped down to the general public. Those who fretted about such matters concentrated on quantity, led by the jingoist press (“We want eight—and we won’t wait!”). Dreadnought had set off a race for capital ships, particularly between Germany and Great Britain, impelled by influential newspaper editors, journalists, and navy leagues in both nations. The race reached a peak in the panic of 1909, when Winston Churchill, at the time an opponent of naval expansion, contended tongue-in-cheek that the government had asked for four dreadnoughts, extreme navalists demanded six, and the government compromised at eight! Although this agitation focused almost exclusively on quantity, not quality.

Successive Royal Navy attachés stationed in Germany pointed out the sobering areas of capital ship inferiority. But apparently only one man worried about the qualitative state of the Royal Navy, and that was the commander in chief-designate of the Grand Fleet, Admiral Sir John Jellicoe. It was he who tried to bring these matters to the attention of the First Lord of the Admiralty (the political minister in charge), Winston Churchill. Jellicoe concluded that capital ships could not even be considered the equal of their German contemporaries, something of a stretch, as most historians would now agree. (But it should be noted that Jellicoe was an inveterate worrier, as will be seen in his actions at Jutland.) But at least publicly, Churchill proclaimed “the undoubted superiority of our ships, unit for unit.”

It was just as well that the public did not know of the Grand Fleet’s material failings; such knowledge might have undermined the main area in which the navy enjoyed unchallenged supremacy—the spirit of its officers and men. They knew that they were the inheritors of an unbroken 150-year tradition of naval warfare in which they had never been defeated in a major fleet action and had lost
precious few individual warships, and those mostly to their cousins, the Yanks. Still, the Royal Navy’s top commanders were for the most part a mediocre lot. Jellicoe himself has never been rated as one of history’s great naval commanders.

German naval commanders may have been more professional, but they seemed clueless in their relations with the lower deck. This attitude caused a mutinous, sullen, even revolutionary rot later in the war, which spread throughout the High Seas Fleet and would, in the end, lead to the downfall of the imperial monarchy. German naval officers tried to ape the manner of army contemporaries, with their greater prestige. Naval officers dueled, drank, ran up debts, and held unofficial courts of honor. The latter may have been somewhat misplaced: After the attempted mutiny on the dreadnought Prinzregent Luitpold, Admiral Reinhard Scheer, commander of the High Seas Fleet, slyly and personally sabotaged the appeal of two naval death sentences to the kaiser, although such appeals were a legal right. It could thus be argued that the personnel rot in the High Seas Fleet started at the very top.

The Royal Navy during World War I had no personnel problem like this one, but almost all the attention focused on the quantity of dreadnoughts, not their quality or that of their crews. Successive Royal Navy post-Dreadnought classes were basically improved versions of that pioneering warship. The next significant advance came with the Orions (Orion, Conqueror, Monarch, and Thunderer, constructed between 1909 and 1912). They were improvements over previous designs and were promptly called super dreadnoughts. Their new 13.5-inch guns gave considerably increased firepower for a small addition in weight and size; range was increased to a spectacular 24,000 yards. The Orions’ main batteries were arranged on a pattern pioneered by the U.S. Navy that would prevail until the last battleship was designed: All turrets were mounted on the centerline, and fore-and-aft turrets were superimposed one on the other, a vast improvement on the German and previous RN wing turrets. The Orions’ armor was extended up to the main deck, eliminating a major weakness of the early dreadnought classes. Still, they suffered from the same lack of beam, which gave inferior underwater protection compared to the German ships. The unsound British argument was that greater beam made the ship more unsteady and reduced speed. The Orions, as noted, were also the last RN dreadnoughts to position their firing platforms directly abaft the forward funnel.

The next major advances in battleship design were seen in the five impressive Queen Elizabeths (Queen Elizabeth, Valiant, Barham,
Well ahead of anything the German Navy would produce, they were confidently designed to outrace a retreating enemy fleet.

The Queen Elizabeths were the world’s first large oil-burning warships. The Admiralty knew full well that the Germans would be unlikely to go over to oil-burning entirely, as the Germans, unlike the British, were presumed to lack an assured oil supply in wartime. (Of course, with their penchant for invading other countries, the Germans might have been expected to take over Romania’s oil fields, which is what they later did in World War I.) Also, oil gave considerably greater thermal efficiency, discharged much less smoke, and released all personnel from the filthy, time-consuming bondage of coaling. Oiling was simply a matter of running out hoses and opening valves. Thus Great Britain, with no domestic oil resources of its own, had given hostages to the world’s petroleum producers.

The Queen Elizabeths were also the first to mount 15-inch main battery guns, and all five units fired those guns at Jutland. They and two units of the following Revenge class (Revenge, Royal Oak, Ramillies, Resolution, and Royal Sovereign, completed 1916–1917) were the last RN battleship class to fight in World War I and, with the Elizabeths, were the only capital ships of any naval power to use their main guns against enemy battleships in both world wars. (Three more units, Renown, Repulse, and Resistance, were suspended, then canceled in 1914 at the outbreak of war.)

Three of the most unusual dreadnoughts of the era were the Brazilian sister ships Minas Gerais and Sao Paulo, as well as Rio De Janeiro/Agincourt. The three were built in British yards for Brazil, a nation flush with prosperity from rubber. Minas Gerais and Sao Paulo were constructed as answers to the powerful dreadnoughts being built (also in Great Britain) for Argentina and Chile. When completed in 1910 with their twelve 12-inch main guns, they were the world’s most powerful warships. But the Brazilians then ordered an even larger dreadnought, Rio De Janeiro, laid down, with far more firepower in its 12 14-inch main battery than any other dreadnought on the stocks. But severe economic difficulties and a mutiny aboard Minas Gerais dampened the nation’s nascent naval gigantism, although Brazilian naval circles pressed for an even larger fourth dreadnought. After declaring war on Germany, Brazil offered to send its two dreadnoughts to serve with the Grand Fleet, but the British refused; the warships were already in poor condition and lacked modern fire control equipment. The British were not just being picky: When Sao Paulo sailed for New York to have its deficiencies
corrected, it broke down along the way. Minas Gerais was modernized in the 1930s and was broken up in 1954. Sao Paulo was never modernized due to its deterioration. It was sold for scrap and sank while under tow to the ship breakers in 1951.

Rio De Janeiro/Sultan Osman I/Agincourt, the third of the Brazilian super-dreadnought trio, was completed in August 1914 as the most heavily gunned battleship of World War I. In early 1914, the Brazilians had more second thoughts and sold the warship to the Ottoman Turks. But the new dreadnought was expropriated by the British, fearful that so powerful a warship would fall into the hands of a government that was already sliding over to the enemy side. This high-handed action, of course, simply confirmed the Turks in their turn to the Central Powers. Named Agincourt by the Royal Navy, the warship mounted no less than 14 12-inch heavy guns in seven turrets. It was said that when it fired its full battery (which it did only once in battle, at Jutland) it looked as though the ship were exploding. Agincourt was scrapped in 1922.

If the Turks had any residual thoughts of remaining neutral in the expanding war, Winston Churchill helped to make up their minds by ordering the seizure of another of their nearly completed dreadnoughts, Reshadieh (formerly Reshad V), being built by Vickers for Turkey. Renamed Erin, it fought at Jutland and was scrapped in 1923. The Turks could be said to have more than gotten their own back when they later turned the naval invasion of their Dardanelles Straits into a graveyard for Allied battleships (in other words, revenge).

Chile also had paid for two dreadnoughts to be built in Britain, Almirante Latorre and Almirante Cochrane, with the Brazilian super-dreadnoughts in mind. Even the high-handed Churchill realized that there could be no question of seizing the paid-for battleships of a friendly power; instead the two dreadnoughts were purchased from Chile. Almirante Latorre was completed as Canada and also fought at Jutland. After the war, it was returned to Chile (although the British taxpayers had already paid for it), was modernized in 1929–1931 in Britain, suffered a short-lived crew mutiny in September 1931 (the same year of the Royal Navy mutiny at Invergordon), and was scrapped as late as 1959.

The Admiralty suspended work on Almirante Cochrane, which had been completed up to the forecastle deck, with boilers and engines installed and the hull plated over. Here was an ideal candidate for an aircraft carrier, and as HMS Eagle, the former Almirante Cochrane served in the Royal Navy until sunk by a German U-boat in August
1942. All of the foreign dreadnoughts in RN service were scrapped soon after World War I, sacrifices to the Washington Treaty.

Argentina’s only two dreadnoughts, *Rivadavia* and *Moreno*, were built in the United States and completed in 1914 and 1915, respectively. They were laid down in response to Brazil’s Minas Gerais class and closely resembled U.S. Navy dreadnoughts of the period. Both led uneventful but lengthy lives, not being scrapped until 1956.

The last odd armorclad warships to enter the Royal Navy were the series of coast bombardment monitors, mounting from 9-inch to 15-inch main guns. They gave good service, several of them seeing action in both world wars. The Royal Navy continued its interest in monitors, constructing two more (*Abercrombie* and *Roberts*) with 15-inch guns as late as World War II. The idea made sense: The Royal Navy had a surplus of guns from various canceled battleship and battle cruiser programs, and they could be mounted cheaply enough on these slow monitors; if they were sunk in their shore bombardment duties, it was no great loss. In fact, no RN monitor was lost during World War I, and only one, *Terror* (a World War I design) was lost during World War II, off the Libyan coast in February 1941.

Italy also built monitors in World War I, mounting heavy naval guns on a wide variety of hulls. The largest single Italian monitor, *Faà di Bruno*, used two main battery 15-inch guns from the never-completed battleship *Cristoforo Colombo* of the never-completed Caracciolo battleship class. *Faà di Bruno* was also used for the defense of Genoa during World War II. Other Italian monitors included a former Austrian barge, *Monfalcone*, which carried one 12-inch gun. *Vodice* was another former Austrian ship, a lighter that also carried one 12-inch gun. The largest monitor class was the Monte Grappas, the only Italian warships designed as such from the keel up that also utilized the main guns from the never-completed Caracciolo. They were not completed in time for World War I service and were stricken in 1924. Only slightly smaller than the Monte Grappas, the Monte Santo-class monitors were, again, two former Austrian barges that somehow also carried one 15-inch gun each intended for the Caracciolo class. The remainder of Italy’s monitor fleet used captured Austro-Hungarian hulls to mount smaller main guns. Their effectiveness in battle is undetermined.

Germany’s first dreadnought-type battleships were the Nassau class (*Nassau*, *Westfalen*, *Rheinland*, and *Posen*, completed in 1910). These warships represented no great advance over *Dreadnought*, but the German Navy did enjoy certain areas of distinct superiority over its RN rival that would persist through World War I. All four Nassaus
fought at Jutland. The following Helgoland class (*Helgoland*, *Ost-friesland*, *Thuringen*, and *Oldenburg*, completed 1911–1912) were improved Nassaus and also fought at Jutland, as did the succeeding Kaisers (*Kaiser*, *Friederich der Grosse*, *Kaiserin*, *Koenig Albert*, and *Prinzregent Luitpold*, completed 1912–1913). These German battleships pioneered super-firing guns and were the first with turbine drives (only one German firm could manufacture large turbines, and von Tirpitz at first reserved its products for his cruisers). Oddly and uniquely, their super-firing turrets were mounted aft only (leading to some British jokes about the Germans taking pains to cover themselves in retreat). They and the succeeding Koenig class (*Koenig*, *Grosser Kurfurst*, *Markgraf*, and *Kronprinz*) also fought at Jutland. The latter class was completed in 1914 and was the last to carry wing turrets, whose arc of fire was constricted by the warship’s superstructure to something like 50 percent of possible sweep.

The last class of German battleships to fight during World War I were the Bayerns (*Bayern* and *Baden*, completed in 1916; two sisters were uncompleted by war’s end). These were the first German battleships to mount 15-inch guns, and they each carried three oil-burning boilers. The remaining 11 boilers were still coal-fired, although oil could be sprayed over the coal to aid combustion. Although neither completed unit was finished in time for Jutland, *Baden* did have an adventurous career: It set out on 18–19 August 1916 against British coastal targets but was nearly cut off by the Grand Fleet; it sortied in the North Sea two months later, then bombarded Russian shore targets in the Baltic Gulf of Riga in the month of the Russian Revolution (October 1917); and it participated in the fruitless High Seas Fleet sweep toward the Norwegian coast in April 1918. Beached by British crews at the Scapa Flow *seppuku*, *Baden* was carefully examined by RN constructors. Its construction was found to be in no significant way superior to contemporary RN battleships. (*Baden* was expended as a target ship in 1921.)

The U.S. Navy, full of imperial visions in the wake of the triumphant Spanish-American War, had every expectation of soon surpassing the size and strength of the Royal Navy. As it was, the U.S. Navy trumped *Dreadnought* with its new South Carolina class (*South Carolina* and *Michigan*, completed in 1910) by arranging all of their heavy guns line-ahead, one turret mounted over another, a design pattern that all dreadnoughts would follow. The British and the Germans persisted in mounting wing turrets until the former’s Orions, laid down in 1909, and the latter’s Koenigs, laid down in 1911. But the U.S. designers hesitated to install turbines, so the South Caroli-
nas had a speed some three knots slower than Dreadnought. The South Carolinas thus were not deployed to European waters during World War I and, in some circles, were not even considered to be dreadnoughts. At any rate, the Americans built their battleships for long range and protection, sacrificing some speed in the process.

The dreadnoughts of the U.S. Navy that came closest to the British ideal were the Delawares (Delaware, North Dakota, also completed in 1910). Delaware retained reciprocating engines, presumably for greater long-range cruising economy, although its sister ship had U.S. Curtis turbines. (As noted, the United States was the only other nation at the time besides Great Britain that could manufacture large turbines to its own designs. More surprisingly, U.S. battleships did not go over to oil fuel until the Nevadas of 1912 (Nevada and Oklahoma, the latter retaining reciprocating triple-expansion engines, the world’s last capital ship to do so). This persistence in coal fueling was odd in light of large domestic U.S. oil supplies.

The Americans were somewhat ambivalent about whom they were building these battleships against. Great Britain? Japan? Germany? Conversely, those nations, as well as Austria-Hungary, France, Italy, and Russia, knew exactly the identities of their potential enemies.

France’s first dreadnought-type battleships, designed to counter Germany and Austria-Hungary, the Courbet class (Courbet, France, Jean Bart I, and Paris, completed 1913–1914) had a curiously predreadnought appearance with their high freeboards and five funnels. But they were turbine-driven, carried 12-inch guns, were much larger than their immediate predecessors, and in some cases were even more long-legged than their RN contemporaries. All four units served in the Mediterranean, where the Austrian submarine U-12 torpedoed Jean Bart in its wine store, although it survived this cruel blow. Courbet sank the Austrian cruiser Zenta on 16 August 1914.

The Austro-Hungarian navy, facing France and later Italy, could boast only one dreadnought class, the four-unit Tegetthoffs (Viribus Unitis, Tegetthoff, Prinz Eugen, and Szent István, laid down between 1910 and 1912 and completed between 1912 and 1914). Their battle honors consisted of only a single shore bombardment of the Italian coast, in May 1915. These were unlucky warships: Szent István was sunk by an Italian torpedo boat in June 1918, Viribus Unitis by a limpet mine laid by two Italian frogmen after the battleship had been handed over to the Yugoslavs. Tegetthoff was ceded to Italy, and Prinz Eugen to France. There were no clashes in the Mediterranean between Austrian and Italian dreadnoughts.
The three Italian immediate pre-dreadnoughts, the Vittorio Emmanuele class (Vittorio Emmanuele, Regina Elena, and Napoli, completed 1907–1908), actually saw more action during World War I than did Italy’s dreadnoughts, carrying out shore bombardment missions against the Austrians.

Italy’s first dreadnought, Dante Alighieri, was completed in 1913. It was the first capital ship with triple main gun turrets (12-inch guns) arranged along the centerline. It was considered the fastest battleship in the world at the time, although its speed, typical for Italian battleships, was gained at the expense of armor. Dante Alighieri participated in only one action during World War I, the bombardment of Austrian-held Durazzo, Albania. Its design, with amidships turrets, precluded any serious modernization, and it was scrapped in 1928. Italy’s two subsequent dreadnought classes, Cavour (Conte di Cavour, Giulio Cesare, and Leonardo da Vinci, completed 1914–1915), and Doria (Andrea Doria and Caio Duilio, completed in 1916 and 1915, respectively) did not participate in World War I. The Italians do have the distinction of being the only naval power to name a battleship after a poet, Dante Alighieri, and an artist, Leonardo da Vinci. (The French did name an armored cruiser after a historian [the Jules Michelet] and a theologian [the Ernst Renan].) Italy also laid down four units of the Caracciolo class, but these first Italian super-dreadnoughts (31,400 tons and 15-inch guns) were never completed, for the same reasons the other naval powers mostly stopped dreadnought construction during World War I: lack of steel and other materials due to their diversion to the construction of submarines, destroyers, and light craft.

The Russian battleship fleet comprised only two classes of dreadnoughts. The first, the Ganguts (Gangut, Sevastopol, Petropavlovsk, and Poltava—all completed in 1914), had a poor reputation and saw very limited service during World War I. All four cost far more than the original budgets, and they were so delayed by design faults and shipyard blunders that they were obsolete when finally launched. The engines and turbines had to be supplied by foreign firms, although the guns were of excellent Russian manufacture. They were, in fact, something of a combination battleship/battle cruiser and were sometimes referred to as Baltic dreadnoughts, with armament heavier than one-third of contemporary German and Royal Navy capital ships, but primarily designed for close-in waters, such as the Baltic Sea and Black Sea. These four dreadnoughts epitomized the turmoil of the late czarist and early Soviet periods. Gangut’s crew mutinied in October 1915, ostensibly because of poor food, and
attacked some of the officers. The uprising was not quelled until the imperial government surrounded the dreadnought with torpedo boats and submarines, threatening to send it and its seditious crew to the bottom. The mutiny had its effect, however, as a planned naval sortie had to be canceled. By the time of the Bolshevik Revolution, the Ganguts were under the influence of the Leninists. All four were taken over by their revolutionary crews, presented to the Soviets, given appropriate revolutionary names (Gangut—Oktiabrskaja Revolutsia; Sevastopol—Parizskaja Kommuna; Petropavlovsk—Marat; Poltava/Frunze) and saw some service during the Russian civil war. All but Poltava/Frunze (damaged beyond worthwhile repair by a boiler-room fire) were extensively rebuilt in the 1930s, probably a case of throwing good money after bad.

During World War II, the three surviving units were used as stationary batteries. Murat reverted to its original Petropavlovsk name (when prerevolutionary themes became more acceptable during World War II), then as an artillery ship it was renamed Volkhov. The Soviet Union was never forthcoming as to the history and fate of its weapons, and it can only be said as a matter of informed speculation that the ships were broken up in the 1950s. (One source has Sevastopol in existence but inactive as late as 1958.)

The second Russian dreadnought class was the unlucky Imperatritsa Mariya (Imperatritsa Mariya, Ekaterina II, and Imperator Alexandr III, completed 1915–1916). These were true dreadnoughts and were able to tip the balance of naval power in the Black Sea to the Russian side. Imperatritsa Mariya and Ekaterina II clashed on three separate occasions with the German battle cruiser Breslau. Another of those common and mysterious magazine explosions sank Imperatritsa Mariya in 1916. After experiencing a Bolshevik mutiny in November 1917, Ekaterina II (Svobodnaja Rossija after April 1917) went over to the Red side and was sunk by torpedoes from a Russian torpedo boat to prevent its falling into the hands of the Germans. Imperator Alexandr III was renamed Volya after the February 1917 revolution even before the ship was completed. It was taken over by the temporarily independent Ukraine in April 1918 but was later seized by the Germans, who commissioned it Volya once again. The fortunes of war saw it temporarily under the control of the interventionist British who, in November, turned it over to anti-Bolshevik forces under Baron Petr Wrangel, who recommissioned it General Alekseev. After the collapse of the Wrangel forces in the Crimea, the ship (easily the most-renamed battleship in history) proceeded to Bizerta off French North Africa in October 1920. Decommissioned
in 1924 and badly deteriorated, it was spared yet another name and ownership change when the Russians refused a French offer; it was finally scrapped in 1936. *Imperator Nikolai I/Demokratiya*, basically a repeat of the *Imperatritsa Mariya*, was never completed; its incomplete hull was seized by the Germans, then was destroyed in 1919 by the British to prevent its capture by the Reds.

**DREADNOUGHT BATTLESHIPS AT WAR**

As late as 1911, the Royal Navy had considered a close blockade of Germany, in blissful disregard of the rapid developments in mines and torpedoes. More sensible counsel prevailed only at the very eve of war in July 1914, when the British Admiralty finally ordered a distant blockade of the German coast, upsetting von Tirpitz’s carefully drawn plans to decimate a British blockading fleet with torpedo and submarine attacks.

The Germans, for their part, rejected the earlier *riskflotte* strategy, in which they hoped to build a navy powerful enough to damage the Royal Navy sufficiently to deter any British aggression. The German naval command, not completely aware of the British switch to a distant blockade strategy, by 1914 actually planned to whittle down the British blockading fleet with clever ambushes so that eventually Der Tag (the great day of reckoning and victory) would when they challenged the Royal Navy head-on in a “super-Trafalgar” of Mahanian proportions. Yet the battleships of the German High Seas Fleet and the British Grand Fleet would meet only once on any great scale.

Far more indicative of future action was the loss early in the war of four elderly battleships, evenly divided between the British and the French, on 18 March 1915, by Turkish mines during the opening of the Dardanelles expedition against Turkey to open the Black Sea. The Dardanelles expedition did not involve battleship-to-battleship combat; it remained a ship-to-shore clash, involving no less than 18 battleships. The idea was to force Turkey out of the war and open Russia to the West by forcing a passage through the Turkish Dardanelles Strait, the entrance to the Black Sea.

Ignoring informed opinion—based upon historical events indicating that ships could not prevail against forts without powerful troop reinforcements—the First Lord of the Admiralty, Winston Churchill, insisted that a fleet alone could succeed, if it were powerful enough. The Turks had no warships in the area but, under German supervision, had
reinforced their coastal batteries and laid minefields. Divided counsels and a lukewarm attitude among most commanders saw to it that the expedition was doomed from the start. The tactical crux of the problem was that the Turkish forts could not be effectively attacked because of the minefields, and the minefields could not be swept because of the forts. And although the outer gun emplacements were effectively silenced, the naval guns could not hit the mobile Turkish howitzers. The Admiralty then turned cautious, demanding the conservation of heavy shells, an odd requirement given the task assigned a fleet of such size. The minefields remained unswept in the face of withering fire on the sweepers and trawlers.

Nonetheless, the great push was set for 18 March 1915. The largest fleet of capital ships ever assembled in the Mediterranean, consisting of 18 capital ships, including one new super-dreadnought (*Queen Elizabeth*), one new RN battle cruiser (*Inflexible*), and 12 British and four French pre-dreadnoughts leading the way against some 100 Turkish guns.

