

War and Society

Warfare at Sea: The Evolution of Naval Power

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We can roughly divide developments in naval warfare into three styles that cover our period of interest.

1 Merchant Marine and Land Tactics

Ship design had not radically changed from antiquity: the most important type of ship was the oared *galley* (which also had limited use of sails). Developed in the Mediterranean around 8th century B.C., the galley remained the principal ship for war until the late 16th century, and saw continued use for trade until the 19th. The galley was well-adapted to the Mediterranean, where it could perform its duties without venturing too far out of sight of land, but was far less capable when it came to operating in the rougher waters of the open seas, so it was not suitable for ocean-faring. Being propelled by rowing, the galley was very maneuverable but going against strong winds was very taxing on the crews, as was attempts to operate for long stretches of time (i.e., more than 20 minutes at top speed) and in high waves (which also added the danger of toppling the low profile ships). Although the ancient Greeks and Romans had experimented with multiple rows of rowers on each side, in practice three proved to be the effective limit (the efficient *trireme*).

In the early modern period, the galleys commonly had only one row of about 25 oars, usually with five men per oar. They mounted guns above the rowers, with a powerful frontal battery as well as guns on each broadside, but in general they could not pack much heavy ordnance. The basic medieval sea tactic had not changed very much since antiquity: although it had eliminated the use of ramming (hitting the enemy vessel using one's momentum), it still relied almost exclusively on boarding and hand-to-hand combat with regular infantry.¹ In other words, the fundamental tactics remained those of land warfare. The galley was essentially a floating castle: in addition to the rowers, it had to carry a complement of soldiers whose job would be to board enemy ships. Because the goal was to close on the enemy in order to extend the boarding platforms, galleys could not approach each other from the side — the oars would entangle and keep them apart — so the standard formation was the “line abreast” where everyone lined up facing the opponent's fleet. The battles in such encounters quickly degenerated in melees, where individual ships would rush at each other so that their boarding parties could join in combat. The artillery, which was still quite primitive to be deadly at long distances (and slow to reload), was only used during the final approach.

From the perspective of a monarch, then, naval warfare tended to be an extension of his land forces, although it did have to take into account some financial aspects that were relevant to sea fighting. Galleys were not cheap to build, and were even more expensive to maintain in seaworthy condition when unused. This worked against maintaining a permanent navy: as soon as peace broke out, many ships would have to be retired from active service, but as soon as they were laid up, they would begin to deteriorate very quickly. It would cost a lot to bring them back into service, as the English found out in the Second Anglo-Dutch War.

¹Ramming could be quite effective, but the Romans had eliminated it in favor of boarding, probably because they were so good at land warfare. After the collapse of the Roman Empire, building techniques were lost and as a result medieval galleys were actually far less maneuverable than their ancient predecessors, and could not gather sufficient momentum to make ramming effective enough.

The only sure way of keeping ships seaworthy was their continued employment, and in peacetime this meant trade. Because of the expense of outfitting and maintaining ships, the natural compromise was for the ruler to rely on merchantmen: they would ply their trade in peace, and could be quickly converted for war purposes once hostilities broke out. Relying on the merchant marine also made sense because whereas the soldiers did not require specialized training (they “did their thing” after boarding the opponent’s vessel), seafaring does require specific expertise. The military component of a galley consisted of a nobleman in charge and his men-at-arms, much like it would in a regular army. But the ruler could not just put peasants on a boat and expect them to become proficient with operating it. Instead, he had to rely on an existing pool of experienced sailors, and these could only come from one source, the merchant marine. Merchantmen were a convenient base not simply because they had amassed vast experience through their continued operation but also because they were already armed (to protect against pirates and privateers).

Navies of this age, therefore, tended to depend on the size and sophistication of the merchant marine, giving serious advantages to the Dutch and the English — whose entire economies were built on commerce and trade, and which depended even during peace on active large merchant fleets for their prosperity, and lesser ones to the French and the Spanish who relied on other sources of wealth.

The huge advantage of relying on essentially mercenary naval forces is that they required very little administrative and infrastructure investment by the government. Aside from the high offices of command that were supposed to coordinate the war strategy when fighting began (with varying degrees of (lack of) success), there was little the government had to do short of helping maintain port facilities so it could collect the customs duties. There was no need to maintain a bureaucratic apparatus — victualling and supply were organized on an *ad hoc* basis from private contractors. Of course, when necessity is the driving force and improvisation is the “strategy”, these contractors could command very high prices.

This is not to say that there were no far-sighted governments that pursued a more consistent approach but there were few and far between. Governments that realized that their livelihood depended on the health of the merchant marine and who invested resources in supporting it created a strong foundation of maritime power. The earliest, and most famous, example of this is the Republic of Venice, whose state-owned Arsenal (shipyards and armories) had been created in the early 12th century, but which had, by the early 14th century, become the largest (and indeed, the only) such enterprise in Europe. It would remain that until the Industrial Revolution, and although the Arsenal would be partially destroyed by Napoleon, it would survive to the present day as a naval base.

Venice developed standard techniques for mass production of fully fitted out ships (reportedly, at its peak the Arsenal could produce a galley in a day or so when it would normally take months) and weapons. In a process that anticipated the division of labor perfected by the assembly lines of the Industrial era, each shipbuilding component was produced by a specialized team of workers, who then passed it on to others to assemble. The Arsenal also experimented with ship design, producing the *galleass* — the very large and heavily armed warships famous for their role in the Battle of Lepanto, and, when they started building sailing ships, the *galleon*. The Arsenal also maintained a large permanent

reserve of about 100 warships in its docks.² The Arsenal provided the backbone on which the Republic's long life as a first-rate maritime power and resulting fabulous wealth rested. Not surprisingly, the Republic routinely devoted at least 10% of its spending on it, and it employed about 16,000 people.

The Dutch, who were also dependent on their merchant fleets, but whose federal government was far more decentralized than the Venetian oligarchy, did not approach this level of state involvement. Instead, their five separate Admiralties each recruited merchantmen for their own fleets, and even when they built ships for particular wars, they also tended to sell them off after the hostilities. This would only change after the defeat in the First Anglo-Dutch War taught the Dutch that they would have to invest in specialized warships and that the States-General (the federal government) would have to take over from the Admiralties to finance their construction and maintenance.

The problem, of course, was that ship owners were not keen on risking their ships in encounters with the enemy. They would often fight feebly or not at all, compromising the fleet's fighting ability. Mobilizing merchantmen also reduced the volume of trade, and could create serious financial strains on governments that relied on taxing that trade through customs duties. Finally, the manner in which rowers were recruited could present the ruler with either financial or security issues. Some fleets, like the Venetian and the Dutch, employed freemen as rowers and paid them competitive wages. This made them reliable in battle but expensive. Some fleets, like the Ottoman, used slaves who were chained in their positions at the oars. This made for cheap labor but presented serious security risks in battle, as the Turks found out at Lepanto where the mostly Christian slave rowers rebelled as soon as their ships were boarded by the Christian forces. Most fleets, like the armies, recruited from the least protected elements of society, and in many cases the navies also used criminals who were condemned to serve there. In a pinch, the navy would also press seamen into service, with the hated roaming press gang provoking serious resistance and outright hostility among the populace.

Finally, a crucial limitation of using converted merchant vessels as warships was that they were designed for carrying cargo. If this need was eliminated — as it would be in a dedicated warship — the ship could be made longer rather than deeper. This would allow it to carry more guns on the broadside and increase its maneuverability and speed. It was the English who were the first to innovate in this design. Even though King Henry VIII is usually credited with the creation of the Royal Navy (the first standing navy did make its appearance during his reign, and he oversaw the creation of permanent supporting facilities), it was Queen Elizabeth I — and, more to the point, her conflict with Philip II of Spain — that turned the navy into more than a glorified coastal force. The Queen spent consistently over decades on the navy, and as a result the English developed ships that were superior to anything not only Spain could put to sea, but what their major competitors, the Dutch, had.