The fleet came under immediate fire from the Turkish mobile batteries. *Inflexible* was so badly hit (29 killed) that it had to limp to Malta for major repairs. The French pre-dreadnought *Gaulois* was repeatedly hit and had to be towed out of the line and beached. Soon after, another French pre-dreadnought, *Bouvet*, was either hit by 14-inch Turkish shells or was mined; it blew up with the loss of 700 crewmembers and was the first French armored ship sunk by an enemy. Unaware that it had run into a new minefield in waters swept and believed safe, the British pre-dreadnought *Irresistible*, its two turrets already put out of action by Turkish batteries, struck a mine and had to be abandoned, although with minimum loss of life. The Dardanelles had claimed another unhappy first: *Irresistible* was the first British armored warship lost in combat. A few hours later, yet another RN pre-dreadnought, *Ocean*, damaged by gunfire and having struck a mine, had to be abandoned—the second British battleship lost in combat. Other battleships were damaged, including the French pre-dreadnought *Charlemagne*, with a stokehold flooded; and the RN pre-dreadnoughts *Agamemnon* (12-inch gun disabled) and *Albion* (fore turret out of action). Allied casualties were at least 800, the Turks about 24. (It was small compensation that five months later the British submarine *E 11* torpedoed and sank the elderly Turkish battleship *Heireddin Barbarossa* [formerly the German *Kurfurst Friedrich Wilhelm*].) Churchill urged a second attempt on the straits but, understandably, was overruled. With four battleships sunk, the remote Dardanelles had become a graveyard of
capital ships. No greater number would be sunk in any single naval battle in either World War I or World War II.

Closer to home, British battleships had been engaged in shore bombardment of the German-occupied Belgian coast from the early months of the war. Pre-dreadnought Revenge, its original 13.5-inch guns relined to 12-inch bore for greater range, and fitted with temporary bulges to lower the draft, was heeled far over to provide effective long-range bombardment of Zeebrugge and Ostend.

The anticipated super-Trafalgar did come with the Battle of Jutland (31 May–2 June 1916), by far the largest clash of battleships in history, the penultimate battle of capital ships that would supposedly settle the fate of empires on the high seas—the reason battleships were constructed in the first place. Almost all of the dreadnoughts possessed by the antagonists were deployed in this clash, giving the Royal Navy nearly a two-to-one battleship superiority. But this great sea battle, imagined by all naval commanders since the Age of Fighting Sail, would prove as tactically inconclusive and as frustrating as the trench warfare on the Western Front. Jutland would be no Trafalgar for the British—no Der Tag for the Germans. The outcome was something less for both sides, and the battle has remained a source of controversy, at least among the British, through the remainder of the century. The Germans simply pointed to the much heavier British losses in men and ships.

The Royal Navy’s Grand Fleet certainly had a strong advantage in numbers, with 28 battleships and nine battle cruisers, against the German High Seas Fleet’s 16 battleships, six pre-dreadnoughts, and five battle cruisers. Admiral Sir John Jellicoe commanded the Grand Fleet, Admiral Reinhard Scheer the High Seas Fleet.

The opening battle-cruiser phase went very badly for the Grand Fleet. The British battle cruiser commander, Sir David Beatty, allowed himself to be lured toward the battleships of the Grand Fleet, and his warships came under heavy and accurate German fire: No less than three Royal Navy battle cruisers were lost. Indefatigable was blown up by German battle cruiser Von Der Tann with no less than three shells from a four-gun salvo at 16,000 yards, an indication of German gunnery precision. Queen Mary and then Invincible blew up with catastrophic loss of life, provoking Jellicoe’s famous laconic remark to his gunnery officer: “Something seems to be wrong with our bloody ships today, Chatsworth.” By contrast, only one German battle cruiser was ever lost (then or later), although some were hit and badly damaged. The problem lay in the Royal Navy’s poor explosives and shell handling, as well as skimpy armor, and, perhaps, better
German optics and nighttime tactics. German gunnery was only slightly better than that of the British, scoring 3.3 hits to the Grand Fleet’s 2.7 overall.

Beatty then reversed his wounded squadron and fell back toward the Grand Fleet. The inexplicable absence of the 5th Battle Squadron, composed of the Grand Fleet’s newest dreadnoughts, the fast Queen Elizabeths, was keenly felt.

In the clash of armored, big-gun titans, the two great fleets met three times, and the Germans suffered heavy damage. On both occasions, Jellicoe was actually crossing the Germans’ $T$, getting them within range and taking them by surprise. But each time, an unfazed Scheer abruptly and brilliantly turned each of his warships about, escaping the guns of the Grand Fleet. With the third turn away, the Germans headed for home, this time under cover of darkness, and escaped. The British commander declined to follow, fearing submarine attacks. Scheer was later criticized for his turn-away maneuver, but not nearly as much as Jellicoe for turning away from German torpedo boat attacks. (The general opinion was that “Nelson would have turned toward the fellows, dammit!”)

Not one dreadnought was sunk or even seriously damaged at Jutland, and only one battleship, the elderly German pre-dreadnought *Pommern*, was lost, blown up with all hands in the latter stages of the battle. *Pommern* was the only German battleship to be sunk in war or peace until World War II. (There was no good reason for Scheer to have allowed the slow and vulnerable pre-dreadnoughts into his battle line; this was a mistake that Jellicoe never made.) But the Royal Navy had lost heavily in battle cruisers, the lightly armored capital ships that followed First Sea Lord Admiral Sir John Fisher’s glib dictum that speed equals armor. Speed was not sufficient to save *Indefatigable*, *Queen Mary*, and *Invincible* from blowing up.

It was not a satisfying outcome for either side. The Germans had inflicted much heavier casualties on the British in both ships and men (6,094 British versus 3,058 Germans). But the Germans had fled. (As an American newspaper writer at the time accurately put it, “The German fleet assaulted its jailer, but is still in jail.” Spector, p. 92.) By 2 June, Jellicoe reported that the Grand Fleet was again ready for battle, whereas it took the High Seas Fleet weeks, if not months, to achieve a similar status. The High Seas Fleet was never risked in battle again, although it did sortie unsuccessfully in August and October 1916. The strategic results of the Battle of Jutland basically confirmed the status quo: Britannia ruled the waves—but below those waves matters were considerably different.
Yet had Germany's High Seas Fleet won a Trafalgar-type victory, would it really have mattered as much as most writers claim? A German victory at sea, although certainly a heavy blow to British morale, would not have decisively interfered with Britain's vital supply ships, considering the short ranges of the German battleships. It is also difficult to see how the German High Command could have diverted sufficient troops for an invasion of the British Isles while maintaining Germany's positions in France and Russia. Britain would have maintained its superiority in battleships and cruisers to continue the German blockade. Admiral Scheer himself wrote, “even the most successful result from a high seas battle will not compel the English to make peace” (Sir Winston Churchill, *The World Crisis*, New York: Charles Scribners’ Sons, 1931, p. 104). Still, it could be argued that the resulting loss of British morale might have forced the British government into some sort of negotiated settlement with imperial Germany.

The naval battle that became critical to the military and naval situation was the Germans’ unlimited submarine campaign and the Allies’ countermeasures. The Western Allies would win that battle by using convoys, and Germany’s unrestricted submarine warfare eventually impelled the United States to enter the war, thus sealing Germany’s fate. As early as October 1916, Jellicoe asserted that protecting commerce had become the Royal Navy’s most pressing question. He did not, however, propose any measures to solve the U-boat attacks on merchant shipping. The obvious answer was the convoy, but that would require considerable pressure from Prime Minister David Lloyd George and the U.S. naval commander, Admiral William Sims, as the United States entered the war. But Jellicoe was acknowledging reality. The merchant ship convoy system was completely successful, and the worst crisis of the war for the Western Allies passed.

Post-Jutland, Germany passed up a real opportunity to affect the course of the war with its surface fleet. A handful of fast and powerful battle cruisers could have wreaked havoc with hit-and-run raids among the troopships carrying the American Expeditionary Force to France (Germany’s later battle cruisers certainly had the range). The mere threat of such an action would have caused the Allies nightmares and lead to a vast diversion of resources from European home waters. This was precisely the mission undertaken by German battleships and battle cruisers through much of World War II (but Germany lacked sufficient numbers of battle cruisers in that conflict).

In the months after Jutland, Germany’s High Seas Fleet seldom ventured out, becoming almost a minor distraction compared to the U-boat war. Both sides seem to have instinctively recognized the ir-
relevance of the dreadnought—but dared not draw such a conclusion openly. Nonetheless, the British Grand Fleet absorbed the lessons of Jutland and became a much better fleet compared to 1916; the High Seas Fleet, by contrast, deteriorated in both men and materiel.

Aside from Jutland, only one other battleship-to-battleship action took place during World War I, a small-scale clash in the Gulf of Riga. On 11 October 1917, the Russian pre-dreadnoughts Slava and Tsarevitch exchanged fire with the German dreadnoughts Koenig and Kronprinz. The elderly Russian warships put up a spirited fight in the unequal contest, but Slava, disabled by several German hits, had to be abandoned and was torpedoed by the Russians.

The German battle cruiser Goeben also clashed on two occasions with the Russian pre-dreadnoughts Evstafi, Ioann Zlatoust, Pantelimon, and Tri Svititelia in the Black Sea. (The last must have been the oldest battleship to fire its main batteries during combat in World War I.)

Meanwhile, the German High Seas Fleet deteriorated during its prolonged inactivity. As early as July 1917, seamen of the battleship Prinzregent Luitpold mutinied, as did those of the Austro-Hungarian pre-dreadnought Monarch in February 1918, but both uprisings were suppressed. The declining relevance of battleships toward the end of the war was seen in the High Seas Fleet’s last sortie: an unsuccessful April 1918 expedition up the Norwegian coast to destroy British-bound convoys. Six months later, that fleet’s command prepared for a Wagnerian “ride of death” at the Grand Fleet, to die in glory if need be. (According to some accounts, the kaiser was to accompany the last ride.) But disaffected German seamen, ashore and idle too long, hungry, and riddled with Bolshevik agitation and propaganda, and in no mood for grand gestures, mutinied on 28 October, refusing to put to sea for such a mad venture.

The dénouement of the battleship in World War I was a grand saga of self-destruction. The Western Allies in November 1918, as part of the Armistice that ended the war, ordered that the High Seas Fleet be interned at the Royal Navy’s Scapa Flow anchorage, pending a share-out among the victors of the best units. (The escorting Allied fleet and the German High Seas Fleet represented the greatest concentration of capital ships since the Punic Wars.)

At Scapa, the idle German warships grew unkempt and rusty; their shabby, idle crews, depressed even further, dreamed of sailor’s communes; others simply became homesick under the perpetual gray skies of cheerless Scapa. Meanwhile, the Allies argued over
who should get what and how much. But Germany’s naval com-
mand would not be cheated of its final _Gotterdammerung_ (twilight
of the gods), and the German commander at Scapa gave the order
on 21 June 1919 to scuttle all vessels. Ten of eleven battleships
went to the bottom, defiantly breaking out the forbidden imperial
German naval ensign on their way down.

The Allies initially reacted with rage to this mass naval _suppuku_,
but soon enough they agreed, with some relief, that the vexing ques-
tion of who got what had been rendered moot. Battleships rarely
seem able to transfer effectively from one flag to another, and the
more modern of those that were handed over in the wake of World
War I were expended as targets. For example, the Royal Navy re-
fused even the latest German battleship, _Baden_, and immedi-
ately offered up its purchased dreadnoughts to the Washington Treaty’s
battleship tonnage limitations.

_Baden_ had been saved from the Scapa sinkings by alert RN tugs
and was carefully examined; this latest example of German battle-
ship construction revealed no significant improvement on British
shipbuilding. It was expended as a target ship.

Elderly Austro-Hungarian pre-dreadnoughts were handed over to
France, Great Britain, Italy, and Yugoslavia, but none entered active
service with their new owners, and all were soon scrapped. The few
exceptions were the capital ships taken over by Great Britain in the
shipyards from foreign customers on the eve of war (they had never
flown an alien flag in the first place), in addition to the battleships
seized as war booty by the Japanese during the Sino-Russian War.
The Japanese were the only naval power to retain enemy battleships
for any length of time. They actually resold some battleships taken
as booty during the Russo-Japanese War to Russia during World
War I as an expression of Allied amity.

Regardless of the Dardanelles disaster and the Scapa capital-ship
suicide, World War I had demonstrated the impressive resistance of
the dreadnoughts. Only six were lost (four to enemy action) be-
tween 1914 and 1918. Two of the lost dreadnoughts were Austro-
Hungarian: _Szent Istvan_, sunk by an Italian motor torpedo boat off
Premuda on 10 June 1918; and _Viribus Unitis_, dispatched by an Ital-
ian explosive charge at Pola on 10 November 1918. The Austrians
may have somewhat evened the score by sinking _Leonardo da Vinci_
on 2 August 1916 with a sabotage charge. (Some claimed that this
was another “accidental” battleship magazine explosion.) One
British dreadnought, HMS _Audacious_, was lost to a German mine
on 27 October 1914. Two dreadnoughts were lost to yet more inter-
nal explosions: Japanese *Kawachi*, in Tokuyama Bay on 12 July 1918, and Russian *Imperatritsa Mariya*, at Sevastopol on 20 October 1916. Not one dreadnought was lost during World War I solely to naval gunfire or even to submarine torpedo.

Still, no less than 23 pre-dreadnought battleships were lost during that conflict, but even among these elderly and vulnerable warships, only one, *Slava*, was perhaps sunk by gunfire alone. The rest of the pre-dreadnoughts were lost to torpedoes, mines, and those mysterious explosions that struck with disastrous loss of life and that, for the most part, have never been fully explained. These internal explosions become more mysterious when it is realized that cruisers, which also have huge stores of explosives aboard, were not similarly fated and that no ironclad was ever lost in this way. It may be surmised that the answer is in the considerably greater storage area of battleships compared to other types of warships.

It can be argued that the naval blockade against the Central Powers, as much as the great land campaigns, brought about the victory in World War I. Well before the final months, Germans and Austrians were close to starvation, and food riots broke out in the last weeks of the war. The Central Powers were brought to this state by the relentless Allied naval blockade. By way of contrast, the Allies could purchase practically every conceivable commodity needed from abroad and bring it home after they (belatedly) instituted convoys. (For a while, by some fluke of the food importation system, pineapples were selling more cheaply in Great Britain than potatoes. Germans, by contrast, were barely existing on turnips during the infamous “turnip winters” of 1917 and 1918.)

It can be asserted that by 1918, it should have been apparent to the naval powers that the battleship was irrelevant and that Germany had nearly forced Great Britain to the conference table with unrestricted submarine warfare, not by any great clash of surface titans. Certainly Fisher and Percy Scott (who basically had taught the Royal Navy how to shoot), and the farsighted Americans Admiral William Sims and Admiral Bradley Fiske (who had patented a torpedo-bomber as early as 1912), foresaw the replacement of the battleship by the aircraft carrier. Yet they did not seem to have envisioned, even with the German example plainly before them, the possibilities of submarine warfare against commerce. The victorious naval powers would actually extend the dreadnought construction race into the post-World War I years. They would continue during the interwar decades, along with the Italians, the Germans, and the Japanese, to build battleships designed to fight other battleships.
Finally, among the lesser naval powers, only Russian battleships did battle with enemy battleships, and very little at that. U.S. and Japanese battleships never fired their main guns in anger at all throughout World War I. When their dreadnoughts' main batteries opened fire in battle, it would be at one another in the Pacific during World War II.

NOTES

1. The Admiralty spent almost as much energy in keeping secret the loss of this modern unit of the Grand Fleet as it did in saving the dreadnought. Unfortunately for their efforts, numerous U.S. passengers on board the liner *Olympic*—sister ship to lost *Titanic*—had witnessed and, in some cases, actually photographed the dreadnought's foundering.

2. Beatty's own flagship would undoubtedly have suffered the same fate were it not for the heroism of the mortally wounded Marine turret captain, F.W.J. Harvey, who flooded his turret after a direct hit and was posthumously awarded the Victoria Cross.
The demise of the battleship had been loudly proclaimed during the immediate post-World War I years by a flamboyant U.S. Army Air Corps general, William “Billy” Mitchell. Mitchell was able to arrange a series of tests of bombers (but not torpedo-bombers; Mitchell despised naval aviation) versus battleships off the Virginia Capes in June 1921 that resulted in the sinking of the elderly German Jutland veteran dreadnought Ostfriesland. (Mitchell’s bombers also sank two U.S. Navy pre-dreadnoughts, Alabama and Virginia, three months later.) The world was mightily impressed by the silent newsreel film of spectacular explosions and of battleships heading for the bottom, all at the hands of a few aerial bombs. But more careful analysis would have made clear that these were anything but hard battle tests: The target ships were dead in the water, and of course they carried no crews. Thus there was no evasive maneuverings, no antiaircraft return fire, and no damage-control parties plugging holes, pumping out seawater, and fighting fires. Even so, Ostfriesland and the other target ships absorbed a vast amount of aerial punishment before sinking. And, as noted, no battleship in World War I was sunk by airpower; the great killers of battleships were the naval mine and the submarine torpedo. Even then, only a handful of dreadnoughts had been sunk from any cause. Yet the myth firmly endures to this day: Billy Mitchell “proved” that battleships could be sunk by aircraft. The French, at roughly the same time, and the British, much later, conducted similar tests on surrendered German
and Austrian capital ships and also found them quite difficult to sink.

In fact, the greatest killer of dreadnought battleships was a naval disarmament treaty. The Washington Naval Conference of 1921–1922 was held in reaction to the seemingly mindless continuation of the battleship and battle cruiser construction programs that were engaging the maritime powers as though World War I were still being fought at sea between great dreadnought fleets. The U.S. capital-ship program of 1916, the largest in world history, had the stated aim of overtaking the Royal Navy in numbers with the largest battleships that could transit the Panama Canal—a fleet second to none.

Under President Woodrow Wilson, battleship construction seemed to take on a momentum all its own: The later-canceled giant South Dakota class, with its main battery of 12 16-inch guns and 40,000 tons (compared to the immediately preceding Colorado class of nine 16-inch heavy guns and 32,600 tons) was begun well after the end of World War I. As if that were not enough, the Wilson administration added a new battle-cruiser construction program in 1919–1920, providing for five battle cruisers mounting 16-inch guns. Apparently afflicted with a windy, arrogant, and vague rhetoric sometimes espoused by Wilson himself, the U.S. Navy proclaimed that its new construction program was to ensure not only the protection of small nations and the preservation of the freedom of the seas, but also the fulfillment of the U.S. “destiny of democratic impulse”—whatever that could mean. Perversely unwilling to accede to that impulse, Japan simply accelerated its own naval construction, embarking, like the United States, upon two major capital-ship construction programs, in 1916 and again in 1919–1920, mirroring the Americans. The British Admiralty, undeterred by the nation’s postwar financial exhaustion, drummed up fiscal authorization for large replacement battle cruisers (after all, only three had blown up at Jutland) and contemplated the construction of two groups of four battleships each, mounting 18-inch main guns.

But wiser councils in Great Britain, as well as in the new U.S. administration of President Warren G. Harding, prevailed. The naval powers had just emerged from the greatest war in history, and all but the United States were, for all intents and purposes, bankrupt. Japan, which had committed few military resources to the war, was nonetheless also on the verge of bankruptcy, primarily due to its capital-ship construction program—hence its willingness to negotiate at Washington. The Americans also understood that their latest
planned monster battleships and battle cruisers would be unable to transit the Panama Canal unless they spent huge additional sums to widen that vital waterway. Furthermore, it seemed that the Japanese would make any sacrifice to retain domination in the western Pacific.

On 12 August 1921, President Harding issued official invitations to the United Kingdom, France, Italy, and Japan to attend a disarmament conference in Washington, D.C., that November. At the conference’s opening, U.S. Secretary of State Charles Evans Hughes, who was expected simply to deliver some innocuous opening remarks, stunned delegates by forthrightly proposing the immediate cancellation of all existing capital-ship construction and a further reduction in fleet sizes through the disposal of older warships. At the time, Great Britain, Japan, and the United States had on hand a total of 48 completed dreadnoughts and 32 older battleships. Thirteen dreadnoughts were under construction in Japan and the United States, and Japan planned eight more.

The Washington Treaty called for the UK to abandon construction of four new battle cruisers and eight battleships under design, to scrap 11 battleships and four battle cruisers, and to scrap 12 older capital ships.

It is an indication of the hold that battleships had on admiralties at the time that Admiral Sir David Beatty, when hearing about the Washington Treaty provisions, according to an eyewitness, lurched forward in his chair “like a bulldog sleeping on a sunny doorstep, who has been poked in the stomach by the impudent foot of an itinerant soap canvasser” (Paul Johnson, Modern Times: The World from the Twenties to the Eighties. New York: Harper & Row, 1983, p. 174). Yet Beatty was perhaps prescient here; on 7 March 1935, the date that Adolf Hitler’s armed forces moved into the demilitarized Rhineland, the Royal Navy had exactly three elderly battleships available to challenge Germany’s three new pocket battleships, undoubtedly a factor in Great Britain’s refusal to make any move against Germany’s open breach of the Versailles Treaty.

Britain was permitted to construct two new battleships, the only RN warships to mount 16-inch main guns. The United States agreed to scrap nine battleships under construction (a tenth, Maryland, had in the meantime been commissioned), as well as a few older capital ships. USS Washington, of the Maryland class, was scrapped when 75 percent completed, much to the chagrin of many U.S. naval officers. Imperial Japanese Navy (IJN) officers felt even worse when they learned that Japan was required to abandon its current capital-ship construction program, consisting of eight battleships and two battle
cruisers, and to scrap three battleships and four battle cruisers under construction as well as four older battleships.

The scrapping provisions of the Washington Treaty amounted to some 2 million tons, and it was noted at the time that Secretary Hughes had destroyed more capital-ship tonnage than all the victorious naval commanders in history combined. Japan had to make the greatest sacrifice, and its delegation succeeded in saving only the battleships *Nagato* and *Mutsu* among all the Japanese capital ships under construction. For all of the signatories, the agreements provided for, in addition to the immediate cessation of all new capital-ship construction programs, a relative ratio of strength among the rival powers (UK 5, United States 5, Japan 3, France 1.75, and Italy 1.75). Qualitatively, the signatories’ battleships were restricted to maximum 16-inch guns and 35,000 tons of displacement; their service life was not to exceed 20 years. A 10-year “construction holiday” stopped all new capital-ship construction for a decade, and each signatory was also assigned a numerical ceiling on capital ships. Of course, defeated Germany and the former Austro-Hungarian Empire were completely out of the picture.

Japan and the United States were permitted to convert to aircraft carriers two each of their fast battle cruisers under construction: *Lexington* and *Saratoga* for the United States; *Akagi* and *Amagi* for Japan. In fact, the two U.S. carriers looked so much alike that a vertical black stripe had to be painted down *Saratoga*’s funnel to differentiate them. *Amagi* was damaged beyond repair in the great Tokyo-Yokohama earthquake of 1 September 1923; it was replaced by the battleship hull *Kaga*.