It is worth noting that it was not necessary to assemble large fleets and seek battle with the opponent's fleet, especially if one's fleet was inferior to the opponent's. Piracy had been preying on merchant ships for as long as those existed and some communities in the Maghreb (usually referred to as Barbary Coast) made their living as pirates terrorizing the

²Glete (1993, 505).

Mediterranean from their ports in North Africa, but also extending their operations along the Atlantic coast of Africa (where they competed for the lucrative slave trade with the Europeans) and sometimes reaching as far as South America. It is to defend against the predations of pirates that merchantmen were armed even in peacetime. When war came, however, harassment of enemy shipping could be beneficial to the overall military strategy. Governments started issuing *letters of marque and reprisal* that authorized private persons (*privateers*) to attack enemy ships, capture them, and bring them to one's own port for sale, allowing of course, the privateer to keep a significant portion of the prize.

Privateering, while dangerous, could be extremely lucrative, and soon entrepreneurial venture capitalists began to invest in outfitting obsolete warships and converting merchantmen to carry larger crews and more guns. Privateers were not subject to naval command and sailed independently, which made it very difficult to integrate their actions into a consistent naval strategy. In fact, although their letters limited the targets there were allowed to attack, these licensed pirates sometimes did not bother to distinguish between enemies, neutrals, and friends. As a rule, they avoided engaging the opponent's navy and preferred attacking isolated merchant vessels. Still, their activities could add up very quickly to significant losses for the enemy: not only would the cargo be captured, but the ships could be integrated into own's own navy, the decrease in the volume of trade would hurt the enemy's income from customs dues, and the increased risk to shipping would drive up the insurance rates, which would also tend to depress commerce, hurting the opponent's economy in addition to his fiscal resources. They could also disrupt the enemy's logistics, jeopardizing any military strategy for land warfare that depended on supply by ships. Although warring sides often agreed to forego the issuance of letters of marque, in practice these solemn promises were often violated. In fact, privateering would not be abolished until 1856, and even after that non-European powers, many of which were not signatories to the Paris Declaration, would continue the practice.³

Thus, while everyone was more or less forced to rely on the converted merchant marine for naval warfare and many issued letters of marque to authorize commerce raiding, some governments had already begun to finance the creation of permanent navies. The resulting change in naval tactics spelled the end to the sea version of land warfare.

The pinnacle of sea power in the age of the galley was achieved at the Battle of Lepanto in 1571, which, however, also proved to be the last hurrah of that age. In this battle, a combined Christian fleet of Venetian, Spanish, and Papal forces numbering 212 ships (all galleys except for 6 galleasses), 70,000 men (about 40% of them soldiers), and over 1,800 guns confronted an Ottoman fleet of 251 ships (all galleys except for 45 galliots), 81,000 men (also 40% soldiers), but with fewer than half the artillery power of the Christians. The Christians towed their enormous galleasses in front of the fleet and the Turks, who had mistaken them for merchant vessels, attacked them. This proved a grievous error because the heavily armed ships wreaked havoc on the much lighter-equipped opponents, who lost about 70 ships even before the major fleets joined battle. Since the galleasses were positioned in four different places, they also forced the attacking Ottoman fleet to split, making it easy prey for the massed formations of the Holy League. When the galleys finally en-

³A curious postscript to this is that the depredations of the Somali pirates have caused some to propose to Congress to permit the government to issue letters of marque and reprisal. Nothing came of it.

gaged, the seasoned Spanish troops managed to best even the feared Janissaries, and the revolts of the Christian crews in the Ottoman fleet further contributed to its defeat. The Ottomans lost 210 ships (most of which were captured and retained by the Christians), while their opponents lost 20 galleys in battle and had to scuttle 30 more afterwards as not being seaworthy due to heavy damage. The Ottoman casualties were 15,000 dead to 7,500 for the Holy League, which had however freed about that many Christian slaves.

In this battle, superior ship construction and morale contributed to the European victory, but it was also the heavily armed galleasses that were an important factor, a fact acknowledged by the Ottomans, who quickly rebuilt their navy and imitated these Venetians capital ships. However, despite their firepower, the galleasses had serious weaknesses. In particular, their large displacement made them difficult to maneuver and especially vulnerable in shallow waters. It was this that allowed the English to be so successful against the Spanish Armada less than 20 years after the Spanish had mounted such a glorious naval effort in the Mediterranean. If the Battle of Lepanto was the heyday of the galley, it also marked the beginning of its demise as a warship.

2 The Battleship and State-Owned Navies

The development of the *sailing ship* spelled the beginning of the end of the oared galleys roughly contemporaneous with the advances in artillery that gradually eliminated the use of converted merchantmen as warships. These twin changes would usher in the era of state-owned specialized warships with immense firepower, with all the attending tactical, strategic, administrative, and social implications.

Let us start with the sailing ship. The oared ships could not venture far from land and were completely unsuitable for transoceanic voyages. In the late 15th and early 16th century, however, the Portuguese and the Spaniards had made advances in shipbuilding and navigation that allowed them to ply their trade in the Indian and Atlantic oceans. They had developed the *carrack*, a three-mast (sometimes four) vessel that was square-rigged (the actual shape is that of a trapezoid) on the fore and main masts, and lateen-rigged (triangular) on the mizzen mast. The most famous of these are the *Santa María* on which Christopher Columbus made his first voyage to America in 1492, and the *São Gabriel* that took Vasco da Gamma to India in 1497. Although useful for trade and long voyages, the carracks were too large, expensive, and lightly armed for use in war. For this purpose, the *galleons* were developed. These purpose-built warships were smaller and cheaper to build but they were also more heavily armed. They turned out to be so versatile, that they gradually displaced carracks in transoceanic voyages as well. From this design, the full-rigged ships — with three or four masts, all square-rigged — were developed.

The galleons did not have the agility of the galleys, which could take advantage of calm weather or unfavorable winds, but what they did not have in speed or maneuverability, they made up in range and displacement (see Figure A). Simply put, these wind-propelled ships could go farther (as long as there was wind) and carry heavier loads than anything that had to be propelled by muscle. When technological advances further improved the range and accuracy of their guns, the end of the galleys was at hand for now the crews of a sailing ship could bring ferocious firepower to bear on any galley long before it had the chance to close the distance and allow its boarding parties to clamber over. Although navies still used

galleys for a while, it would be in support of the large specialized heavily armed sailing *battleship*.

Naval warfare tactics did not change overnight. Of course, a wind-propelled ship could only ram another ship if there happened to be a strong wind and if it was bearing down on the opponent windward. Since ramming was impossible from most positions and in calmer weather, it quickly went out of style. Boarding, on the other hand, was still possible. Spain, for example, clung to its preference to boarding as the main strategy because of its unrivalled infantry. As a result, they built large and heavy *galleons* with high fore and aft castles to give advantage to boarding parties in hand-to-hand combat. The English, on the other hand, preferred their galleons without castles to maximize their speed and maneuverability so that they could fire on their opponents from convenient angles without getting close enough to be boarded. The two strategies were tested against each other in 1588 when the Spaniards outfitted their Armada of galleons and dispatched it to support an invasion of England. The Armada outnumbered and outmassed the English. If we compare the 45 most effective ships on each side, the Spaniards carried 15,235 men to only 8,171 on the English side, and the Spanish tonnage was 35,508 to the English 17,110. But, in keeping with the different fighting doctrines, the English carried 1,600 guns that could deliver a broadside of 7,000 pounds while the Spaniards carried 1,350 guns with a broadside of about 4,500 pounds.⁴

While the Spaniards attempted to close on the English to board their ships and bring the power of their superior infantry to bear, the English galleons fired their guns while well out of range, turned around to fire from the other broadside, and then escaped. They could batter the Spanish ships without giving the latter a chance to engage “properly”. Although this sank few ships (more were lost to bad weather and wear on the long voyage back to Spain around Scotland), it did demoralize their opponent who was denied the opportunity to engage the English, let alone winning.