All four were ships of destiny. The two Japanese carriers would participate in the attack on Pearl Harbor, and the two U.S. giants on several occasions were all that stood athwart Japan’s domination of the Pacific. Of the four, all but *Saratoga* would be sunk by enemy action. The big-gun mentality of naval high commands at the time can be seen in the four 8-inch guns mounted in two turrets in *Lexington* and *Saratoga*, eight of the most useless medium guns ever mounted on a warship. They, of course, never fired a shot in anger. This dead weight was removed as the realities of naval air warfare became obvious early on during the Pacific War. Any warship that might have come within range of an 8-inch gun would have riddled these relatively unarmored carriers. Their air arm would see to it that this never happened.

The four converted aircraft carriers proved valuable for both sides, even essential, during the Pacific War (1941–1945), much
more so than any giant battle cruiser. But the U.S. Navy twins were also significant for carrying out a mock aerial raid on Pearl Harbor, home base to the U.S. Pacific Fleet, in 1927. Coming in over the sleeping fleet anchorage early on a Sunday morning, they achieved complete surprise.

Because the latest U.S. and Japanese battleships already mounted 16-inch guns, the Washington Treaty permitted the British to construct two capital ships, *Nelson* and *Rodney*, the only battleships in any navy designed and completed during the 1920s, and the only Royal Navy battleships ever to mount 16-inch guns. These were strange-looking warships, mounting all main guns forward to consolidate armor and thus keep under the treaty’s tonnage limits. (The British referred to them facetiously as “cherry trees . . . cut down by Washington”).

None of the major signatories of the Washington Treaty were completely satisfied. Japan was outraged at being assigned an inferior ratio to the British and the Americans and considered this provision as just another racial insult. The counterarguments—that the British and Americans had far-ranging maritime responsibilities compared to the Japanese—failed to mollify Tokyo. The British, whose island nation (like Japan) was dependent on imports for so much, were also disturbed at their parity with the self-sufficient Americans. The Americans themselves were alarmed that they could not build bases in the western Pacific, which put them in an impossible strategic position vis-à-vis Japan—and doomed the Philippines to Japanese seizure early in World War II.

The Washington Treaty was one of the few arms-limitation agreements actually to have resulted in such. Yet it did little to prevent Europe’s and Japan’s slide into war during the late 1930s, although it did relieve the burden on taxpayers and temporarily defused international tensions. Several later naval conferences continued the attempt to limit capital ships, but their lack of success was an indication of the deteriorating global situation. The Rome negotiations of 1930 were abortive, as were conferences in 1932 and 1933, and Japan withdrew from the Washington Treaty in 1934.

The lot of the ordinary seaman did improve gradually throughout the interwar years as a result of continuing interest in the working class, as well as fear of (or hopes for) socialism. A career path as an officer opened up for some, even in the Royal Navy. The heavy lifting that characterized the Age of Fighting Sail was alleviated with machinery. A potential wealth of higher-paying career skills, ranging from radio operator to torpedo specialist, all learned at government
expense, opened up for naval recruits. The seamen of the Royal Navy were finally issued shoes so that they no longer scampered about barefoot.

The worldwide Depression directly affected the seamen of the Royal Navy in 1931, when Great Britain, facing the necessity of economic retrenchment, attempted to cut wages. In protest, sailors of the Atlantic Fleet near the Scottish port of Invergordon refused duty on 15 September 1931; they considered themselves passive strikers rather than mutineers. The following day, the Admiralty agreed to moderate the pay cuts and announced that no one would be penalized for their part in what the government termed disturbances. Nevertheless, two dozen seamen, suspected ringleaders, were eventually discharged, a severe enough penalty in those years of skyrocketing unemployment. The disturbances weakened confidence in the British economy and had a bearing on London’s decision to suspend the gold standard a week later. Personnel matters did not reach nearly so embarrassing a pitch in the other navies, and in the 1930s, the satisfaction of being employed muted most grievances. In fact, by the late 1930s, improvements in pay and benefits increased the sailors’ prestige compared to soldiers and merchant seamen.

Under Adolf Hitler, Germany had no such ostensible labor problems, and it emerged as a renewed naval power when it renounced all of the Versailles restrictions on rearmament. An agreement in 1935 followed in which Great Britain, despite Hitler’s unilateral breach of Versailles, agreed that Germany could rebuild up to 35 percent of Royal Navy strength. Germany was also allowed a maximum battleship tonnage of 183,750 tons, as well as parity in submarine tonnage. This was one of the few international agreements that Hitler, fearing an Anglo-German naval race, did not tear up.

The London Naval Agreement of 1936 was drawn up in the absence of Japan and Italy, the former because its demands for parity with the other two major naval powers was rebuffed, the latter feeling insulted by sanctions imposed by the League of Nations in the wake of the Italian invasion of Ethiopia. This treaty, between the isolationist-minded United States, Britain, France, and the Soviet Union (whose few old battleships were in a dismal state), kept the Washington Treaty’s 35,000-ton limit; eliminated the restriction on the number of battleships per nation; stipulated that the naval powers would keep each other informed of battleship construction particulars; and provided for the reduction of maximum gun caliber to 14 inches from 16 inches—subject to Japan’s agreement. Japan, which had pioneered the 16-inch gun, refused. (Actually, the Japa-
nese 16-inch gun on the Nagatos preceded the similarly armed U.S. Colorado by only four months.) A supplementary agreement raised the maximum permitted displacement to 45,000 tons.

From 1937 on, the naval powers prepared for the construction of new battleships—and for war. If nothing else, all the diplomacy demonstrated that, for naval powers, the battleship remained the single-most powerful weapon for modern warfare. A contemporary U.S. Navy committee, charged with determining whether the warplane had rendered the battleship obsolete, concluded that the battleship was the ultimate warship in the fleet and that all other fleet units existed to assist the battleship in its mission. This was not a particularly inspired peek into the near future, but in light of the state of aircraft technology of the time, perhaps it was understandable. As late as 1940, the most influential military strategist in the United States, Bernard Brodie, gave pride of place in the new world war to the battleship.

A more defensible move saw Britain, Italy, and the United States extensively modernize the best of their World War I-era dreadnaughts between the late 1920s and the 1930s. Because of the restrictions imposed by the Washington Treaty, battleship development was confined to reconstruction and modernization of current units. As noted, only Great Britain was permitted two new battleship units. Most of the reconstructed capital ships were so extensively rebuilt that in many cases only the heavy guns and the hull remained original. The Royal Navy rebuilt three battleships, all of the valued Queen Elizabeth class (Warspite, Queen Elizabeth, and Valiant), with smaller but more powerful engines and boilers, completely rebuilt superstructures, as well as extensive antiaircraft protection (perhaps this last calculation was prescient, as all three survived World War II).

The U.S. Navy extensively rebuilt only the New Mexicos, with new engines and boilers and antitorpedo bulges. The follow-on Tennessees, New Mexicos, and Marylands received more limited reconstruction after the Pearl Harbor attack.

Italy extensively rebuilt all of its remaining dreadnoughts. (Leonardo da Vinci had been destroyed in 1916 in yet another catastrophic, unexplained battleship explosion.) All had new main engines installed and their hulls were lengthened, leading to considerably increased speed. Like Italy, Japan modernized all of its World War I-era dreadnoughts, installing new engines and boilers, reinforcing horizontal armor, and fitting antitorpedo bulges (often filled with steel tubes) on the hulls.
The battleship modernization programs were getting under way just as the air forces of the major powers finally developed the weapon that could sink a battleship: the aerial torpedo, which had actually been in the armories of the naval powers since late in World War I. However, an efficient delivery vehicle for the aerial torpedo had to await the aviation revolution of the mid-1930s, which introduced monocoque all-metal construction, retractable landing gear, variable-pitch propellers, advanced control flaps, and enclosed cockpits. Even so, despite such technological advances, only the IJN had an effective torpedo-bomber at the beginning of World War II; the Royal Navy Blackburn Skua and the U.S. Navy Douglas Devastator never sank any major surface warship, and the latter was far more likely to be shot down by its target. In an indication of the artificiality of the naval exercises of the times, in the mid-1920s Royal Navy torpedo-bombers were scoring 30–60 percent hits, an extraordinarily accurate—and misleading—rate.

So it was that even airpower enthusiasts derided the new carrier as nothing more than a sinkable airfield, housing underpowered and weak warplanes. In only one case, the *Prince of Wales*, was a heavy surface warship ever sunk by land-based level bombers. (Even then, the battleship had already been severely wounded by aerial torpedoes, and the level bombers were Imperial Japanese Navy warplanes.)

Until 1937, Britain’s Fleet Air Arm was a component of the Royal Air Force (RAF), with lamentable consequences. Britain’s air strategy was directed toward Europe, and the RAF was fixated on landing the knockout blow with heavy bombardment against the enemy’s industrial and political heart (and, later, in developing means of warding off such a blow against itself). Thus the Fleet Air Arm, during a time of severe financial constraints, was given a low priority by the RAF. This lack of development was seen most vividly during the coming conflict, when the Fleet Air Arm had to be equipped with U.S. Navy aircrafts for much of the war and when their British-built replacements provided no great advance in performance.

However, U.S. naval aviation was no better off during the early phases of World War II. Aware of its limitations in aerial torpedo warfare against battleships, the U.S. Navy had laid down its Iowa class of fast battleships in 1940 specifically to escort carriers and provide the big-gun knockout blow against enemy armored warships.

Thus, it is not surprising that the major naval powers hardly seemed aware of the impending demise of the battleship. Admiral Beatty in the 1920s, reacting to the postwar attacks on battleships
by far-sighted naval officers and by airpower enthusiasts, exclaimed that “it will be impossible to obtain money for battleships if this campaign continues” and demanded from one of his advisers “arguments to show that battleships are necessary”—a good example of a priori reasoning (Padfield, p. 255).

Beatty must not have been alone; all of the major naval powers began again to construct battleships, commencing at the beginning of the 1930s with the French; and they continued to lay down battleships until late in the decade. (And, as noted, the naval powers completed major modernizations of their World War I capital ships.) The battleship construction programs through 1940 were finally halted under pressure to construct submarines, antisubmarine warships, landing craft, and aircraft carriers. Yet not only did Italy and Germany commission new battleships from the late 1930s through 1940, but also neither completed an aircraft carrier. (France had already converted one carrier from a battleship already on the stocks in the early 1920s, but *Béarn* was fit for little more than aircraft ferrying duties by 1939.) Such was the hold of the dreadnought on the maritime powers well into World War II.

The superb Imperial Japanese Navy was the most battleship-oriented service of World War II. Nonetheless, it possessed the superior air arm; and it was that force—perhaps paradoxically—that spelled the end of the battleship. Just months before the opening of the Pacific War, the IJN had grouped its carriers into a task force, and it was this task force that rampaged through the Pacific in 1941–1942, sinking every major enemy warship in its path.

The oldest battleships deployed by Japan during World War II were Nippon’s first dreadnought class, the four impressive Kongos (*Kongo*, *Hiei*, *Haruna*, and *Kirishima*). These were the only warships ever to have begun their service lives as battle cruisers and to be later rebuilt into battleships. They were slightly faster than contemporary RN battle cruisers, yet their protection was almost on a battleship level. Although the designs were British, *Kongo* was the last Japanese battleship to be actually built abroad (design and construction by Vickers of Great Britain). In a foresighted move, similar to that of the U.S. Navy with the Iowas, all four units were modernized, beginning in the mid-1930s, to increase speed specifically to serve as escorts for Japan’s projected aircraft carrier task force in the event of war. They emerged from this modernization as true battleships. (*Hiei*, declared in violation under the terms of the Washington Treaty, was partially disarmed, stripped of heavy side armor, and lost 25 of its 36 boilers to reduce speed; it was rearmed, rearmored,
and reboilered in the 1930s.) This was a time when the IJN and the U.S. Navy considered carriers to be primarily the eyes of the fleet. The Kongos enjoyed so high a reputation that the British, during World War I, had requested them on loan!

As with the Kongos, the next Japanese battleship class, the Fusos, Japan’s first super-dreadnoughts, were completely modernized in the mid-1930s and given bizarre pagoda foremasts, in which platforms, bridges, masts, and the like seemed piled one on top of the other to no discernable pattern. Both were sunk at the Battle of Surigao Strait on 25 October 1944. The Ise class (Ise and Hyuga), follow-ons to the Fuso class, were also modernized during the 1930s.

The Nagatos were the first exclusively Japanese-designed battleships; previous battleships after Kongo had been built in Japan to foreign plans. They were also the last of the World War I-era Japanese capital ships. Although roughly contemporaneous to the U.S. Colorados, their big-gun calibers were slightly larger and their speed 5.5 knots faster. They, too, were rebuilt in the 1930s, although their engines were not replaced, as with previous classes of Japanese battleships.

The Japanese clearly got their money’s worth from modernized Nagato. That battleship sank three U.S. destroyers and the small U.S. carrier Gambier Bay in one of only two cases of a battleship sinking an aircraft carrier; it even survived the war, the only Japanese battleship with that distinction. Her sister ship, Mutsu, was destroyed by yet another of those mysterious battleship explosions, in June 1943, leaving 1,222 dead. (The explosion was so great that postwar U.S. Navy divers could not even locate this battleship’s aft portion. Some have speculated that liquor illicitly brewed from Japanese torpedo fuel caused Mutsu’s demise (Spector, p. 158).

Japan’s final battleship class, the four Yamatos, saw only Yamato and Musashi completed as battleships in 1941 and 1942, respectively. Shinano was converted to an aircraft carrier while on the stocks in 1944; No. 111 was broken up uncompleted in 1942, and No. 797 was never even laid down. These battleships have certainly earned their place in history and myth as by far the largest and most powerful capital ships ever built. They were not mere exercises in gigantism; rather they were the result of Japan’s realization that it could never match the United States battleship-for-battleship—but it could build individual units that were bigger and more powerful. The class was intentionally constructed so large that any U.S. ship built to match would not be able to transit the Panama Canal (and thus was not likely to be built in the first place).
The Yamatos displaced 63,000 tons, their armor protection exceeded that of all other battleships, and they were armed, uniquely, with nine 18-inch main battery guns. The units were constructed in the utmost secrecy, surrounded by so many concealing sisal mats that a shortage of the fiber led to complaints from Japan’s vital fishing industry, which needed the fiber for lines. (Even the special gun-carrying freighter was shrouded in sisal.) The sisal must have done its job well enough: Only two known photographs exist of these monster warships. Their guns were so heavy that a special freighter had to be constructed to transport them from their maker to the shipyards. Yet they never fired their guns in anger. *Yamato* and *Musashi* were dispatched by U.S. naval warplanes (in 1945 and 1944, respectively). Carrier *Shinano* was sunk by a U.S. submarine in 1944. And Japan actually proposed two super Yamatos of 70,000 tons and even larger guns. Although the Japanese built mockups of the magazines and handling rooms, reality prevailed, and the project was dropped in 1942.

Considering the construction and extensive modernization of battleships during the 1930s, the world’s major naval powers on the eve of World War II obviously looked upon the battleship as the backbone of the fleet. That would change in the crucible of battle.
The dreadnought was easily the most expensive weapon of World War I. By contrast, the most costly war tool of World War II (1939–1945) was the U.S. Army Air Force’s B-29 Superfortress heavy bomber. Obviously, the battleship’s status had considerably depreciated since 1918; not one battleship was laid down and completed during World War II.

Yet paradoxically, there were considerably more battleship-to-battleship clashes in World War II than in World War I, although, as in World War I, there would be only one large fleet battleship action. Yet despite their diminished role in World War II, roughly the same number of battleships would be lost as in World War I (23 versus 25, including self-scuttlings).

Like the other naval powers, all battleship-oriented, the Royal Navy entered World War II with a collection of World War I-era battleships, modernized and unmodernized, and with new battleships on the way. It also had the only battleships in any navy designed and completed during the 1920s, Nelson and Rodney. Except for the Nelson class, the Royal Navy during World War II would lose one each from its other battleship classes, in all losing three battleships: Royal Oak, Prince of Wales, and Barham. The oldest of the Royal Navy’s battleships serving in World War II were the five Queen Elizabeths. Of them, Valiant, Warspite, and Queen Elizabeth had been
given the most complete reconstructions of any RN battleship. The unmodernized Barham would be lost to submarine torpedo, taking 862 crewmembers, in 1941. Later came the five Royal Sovereigns, of which Royal Oak was lost in Scapa Flow, with 786 dead, in 1939, again to a German submarine torpedo. These later but cheaper warships were not as highly valued as the Queen Elizabeths, perhaps because they were slower and they did not undergo nearly as extensive a modernization. In fact, the Admiralty seriously considered expending two of this class as blockade ships off the German coast. One, Royal Sovereign, was loaned to the Red Fleet for the war’s duration.

The newest RN battleships of World War II were the King George V class (King George V, Prince of Wales, Duke of York, Anson, and Howe, not to be confused with the King George V class of 1911–1912). Again, one unit of this class, Prince of Wales, was lost during the war, this time to aerial attack by the Japanese in December 1941. The class was severely criticized for its 14-inch main guns. This retrograde decision (after all, the considerably older Nelson and Rodney boasted 16-inch guns) was made in order to get at least the first two units of the class completed in 1940, by which date conflict with Germany was expected. As it was, only King George V was ready for service in 1940. Like the Nelson class, the King George V class had significant main-gun mounting problems. Nonetheless, the Royal Navy generally felt that the class gave good value for the money.

A follow-on class, the Lions, was designed to mount 16-inch guns, but the realities of World War II saw to it that these battleships did not get past the laying-down stage, if that. Even so, as late as 1943–1944, there was actually a brief flurry of interest in completing the Lions, which went nowhere. Two years into World War II, Great Britain laid down HMS Vanguard as a mount for the never-installed 15-inch guns of the freak giant battle cruisers Glorious and Courageous, long since converted to aircraft carriers. Vanguard was basically Winston Churchill’s idea (the prime minister always had a soft spot for battleships) and was supposed to reinforce the RN fleet at Singapore. But long before Vanguard was launched in 1944, the Singapore bastion had fallen ignominiously, and Prince of Wales (along with the battle cruiser Repulse) had been lost to Japanese airpower off Malaya. Work proceeded very slowly during the war on Vanguard, the largest and last British battleship ever built; it was not completed until 1946, never fired a shot in anger, and was scrapped in 1960.

The cancellation of the Lions and the slow pace of construction on Vanguard should not be taken as an indication that the Royal Navy had given up entirely on battleships. Incredibly, the First Sea
Lord (i.e., the highest-ranking RN officer), Admiral Andrew Cunningham, in May 1944, well after Taranto, Pearl Harbor, and the loss of Prince of Wales and Repulse, argued that, for the postwar Royal Navy, “the basis of the strength of the fleet is in battleships and no scientific development is in sight which might render them obsolete” (quoted in Eliot A. Cohen, Supreme Command: Soldiers, Statesmen, and Leadership in Wartime, New York: The Free Press, 2002, pp. 121–122). Admiral Cunningham was no armchair theoretical navalist, but probably the best admiral the Royal Navy produced during World War II. Yet by the time Cunningham made his lamentable projection, the Royal Navy had ceased all battleship construction except for its leisurely work on Vanguard; after World War II it would lose no time in scrapping all its surviving battleships (except for Vanguard).

Germany, stripped of its World War I-era dreadnoughts, had only two true battleships between 1919 and the early 1930s: Schleswig-Holstein and Schlesien, pre-World War I relics that the victors had grudgingly allowed for coastal defense, presumably against the resurgent Poles (the sister ship Hannover was still in existence but apparently not in active service). Schleswig-Holstein does, however, have a claim to dubious fame: By opening fire on the Polish fortifications at Westerplatte (Danzig) at 4:45 A.M. on the morning of 1 September 1939, this elderly battleship fired the first shot of World War II. (The three units of the even older Braunschweig class [Hessen, Braunschweig, and Elsass] were rebuilt as coast-defense battleships and reequipped with 280mm and 170mm guns. Only Elsass, converted into a target vessel, survived into the 1930s and beyond.)

The Third Reich’s battleship ambitions were every bit as grandiose as those of any other naval power. Germany’s naval chief, Eric Raeder, was in close harmony with Adolf Hitler’s global goals. Raeder and Hitler foresaw Germany eventually going to war with Great Britain, the United States, and even Japan, and envisioned a fleet for those eventualities. As a temporary deterrent to Great Britain, the aborted Plan Z (1939) envisioned 10 (some sources say six) super-Bismarcks of 56,000 tons, three battle cruisers, four aircraft carriers, and 249 submarines, with top priority over air force and army requirements, all to be completed in six years. Plan Z was the basis for the even larger blue-water battleship-based navy programs of 1940 and 1941, drawn up to take on the rest of the world’s major naval powers and featuring capital ships of 98,000–141,500 tons armed with 20-inch guns. It is also indicative of German battleship-mindedness that its navy never completed an aircraft carrier.

Thanks to post-World War I Allied policies, the Third Reich entered World War II with only fast and modern battleships (not
counting those two nearly-valueless pre-dreadnoughts). Its three pocket battleships laid down in the late 1920s and early 1930s (and thus predating Hitler's assumption of power in 1933) were Lutzow, Admiral Scheer, and Admiral Graf Spee. (Lutzow was originally named Deutschland, but Hitler, worried about the domestic reaction if a warship named after the German nation were sunk, ordered it renamed.) Although high speed was supposed to be the main advantage of these small capital ships, their average of 28 knots was soon enough surpassed by the following Scharnhorst class’s 32 knots. Nonetheless, the Deutschlands/Lutzows, a well-balanced pioneering design, served as the embryo of many later, much larger warships, such as the Scharnhorst class, and Germany’s first and only true post-World War I first-class battleships (Bismarck and Tirpitz), as well as for the Royal Navy’s King George V class, and even for the last three U.S. Navy battleship classes. The Lutzows were also notable for their pioneering of welded construction and unique diesel propulsion, the latter a feature never repeated in any other capital ship. They could also be called cruisers (and were actually reclassified in 1940 as heavy cruisers), but their six 11-inch guns were not matched in any other cruiser until the U.S. Alaskas, which were officially classified by the U.S. Navy as large cruisers. Whatever the nomenclature, these were the Kriegsmarine’s most successful heavy units. Specifically designed as commerce raiders that were to be more powerful than any faster warship, the three destroyed some 300,000 tons of Allied shipping. Thus the Scharnhors and the Lutzow/Deutschlands did what battle cruisers were supposed to do—attack enemy commerce—and avoided what battle cruisers were supposed to avoid—enemy battleships—something the Royal Navy, to its cost, never learned.

The Scharnhors (Scharnhorst and Gneisenau) were both laid down in 1935. There is little question that these two units were true battleships, but even with more than twice the displacement of the Lutzows, they mounted only the same 11-inch main guns. The German admiralty planned to up-gun these warships at the beginning of World War II, but the complexity and the costs not only of the bigger guns themselves but also of their intricate mountings precluded this proposal in the German Navy (or in any other navy, for that matter).