The fate of the Armada pointed the way to the future: the sailing ships would rely on firepower, not hand-to-hand combat, to fight. Boarding could still occur, but only after the opposing ship was disabled. But firepower meant more, and heavier, artillery, and this introduced a host of problems.⁵ Three in particular would ensure that converted merchantmen would be of no use in the new struggles at sea. First, the ship had to carry the guns sufficiently high above water to ensure that they could be used both in calm and somewhat inclement weather (if they are too close to the water line, the gun ports could easily be flooded). In practice this meant putting the guns on the upper deck, which shifted the ship’s center of gravity and destabilized it. It was not unusual for early ships to capsize in rough weather. The gun deck needed reinforcement because of the weight of the bronze and iron guns, and additional structure to ensure its stability. Moreover, the focus on firepower soon led to the proliferation of gun decks until the standard battleship had two, heavy flagships had three or four, and single-deckers (soon called *frigates*) were relegated to supporting and scouting roles. This, of course, increased both the height and the weight of the ship. Second, the ship had to be able to absorb the shock of recoil when its own guns fired: a broadside would move between 60 and 80 tons suddenly and violently. This required even

⁴These numbers can be found in Preston, Roland, and Wise (1991, 112).

⁵For a detailed explanation of warship design issues, see Glete (1993, 35–56).

more reinforcement, which increased the weight of the ship. Third, the ship had to be able to take the enemy's fire, which meant thicker oak frames and planks, and later iron, for protection.

In this way, the superiority of firepower over hand-to-hand combat meant that any navy that wanted to win would have to find ships that were not only larger and heavier, but also more stable than a merchantman. The merchant vessels could be quite large but this is because they had a lot of cargo capacity, and they all carried the cargo near the bottom where it automatically stabilized the ship. The top-heavy warship design requirements made them quite unsuitable for conversion. Since the cargo holds could not be used for the weapons and ordnance, all this weight had to be accommodated elsewhere. In other words, there was a basic trade-off between cargo capacity and ability to carry weapons. Warships were not only inefficient as cargo-carriers, they were even less optimal because the specialized structural and defensive features added to the weight. Warships and merchant vessels ceased to be interchangeable. Even the heaviest armed ships of the East India Company could not hold their own to a specialized warship.

The dominance of firepower made possible by the development of artillery and the increased carrying capacity made possible by the development of the sailing ship together put an end to the use of converted galleys from the merchant marine as warships, at least in countries where the government could take the obvious next step and build dedicated battleships. Without the protection of warships, merchantmen had been forced to arm themselves, which in turn had made them attractive for mobilization during times of war. Until artillery influenced ship design, merchantmen and warships (oared or sailing) had been sufficiently similar to make it feasible to rely on such a mobilization. The large guns — or, more to the point, their weight, distribution, and use requirements — changed the design so fundamentally that merchantmen became useless in a battle against enemy warships. As we shall see, this did not mean that they were useless in war more generally, but it did mean that anyone who wished to engage the opponent's battle fleet would better be prepared to do so with a battle fleet of his own.⁶

In a sense, the shift from a converted cargo-carrier to a specialized warship did not require the government to build the latter; after all, the private purpose-built privateers were warships and they were employed by states for warfare until the mid 19th century. However, the evolution in tactics for naval warfare made privateers essentially useless for the dominant form that sea battles were about to assume. With most guns mounted on the broadsides, the battleships would not have been able to deliver massive salvos if they had been arrayed for battle the ways galley fleets had been (line abreast with bows facing the opponent) or if they charged the enemy using their few bow guns and canting the side guns as much as possible.

Instead, ships were to form a line-ahead (i.e., line up bow to stern) and deliver broadsides against the opponent. It was also crucial to prevent the opponent from “crossing the T”; that

⁶See Figure B for a cut-out schematic of the three-decker *H.M.S. Temeraire* that famously saved the British flagship *Victory* during the Battle of Trafalgar. Perhaps more poignant, however, is the story of the French ship that had been battering *Victory* and, after mortally wounding Vice Admiral Nelson, was about to board it when *Temeraire* intervened. The *Redoutable*, built in 1791, was surrounded by three ships, each larger than itself, and mercilessly pounded until it lost all its artillery, its masts, and more than 500 of its 643 crew. Only then did it surrender, and its captain Lucas was subsequently awarded the Legion of Honor by Napoleon.

is, cutting an arc in front (or in the midst) of the line forcing the ships that form the line to only use their stern weapons to fire (firing from the bow would hit one's own ship in front, and the side weapons would have to be canting again). In other words, the line was most effective when it crossed the enemy's T: moved perpendicular to the enemy's formation or broke it up (see Figure 1). It was these tactics that gave the battleship its common name *ship-of-the-line*.

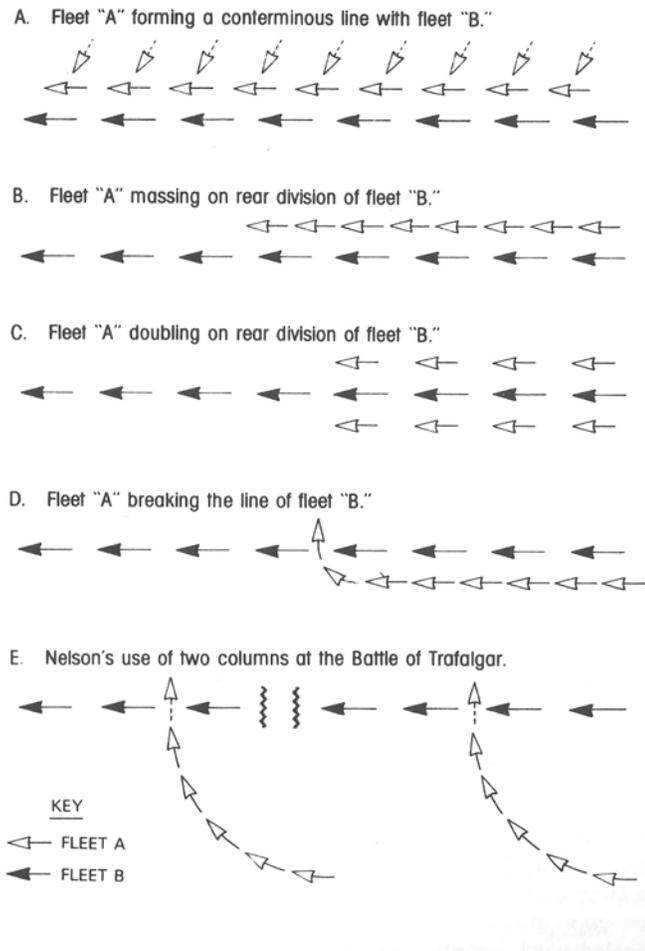


Figure 1: Fleet Tactics in the Age of Sail, from Addington (1994, Diagram 2, p. 10).

The fleet's main goal in such a battle was to hold the line, which meant that its ships had to withstand heavy fire while maintaining speed and stability.⁷ The crew, especially the officers, had to keep their heads because if discipline faltered and one ship broke formation,

⁷The famous painting *Battle of the Capes*, rendered in Figure D, fought between the French and the British on September 5, 1781 off the Virginian coast was probably the decisive naval encounter in the American Revolutionary War. During the battle, six of the British but only two of the French ships were seriously damaged. The fleets disengaged but the French eventually made their way to Chesapeake Bay where they received reinforcements. The British Admiral, having realized that he was now no match for the 36 French ships-of-the-line, retreated, leaving the bay in French hands. This deprived Cornwallis from receiving reinforcements

the enemy could charge into the opening and devastate the rest. These requirements made privateers quite unsuited for line tactics: they were not as heavily armed (since their main role was as hit-and-run vessels), their owners were unlikely to obey officers, and their crews — who had signed up to make a profit — were also unlikely to sit tight under withering gunfire. As a practical matter, these tactics required professional officers with specialized warships that were of little use for anything else other fighting.⁸ This is what got governments so heavily involved with the construction and maintenance of state-owned navies, along with the permanent officer corps and administration that came with them.