Bismarck and Tirpitz were the last and by far the most powerful battleships built by Germany. Although nominally still bound by the London Naval Agreement, they exceeded its tonnage limitations by a wide margin. In this case “wide” can be taken literally; they were the broadest-beamed of any contemporary capital ship, which gave
them outstanding stability. (Only the aborted U.S. Montanas would have measured wider.) Their intricate internal subdivision made them extraordinarily difficult to sink. Yet at the end of the war, and in sharp contrast to World War I, not one German capital ship survived to be turned over to the Allies.

The Allies’ victories would come with the aid of battleships, not because of battleships. With the purge at the top in the wake of Pearl Harbor, U.S. battleships were basically relegated to coastal bombardment, antiaircraft duties, and (for the South Dakotas and Iowas) fast carrier task force protection, where they served very well indeed. The new U.S. Navy Chief of Naval Operations, Admiral Ernest King, gave battleships sixth-place in his listing of material priorities. Only those under construction at the time of Pearl Harbor would be completed.

The IJN fought its epic struggle with the United States, and to a much lesser extent with the British, almost entirely in the Pacific and lost all but one of its capital ships. In addition to Yamato and the aging Kongos, the IJN could deploy the World War I-era Fusos (Fuso and Yamashiro, laid down in 1912 and 1913, respectively); Ises (Ise and Hyuga, both laid down in 1915), and the Nagatos (Nagato and Mutsu, laid down in 1917 and 1918, respectively).

The U.S. Navy entered World War II with 17 battleships in service and completed 10 during that war: two Washingtons, four South Dakotas, and four Iowas. This compares to the Royal Navy’s 12 battleships in 1939, and its addition of four more (King George Vs). The oldest U.S. Navy battleship deployed in World War II was Arkansas, laid down in 1910, that is, well before even the outbreak of World War I. Arkansas carried twelve 12-inch main guns and could make 20.5 knots. During World War II, this old warhorse served in convoy escort and shore bombardment roles. Its sister ship, Wyoming, had been demilitarized during the mid-1930s and served as a training ship throughout World War II. (The even older Utah, laid down in 1909, was demilitarized after World War I and used as a target and training ship. It was sunk by two Japanese aerial torpedoes at Pearl Harbor. Legend has it that this aged and disarmed battleship “died of fright,” with 58 killed, and remains where it sank).

The next-oldest class was represented by the New Yorks (New York and Texas, both laid down in 1911) carrying 10 14-inch main guns; they were the last to use reciprocating engines, which gave 21 knots. New York boldly engaged the uncompleted but much more powerful French battleship Jean Bart at Casablanca in 1942 and then carried out shore bombardment duties in the Pacific for the rest of the war;
it was also the first U.S. battleship to carry radar. (Arkansas, New York, and Texas had been dispatched for service with the Royal Navy Grand Fleet in 1918.)

Oklahoma and Nevada, both laid down in 1914, mounted ten 14-inch guns and were actually a half-knot slower than the New Yorks. Nevada was deployed to Ireland for convoy protection service in 1918. Oklahoma capsized at Pearl Harbor with heavy loss of life after being struck by three aerial torpedoes. It was raised afterward but not considered worth rebuilding; it sank in 1947 while being towed to a California salvage yard. Nevada, also sunk at Pearl Harbor, was raised and modernized, and also conducted convoy escort as well as shore bombardment duties in World War II. It was used as a target vessel (but survived) for the underwater atomic bomb experiments at Bikini Atoll in 1946. It took an explosive charge, a near-miss by a guided missile, bombardment from battleship Iowa’s 16-inch main battery, three cruisers, and an aerial torpedo finally to sink the old warship in July 1948. New York was just as tough, surviving both Bikini atomic bomb blasts, then scuttled. Both battleships were sunk rather than scrapped because of their intense radioactivity.

Pennsylvania and the sister ship Arizona were both laid down in 1915 and mounted 12 14-inch main guns and reached 21 knots. Pennsylvania (the one battleship only lightly damaged at Pearl Harbor) was used for convoy and shore-fire support and fought at Surigao Strait. By the end of the war, it was worn out and served as a target at Bikini, like Nevada and New York, and had to be dispatched by aerial torpedoes in February 1948. Arizona was sunk at Pearl Harbor, the greatest single-ship loss in U.S. Naval history (1,117 killed). The wreck today is a shrine at Pearl Harbor, and Arizona is still carried on the official roll of U.S. Navy warships.

The first units of the New Mexico class (New Mexico, Mississippi, and Idaho) were all laid down in 1915 and could operate at 21 knots. Only Mississippi saw active service in World War I, but like the other U.S. Navy dreadnoughts, it never fired a main gun in anger during that conflict. The follow-on California class (California and Tennessee) were laid down in 1916 and 1917. The succeeding Colorados generally resembled the New Mexicos except for their eight 16-inch main guns. Both classes’ turbines could turn out a speed of 21 knots.

The eight units of the New Mexico/Tennessee/Maryland class may be considered as among the most graceful warships of the dreadnought era. With their nearly unique clipper bows and trim lines, par-
particularly after their cumbersome lattice (or wastepaper basket) masts were finally removed by the late 1930s, they made their predecessors look positively lumbering. The first three units of this class were the last U.S. Navy battleships to carry secondary guns in the hull; these positions were soon plated over in the interests of watertight integrity. The remaining units carried no such problematic weapons.

_Idaho_ and _Mississippi_ retained direct turbine drive, but the remaining units expressed the U.S. enthusiasm at the time for electric propulsion (which was also applied to motorbuses in a few U.S. cities). Electric drive had been pioneered on a lowly collier, USS _Jupiter_ (later converted to the U.S. Navy’s first carrier, _Langley_). In this type of marine propulsion, two turbines were directly connected to two 4,242-volt, two-phase generators, which in turn fed four 5,200-kilowatt, slow-turning motors directly coupled to the propeller shafts in place of gearing. With electric drive, warships could dispense with the separate reverse turbine, would enjoy greater watertight subdivision (the turbogenerator did not have to be directly connected to the drive shafts), and all screws could be operated even if one generator failed. But the electric drive’s disadvantages were serious: greater expense, dangerous high-voltage cables throughout the hull, vulnerability to moisture and battle damage, and heavier weight and lower efficiency than direct-turbine plants of comparable power. After the New Mexicos/Tennessees/Marylands, no other battleships of any nation used this propulsion method. Still, it should be noted that the electric propulsion system in this class gave little trouble throughout the warships’ long service lives.

_New Mexico_, _Mississippi_, _Idaho_, _Tennessee_, and _California_ mounted 12 14-inch, caliber .50 heavy guns in four turrets (three guns to each turret). But _Colorado_, _Maryland_, _Washington_, and _West Virginia_ carried the new 16-inch, caliber .45 heavy guns pioneered by the Japanese. The main battery of eight guns was carried in four turrets, two guns per turret. The class had the same armor arrangement and thickness as the preceding _Nevada_ class. Construction on _Washington_ was halted under the terms of the Washington Treaty of 1922, when the unit was more than 75 percent completed; it was expended as a target vessel in 1924. The first four units of the class carried a single trunked funnel; the remainder could be distinguished by their two separate funnels.

The first three units of the class received new engines and boilers in the mid-1930s, and the remainder underwent extensive reconstruction in the wake of Pearl Harbor. _California_ and _West Virginia_
were sunk at Pearl Harbor (California probably more through poor damage control than because of Japanese ordnance), and both were raised. Tennessee was hit by two bombs and suffered moderate damage. All battleships of this class were extensively modernized for World War II service, and their new compact upperworks bore a strong resemblance to those of later U.S. battleship classes and the Royal Navy re-built King George class. The class was used, like its predecessors, for coastal bombardment and convoy duties, although California, Maryland, and West Virginia also fought at Surigao Strait. Run almost to exhaustion during World War II, the class may be considered the finest example of the battleships completed before the Washington Treaty.

Washington and North Carolina were the first U.S. battleships not designed before World War I and were the first to be built once the Washington Treaty construction holiday had expired. They can thus be considered the first modern capital ships of the U.S. Navy during World War II. Both units and all subsequent U.S. Navy battleships were armed with 16-inch, caliber .45 and caliber .50 main guns. North Carolina and Washington were also 7 knots faster than their immediate predecessors, the Colorados.

The next class was the somewhat truncated South Dakotas (South Dakota, Indiana, Massachusetts, and Alabama), an attempt to combine stronger protection with the speed of the North Carolinas. The resulting battleships were cramped in their upperworks and were, at 27–28 knots, actually slightly slower than the preceding Washingtons. Nonetheless, they gave good service during the war, with South Dakota sinking the Japanese battle cruiser/battleship Kirishima during the night of 14–15 September 1942 off Savo Island in the Solomons. In the same month, Massachusetts dueled with uncompleted French Jean Bart, scoring several hits and taking only light blows in return. The rest of the class for the remainder of the war engaged mostly in carrier escort shore bombardment duties.

The Iowa class was the last and greatest of the U.S. battleships, perhaps the best all-around battleships ever built. Iowa, New Jersey, Missouri, and Wisconsin, laid down in 1940 and 1941, were completed between 1943 and 1944. Uncompleted Illinois and Kentucky, both laid down in 1942, were scrapped after the war (although not before Kentucky’s bow was grafted onto the stem of Wisconsin, which had been crumpled in an at-sea collision in May 1956). The Iowas were basically South Dakotas lengthened for greater speed (28–33 knots) to keep pace with carrier task forces, an advanced concept for a battleship-minded navy, and mounted 16-inch (caliber .50) main
guns. They were easily the fastest battleships in history. In fact, they were some 5 knots swifter than the Japanese Kongos, to which they had been built as an answer (the Kongos themselves were so fast that they were originally considered battle cruisers). The Iowas never engaged an enemy capital ship, and their duties, like those of recent predecessors, consisted primarily of carrier escort and shore bombardment. Wisconsin was laid down last (25 January 1941), but Missouri was completed some two months later (11 June 1944) and was thus the last U.S. Navy battleship to go into service. (Thus, there remains some question as to which was the last U.S. battleship, depending on how one defines “last.”) All four would serve the United States extensively during post-World War II conflicts.

The United States would lose only three battleships during World War II, all at Pearl Harbor: Arizona, Oklahoma, and the disarmed Utah. If Maine is categorized as a battleship, then the U.S. Navy lost only four battleships in its history. In any event, no U.S. battleship was ever sunk while under weigh.

The French Navy entered World War II with a fleet more modern than at any time since the ironclad era. Its oldest World War II battleships, the Provence class (Provence, Bretagne, and Lorraine), had been completed in 1915–1916 and mounted 10 13.4-inch main guns. But between the wars they were given, almost uniquely, new main guns (although of the same caliber) and converted to fuel oil. All of the following Normandie class were aborted on the slipways upon the outbreak of World War I. The hull of the last ship of the class, Béarn, was converted into France’s only aircraft carrier.

The first modern French battleships (battle cruisers, according to some authorities) were Dunkerque and Strasbourg, completed in 1937 and 1938, respectively, built as answers to the German Deutschland-class armored cruisers and the newest Italian Litto-rio-class battleships. The two French warships continued the odd arrangement of the British Nelson and Rodney, with 13-inch guns, but with four per turret, in two forward turrets to allow a shorter armored citadel and to keep within to the London Naval Agreement’s tonnage requirements.

In the end, Strasbourg earned the dubious distinction of being sunk twice (by the French themselves, then by an ally) and of being raised three times. Both Dunkerque and Strasbourg were scuttled by their crews when the Germans overran the French naval base at Toulon in 1942. Strasbourg was raised by the Italians and then sunk again by an Allied bombing raid on Toulon. It was salvaged yet a third time and used as an experimental hulk; it was finally scrapped in 1958.
The last French battleships, the impressive *Richelieu* and *Jean Bart*, were launched in 1939 and 1940, respectively. They, too, like the Dunkerques, grouped their main eight 15-inch gun battery forward in two turrets; their careers were hardly less checkered. *Richelieu*, 95 percent complete at the time of France’s surrender, was ordered to Dakar, North Africa, and there was damaged by British naval air attacks and beat off the elderly British battleship *Resolution*. *Richelieu* later went over to the Free French, proceeded to the United States for a major refit, and ended the war as France’s only capital ship in the Pacific, attached to the British Eastern Fleet in 1944–1945.

*Jean Bart*, the last French battleship, was about 77 percent complete in July 1940. It nonetheless escaped to Casablanca under its own power and in November 1942 was hit by aerial bombs and by five 16-inch shells from *Massachusetts*. Surviving the war, *Jean Bart* took its initial trial runs as late as 1949 and participated in the 1956 Anglo-French-Israeli Suez operation, bombarding Egyptian shore facilities. *Jean Bart* was thus the world’s last battleship to be completed and the last non-U.S. battleship to see action.

Italy’s oldest battleships to serve in World War II were the two survivors of the Conte di Cavour class (*Conte di Cavour* and *Giulio Cesare*, completed in 1914 and 1915, respectively, and mounting 13 12-inch main guns). The third unit, *Leonardo da Vinci* (the only battleship ever named after an artist), sank in 1916 in yet another of those mysterious battleship magazine explosions. *Conte di Cavour* and *Giulio Cesare* were completely modernized during the mid-1930s.

Having already received one 15-inch shell hit from *Royal Sovereign* off Punta Stilo, *Conte di Cavour* was later sunk by RN aerial torpedo-bombers at Taranto in November 1940. It was subsequently raised and towed to Trieste, only to be scuttled by the Italians at their surrender, raised by the Germans, sunk again by U.S. aerial attacks, and finally raised and scrapped in 1952–1953. (Having been sunk and raised a record three times, *Conte di Cavour* might better have been named *Resurgo*.) Modernized, *Giulio Cesare* enjoyed a much less checkered record than its sister ship, but it does have the distinction of being the only battleship war booty from either world war to be accepted by a former enemy and put into active service.

The next class, the Caio Duilios (*Caio Duilio* and *Andrea Doria*, completed in 1915 and 1916, respectively), were virtual copies of the preceding class. They, too, underwent the same modernization program as the Cavour class. *Caio Duilio* survived the British air raid on Taranto, but otherwise these two battleships had a much less active wartime career.
The first modern Italian battleships, the three Vittorio Venetos, were also the last. They displaced some 40,000 tons, were armed with nine 15-inch main battery guns, and their indigenous Belluzo geared turbines gave them the impressive speed of 30 knots, faster than the contemporary King George Vs, and only exceeded by the U.S. Iowas. Vittorio Veneto and Littorio/Italia were completed in 1940, and in November of that year Littorio was badly damaged by British aerial torpedoes at Taranto. It was repaired and renamed Italia after the fall of Italian dictator Benito Mussolini. Vittorio Veneto survived a number of unsuccessful actions against the Royal Navy in the Mediterranean. The last unit of the class to enter service, and the last Italian battleship, Roma, completed in June 1942, was not so fortunate. Roma was blown up with heavy loss of life by a German television-controlled glider bomb in September 1943 as it was proceeding to surrender to the Allies. No dreadnought ever had so brief a career. Work on the fourth ship of the class, Impero, was suspended, but the hull was taken over by the Germans as war booty in 1943 and used as a target and test subject; it then sank during a U.S. air raid, was later salvaged and towed to Venice, and there beached and broken up by 1950, a never-completed battleship.

As for the Soviet Union, by the late 1930s Soviet dictator Josef Stalin believed that his nation, like all the other major naval powers, should once again begin the construction of battleships. Ignoring the restrictions of the 1936 London Naval Agreement, Stalin ordered the construction of four battleships of no less than 58,000 tons (10,000 tons more than the contemporary U.S. Iowas) and nine 16-inch main guns (the same armament as the Iowas). The Soviets were able to purchase design assistance from the preeminent U.S. naval architectural firm of Gibbs & Cox, but their hopes to buy guns, mountings, armor plate, and perhaps even a complete U.S. battleship were frustrated by the Franklin Roosevelt administration. Sovetskiy Soyuz, Sovetskaya Byelorussiya, and Sovetskaya Ukraina were laid down in 1938–1939. None was ever completed. The three ships (a fourth, Sovetskaya Rossija, was never laid down) would have far exceeded the limits of the Washington Treaty and were scheduled for completion, optimistically, in 1941. Although it is generally believed that their construction was halted by the German invasion of the Soviet Union commencing in June 1941, building was actually canceled in 1940, and the incomplete rusty hulls, home to thousands of crows, were dismantled in the late 1940s.

Soviet battleships played a minor role in World War II. The oldest on active duty were the elderly Ganguts, Russia’s first dreadnoughts.
Gangut/Oktiabrskaja Revolutsia, Sevastopol/Parizskaja Kommuna, Petropavlovsk/Marat/Petropavlovsk, and Poltava/Frunze engaged in shore bombardment. Petropavlovsk was sunk in shallow water by German aircraft, but three of its turrets remained intact and continued to fire on enemy positions.

Surprisingly, none of the three units of the later Imperatritsa Mariya class of Russian dreadnoughts had survived to participate in World War II. Thus, we can understand Stalin’s interest in acquiring battleships, one way or another, first from the Americans, then from the British, and even later, from the Italians.

**WORLD WAR II**

**BATTLESHIPS IN ACTION**

Battleship missions in World War II were not all that different from those in World War I: convoy escort, shore bombardment, and surface clashes. And as in World War I, there was only one battleship-to-battleship fleet action. Also, as noted, there were actually more battleship-to-battleship clashes during World War II than World War I, even though far fewer battleships were active.

The first dreadnought to fire its main battery guns in World War II was the Royal Navy’s World War I Jutland veteran HMS Warspite. (It was the German pre-dreadnought Schleswig-Holstein that opened the conflict by firing on Polish defenses near Danzig early on the morning of 1 September 1939). On 13 April 1940, Warspite, accompanied by nine destroyers, bombarded a German destroyer flotilla off Norway, sinking no less than eight. During the Norwegian campaign, German battleship Scharnhorst exchanged fire with the RN battle cruiser Renown and, along with sister ship Gneisenau, sank the RN aircraft carrier Glorious with very heavy loss of life.

Five months after the unhappy Norwegian campaign, Revenge carried out a long-range bombardment of German-occupied Cherbourg. This bombardment may have helped to discourage German plans for invading the British Isles by demonstrating the power of the undefeated Royal Navy.

All of France’s eight battleships in active service were outside French territorial waters at the time of its capitulation to Germany in June 1940. Due to fears that the French fleet might fall into Hitler’s hands, British Prime Minister Winston Churchill made perhaps his most difficult and controversial decision of the war. After negotiations
to disarm or immobilize the major French fleet units outside France failed (except in the case of battleship *Lorraine*), Churchill ordered the recalcitrant units sunk. On 3 July 1940, the French battleships *Bretagne*, *Dunkerque*, *Provence*, and *Strasbourg* were attacked at Mers el-Kébir (Oran, Algeria) by the Royal Navy’s super-battle cruiser *Hood* and battleships *Barham* and *Resolution*. British 15-inch shells nearly sunk *Dunkerque* but caused only slight damage to *Strasbourg*. *Bretagne*, after taking several 15-inch shell hits, blew up, capsized, and sank; 977 of its crew perished. Badly damaged, *Provence* managed to beach. *Richelieu*, 95 percent complete, was also attacked (on 8 July, by *Resolution*) but to no significant effect. *Jean Bart*, at Casablanca, was presumably spared because of its unfinished state.

The very next day, Admiral Andrew Cunningham, one of the Royal Navy’s best commanders, in the modernized battleships *Warspite*, *Malaya*, and *Royal Sovereign* (all World War I designs) scored a single hit on *Giulio Cesare* (another modernized World War I capital ship) from *Warspite* at the extraordinarily long range of 13 miles. The Italian fleet commander, Admiral Angelo Campioni, then broke off the engagement and retired at speed with the British in pursuit. (The Italians always built their battleships for speed.)

The French Navy may be said to have achieved a measure of revenge for Mers el-Kébir some three months later. *Operation Menace* (23–25 September 1940), the aborted British-Free French attempt to seize Dakar, French West Africa (now Senegal), involved no fewer than 23 Royal Navy warships, including the unmodernized battleships *Barham* and *Resolution*, the aircraft carrier *Ark Royal*, four cruisers, and 16 destroyers. The Vichy French forces could muster two cruisers and the incomplete modern battleship *Richelieu*. However, accurate fire from the shore batteries and from *Richelieu*’s 15-inch guns, as well as a Vichy submarine torpedo hit on *Resolution*, discouraged any further attempts on Dakar.

Undaunted, the Royal Navy turned on the Italians, mounting one of the most successful naval air raids in history, on the Italian naval base at Taranto on 11 November 1940. All six Italian battleships were in the harbor as 21 obsolete biplane Fairey Swordfish torpedo bombers glided in, their engines cut off to achieve surprise. Torpedoes specially altered to avoid porpoising in shallow water slammed into three Italian battleships from a distance of several hundred yards. *Conte di Cavour* was the only battleship actually sunk during the attack. *Duilio* and *Littorio* were tugged to shore to prevent sinking. *Conte di Cavour* was raised and underwent repairs but was never recommissioned. At a stroke, the balance of naval power in the Mediterranean was altered,
albeit temporarily. The Imperial Japanese Navy carefully studied the Taranto naval air raid; apparently, the U.S. Navy did not.

Continuing its offensive against Italy, the Royal Navy deployed its battleships in a series of successful and almost cost-free bombardments of the Italian coasts and Italian-held coasts in North Africa. First, the modernized sister ships Warspite and Valiant fired 100 15-inch shells on 18 December 1940 into Valona, Italy’s main supply base for its invasion of Greece, although apparently to little effect.

Things went much more decisively less than a month later, on 3 January 1941, when the two battleships were joined by another sister ship, the unmodernized Barham, the carrier Illustrious, the monitor Terror, cruisers, destroyers, and gunboats and saturated Bardia on the North African coast. This powerful combination, with its aerial strikes and the gunnery of three battleships and a host of other warships, was instrumental in the fall of Bardia to the Australians and the capture of 25,000 Italian troops three days later.

The battle cruiser Renown, the modernized battleship Malaya, the cruiser Sheffield, and ten destroyers made one of the war’s most successful bombardment missions a little more than a month after the Bardia pounding, on 9 February 1941. In their bombardment of Genoa, shipyards, industrial complexes, dry docks, railway marshaling yards, oil tanks, and merchant ships were hit and large fires observed. Surprise was complete. On 18 April, another attacking force, consisting of Warspite, Barham, and Valiant, plus the carrier Formidable, two cruisers, and screening destroyers, pumped 15-inch shells into the Italian base at Tripoli, Libya, for 45 minutes. Return fire was wild and the British squadron departed unharmed. These British battleship bombardments, carried out with near impunity, must have made many Italians wonder if they might not have entered the war on the wrong side and to doubt Mussolini’s bombast of the Mediterranean as mare nostrum (our sea).

The new Italian battleship Vittorio Veneto came close to seeing action, along with Giulio Cesare, on 27 November 1940, when an Italian force consisting of the two battleships, six cruisers, and six destroyers, commanded by Admiral Ingio Campioni, attempted to attack a British convoy escorted by the RN battleship Ramillies, the battle cruiser Renown, the aircraft carrier Ark Royal, as well as light cruisers, destroyers, and support vessels, under the command of Admiral Sir James Somerville. The forward cruiser forces on both sides exchanged fire at a range of 12 miles. But when the Italians learned of the presence of an RN aircraft carrier, they turned about for homeport Naples. This clash took place only about two weeks
after the devastating RN carrier raid on the Italian fleet at Taranto, and the Italians were apparently still demoralized.

The Battle of Cape Matapan (28–29 March 1941) opened when a British force under Admiral Cunningham in his flagship, Warspite, and two additional battleships, the unmodernized Barham and the modernized Valiant (in which the young Prince Phillip, future consort to Queen Elizabeth II, was serving), sortied from Alexandria to intercept an Italian force attempting to attack British convoys in the area of the beleaguered British-held island of Crete. Vice Admiral Angelo Iachino commanded the new flagship Vittorio Veneto, eight cruisers, and 17 destroyers. But having lost the element of surprise, Iachino withdrew toward home, steadily pursued by Cunningham. The Italians were too swift for Cunningham’s warships to inflict any damage, so the job was assigned to aircraft carrier Formidable. Vittorio Veneto was badly holed by one British aerial torpedo, but once again an Italian battleship escaped due to its superior speed. (Vittorio Veneto actually straddled several British cruisers at the great range of 16 miles but scored no hits.) Several Italian cruisers and destroyers were reduced to flaming wrecks by the main and secondary fire of the British battleships. Cunningham had used radar (which the Italians still lacked) to great advantage in tracking and forestalling Iachino’s moves.

The chase and ultimate sinking of Germany’s monster battleship Bismarck (24–27 May 1941) involved no less than five RN battleships, two aircraft carriers, nine cruisers, and 18 destroyers. Bismarck had completed its sea trials the previous month. (Captain Ernst Lindemann was granted special permission to refer to the ship as “he,” in honor of former chancellor Otto von Bismarck.) In the initial stages of the battle, fire from Bismarck’s consort, the heavy cruiser Prinz Eugen (some claim that the fatal fire came from Bismarck), caused the British super-battle cruiser Hood to explode with the loss of all but three of its 1,500 crewmen. It was only Hood’s second serious combat in her 20-year lifespan. Although by 1941, Hood was elderly and unmodernized (plans to thicken its armor protection had been aborted with the onset of war), its loss was considered a national tragedy. Hood was the fastest and largest capital ship of the time, actually weighing some 5,000 tons more than the new Prince of Wales class of battleships. Prince of Wales, in its first engagement, and with workmen still aboard, did not fight efficiently and was the target of both German warships; it broke off the engagement and fell away under cover of a smokescreen. (Bismarck was also a new battleship, but it did have the advantage of several months of work-up cruises.) As if losing Hood were not bad enough, now a Royal Navy
battleship, part of a superior British force, had \textit{retreated} in the face of the enemy. Actually, the RN side of the battle had been badly handled, with Admiral Lancelot Holland in \textit{Hood} allowing \textit{Bismarck} and \textit{Prinz Eugen} to cross the \textit{T} of his two main warships; Holland paid for this blunder with his life. But \textit{King George V} (sister ship to \textit{Prince of Wales}) and \textit{Rodney} had devastated \textit{Bismarck}'s upperworks with concentrated fire. It was finally dispatched some 600 miles off the French coast by torpedoes from the cruiser \textit{Dorsetshire}. There is even some persuasive argument that its own crew scuttled \textit{Bismarck} in a final act of defiance.\textsuperscript{12} (\textit{Prinz Eugen} managed to escape the British net, later made the Channel Dash with \textit{Scharnhorst} and \textit{Gneisenau}, was used as a target vessel after the war [surviving two atomic explosions at Kwajelein/Bikini Atoll in July 1946], and sank after an accident disabled its stern.)

The largest collection of Italian battleships to fight in World War II, at the First Battle of Sirte, on 17 December 1941, engaged a British convoy shepherding just one tanker to Malta as the Italians were escorting their own convoy to North Africa. \textit{Caio Duilio}, \textit{Littorio}, \textit{Andrea Doria}, and \textit{Giulio Cesare} were escorted by four cruisers, 13 destroyers, and six submarines. The British squadron was composed of one antiaircraft cruiser, two light cruisers, and seven destroyers—all to escort that vital tanker. Nonetheless, the British commander, Admiral Philip Vian, was ordered to turn toward the overwhelmingly powerful Italian squadron (whose “intelligence” had identified the oiler as a battleship). \textit{Littorio} opened fire first, followed by the Italian cruisers. This engagement lasted all of 11 minutes, and the Italian commander (who was actually commander in chief of the Italian navy), Angelo Iachino, with his own convoy safe and, for some reason, unprepared for night action, turned away, as did Vian, whose main concern was covering the oiler. In the end, the irreplaceable tanker and the Italian convoy reached their respective destinations, and the Italians claimed victory, although it was difficult to account for five battleships and their escorts turning away from a few cruisers and destroyers.

The Second Battle of Sirte, three months later, again saw \textit{Littorio} attempting to thwart a small Malta supply convoy. In confused fighting, a Royal Navy cruiser-destroyer force made Iachino turn away, battleship and all. Even though four of the escorted merchantmen were sunk, this second victory over enemy battleships boosted British morale at a difficult time in the war.

The Royal Navy did not neglect the German enemy at this time. \textit{Tirpitz}, sister ship to \textit{Bismarck}, was attacked no less than six times
by RN carrier torpedo-bombers before it was even ready to go to sea; once each by Soviet and British bomber aircraft and a Soviet submarine; and once by British midget submarines. Finally, on 12 November 1944, 36 Royal Air Force bombers, armed with 5.5-ton bombs, scored three direct hits. Germany’s last battleship capsized with heavy loss of life. It is indicative of the amount of metal that went into the construction of a battleship that it took nine years to dismantle *Tirpitz* for salvage.

The United States entered World War II reeling from the second greatest battleship loss in wartime naval history, the surprise Japanese attack on the naval base at Pearl Harbor, Hawaii, on 7 December 1941. This tale, told often, never ceases to fascinate. It started with a labyrinth of missed warnings, conceptual blindness, peacetime routine, and complacency in a world already at war for more than two years. The circumstances compelled some writers (but very few historians) to imagine some sort of a plot using the old battleships of the U.S. Pacific Fleet as bait to hook Japan into an unwinnable conflict. It was believed by some that a defeat of such magnitude could not happen without betrayal. The facts, of course, were that President Roosevelt had his hands full trying to get the U.S. public ready for war with Germany. He could hardly have welcomed another conflict on the other side of the world (although he was certainly pressuring Japan, perhaps recklessly, to get out of China).

In an odd constellation of irony, the official program for the November 1941 Army-Navy football game featured on its cover the ill-fated battleship *Arizona*. The caption proclaimed (in a close regard for truth), “Despite the claims of air enthusiasts no battleship has yet been sunk by bombs.” Less than two weeks later, *Arizona* would go to the bottom of Pearl Harbor, along with most of its crew, victim of a Japanese bomb.

Japanese torpedo-bombers, level bombers, and fighters from an undetected six-carrier task force had sunk six U.S. battleships. *Arizona*, almost torn in half, was the greatest single loss of life ever on any U.S. warship (1,103 fatalities). And 415 were killed when *Oklahoma* capsized. *West Virginia*, *Nevada*, and *Tennessee* were also lost, although with lighter casualties. Only *Pennsylvania*, in dry dock, escaped significant damage, although 19 died even there. (For the Japanese aviators, a battleship was a battleship, and that included the disarmed target battleship *Utah.*)

Only the Russians at Tsushima had lost more battleships in a single action. Several cruisers and destroyers were also sunk or exploded. Almost 3,000 perished, mostly military personnel. Yet all of
the battleships were sunk in the shallow waters of Pearl Harbor, and all of those but Arizona were raised in an epic engineering feat of salvage, and all of those but Oklahoma were modernized and sent into action against the Japanese. Further, the oil-tank farms and the machine shops had been spared much damage. The sunken warships thus could be raised, given temporary repairs, refuel, and transit the Pacific to West Coast shipyards.

Much more importantly, the Japanese had completely missed the carriers, which were out to sea on other missions. In an act of strategic myopia, the Japanese had succeeded in bringing outraged Americans to war by sinking a number of obsolete battleships. The U.S. Navy would not lose another battleship during this war, whereas the IJN would lose all but one. The United States, seeing the future through the haze at Pearl Harbor, did not complete any battleships afterward (same for the Japanese). In this war in the Pacific, the carrier became the capital ship that would bring total victory to the Allies.

Yet incredibly, for a moment after Pearl Harbor, U.S. naval planners actually husbanded the surviving battleships for a projected advance across the Pacific against the Japanese, in accordance with Plan Orange, one of the prewar plans that outlined potential responses to conflict. Such a traditional operation, with the lumbering battleship as the backbone, would undoubtedly have met disaster. In all likelihood, most of the surviving U.S. battleships would have been sunk by the Japanese irretrievably in deep waters.

Within days after Pearl Harbor, the Royal Navy suffered a worse disaster with the loss of Prince of Wales and Repulse. Admiral Sir Tom Philips, RN commander of the British Pacific Fleet, was convinced (as was Winston Churchill, apparently) that a well-handled battleship could fight off aerial attackers. Admiral Philips learned the hard way how wrong he was. Japanese aerial torpedoes on 10 December sank Prince of Wales, along with Repulse, off the Malay coast in less than two hours. Admiral Philips was not among the survivors.

The loss of these warships was a greater blow to the British than Pearl Harbor was to the Americans. Although the Pearl Harbor united Americans in their resolve to crush the Japanese, the Malayan disaster unnerved the British. They handed over Malaya-Singapore without effective resistance, even though they well outnumbered the Japanese. In the long run, the loss of the Singapore bastion signaled the end of European colonialism in Asia. Anyone could see that Asians had badly beaten Europeans with their own modern weapons.

It was a time of general Allied distress at sea. In the European Theater, the notorious Channel Dash of 11–13 February 1942, by
Scharnhorst and Gneisenau with an escort of destroyers and aircraft, might be termed a comedy of errors but for the great loss of life—almost all British. Both German warships slipped from their French bases, steamed through the English Channel past slack British defenses, and found haven in Germany. It was the first time since 1588 than an enemy fleet had managed to pass through the English Channel. This, after the Royal Navy had been at war at sea for more than two years. Two days later, on the other side of the world, Singapore ignominiously capitulated.

However, matters improved with the Allied invasion of North Africa beginning on 8 November 1942. Participating battleships were the Royal Navy’s new Duke of York (flagship, King George V class), Rodney, and the battle cruiser Renown, as well as the U.S. battleships New York, Texas, and the new Massachusetts. The French, who seemed to have fought more resolutely against their former allies than against their current enemies, resisted with some vigor. On 8 November, Massachusetts fired the first salvo from a U.S. battleship main gun at an enemy warship since the Battle of Santiago in 1898. It badly damaged the uncompleted, anchored French battleship Jean Bart at Casablanca with five 16-inch shells (although only two exploded), receiving light damage in return. USS New York then shot up Jean Bart, which also suffered some bomb damage.

November 1942 was the peak of action for battleships. In the Pacific on 13 November, the Japanese battleship-battle cruiser Hiei was sunk by a combination of U.S. cruiser fire, two aerial torpedo hits from the U.S. carrier Enterprise, and one bomb from a U.S. B-17 bomber. Two days later, the U.S. Navy’s new battleship Washington sank Hiei’s sister ship, Kirishima, off Savo Island, receiving some superficial damage in return. Even newer South Dakota was also involved in this battleship-to-battleship clash, receiving 42 hits, some serious, resulting in 30 dead, the highest ever suffered by a U.S. Navy battleship in action under weigh. This necessitated its return to the New York Navy Yard for repairs. It is not known if South Dakota scored any hits in return.

Also in November 1942, in response to the North African landings, the Germans took over the unoccupied zone of France, and the French promptly fulfilled an earlier understanding with the British, despite bitterness over Mers el-Kébir, that they would never allow the Germans to take over the French fleet. French crews scuttled the battleships Dunkerque and Strasbourg along with many smaller French warships at the Toulon naval base as German tanks raced toward the docks.
The Aleutian Islands campaign could be considered a sideshow; the U.S. determination to retake these territorial islands may have been more a matter of national honor than a strategic ploy. Still, no less than six elderly U.S. Navy battleships (New Mexico, Mississippi, Idaho, Pennsylvania, Nevada, and Tennessee—the latter three rehabilitated survivors of Pearl Harbor) were deployed to the frigid Bering Sea between May and August 1943 to blast the Japanese invaders. None received any damage in return.

Almost all the Royal Navy battleships were on hand for the invasion of Sicily in July 1943 to deal with the Italian fleet, should it come out to defend its homeland. But Nelson, Rodney, Warspite, Valiant, Howe, and King George V had little to do (the RN monitor Abercrombie's heavy guns did assist the Americans with shore bombardments at Gela). British battleships, plus three monitors, bombarded several coastal batteries during the 3 September crossing of the Strait of Messina to Italy. It proved a waste of ammunition, as the Germans had already slipped across the strait and the Italians had essentially ceased fighting. The Salerno landings in September 1943 saw RN battleships Valiant and Warspite in much heavier action (Nelson and Rodney were standing by if needed). The two capital ships hit traffic concentrations and blew up ammunition dumps. In return, however, Warspite was hit by two German radio-controlled bombs and was severely damaged.

Three months later, on 26 December 1943, the Royal Navy's new Duke of York sank the German pocket battleship Scharnhorst off North Cape, Norway. Scharnhorst was attempting to disrupt Arctic convoys to the Soviet Union, but its movements were being tracked by British radar and by the ULTRA intercepts of German radio communications. Sir Bruce Fraser, commander of Force 2, in Duke of York, maneuvered between Scharnhorst and Convoy JW 55B and opened fire with his 14-inch guns. Caught by surprise, Scharnhorst fought back hard and even straddled Duke of York several times, but its 14-inch shells and destroyers' torpedoes sent Scharnhorst to the bottom; only 36 of its crew survived the blast, fire, and icy water. The Battle of North Cape was the last time a Royal Navy battleship squared off against another battleship.

Gneisenau's career was much less eventful. It clashed with Renown on 9 April 1940 during the Norwegian campaign and received three hits from the elderly British battle cruiser's 15-inch main guns. It also made the Channel Dash with Scharnhorst but was later decommissioned due to heavy mine and bomb damage and was blown up in 1945 before advancing Soviet forces. The Germans
had already parceled out its heavy guns, including one complete turret, to shore batteries in Poland and Holland.

During the Normandy landings on 6 June 1944, Warspite (still wrapped in a cofferdam after its wounding at Salerno) and old Ramilies, plus the monitor Roberts, attacked and silenced most German coastal guns from the Seine to Cape Barfleur. (At Le Havre, the Germans had emplaced four 16-inch guns, bigger than any mounted on RN battleships except for Nelson and Rodney.) Later, Nelson joined the task force and bombarded Caen. After D-Day, Malaya bombarded the German-held island of Cezembre, destroying the two large batteries that were denying the port of Saint-Malo to the Allies.

With the Allies having secured a foothold on the European continent, the Royal Navy then dispatched most of its battleships to the Pacific to aid the Americans in the war against Japan. All surviving RN battleships had been removed from Asian waters after the disasters at Singapore and Burma, and the sinkings of Prince of Wales and Repulse. British battleship operations were renewed in the Pacific in April 1944, when Queen Elizabeth began escort and bombardment duties against the Japanese in the Dutch East Indies on the northeast end of Sumatra. Queen Elizabeth was soon reinforced by Howe, which served as flagships for Admiral Sir Bruce Fraser (after January 1945, the British Pacific Fleet). These two RN battleships were joined by King George V in December 1944. The RN battleships pounded Sumatra again in December 1944 and January 1945, closing down one of the largest refineries in the world for a long period. Queen Elizabeth helped cover amphibious landings in May 1945 for the capture of Rangoon, Burma; and King George V, along with the U.S. Pacific Fleet, ranged off the Japanese coast itself, bombard ing Tokyo and other parts of Honshu Island in July and during 9–15 August 1945. The day Japan surrendered, 15 August, was the last time a British battleship fired its guns against an enemy.

World War II’s only battleship fleet action took place on the night of 25 October 1944 at Surigao Straits, near Leyte, the Philippines, matching vintage U.S. battleships California, Mississippi, Maryland, Tennessee, and Pennsylvania (all but Mississippi were Pearl Harbor survivors), one Australian and seven U.S. cruisers, and a destroyer flotilla against Japanese battleships Fuso and Yamashiro (sister ships of roughly the same era as that of the U.S. battleships opposing them). The U.S. commander, Admiral Jesse Oldendorf, had before him the tactical setup dreamed of by generations of incipient naval commanders: He was crossing the enemy’s T. Since the Age of
Fighting Sail, this maneuver had been accomplished only four times, by Togo at Tsushima, by Jellicoe (twice) at Jutland, and by Gunther Lütjeans, Bismarck's commander. It must be some indication of the artificiality of the concept (studied almost to death) that only four commanders were ever able to do it.

Admiral Oldendorf certainly made the most of his historic opportunity. Fuso was quickly sunk by destroyer torpedoes before the U.S. big guns even opened fire, and Yamashiro, battered by heavy, accurate gunfire at 26,000 yards as well as destroyer torpedoes, sank in little more than 10 minutes, the last battleship to be sunk in battle against other battleships. Only one U.S. destroyer had been hit, and that mostly by its own side. The one-sided Battle of Surigao Strait is considered almost a footnote to the main action of the Battle of Leyte, the greatest naval clash in history.17 When the elderly battleship Mississippi shut down its guns at just after 4:08 A.M. on 25 October 1944, it had fired the last round in the last battleship-versus-battleship clash in history.

Six months later, the IJN would establish yet another melancholy nadir for the record books. The super-battleship Yamato, pounded mercilessly by U.S. carrier airpower, slid beneath the waves on 7 April 1945, the last battleship in history to be sunk in battle.

BATTLESHIPS
AFTER WORLD WAR II

In the immediate post-World War II years, most of the world’s remaining battleships served as useful metal mines in a world of shortages; they were picked apart, scrapped, and recycled wholesale. But Nagato, the only Japanese battleship to survive, was seized by the United States as war booty and expended as a target at the Bikini atomic tests. No German battleship survived the war.

The Royal Navy never employed battleships in action after 1945, scrapping them all despite some outcry that at least Warspite, veteran of two world wars, should be saved from the cutting torch. Vanguard, Britain’s largest and latest battleship, was scrapped in 1960. France’s Jean Bart, finally completed in the postwar years, participated in the 1956 Suez invasion (again, for shore bombardment) and was scrapped in 1970. It was the last non-U.S. battleship on active duty, in combat, and in existence. Of Italy’s three surviving battleships, Lit-
And Vittorio Veneto were allocated to the United States and Great Britain, respectively. But both nations had plenty of old battleships ready for scrap and allowed the Italians to break up their own. In 1948, Stalin finally took possession of the third, Giulio Cesare, as reparations. Incorporated into the Black Sea Fleet as Novorossisk, it was reportedly sunk by an errant mine in the 1950s.18

Stalin, not finished with his interest in battleships, acquired two from the West. The elderly and unmodernized Royal Sovereign19 had been loaned to the Red Navy in 1944, in place of a more modern but unavailable unit of the Italian fleet, and was renamed Archangelsk. After a most unadventurous wartime career, Royal Sovereign/Archangelsk was returned in February 1949 with punctilious ceremony to Great Britain, which wasted no time in scrapping the worn-out battleship later that year. Incredibly, the Soviets even claimed as war booty the aged pre-dreadnought German Hessen, taking it into the Red Navy as Tsel. Considering the age and problematic usefulness of these three foreign battleships, one must conclude that Stalin was truly hard up for battleships in an age that had long passed them by. The Red Navy’s own aged Ganguts lingered in obscurity until the last, supposedly Sevastopol, was scrapped in 1959. Yet for all his interest in capital ships, Stalin’s Soviet Union never succeeded in building or buying a battleship of its own.20

The United States did not see fit to complete the final two units of the Iowa class (Kentucky and Illinois) after World War II; all but Missouri of that class were mothballed in preservative cocoons and put in reserve.21 All pre-Iowas were scrapped, except for Texas, Massachusetts, and Alabama, allotted to their coastal namesake states as eponymous museum ships.

The magnificent Iowas had decades of on-again, off-again duty remaining. All four served during the Korean War, bombarding North Korea’s shores. There were assertions that these battleships broke up enemy division-sized attacks on South Korean battlefields, and the United Nations Command was glad to have them. Overhauled, New Jersey served on a similar mission in Vietnam. Prisoners of war had become an important political issue during the Vietnam War, and the U.S. Navy and Marines particularly valued the battleship’s fire-and-forget ability. No hostages would be given to the enemy with New Jersey’s shore bombardment missions. But the quantifiers in the Pentagon at the time could only see the battleship’s age and heavy personnel costs; New Jersey was withdrawn and recocooned in 1969 on the mendacious grounds that there were no
more liners for its main guns. Actually, there was a warehouse filled with them.

The Iowas’ cocoons were reopened during the military buildup under the Ronald Reagan administration. It was argued convincingly that these warships, for all their age, had seen little hard service over the decades, were in comparatively good condition, and that their 16-inch guns could wreak havoc on bunkers and emplacements far beyond land artillery range with minimal risk to personnel. Still, these battleships were built for an era of much cheaper conscripted manpower; personnel costs, despite austere manning, were very high and were the greatest drawback in the era of an all-volunteer force.

Nonetheless, during the early 1980s all four were modernized, with antiship and shore-attack cruise missiles, as well as new electronics and support systems. Their modernization was nothing like that carried out between the world wars: Their engines remained unchanged and their hulls unmodernized. Most of the work and expense entailed bringing the ships into the electronic and missile age and make living spaces more attractive to an all-volunteer crew. Because the United States anticipated complete control of the air, antiaircraft artillery protection was drastically reduced.

Semimodernized, New Jersey returned to service in 1982 and conducted shore bombardment missions off Lebanon in 1983–1984, with problematic results. During the 1991 Gulf War, Wisconsin and Missouri came in close to the Kuwaiti coast to provide gunfire support for a possible amphibious landing (and to fool the Iraqi command that such was indeed the Coalition’s plan). The two battleships fired cruise missiles and no less than 1,102 shells from their 16-inch guns in support of the ground campaign. Iowa missed the Gulf War because it had suffered a disastrous turret explosion on 19 April 1989, in which 47 crewmen were killed.

In these later missions, the armored warship had come full circle: from the ironclad Kinburn Batteries’ bombardment of Russian forts in the Crimean War, to the final battleships’ pounding of shore targets in their last decades, from North Korea to the Persian Gulf.

For all of the old Iowas’ usefulness, one cannot imagine any new big-gun capital ships ever being built. But battleships have not altogether departed. Surviving into the twenty-first century is one example of the wooden battleship era, HMS Victory, as well as three from the ironclad age, Buffel and Schorpioen (the Netherlands) and Huascar (Peru/Chile). As for battleships, only one remains, Mikasa, Admiral Togo’s flagship at Tsushima, preserved by a grateful nation and rehabilitated by American occupation forces after World War II.
Only one dreadnought remains: USS Texas. But no less than seven super-dreadnoughts are extant, all U.S.: North Carolina, Massachusetts, Alabama, Iowa, New Jersey, Missouri, and Wisconsin. Texas was deeded to the Lone Star State as far back as 1948; North Carolina was turned over to its namesake as a museum ship in 1961. Alabama and Massachusetts went to their namesakes for preservation and display in 1964 and 1965, respectively.22

The U.S. Navy’s policy of naming all of its battleships but one (Kearsarge) after the states of the union undoubtedly has had much to do with this outcome. It was considerably easier to raise money in, say, North Carolina, for the purchase of battleship North Carolina, than to attempt the same enterprise throughout Great Britain for, say, HMS Warspite, the splendid super-dreadnought that had fought in both world wars. That said, it should be pointed out that the British have preserved Horatio Nelson’s flagship, the three-decker ship-of-the line HMS Victory, at great and continuing expense, in excellent condition for more than two centuries. HMS Warrior, the world’s first seagoing ironclad, was also meticulously restored in recent decades, also at enormous cost.

As for the Iowa class, Iowa came the closest to being scrapped, in October 1990, because of the damage it suffered in its turret explosion. But it was retained for parts, then returned to reserve status, and was finally relocated to San Francisco as a museum ship. New Jersey also went back to reserve status in 1991, then was donated to the state of New Jersey and towed to the Delaware River port at Camden, where it became a museum ship. Missouri, last of the completed U.S. battleships, was stricken for disposal in 1995 and was donated as a museum ship at Ford Island, site of the Pearl Harbor debacle, tomb of Arizona, and the wreck of the demilitarized Utah.23 Wisconsin was returned to reserve status in 1998 and berthed at Norfolk, Virginia, also as a museum ship, yet still in reserve. Presumably, the U.S. Navy has not written off its remaining battleships.24 But the inactivation of Wisconsin, the world’s last laid-down battleship to be completed, closed the battleship saga.25

After four centuries, the story of the first-class warship—from the galley-ram, to the wooden three-decker, to the turreted steam ironclad, to the battleship, and to the massive big-gun dreadnought—had ended. Yet it is something of a paradox that these warships, so devoted to their big guns that they were considered mere gun platforms, were much more likely to fall victim to mine, torpedo, or aerial bomb than to gunfire from another behemoth. Of the 112 lost ironclads, battleships, and dreadnoughts, only 13 were
lost to gunfire; no less than 48 were lost due to underwater or aerial attack.26

Beginning with *La Gloire*, the world’s naval powers completed some 704 big-gun armored warships.27 Of these, about 112 were lost to unnatural causes, excluding those run aground or lost in storms.28 (See tables: Lost Ironclads, Lost Battleships, and Lost Dreadnoughts.) Whatever the cause of their demise, capital ship wrecks litter the ocean floor, from Mobile Bay, Tsushima Strait, the Mediterranean, the Dardanelles, the North Sea and the North Cape, Scapa Flow, Pearl Harbor, and Surigao Strait. Although wooden capital ships were extraordinarily difficult to sink, their armored successors, when they went to the bottom, usually took most of their crews with them. *Tecumseh*, *Re d’Italia*, *Petropavlovsk*, *Pommern*, *Slava*, *Royal Oak*, *Arizona*, *Prince of Wales*, *Barham*, *Bismarck*, *Roma*, *Scharnhorst*, *Kirishima*, *Yamashiro*, *Yamato*, and others stand as sentinels to a past age. And thus a somber adage from the great British writer Rudyard Kipling is fitting to close out this story: “If blood be the price of admiralty, Lord God, then we have paid in full.”29

NOTES

1. There is the persistent urban myth of the Watchmaker of Scapa Flow, a German immigrant who bided his time through the interwar years and finally guided, with signals from ashore, his true countrymen’s U-boat to *Royal Oak*. What the legend fails to explain is why such effort would be made for so elderly, unmodernized a battleship when there were many more valuable targets in the same area at the same time.

2. His Majesty King George V thus became the only person in history to have two entire classes of battleships named after him, as well as the battleship *Prince of Wales* (completed 1904). Eighteenth century Admirals Anson and Howe shared the honors of being the only two persons to have more than one individual battleship named for them.

3. It has also been argued that the dispersal of so many skilled tradesmen in the high unemployment interwar years made it impossible to reassemble such workmen to construct the complex 16-inch gun mountings.

4. From a fiscal viewpoint alone, such plans were impossible and had much to do with Germany’s subsequent exhaustion and defeat in both world wars. Great Britain and Japan did indeed mobilize large armies, navies, and air forces; Japan lost its war and Great Britain went bankrupt in the process. Only the United States had the resources for such grand military expansion across the elements, and it actually emerged from both world wars financially stronger. The former Soviet Union may have had the
resources, but that nation also bankrupted itself and eventually went out of business.

5. Undeterred by such considerations, France and Italy both named battleships after their nations, and the United States completed an aircraft carrier long after World War II named America, not to mention a record-breaking ocean liner, USS United States.

6. They are sometimes also called battle cruisers. It is an indication of the meticulous nomenclature for warships of the U.S. Navy that these battleship-like ships units named after territories of the United States. (U.S. Navy cruisers, of course, were named after cities.)

7. The two Washingtions were completed just before Pearl Harbor.

8. Vanguard was completed after the war.

9. U.S. battleships of the World War I era saw so little service in that conflict and so much in World War II that it was thought best to describe them in the World War II chapter.

10. The system also powered the two giant U.S. Navy carriers built on the hulls of cancelled super-battle cruisers, Lexington and Saratoga.

11. Colorado was not at Pearl Harbor on 7 December 1941.

12. In 1989, the famed undersea explorer Robert Ballard, discoverer of Titanic, located Bismarck some 600 miles off the French coast. His conclusions support the German view that Bismarck was scuttled by its own crew.

13. The date is so iconographic that one has only to say “December 7.”

14. Were FDR misguided enough to provoke war with Japan by arranging for the killing of thousands of Americans, he could have managed things better by having the Pacific Fleet meet the advancing Japanese on the high seas, where they would have had a chance to hit back. A full-scale naval battle would certainly have impelled the United States into war.

15. Quoted in Spector, p. 166. The single Italian battleship sunk at Taranto fell victim to RN aerial torpedoes, not bombs, but it was indeed sunk from the air.

16. Oklahoma was judged not worth repairing and sank at sea while under tow to the ship breakers’ yard in 1947.

17. Some of the great naval clashes of the ancient Punic Wars may have involved as many main ships, but they did not fight over nearly so large an expanse of water.

18. Other sources contend that Giulio Cesare sank at its moorings at Sevastopol, with Soviet authorities suppressing news of this embarrassing event.

19. Perhaps this was an obscure jest played on a dictator whose comrades had murdered the czarist Russian royal family.

20. The Soviets also teased the West with stories, carried by gullible popular scientific magazines in the early 1950s, of impossible giant Soviet battleships mounting missiles.

21. Missouri suffered a most embarrassing grounding off the Virginia Capes early in 1950.

22. The battleship Oregon, a veteran of the Battle of Santiago, was actually the first battleship to be saved. It served as a floating museum in Portland,
Oregon, but was hulked and served as a munitions storeship off Guam during World War II and its remains were scrapped in 1956. It is difficult to imagine such a warship being so treated in today’s historic preservation-conscious era.

23. All warships passing the Arizona memorial render honors to the sunken battleship.

24. The states of Washington and California can contend for the dubious distinction of being the last coastal states to neglect to save their eponymous battleships, when Washington and California were broken up for scrap in 1959.

25. Yet even now there are efforts by U.S. citizens to reactivate the Iowas. These groups point to their enormous firepower from the world’s biggest guns.

26. These figures are necessarily tentative because some capital ships were sunk by a combination of weapons and the cause of loss of others is unclear. (Was Bismarck, for example, sunk by its crew or by enemy action or by both?)

27. This figure includes coast-defense vessels but not battle cruisers or uncompleted capital ships.

28. Numbers may vary, depending on whether one counts coastal and riverine ironclads, coast-defense battleships, the German pocket battleships, and so on.

APPENDIX

Ironclads and Battleships Through History
**AUSTRIA-HUNGARY: HAPSBURG CLASS**

**Construction:** Hapsburg (1899–1902); Arpad (1899–1903); Babenberg: all Stablimento Technico (1899–1904)

**Displacement (note: displacement may vary among warships of some classes):** 8,232 tons (empty; all data for time of commissioning)

**Dimensions:** 375'10" x 65' x 24'6"

**Armament:** 3 x 24 cm (bow twin turret, stern single) 12 x 15 cm

**Armor:** 180–220 cm belt; 210–280 cm turret and casemates; 40 mm deck

**Machinery:** 2 x shaft, 4 x cylinders triple-expansion engines = 14,500 indicated horsepower (ihp) = average 19.7 knots

**Complement:** 638

**Fate:** All three ceded to Great Britain at the end of World War I, but scrapped in Italy in 1921.
**AUSTRIA-HUNGARY: VIRIBUS UNITIS CLASS**

**SUMMARY:** Austria-Hungary’s only true dreadnoughts, these excellent battleships packed a heavy broadside on a considerably shorter hull than comparable Italian battleships, which were designed for similar duties in the same marine environment.

**CONSTRUCTION:** *Prinz Eugen*: Trieste Dockyard (January 1912–July 1914); *Szent Istvan*: Fiume Dockyard (January 1912–November 1915); *Tegetthoff*: Trieste Dockyard (May 1910–July 1913); *Viribus Unitis*: Trieste Dockyard (April 1910–October 1912)

**DISPLACEMENT:** 20,000 tons

**ARMAMENT:** 12 x 12", 3 x 4 turrets

**ARMOR:** 8"–11" belt; 2.5" decks; 11" turrets

**MACHINERY:** 4 x shaft Parsons geared turbines = 25,000 shp (shaft horsepower) = 20.5 knots

**COMPLEMENT:** 1,000

**FATES:** All four on active service in Mediterranean in World War I. *Prinz Eugen*: surrendered to France, expended as target. *Szent Istvan*: sunk off Premuda by Italian torpedo boat MAS 15, 10 June 1918. *Tegetthoff*: ceded to Italy and broken up at La Spezia (1924–1925). *Viribus Unitis*: handed over to new Yugoslavia government on 1 November 1918, but on 10 November it was sunk by an Italian explosive charge.
**FRANCE: LA GLOIRE**

**SUMMARY:** World's first seagoing armored warship.

**CONSTRUCTION:** Imperial Shipyard, Toulon (1858–1859)

**DISPLACEMENT:** 5,617 tons

**DIMENSIONS:** 80.4 meters x 17.0 meters

**ARMAMENT:** 36 x 6.4" rifled muzzle-loaders (replaced by 6.4" breechloaders)

**Armor:** 4.7" waterline belt; 3.4" deck

**Machinery:** 1 x 2 x cylinder engine = 2,540 ihp = 12.5 knots

**Complement:** 570

**Fate:** stricken, 1879.
FRANCE: ADmiral Duperré

**Construction:** La Seyne (1877–1883)

**Displacement:** 11,240 tons

**Dimensions:** 97 meters x 20 meters

**Armament:** 4 x 34 cm in open barbettes; 14 x 14 cm in the battery deck

**Armor:** 10"–22" belt; 12" with 4" tubes

**Machinery:** 2 x triple expansion engines = 7,100 ihp = 14 knots

**Complement:** 660

**Fate:** stricken, 1909.
Réquin (Courtesy of Art-Tech/Aerospace/M.A.R.S/TRH/Navy Historical)

FRANCE: RÉQUIN

**SUMMARY:** Its tumble home, large fighting tops, and fierce-face appearance was typical of late-nineteenth-century French battleships.

**CONSTRUCTION:** Chide la Gironde (1878–1888)

**DISPLACEMENT:** 721 tons

**DIMENSIONS:** 271'6" x 59' x 26'2"

**ARMAMENT:** 2 x 10.8" (2 x 1-gun turrets)

**ARMOR:** 19.5" compound belt, 3"–4"; 9.5" turrets

**MACHINERY:** 2 x shaft compound reciprocating = 11,200 hp = 15 knots

**COMPLEMENT:** 373 (later 332)

**FATE:** After reduction to gunnery hulk in 1908, coast defense duties, 1914, defense of Suez Canal same year, bombardment of Gaza, November 1917, stricken, 1920. Perhaps the oldest battleship to see combat service in World War I.
FRANCE: COURBET CLASS

CONSTRUCTION: Courbet: Arsenal de Brest (September 1910–November 1913); France: A C de la Loire, St. Nazaire (November 1911–August 1914); Jean Bart: Arsenal de Brest (November 1910–June 1913); Paris: F C de la Mediterranee, La Seyne (November 1911–August 1914)

DISPLACEMENT: 22,189–25,579 tons

DIMENSIONS: 541' 4" x 544' 7" x 88' 7" x 29'

ARMAMENT: 12 x 12" caliber .45 in 6 x 2–gun turrets

ARMOR: 10.6" x 7.1" belt at ends; 7.1" upper belt; 2.8" main deck; 7.1" casemates

MACHINERY: 4 x shaft Parsons turbines, 24 Belleville (France and Paris Niclausse) boilers = 28,000 shp = 20 knots

COMPLEMENT: 1085–1108

FATE: All four units served in the Mediterranean in World War I. Courbet: sank the Austrian cruiser Zenta, 16 August 1914. Reduced to training ship, 1931. Employed as coastal battery in June 1940, interned in Great Britain, turned over to Free French, grounded during D-Day invasion as breakwater off Ouistreham, hit by two German manned torpedoes, later broken up there. Jean Bart: stationary training ship and hulk, 1931, scuttled at Toulon, 27 November 42, used by German navy as target vessel, hit by Allied bomb in 1944, salvaged in 1944, broken up by December 1945. France: ran aground on uncharted rock in Quiberon Bay, sank, 26 August 1922. Paris: training ship from 1931, but in action against advancing Germans, June 1940, interned in Great Britain, July 1940. Barracks ship for Polish troops, returned to Brest after World War II, but not broken up until 1956.
FRANCE: PROVENCE CLASS

**Construction:** *Provence:* Arsenal de Brest (May 1912–June 1915); *Bretagne* (July 1912–September 1915); *Lorraine* (August 1912–September 1915)

**Displacement:** 22,189 -26,180 tons

**Dimensions:** 541' 4" x 544' 7" x 88' 7" x 29' 2"

**Armament:** 10 x 13.4" caliber .44 main battery guns in 5 x 2-gun turrets

**Armor:** 6.3"–10.6" belt; 2.8" main deck; 9.8" barbettes; 9.8" turrets (center); 15.7" (superfiring), 13.4" (end turrets)

**Machinery:** 4 x shaft Parsons geared turbines, 24 x Niclausse (*Provence* 18 Belleville, *Lorraine* 24 Guyot du Temple) boilers

**Complement:** 1,124–1,133

**Fate:** *Provence:* shelled by RN battleships at Mers el-Kébir 3 July 1940, settled in shallows, salvaged, sent to Toulon, scuttled there 27 November 1942, raised by the Germans, sunk again by Germans as blocking ship, raised, 1949, and scrapped. *Lorraine:* broken up, 1954; *Bretagne:* shelled by RN battleships at Mers el-Kébir, blew up with heavy loss of life.
FRANCE: RICHELIEU CLASS

**Construction:** Richelieu: Arsenal de Brest (October 1935–July 1940); Jean Bart: A.C. de St. Nazaire-Penhoet (January 1939–January 1949); (Two other sister ships were authorized: Clemenceau was canceled when 10 percent complete; Gascoigne never laid down.)

**Displacement:** 38,500–49,850 (average of the two)

**Dimensions:** 794’ x 813’2” x 31’7” (average of the two)

**Armament:** 8 x 15” in 4 x 2-gun turrets

**Armor:** 13.5” belt; 16.9” main turrets; 5.9”–6.7” main deck

**Machinery:** 4 x shaft Parsons geared turbines = 150,000 shp = 30 knots; Jean Bart 165,000 shp = 32 knots

**Complement:** Richelieu, 1,670; Jean Bart as flagship, 2,134

**Fate:** Richelieu: scrapped 1964; Jean Bart: not completed until after World War II, scrapped 1970.

Richelieu, March 1955 (Courtesy of Art-Tech/Aerospace/M.A.R.S/TRH/Navy Historical)
**GERMANY: SIEGFRIED CLASS**

**Construction:**
- **Siegfried:** Germania (1888–1890);
- **Beowulf:** Wesser (1890–1892);
- **Frithjof:** Wesser (1890–1893);
- **Heimdall:** Wilhelmshaven, Dockyard (1891–1894);
- **Hildebrand:** Kiel Dockyard, 1890–1893;
- **Hagen:** Kiel Dockyard (1891–1894);
- **Aegir:** Kiel Dockyard (1892–1896);
- **Odin:** Schichau (1893–1896)

**Displacement:** 4,100 tons

**Dimensions:** 259’2” x 49’ x 19’

**Armament:** 3 x 9.4” caliber .35 in 3 x 1-gun turrets

**Armor:** 7”–9” belt; 1.25” deck; 5.5” turrets

**Machinery:** 2 x shaft vertical triple-expansion, 3 x cylinder engines 8 x Schulz-Thornycroft boilers = 5,100 hp = 15.5 knots

**Complement:** 307

**Fate:** All relegated to coast defense and then various noncombat duties during World War I. *Frithjof* and *Odin* are two very rare examples of battleships converted successfully to merchant vessel; the former broken up in 1930, the latter in 1935. Remainder of class broken up in the 1920s. These Wagnerian-titled predreadnought battleships were designed to counter small French coastal capital ships and were thus a reflection of the modest naval aspirations of Germany under Chancellor Bismarck.
**GERMANY: NASSAU CLASS**

**CONSTRUCTION:** Nassau: Wilhelmshaven Dockyard (July 1907–June 1907); Westfalen: Weser, Bremen (August 1907); Rheinland: Vulcan, Stettin (June 1907–April 1910); Posen: Germaniawerft, Kiel (June 1907–May 1910)

**DISPLACEMENT:** 18,507–21,000 tons

**DIMENSIONS:** 451'9" x 479'4" x 88'5"

**ARMAMENT:** 12 x 11" caliber .45 main battery in 6 x 2-gun turrets

**ARMOR:** 80–300mm belt; 90–210mm bulkheads; 50–280mm barbettes; 60–280mm turrets

**MACHINERY:** 3 x triple-acting three-cylinder expansion engines driving 3 x shafts, 12 x naval boilers = 22,000 ihp = 19 knots

**COMPLEMENT:** 1,008–1,139

**FATE:** All four broken up in early post-World War I years.
GERMANY: BAYERN CLASS

**Construction:** Bayern: Howaldswerke, Kiel (September 1913–March 1916); Baden: Schichau, Danzig (September 1913–October 1916); (Sister ships Sachsen and Wurttemberg uncompleted at end of war.)

**Displacement:** 28,074–31,690 tons

**Dimensions:** 589'10" x 98'5" x 27'8" x 30'9"

**Armament:** 8 x 15" caliber .45 4 x 2-gun turrets

**Armor:** 4.7"–13.8" belt; 5.5"–11.8" bulkheads; 1"–13.8" barbettes; 3.9"–13.8" turrets

**Machinery:** 3 x shaft Parsons turbines, 14 Schultz-Thornycroft boilers = 48,000 shp = 21 knots

**Complement:** 1,187–1,271

**Fate:** Bayern: scuttled at Scapa Flow, 21 June 19. Baden: saved from Scapa Flow mass scuttling, examined by British naval authorities, expended later as target.
GERMANY: SCHARNHORST CLASS

**Construction:** Scharnhorst: Wilhelmshaven Dockyard (May 1935–January 1939); Gneisenau: Deutsche Werke (May 1935–May 1938)

**Displacement:** 31,850–38,900 tons

**Dimensions:** 741'5" x 753'11" x 98'5" x 27', 32'6"

**Armament:** 9 x 11" in 3 x 3-gun turrets

**Armor:** 13.8–6.7" belt; 2" deck; 5.9"–14.2" main turrets

**Machinery:** 3 x shaft Brown-Boveri geared turbines = 165,000 shp = 32 knots

**Complement:** 1,669–1,840

**Fate:** Scharnhorst: sunk by RN Duke of York and others off North Cape, Norway, 26 December 1943. Gneisenau: self-scuttled 28 March 1945 as block ship after being badly damaged by RAF attacks.
GERMANY: BISMARCK CLASS

**Construction:** *Bismarck:* Blohm & Voss (July 1936–August 1940); *Tirpitz:* Wilhelmshaven Dockyard (October 1941)

**Displacement:** 41,700–42,900 tons

**Dimensions:** 792’4” x 813’8” x 118’1” x 28’6” x 34’9”

**Armament:** 8 x 15” in 3 x 3-gun turrets

**Armor:** 10.6”–12.6” belt; 3.1”–4.7” deck; 7.2”–14.2” turrets

**Machinery:** 3 x shaft Blohm & Voss (Tirpitz Brown-Boveri) geared turbines = 138,000 shp =29 knots

**Complement:** 2,092–2,608

**Fates:** *Bismarck:* sunk by RN task force, 27 May 1941. *Tirpitz:* damaged by mines from midget submarines and finally sunk by Fleet Air Arm and RAF heavy bombs.
GREAT BRITAIN: VICTORY

**SUMMARY:** Horatio Nelson’s flagship at Trafalgar, and typical of the wooden, sailing, first-rate ship-of-the-line of the late-eighteenth-century Age of Fighting Sail

**CONSTRUCTION:** Royal Dockyard, Chatham (1765)

**DISPLACEMENT:** 3,100 tons (some sources give 4,000 tons)

**DIMENSIONS:** 62.8’ x 16’

**PROPULSION:** sail

**ARMAMENT:** 30 x 32-pounders, 28 x 24-pounders, 30 x 12-pounders (all smoothbores) on 3 x gun decks

**ARMOR:** nil

**COMPLEMENT:** 850 (at Trafalgar)

**FATE:** preserved as national monument.
**GREAT BRITAIN: WARRIOR**

**Construction:** *Warrior*: Mare (1859–1861); *Black Prince*: Napier (1859–1862)

**Displacement:** 9,000-plus tons

**Dimensions:** 380' x 58.25' x 26'

**Armament:** 10 x 110-pounders, 4 x 70-pounder rifles, 20 x 68-pounder smoothbores, 40 x 8" smoothbores

**Armor:** 4.5"

**Machinery:** 1 x shaft Penn trunk engine = 5,000 hp = 14.3 knots

**Complement:** 707

**Fate:** restored and preserved as national monument.
**GREAT BRITAIN: BELLEROPHON**

**SUMMARY:** Typical Reed-designed box-battery sailing ironclad.

**CONSTRUCTION:** Chatham Royal Dockyard (1863–1866)

**DISPLACEMENT:** 755 tons

**DIMENSIONS:** 300' x 56' x 25' 8''

**ARMAMENT:** 10 x 9", 5 x 7" muzzle-loading rifled guns (MLRs)

**ARMOR:** 6" belt and battery; 5" bulkheads

**MACHINERY:** 1 x shaft Penn

**COMPLEMENT:** 650

**FATE:** broken up, 1922.
GREAT BRITAIN: CAPTAIN

**Construction:** Lairds (1867–1870)  
**Displacement:** 7,767 tons (almost 1,000 tons more than in the original design)  
**Dimensions:** 320’ x 53.25’ x 24’ x 25.5’  
**Armament:** 4 x 12” muzzle-loading guns (MLs)  
**Armor:** 4”–7” belt; 9” turrets  

**Machinery:** 2 x shafts, 2 x trunk engines = 1,400 hp = 14.25 knots  
**Complement:** 500  
**Fate:** A disastrous essay in low-freeboard sailing turret ships; capsized, 6 September 1870, in the worst naval disaster of the nineteenth century.
GREAT BRITAIN: DEVASTATION CLASS

**Summary:** World's first seagoing, mastless capital ship. The prototype of all future battleships.

**Construction:** *Devastation:* Portsmouth Naval Yard (1869–1873); *Thunderer:* Pembroke Naval Yard (1869–1877)

**Displacement:** 3,310 tons

**Dimensions:** 285' x 62.3' x 27'6"

**Armament:** *Devastation,* 4 x 35-ton MLR; *Thunderer,* 2 x 35-ton MLRs, 2 x 38-ton MLRs

**Armor:** 8.5"–12" sides; 10"–12" breastwork; 10"–14" turrets

**Machinery:** 2 x shaft, 2 x Penn direct-action trunk engines

**Complement:** 358

**Fate:** *Devastation:* broken up, 1908.

*Thunderer:* scrapped, 1909.
GREAT BRITAIN: **INFLEXIBLE**

**SUMMARY:** The final development of the muzzle-loading, turreted, semimasted ironclad in the Royal Navy.

**CONSTRUCTION:** Portsmouth Navy Yard (1881)

**DISPLACEMENT:** 11,880 tons

**DIMENSIONS:** 320' x 75' x 24.5'

**ARMAMENT:** 4 x 16" main MLRs

**ARMOR:** 20"–24" citadel; 14"–22" bulkheads

**MACHINERY:** 2 x shafts, 2 x Elder inverted compound

**COMPLEMENT:** 440

**FATE:** sold off, 1903.
**SUMMARY:** The Royal Sovereigns set the pattern of fore-and-aft turrets and moderately high freeboard for almost all succeeding battleships.

**Construction:**
- **Royal Sovereign:** Portsmouth (1889–1892); Empress of India: Pembroke Dock Yard (1889–1893); Ramillies: Thompsons (1890–1893); Repulse: Pembroke Dockyard (1890–1894); Resolution: Palmers (1890–1893); Revenge: Palmers (1891–1894); Royal Oak: Lairds (1890–1894)

**Displacement:** 14,150 tons

**Dimensions:** 380' x 75' x 27–28'

**Armament:** 4 x 13.5" main battery

**Armor:** 14"–18" belt; 14"–16" bulkheads; 2.5"–3" decks; 11"–17" barbettes

**Machinery:** 2 x triple-expansion = 9,000 hp = 15.5 knots

**Complement:** 712

**Fates:** Empress of India: sunk as target, 1913. Revenge: used as coastal bombardment warship in World War I and as such was oldest RN battleship to see active service in World War I. Sold out of service in 1919. Remainder sold out of service, 1911–1914.
Dreadnought is rightly famous for introducing the all-big gun capital ship to the world’s navies. But this development was the result of a steady progress in naval design, a growing realization that smaller-caliber guns led to confusion in gunnery spotting in battle, and that a single heavy gun size would simplify matters across the board. But Dreadnought’s greatest innovation was in its power plant: steam turbines. At the time the first large commercial turbine ship had not even been laid down, and the first RN turbine-propelled destroyers had only been at sea for four years. The turbine gave the British such a technological lead that for years afterward even such advanced maritime powers as Japan and Germany had to build their turbines under licenses from United Kingdom firms; the first German turbine-powered battleships, the Kaiser class, were not laid down until almost five years after Dreadnought.

Dreadnought fought at Jutland.

Construction: Portsmouth Dockyard (October 1905–December 1906)

Displacement: 18,000–21,000 tons

Dimensions: 490’ x 572’ x 82’ x 31’ deep load

Armament: 10 x 12” caliber .45 main battery in 5 x 2-gun turrets

Armor: 4”–11” belt; 11” barbettes, turret faces, and conning tower; 1.5”–3” decks

Machinery: 4 x shaft Parsons turbines, 18 Babcox boilers = 23,000 shp = 21 knots.

Complement: 695–773

Fate: sold for scrap, 1921.
Great Britain: Orion Class

Summary: With the Orions, the Royal Navy went over to 13.5-inch guns, giving greater range and hitting power with improved shooting, a significant advantage over the German 12-inch gun. Also, the problematic wing turrets were finally removed, giving all future RN battleship all-centerline turrets. All four units fought at Jutland.


Displacement: 22,200–25,870 tons
Dimensions: 545' x 581' x 88'6" x 24'11"
Armament: 10 x 12.5" caliber .45 main battery in 5 x 2-gun turrets
Armor: 8"–12" belt; 3"–10" bulkheads; 3"–10" barbettes; 1"–4" decks
Machinery: 4 x shaft Parsons turbines, 18 Babcox & Wilcox boilers (Monarch Yarrow boilers) = 27,000 shp = 21 knots
Complement: 752
Fate: Orion: sold for scrap, 1922. Conqueror: sold for scrap, 1922. Monarch: decommissioned, 1922, then used as target for bombs, torpedoes, and gunnery tests; sank as a result of naval gunfire, 1925. Thunderer: sold for scrap, 1926.
GREAT BRITAIN: QUEEN ELIZABETH CLASS

**SUMMARY:** The first battleships to mount 15-inch main battery guns, the Queen Elizabeths were also the first large warships to be oil-fired.

**CONSTRUCTION:**
- *Queen Elizabeth:* Portsmouth Dockyard (October 1912–January 1915);
- *Warspite:* Devonport Dockyard (October 1912–March 1915);
- *Valiant:* Fairfield (January 1913–February 1916);
- *Barham:* John Brown (February 1913–October 1915);
- *Malaya:* Armstrong (October 1913–February 1916)

**DISPLACEMENT:** 27,500–31,500 tons

**ARMAMENT:** 8 x 15" caliber .42 main battery in 4 x 2-gun turrets

**ARMOR:** 6"–13" belt; 4"–6" bulkheads; 4"–10" barbettes; 13" turret faces; 1"–3" decks

**MACHINERY:** 4 x shaft Parsons turbines (Barham, Valiant, Brown-Curtis); 24 Babcox & Wilcox boilers (Barham, Valiant, Yarrow boilers) = 56,000 shp = 23 knots.

**COMPLEMENT:** 925–951

**FATES:** All but *Queen Elizabeth* at Jutland; all in active service during World War II, during which *Queen Elizabeth* suffered more battle damage than any unsunk British battleship. *Barham* torpedoed by U-331 in eastern Mediterranean, 25 November 1941, and blew up with loss of 862 lives. Remainder of these worn-out battleships sold for scrap in the immediate post-World War II years.
SUMMARY: Nelson and Rodney were the only two battleships designed and completed in the 1920s.


DISPLACEMENT: 33,950 tons

DIMENSIONS: 660' x 106' x 30'

ARMAMENT: 9 x 16" in main battery guns in 3 x 3-gun turrets

ARMOR: 14" belt; 9"–16" turrets

MACHINERY: 2 x shaft Brown-Curtis geared turbines = 45,000 hp = 23 knots

COMPLEMENT: 1,314

GREAT BRITAIN: KING GEORGE V CLASS

**SUMMARY:** The Royal Navy’s last battleship class.

**CONSTRUCTION:** *King George V:* Vickers-Armstrong (1937–1940); *Prince of Wales:* Cammel Laird (1937–1941); *Howe:* Fairfield (1937–1942); *Duke of York:* Clydebank (1937–1941); *Anson:* Swan Hunter (1937–1942)

**DISPLACEMENT:** 36,750 tons

**DIMENSIONS:** 700' x 745' x 103' x 35'6"

**ARMAMENT:** 10 x 14" in 2 x 4-gun turrets and 1 x turrets

**ARMOR:** 15" belt over magazines, 14" over machinery; 16" barbettes; 16" main turret faces, 15" sides, 9" roofs

**MACHINERY:** 4 x shafts, single-reduction geared turbines, 110,000–125,000 shp = 29.5 knots

**COMPLEMENT:** 1,640

**FATE:** *Anson, Howe, King George V:* scrapped 1957; *Prince of Wales:* sunk by Japanese air action December 1941.
<table>
<thead>
<tr>
<th><strong>Construction:</strong></th>
<th><strong>Displacement:</strong> 10,962 tons</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dimensions:</strong></td>
<td>339' x 358'11&quot; x 64'9&quot;</td>
</tr>
<tr>
<td><strong>Armament:</strong></td>
<td>4 x 1.7&quot; guns in 2 x guns in 2 x turrets</td>
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<tr>
<td><strong>Armor:</strong></td>
<td>21.5&quot; sides; 1.2&quot;–2&quot;; turrets; 17&quot; citadel</td>
</tr>
<tr>
<td><strong>Machinery:</strong></td>
<td>2 x shaft vertical compound engines = 7,711 ihp</td>
</tr>
<tr>
<td><strong>Complement:</strong></td>
<td>420</td>
</tr>
<tr>
<td><strong>Fate:</strong></td>
<td>stricken, 1909.</td>
</tr>
</tbody>
</table>

*Duilio* (Castellamare Naval Dockyard 1873–1880); *Dandolo* (La Spezia 1873–1882)

*Dandolo* (Courtesy of Art-Tech/Aerospace/M.A.R.S/TRH/Navy Historical)
ITALY: REGINA MARGHERITA CLASS

**Summary:** Both units were destroyed in World War I. They were so lightly protected that they could be considered as progenitors of the battle cruiser concept. (Italian naval designers tended to favor speed over protection.)

**Construction:** Regina Margherita: Arsenale Spezia (November 1898–April 1904); Beneditto Brin: Castellamare Dockyard (January 1899–September 1905)

**Displacement:** 13,400 tons

**Armament:** 4 x 12", 2 x in 2 x turrets; 4 x 8" guns, 1 x in 4 turrets

**Armor:** 2"–6" belt; 3" deck; 8" turrets

**Machinery:** 2 x shaft 4 x cylinder triple expansion engines = 20,000 hp = 20 knots

**Complement:** 1,170

**Fates:** Regina Margherita: sank off Valona 11 December 1916 after striking two mines laid by German submarine UC 14. Beneditto Brin: exploded at Brindisi, 27 September 1915, probably by defective cordite.
ITALY: DANTE ALIGHIERI

**Summary:** Italy’s first dreadnought.
**Construction:** Castellamare Royal Dock Yard (1907–1913)
**Displacement:** 19,552 tons
**Dimensions:** 518'5" x 551' 5" x 87' 3" x 28' 10"
**Armament:** 12 x 12" guns in 3 x 3-gun turrets
**Armor:** 10" side; 1.5" deck; 12" main turrets
**Machinery:** 4 x shaft Parsons geared turbines = 31,190 hp
**Complement:** 980
**Fate:** stricken, 1928.
ITALY: CAIO DUILIO CLASS

**Construction:** *Andrea Doria:* La Spezia Royal Naval Dockyard (March 1912–March 1916); *Caio Duilio:* Castellamare Royal Naval Dockyard (February 1912–September 1915)

**Displacement:** 22,956–22,994 tons

**Dimensions:** 554'1" x 557'5" x 91'10"

**Armament:** 13 x 12"

**Armor:** 10" belt; 5.1"–11" turrets

**Machinery:** 4 x shaft Parsons geared turbines = 30,000 shp = 21.3 knots; modernized with 2 x Belluzo turbines, driving 2 x shafts = 85,000 shp = 27 knots.

**Complement:** 1,233

**Fates:** Both transferred to Allied control in 1943, returned to Italy the following year, and stricken in 1956.
ITALY: VITTORIO VENETO CLASS

**Summary:** Italy’s last battleships.

**Construction:**
- *Littorio/Italia:* Ansaldo (October 1934–May 1940);
- *Roma:* CRDA (September 1938–June 1942);
- *Vittorio Veneto:* CRDA (October 1934–April 1940);
- (A fourth unit, *Impero,* was broken up, uncompleted, in 1948–1950.)

**Displacement:** 40,724–45,485 tons

**Dimensions:** 735' x 780' x 107'5" x 31'5" (averages for class)

**Armament:** 9 x 15" 4 x 3-gun turrets

**Armor:** 13.8" belt; 3.5"–6.4" main deck; 7.9"–13.8" turrets

**Machinery:** 4 x shaft Belluzo geared turbines = 128,200 hp = 30 knots

**Complement:** 1830–1950

**Fate:**
- *Roma:* sunk by German television-guided glider bomb, 9 September 1943.
- *Vittorio Veneto:* allocated to Britain as war reparations, scrapped 1948–1951.
Summary: The first true dreadnought battleships to be built in Japanese yards.

Construction: Satsuma: Yokosuka Dockyard (May 1905–March 1909); Aki: Kure Dockyard (March 1905–March 1911)

Armament: 4 x 12", 2 x 2-gun turrets; 8 x 12" in 4 x 2-gun turrets

Armor: 4"–9" belt; 8" turrets; 2" deck

Machinery: Satsuma: 2 x shaft vertical triple expansion, Aki: 2 x shaft Curtis turbines (built in United States) = 25,000 hp = 20 knots.

Complement: 800

Fates: both broken up in 1924.
**Summary:** These handsome battle cruisers/battleships were so highly regarded that the Royal Navy actually requested during World War I that the Japanese lend all four units to their British ally!

**Construction:**
- **Kongo:** Vickers (January 1911–August 1913);
- **Hiei:** Yokosuka Dockyard (November 1911–August 1914);
- **Haruna:** Kawasaki (March 1912–April 1915);
- **Kirishima:** Mitsubishi (March 1912–April 1915)

**Dimensions:** 659'4" x 704' x 27'7"

**Armament:** 8 x 14" caliber .54 2 x in x 4 turrets

**Armor:** 3"–8" belt; 9" turrets; 1.65"–2.25" decks

**Machinery:** 4 x shaft Parsons turbines (Brown-Curtis in Haruna) = 64,000 hp = 27.5 knots

**Complement:** 1,201–1,221

**Fates:**
- **Haruna:** sunk in shallow water at Kure by U.S. air attack, 1945, broken up, 1945–1946. **Hiei:** sunk 13 November 1942 by U.S. naval air and subsurface torpedoes and one aerial bomb, near Guadalcanal. **Kirishima:** sunk by gunfire from U.S. battleships Washington and South Dakota off Savo Island, only two days after loss of Hiei. **Kongo:** torpedoed off Formosa 21 November 1944 by U.S. submarine Sea Lion.
JAPAN: YAMATO CLASS

**Summary:** The largest battleships ever built and among the most famous.

**Construction:** *Yamato*: Kure Naval Yard (November 1937–December 1941);
*Musashi*: Mitsubishi (March 1938–August 1942); *(Shinano completed as aircraft carrier; No. 111, broken up uncompleted.)*

**Displacement:** 62,315–69,990 tons

**Dimensions:** 800'6" x 839'11" x 862'9" x 121'1" x 34'1"

**Armament:** 9 x 18-inch main battery

**Armor:** 16.1" belt; 21.5" barbettes; 7.5"–25.6" turrets; 7.9"–9.1" deck

**Machinery:** 4 x shaft Kampon geared turbines, 12 x boilers = 150,000 shp = 27 knots.

**Complement:** 2,500

**Fate:** Both units sunk by U.S. carrier aircraft attack.
RUSSIA: IMPERATRITSA EKATERINA II CLASS

**SUMMARY:** The class was noted for its unusually heavy main battery.

**CONSTRUCTION:** *Sinope:* Sevastopol (1883–1890); *Tchesma:* Sevastopol (1883–1889); *Ekaterina:* Nicolaiev (1883–1889); *Georgi Pobiedonosetz:* Sevastopol (1883–1894)

**DISPLACEMENT:** 10,500 tons

**ARMAMENT:** 6 x 12" caliber .35 in 2 x 3-gun turrets; *Sinope* rearmed 1914 with 4 x 8" caliber .50, 12 x 1" caliber .45, 2 x 47mm

**ARMOR:** 10"–16" belt; 2.5" decks; 2" turrets

**MACHINERY:** 2 x shaft vertical triple expansion = 10,600 hp = 16.5 knots

**COMPLEMENT:** 665

**FATES:** *Sinope:* provided fire support in World War I, machinery wrecked by British interventionist forces, scrapped by Soviets, 1923–24. *Georgi Pobiedonosetz:* incorporated into the new Red Fleet after the Bolshevik Revolution, then seized by White forces, and machinery wrecked. *Tchesma* and *Ekaterina:* stricken, 1907.

**NOTE:** The Soviet Union itself never completed a battleship.
**RUSSIA: IMPERATRITSA MARIYA CLASS**

**SUMMARY:** The last Russian battleships ever completed.

**CONSTRUCTION:** *Imperatritsa Mariya:*
- Russian Shipbuilding Co. (1911–July 1915); *Ekaterina II:* Nikolaev Factories Co. (November 1911–October 1915);
- *Imperator Alexandr III:* Russian Shipbuilding Co. (November 1911–June 1917)

**DISPLACEMENT:** 22,600–24,960 tons

**DIMENSIONS:** 550'6" x 89'6" x 27'6"

**ARMAMENT:** 12 x 12" main battery, 3 x in 4 x turrets

**ARMOR:** 5"–11" belt; 3" decks; 10" barbettes; 12" turrets

**MACHINERY:** 4 x shaft (*Emaptor Alexandr II* Brown-Curtis) turbines; 20 Yarrow boilers = 26,500 (*Ekaterina* 27,000) shp = 21 knots

**COMPLEMENT:** 1220

**FATE:** *Imperatritsa Mariya:* sunk by internal explosion, 20 October 16. *Ekaterina II:* renamed *Svobodnaja Rossija,* handed over to the victorious Germans, forestalled by being sunk by torpedoes from Russian destroyer, 16 June 18.

*Imperator Alexandr III:* taken over by Germans, renamed *Volya* (1 October 18), returned to Russia at end of World War I; under Whites, renamed *General Alekseev,* interned at Bizerta by French from 1920 onward; scrapped, 1936.
UNITED STATES: STEVENS IRONCLAD BATTERY

**Construction:** Stevens Bros., Hoboken, NJ (1843—never completed)

**Displacement:** 4,683–6,000 tons

**Dimensions:** 415' x 48' (1856)

**Armament:** 8 x 10" or 12" 4 x 15" or 18" MLR (never mounted)

**Armor:** 6.75"

**Machinery:** 8 x condensing engines = 8,624 hp = 20 knots

**Complement:** 150 (estimated)

**Fate:** Never completed; scrapped 1881.
UNITED STATES: CSS VIRGINIA

SUMMARY: Prototype for all subsequent Confederate ironclads

CONSTRUCTION: Confederate Navy authorities, Norfolk, VA (1861–1862)

DISPLACEMENT: 4,500 tons

DIMENSIONS: 263’

ARMAMENT: 6 x 9” Dahlgren smoothbore (SB) guns; 2 x 6.4” Brooke-designed RML; 2 x 7” Brooke-designed RML

ARMOR: 2’ oak and pine plus 4” rolled iron

MACHINERY: 1 x marine engine = 1,200 hp = 9 knots

FATE: Burned and scuttled by crew in 1862 to prevent capture.
The Ericsson Ironclad Battery Monitor (Courtesy of Art-Tech/Aerospace/M.A.R.S/TRH/Navy Historical)

**UNITED STATES: MONITOR**

**SUMMARY:** Participated in the world's first ironclad-versus-ironclad clash.

**CONSTRUCTION:** Continental Iron Works (1861–1862)

**DIMENSIONS:** 172’ x 41’ x 10’6”

**ARMAMENT:** 2 x 11” SB guns in 1 x turret

**ARMOR:** 2”–4.5” side; 8”–9” turret; 1” deck

**MACHINERY:** 2 x shaft 2 x Ericsson vibrating engines = 320 ihp = 6 knots

**COMPLEMENT:** 49

**FATE:** foundered in gale, 31 December 1862.
UNITED STATES: CANONICUS CLASS

**Summary:** Improved Passaics and typical of the U.S. monitor type.

**Construction:** Canonicus: Harrison Loring (1862–1864) (all units of class commenced construction in 1862 and were completed in 1864, except Manayunk (1865) and Tippecanoe (undetermined date); Catawba: Alex Swift & Niles (1862–1864); Mahopac: Secor; Manayunk: Snowdon & Mason (1862–1864); Manhattan: Perine, Secor, Alex Swift & Niles (1862–1864); Oneonta: Alex Swift & Niles (1862–1864); Saugus: Harlan & Hollingsworth (1862–1863); Tecumseh: Secor; Tippecanoe: Miles Greenwood (1862–1864)

**Displacement:** 2,100 tons

**Dimensions:** 223’–225’ x 43’4” x 12’5”

**Armament:** 2 x 15” SB in 1 x turret

**Armor:** 3”–5” side; 10” turret; 1.5” deck

**Machinery:** 1 x shaft 1 x Ericsson

**Complement:** 100

**Fate:** Catawba and Oneonta were never commissioned in U.S. Navy; both were sold to Peru in 1868. All except Tecumseh were sold off in the late 1800s to early 1900s. Tecumseh was the first example of the near-instantaneous destruction of a warship, lost at Battle of Mobile Bay, August 1864.
UNITED STATES: MAINE

**Summary:** Second-class battleship (originally classified as armored cruiser).
The first U.S. Navy battleship —if indeed it might be termed a battleship.

**Construction:** New York Navy Yard (1888–1895)

**Armament:** 4 x 10" guns in 2 x turrets, 6 x 6" guns: 561

**Armor:** 6"–12" belt; 12" barbette; 8" turrets

**Machinery:** 2 x shaft vertical inverted triple expansion engine = 9,000 hp = 7 knots

**Displacement:** 6,682 tons

**Complement:** 374

**Fate:** Destroyed in mysterious explosion, Havana Harbor, 1898, precipitating the Spanish-American War.

USS Maine (Courtesy of the Mariner's Museum, Newport News, Va.)
**SUMMARY:** First truly seagoing U.S. Navy battleship, but its 12-inch main armament was behind the standards of the time, and *Iowa* rapidly became obsolete. Participated in Battle of Santiago, 3 July 1898.

**CONSTRUCTION:** Wm. Cramp & Sons, Philadelphia (August 1893–June 1897, commissioned)

**UNITED STATES: IOWA**

**DISPLACEMENT:** 11,540 tons

**DIMENSIONS:** 362' 5" x 72'3" x 24'

**ARMAMENT:** 4 x 12" caliber .35 guns in 2 x turrets

**ARMOR:** 4"–14" belt; 2.73"–3" deck; 12.5" barbettes; 15"–17" turrets

**MACHINERY:** 2 x shaft vertical expansion engines = 11,000 hp = 16 knots

**COMPLEMENT:** 486–654
 UNITED STATES: SOUTH CAROLINA CLASS

**SUMMARY:** First U.S. Navy single-caliber battleships, their design actually preceded that of HMS Dreadnought but took much more time in construction.

**CONSTRUCTION:** *South Carolina:* Cramp (1906–1910); *Michigan:* New York Shipbuilding (1906–1910)

**DISPLACEMENT:** 16,000 tons

**DIMENSIONS:** 450' x 452'9" x 80'5" x 24'7"

**ARMAMENT:** 8 x 12" main guns, 2 x 4-gun turrets

**ARMOR:** 8"–10" belt (10"–12" over magazines); 8"–10" barbettes; 12" turret faces

**MACHINERY:** 2 x shaft, vertical triple expansion = 16,500 ihp = 18.5 knots

**COMPLEMENT:** 869

**FATES:** stricken, 1924.
Displacement: 31,400 tons
Dimensions: 600' x 608' x 97 x 28'10"
Armament: 12 x 14" main battery
Armor: 8"–13.5" belt; 3" deck; 16"–18" turret faces
Machinery: 4 x shaft Curtis turbines = 31,500 shp = 21 knots

Complement: 915
Fate: Pennsylvania: used as target in 1946 Bikini atomic bomb tests and finally sunk by naval air in February 1948. Arizona: sunk at Pearl Harbor by eight bombs and one torpedo; 1,177 lives lost, the highest single ship loss in U.S. naval history. Wreck and site today are a national monument.
UNITED STATES: NEW MEXICO/TENNESSEE/COLORADO CLASS

**Construction:** New Mexico Class (New Mexico, Mississippi, Idaho): New Mexico: New York Navy Yard (1915–1918); Mississippi: Newport News Shipbuilding (April 1915–December 1917); Idaho: New York Shipbuilding (January 1915–March 1919)

Tennessee Class (Tennessee, California, Colorado, Maryland): Tennessee: New York Navy Yard (1917–1920); California: Mare Island Navy Yard (1916–1921)

Colorado Class (Colorado, Maryland, Washington, West Virginia): various builders (1917–1923)

**Displacement:** 32,000–33,000 tons

**Dimensions:** 600' x 624' x 97'5" x 30'2"

**Armament:** 12 x 14", 4 x 3 (New Mexico, Tennessee classes); 8 x 16" (Colorado class), 4 x 2

**Armor:** much reduced from preceding Nevada class, mainly to protect machinery, guns, and buoyancy: 13.5" belt; 18" turrets; 2"–3.5" decks; 16" conning tower

**Machinery:** 4 x shaft Curtis (Idaho Parsons; Tennessee Westinghouse; California General Electric) turbines, 8–9 Babcox & Wilcox boilers = 27,000–32,000 shp = 21 knots.

**Complement:** 1,080

**Fates:** New Mexico, Idaho: stricken, 1947. Tennessee, California, Colorado, Maryland, West Virginia: stricken, 1959. Washington: construction halted when 75.9 percent complete; expended as target 1924.
**UNITED STATES: IOWA CLASS**


**Displacement:** 48,110–57,540 tons

**Dimensions:** 860’ x 887’3” x 108’2” x 26’2”

**Armament:** 9 x 16”, 3 x 3-gun turrets.

**Armor:** 12” belt; 7.25”–19.7” turrets; 6” deck

**Machinery:** 4 x shaft General Electric turbines, 8 x Babcock & Wilcox boilers = 212 shp = 32.5 knots.

**Complement:** 1921

**Fates:** All in existence in museum/reserve status.
### Number of Completed Ironclads

*To Early Battleship Era*¹

<table>
<thead>
<tr>
<th>Country</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>France</td>
<td>106</td>
</tr>
<tr>
<td>(includes 69 coastal ironclads)</td>
<td></td>
</tr>
<tr>
<td>Great Britain</td>
<td>64</td>
</tr>
<tr>
<td>United States</td>
<td>36</td>
</tr>
<tr>
<td>(does not include aborted light-draft Civil War monitors)</td>
<td></td>
</tr>
<tr>
<td>Russia</td>
<td>37</td>
</tr>
<tr>
<td>Netherlands</td>
<td>20</td>
</tr>
<tr>
<td>Italy (Piedmont-Sardinia)</td>
<td>20</td>
</tr>
<tr>
<td>Austria-Hungary</td>
<td>17</td>
</tr>
<tr>
<td>Germany</td>
<td>16</td>
</tr>
<tr>
<td><em>Turkey</em></td>
<td>16</td>
</tr>
<tr>
<td><em>Brazil</em></td>
<td>15</td>
</tr>
<tr>
<td><em>Denmark</em></td>
<td>12</td>
</tr>
<tr>
<td><em>Spain</em></td>
<td>8</td>
</tr>
<tr>
<td><em>Japan</em></td>
<td>7</td>
</tr>
<tr>
<td><em>Greece</em></td>
<td>5</td>
</tr>
<tr>
<td>Sweden</td>
<td>4</td>
</tr>
<tr>
<td>Norway</td>
<td>4</td>
</tr>
<tr>
<td><em>Argentina</em></td>
<td>4</td>
</tr>
<tr>
<td><em>Peru</em></td>
<td>3</td>
</tr>
<tr>
<td><em>Chile</em></td>
<td>2</td>
</tr>
<tr>
<td>(includes captured Peruvian <em>Huascar</em>)</td>
<td></td>
</tr>
<tr>
<td><em>China</em></td>
<td>2</td>
</tr>
<tr>
<td><em>Portugal</em></td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>399</td>
</tr>
</tbody>
</table>

¹Numbers may vary somewhat because of differences in counting coastal defense, purchased, or captured ironclads, or armored cruisers.

*These nations only purchased ironclads.
## Number of Completed Dreadnoughts

<table>
<thead>
<tr>
<th>Nation</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Great Britain</td>
<td>43</td>
</tr>
<tr>
<td>United States</td>
<td>30</td>
</tr>
<tr>
<td>Germany</td>
<td>26</td>
</tr>
<tr>
<td>France</td>
<td>16</td>
</tr>
<tr>
<td>Japan</td>
<td>14</td>
</tr>
<tr>
<td>Italy</td>
<td>10</td>
</tr>
<tr>
<td>Russia</td>
<td>7</td>
</tr>
<tr>
<td>Austria-Hungary</td>
<td>4</td>
</tr>
<tr>
<td>*Spain</td>
<td>3</td>
</tr>
<tr>
<td>*Greece</td>
<td>2</td>
</tr>
<tr>
<td>*Argentina</td>
<td>2</td>
</tr>
<tr>
<td>*Brazil</td>
<td>2</td>
</tr>
<tr>
<td>*Chile</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>160</td>
</tr>
</tbody>
</table>

* These nations only purchased dreadnoughts.
LOST IRONCLADS

Of the 372 armored warships completed between 1861–c. 1889 (roughly the ironclad era), 34 were lost, beginning with CSS Manassas, which was bombarded by USS Mississippi, caught fire and exploded off the Confederate forts on the lower Mississippi River, 24 April 1862.\(^a\)
The remaining lost ironclads were:

Albemarle (Confederate)—spar charge, 1864
Assari Tewfik (Turkish)—hit mine, bombarded by Bulgarian shore artillery, 1891
Avni Illah (Turkish)—(?) Italo-Turkish War, 1912
Blanco Encalada/Valparaiso (Chile)—torpedo, 1891
Captain (British)—capsized, 1870
Grosser Kurfurst (German)—fratricidal ramming, 1878
Independencia (Peru)—wrecked and blown up, 1879
Javary (Brazil)—sunk (?), 1893
Keokuk (United States)—gunfire, Charleston Harbor, 1863
Lufti Djelil (Turkish)—internal explosion, 1877
Magenta (French)—internal explosion, 1875
Manassas (Confederate)—burned, scuttled, 1862
Messudieh (Turkish)—torpedo from RN submarine, 1914
Minin (Russian)—submarine, mine, 1915
Monitor (United States)—foundered in storm off North Carolina, 1862
New Ironsides (United States)—accidentally burned, 1866
Palestro (Sardino-Italian)—gunfire, blown up, Battle of Lissa, 1866
Patapsco (United States)—mined, Charleston Harbor, 1865
Re d’Italia (Sardino-Italian)—rammed, Battle of Lissa, 1866

\(^a\)Includes coastal defense ironclads, but not purely riverine armorclads. Figures may vary because of differing definitions, as between late ironclads and early battleships. Some of these wrecks may have subsequently been raised. Does not include ironclads known to have been subsequently raised.
Rio de Janiero (Brazilian)—gunfire, Brazilian-Paraguayan War, 1866
Seyfi (Turkish)—Russian spar torpedo, Russo-Turkish War, 1877
Tecumseh (United States)—mined, Mobile Bay, 1864
Tetuan (Spanish)—blown up by rebels, 1873
Vanguard (British)—fratricidal ramming, 1875
Virginia (Confederate)—burned, 1862
Virginia II (Confederate)—scuttled, 1865
Weehawken (United States)—foundered, Charleston Harbor, 1863
DREADNOUGHTS LOST TO MISADVENTURE

_Arizona_ (United States)—aerial bomb, Pearl Harbor, 1941
_Audacious_ (Great Britain)—German mine, off Irish coast, 1914
_Barham_ (Great Britain)—submarine torpedo, Mediterranean, 1941
_Bismarck_ (Germany)—torpedoes, self-scuttled (?) Atlantic, 1941
_Bretagne_ (France)—British gunfire, Mers el-Kébir (broken up), 1940
_Danton_ (France)—German torpedo, Western Mediterranean, 1917
_Dunkerque_ (French)—self-scuttled, Toulon (broken up), 1942
_Imperatritsa Ekaterina II/Ekaterina Velikaya Svobodnaja Rossija_ (Russia)—Russiate destroyer torpedoes, 1918
_France_ (France)—ran aground in Quiberon Bay (broken up), 1922
_Friedrich der Grosse_ (Germany)—self-scuttled, Scapa Flow (broken up), 1919
_Fuso_ (Japan)—U.S. naval gunfire, torpedoes (?), 1944
_Grosser Kurfurst_ (Germany)—self-scuttled, Scapa Flow (broken up), 1919
_Giulio Cesare_ (Italy)—mine (?) (in Russian service), 1955
_Haruna_ (Japan)—U.S. naval bombing (broken up), 1944
_Hiei_ (Japan)—U.S. aerial torpedoes, bombs, off Russell Islands, 1945
_Hyuga_ (Japan)—U.S. aerial bombs, Kure (broken up), 1945
_Imperatritsa Mariya_ (Russia)—internal explosion, Sevastopol Harbor (broken up), 1916
_Ise_ (Japan)—U.S. naval air, Kure (broken up), 1945
_Kawachi_ (Japan)—magazine explosion, Tokuyama Bay (broken up), 1918
_Kirishima_ (Japan)—U.S. battleship gunfire, Savo Island, Guadalcanal, 1942
_Koenig Albert_ (Germany)—self-scuttled, Scapa Flow (broken up), 1919
_Kongo_ (Japan)—U.S. submarine torpedo, off Formosa (Taiwan), 1944
_Leonardo da Vinci_ (Italy)—internal explosion (?) Austrian sabotage (?)
_Taranto_ (broken up), 1916
_Markgraf_ (Germany)—self-scuttled, Scapa Flow (broken up?), 1919
_Musashi_ (Japan)—U.S. carrier air bombs and torpedoes, south of Luzon, 1944
_Mutsu_ (Japan)—internal explosion, Hiroshima Bay, 1943
_Oklahoma_ (United States)—Japanese aerial torpedoes, Pearl Harbor, raised, sunk while under tow, northwest of Pearl Harbor, 1941
Prince of Wales (Great Britain)—Japanese aerial bombs, torpedoes, off Malaya, 1941
Roma (Italy)—two television-guided bombs, Mediterranean, 1943
Royal Oak (Great Britain)—torpedoed, Scapa Flow, 1939
Scharnhorst (Germany)—British battleship gunfire (HMS Duke of York) and torpedoes, off North Cape, Norway, 1943
Settsu (Japan)—U.S. aerial bomb, Kure (had been converted to target, broken up), 1945
Strasbourg (France)—self-scuttled, Toulon (salvaged by Italian navy and sunk again, again at Toulon, and salvaged yet again (broken up), 1942
Szent Istvan (Austria-Hungary)—Italian motor torpedo boat torpedo, Southern Adriatic, 1918
Tirpitz (Germany)—Norway; British and Russian bombs, torpedoes, and midget submarines (broken up), 1944
Utah (United States)—aerial torpedoes, Pearl Harbor (had been disarmed), 1941
Vanguard (Great Britain)—internal explosion, Scapa Flow, 1917
Victoria (Great Britain)—accidentally rammed and sunk by HMS Camperdown off Malta, 1893
Viribus Unitis (Austria-Hungary)—Italian limpet mine, Pola Harbor (broken up?), 1918
Yamashiro (Japan)—U.S. destroyer torpedoes, Surigao Strait, 1944
Yamato (Japan)—U.S. carrier torpedoes and bombs, off Kyushu, 1945
BATTLESHIPS LOST TO MISADVENTURE

**Summary:** Pre-dreadnought battleships were extremely vulnerable, particularly to mine and internal explosion. Some 30 such warships were lost to misadventure (extraordinarily, only five to enemy gunfire).

Admiral Ushakov (Russian)—gunfire, Tsushima, 1905  
Asahi (Japanese)—submarine torpedo (U.S.), off Cape Padras, Indochina, 1942  
Aquidaban (Brazil)—internal explosion, 1906  
Benedetto Brin (Italian)—internal explosion (sabotage?), 1915  
Borodino (Russian)—gunfire, Tsushima, 1905  
Bouvet (French)—mine, Dardanelles, 1915  
Britannia (British)—submarine torpedo, Medway, 1918  
Bulwark (British)—internal explosion, off Sheerness, 1914  
Cornwallis (British)—submarine torpedo, Mediterranean, 1917  
Danton (French)—German torpedo, Western Mediterranean, 1917  
Formidabile (British)—submarine torpedo, Channel, 1915  
Gangut (Russian)—uncharted rock, 1897  
Gaulois (France)—submarine torpedo, 1916  
Goliath (British)—torpedo boat torpedo, Dardanelles, 1915  
Heireddin Barbarossa (Turkish)—submarine torpedo Dardanelles, 1915  
Hatsuse (Japanese)—mine, off Port Arthur, 1904  
Idaho/Lemnos (Greek)—German dive-bombers, Salamis, 1941  
Imperator Alexandr III (Russian)—gunfire, Tsushima, 1905  
Irresistible (British)—mine, Dardanelles, 1915  
King Edward VII (British)—mine, off Cape Wrath, 1916  
Kniaz Suvarov (Russian)—gunfire, Tsushima, 1905  
Liberté (French)—exploded, Toulon Harbor, 1911  
Majestic (British)—mine, Dardanelles, 1915  
Maine (United States)—internal explosion (sabotage?), Havana Harbor, 1898  
(Maine was the only U.S. battleship to be sunk in war or peace until World War II)  
Messudieh (Turkish)—submarine torpedo, Dardanelles, 1914  
Mississippi/Kilkis (Greek)—German dive-bombers, Salamis, 1941
Montague (British)—wrecked on Lundy’s Island, 1906
Ocean (British)—mine, Dardanelles, 1915
Osliaba (Russian)—gunfire, Tsushima, 1905
Peresvet (Russian)—submarine torpedo, off Port Said, 1917
Petropavlovsk (Russian)—mine, off Port Arthur, 1904
Pommern (German)—mine, Jutland, 1916 (only German battleship to be sunk until World War II)
Regina Margherita (Italian)—mines, off Valona, 1916
Rostislav (Russian)—scuttled (?) off Kertch, 1920
Russell (British)—mine, off Malta, 1916
Slava (Russian)—gunfire (?), Baltic, 1917
Sissoi Velike (Russian)—self-scuttled after Tsushima, 1905
Suffren (French)—submarine torpedo, off Portuguese coast, 1916
Ting Yuen (Chinese)—surface torpedo, off China coast, 1894
Triumph (British)—submarine torpedo, Dardanelles, 1915
Victoria (British)—fratricidal ramming, off Malta, 1893
Wien (Austro-Hungarian)—torpedo-boat torpedo, off Trieste, 1917
Yashima (Japanese)—mine, off Port Arthur, 1904

1 Peresvet, hit repeatedly by Japanese shellfire, was scuttled off Port Arthur in 1904. It was raised by the Japanese (renamed Sagami), sold back to Russia, went aground off Vladivostok, and was finally sunk by a German mine off Port Said, 1917.
Admiralty: controlling headquarters of the Royal Navy of Great Britain. Ministry of Marine for France, Secretary of State for Germany, and Department of the Navy for the United States
armor: steel or iron protection for a warship
armor-piercing shell: projectile with hardened tip to penetrate warship armor
armorclad: see “ironclad”
barbette: originally an open mounting for a warship’s heavy guns; later the vertical passage for passing shells and propellant upward to the turret
battleship: first-class warship; includes two-and three-decker wooden sailing ships, larger ironclads, pre-dreadnoughts, and dreadnoughts; term dates from c. 1889
blockade: method of naval warfare in which warships off an enemy coast seek to prevent entrance to or exit from that coast
blue-water navy: a navy with the ability to cruise and fight on the world’s oceans; the opposite of a coast-defense navy
boarding: the method of seizing an enemy warship by sending armed parties across from an opposing warship, usually lashed alongside
breechloader: gun loaded from the breech (rear)
broadside: method of firing by warships with their guns arranged along both sides. All of the main guns on a side are discharged one after the other, in “ripple” firing.
bunkerage: fuel capacity of a ship
capital ship: see “battleship” and “ironclad”
cat ‘o nine tails: whip used on ships for flogging, usually consisting of nine leather thongs, often interwoven with bits of metal or glass
Chief of Naval Operations: chief professional head of U.S. Navy
citadel: armored structure (box) protecting warship vitals
complement: number of personnel regularly assigned to a particular ship
conning tower: heavily armored small structure used to direct a warship and/or its fire control
continuous aiming: system of fire control in which the sights remain on a target due to continuing adjustments to track the target’s speed, course, and range
crossing the T: a fleet action in which one fleet’s capital ships cross in front of the head of an enemy fleet arranged in line
director firing: see “fire control”
displacement: weight of a ship, determined by the weight of the amount of water it pushes aside
échélon: method of fleet action in which the warships are arranged offset from each other, thus no warship’s ahead-fire is masked; popular during the ram craze
fierce face: form of naval architecture favored by the French in the late nineteenth century (and emulated by the Russians and, to a lesser degree, by the Americans), featuring piled-up superstructures, exaggerated ram bows, and long gun barrels protruding from small turrets
fire control: system of gun laying in which a warship’s guns track a target by combining the target’s and the firing warship’s speed, range, and direction as well as pitch and roll
fireship: expendable ship packed with incendiary and explosive material for use against enemy warships
First Lord of the Admiralty: political head of the Royal Navy, always a civilian and always a cabinet officer (U.S. Navy equivalent is secretary of the navy)
First Sea Lord: chief professional officer in the Royal Navy (U.S. Navy equivalent Chief of Naval Operations)
freeboard: that portion of hull exposed between the waterline and the first open deck
galley: oar-propelled warship, usually with auxiliary sail equipment; also ship’s stove and kitchen
guerre de course: raiding an enemy’s commercial ships (also knows as anti-commerce warfare)
hogging: a wooden ship’s hull bowing upward along the keel line
ironclad: term for armored warship, in use c. 1859–1889, referring to first-class armored, coastal, and riverine protected warships
jingo: popular term used to describe an ultranationalist. The term was first popularized in an English music hall ballad during the 1877–1878 crisis brought about by the Russo-Turkish War (“We don’t wish to fight, but, by jingo, if we do, we’ve got the ships, we’ve got the men, we’ve got the money, too!”)
line-ahead: method of fleet action in which the warships are arranged one behind the other
mêlée: method of fleet action in which the warships are in no particular arrangement
monitor: completely armored, low-freeboard, mastless turret ship
muzzleloader: gun loaded from the muzzle (front)
navalist: one who strongly and consistently supports the navy of his nation; term much in use in the early twentieth century in Germany, Great Britain, and the United States
pocket battleship: class of small battleships/large cruisers completed by Germany before World War II to be used as commerce raiders

pre-dreadnought: all battleships completed before the advent of HMS Dreadnought (1905–1906)

ram bow: reinforced bow of warship for piercing enemy ships, used on almost all ancient galleys and on ironclads and pre-dreadnoughts, 1859–1905

ram: type of ironclad warship, designed to be used primarily for ramming, c. 1864–1900

reciprocating engine: engine in which back-and-forth motion by pistons, vertical or horizontal, is translated to the rotary motion of a drive shaft

rifling: fitting grooves or lines inside a gun barrel to give the projectile a spin, thus improving accuracy and range

risk theory: naval postulate that one fleet could deter another simply by being powerful enough to pose a threat of severe damage

salvo: cluster of fired shells

scuttle: to self-sink a ship without use of weapons, usually to prevent capture by an enemy.

secretary of the navy: political head of the U.S. Navy and always a civilian; Cabinet officer until 1947; equivalent to the RN’s First Lord of the Admiralty and Germany’s Secretary of State for the Navy

shell: projectile fired from cannon and designed to explode within an enemy warship; can be fired vertically or horizontally

shot: projectile fired from smooth-bore or rifled cannon, with either solid or exploding shell

sortie: forward deployment by a warship or warships that involves leaving port

squadron: a naval unit consisting of two or more divisions and escorting warships

stern walk: structure around the stern of a warship (usually a capital ship) for the use of the captain and the highest-ranking officers

sponson: gun-mount structure extending from the hull of a warship

stability: inertial force that resists a vessel’s capsizing

torpedo: circular, self-propelled naval weapon used to sink ships from beneath the surface; driven by compressed air, flywheel, or clockwork and carries an explosive charge

tripod mast: mast consisting of three legs, thus reducing vibration and (if mounting a gun control observer and system) easing fire control

triple-expansion engines: marine engines in which the exhaust steam is vented through three cylinders of progressively smaller diameter, thus expanding the engine’s power

tumble-home: the progressive drawing-in of the upper portion of a warship’s hull to give ahead-fire

turbine engine: engine in which jets of steam play on vanes mounted on a spindle to give rotary motion

turret: armored, revolving metal structure holding between two and four large naval guns
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