All of this was terribly expensive: the warships were capital intensive. They required a lot of high quality timber (e.g., *H.M.S. Temeraire* used up 5,000 trees for the hull) and skilled labor for construction but also for periodic maintenance to deal with rot. To minimize the deleterious effects of service, ships were laid up in drydocks (kept covered and dry in special facilities) when not in use during war, a practice that would continue to the middle of the 19th century. This put the emphasis on longevity over innovation: after all, if the goal is to keep ships in service for as long as possible, one can hardly keep introducing new features that would require separate maintenance skills and facilities. Thus, naval technology effectively stagnated for several centuries. States tended to use ships until they sank or their hulls lost structural integrity due stress from service and so rot could no longer be effectively repaired. They also tried to capture enemy warships so they can put them to use in their own navy instead of sinking them. Although there is no meaningful average lifespan of a battleship, in practice great ships could be useful for 60 to 80 years (although, of course, they could be disabled within five or fewer).

As I mentioned above, one cost-saving strategy was to lay up the battle fleet during peacetime with only a skeleton maintenance crew and a few officers.⁹ Unlike soldiers, whose specialized skills are not particularly useful during peacetime, sailors were employable in the merchant marine. Thus, unlike a standing army that had to be regularly paid during peacetime, the bulk of the manpower for the navy could be transferred to civilian employment. There were, however, several drawbacks to this. Since sailors were gainfully employed, there was no peacetime training, which further limited the spread of effective fighting techniques and skills. Second, the fact that they were paid made it more expensive to recruit them during war. This put upward pressure on wages when it came to skilled seamen, and forced governments to use other measures to lower wages for the rank and file.

The navy, like the army, recruited from socially undesirable elements: the unemployed, the criminals, the vagrants, essentially anyone without prospects for getting employed on a regular basis. When this was not enough (i.e., almost always) the navy resorted to compulsion. Impressment, which was regularly practiced in Britain, forced merchant sailors into service. Most of the men were taken from ships at sea, but the press gang would often seize people on land — the so-called “landsmen” — without bothering to inquire too closely into their seafaring abilities. The distinctive clothes usually worn by sailors made them readily identifiable targets in the street. At sea, the navy would patrol close to ports, stop merchant

while simultaneously providing supplies to Washington who had him besieged at Yorktown, and was crucial for Cornwallis' decision to surrender.

⁸See Harding (1999, 104–5) for the shortcomings of the merchant marine during the First Anglo-Dutch War.

⁹Glete (1993, 173–4).

ships, and then pick the most able of their sailors, replacing them with landsmen from their own ship. Seamen pressed into service obviously did not have high morale, but desertion was common among volunteers as well, especially during the initial shake-out period before men had time to adjust and to make friends. To get a sense of the scale of coercion, about half of the Royal Navy — or about 60,000 men — were pressed into service.

Impressment — a fairly violent form of coercion — is interesting because it was practiced by one of the few countries with a constitutional monarchy and without conscription for the regular army. It could also prove highly explosive internationally, as it did in the last decade of the Napoleonic Wars when the Royal Navy impressed sailors from American ships on the (not altogether unreasonable) pretext that subjects of the Crown could try to evade their legal obligations by hiding amid another English-speaking crew. It was this practice (among other things) that precipitated the War of 1812 between the United States and Great Britain. Other countries had a more bureaucratic regularized version that used registrations and quota systems that distributed the burden among different locales (cities, provinces). It was predictable, it was less arbitrary, and as a result it met with less resistance. Governments would also impose wartime restrictions on the merchant marine (e.g., how many ships could sail) in order to deepen the pool of unemployed sailors who might then be induced to volunteer for service on the warships. This was crucial because merchant pay tended to rise during hostilities to compensate for the increased risks, which of course made it even harder to compete at market wages. France, Denmark, and Sweden all practiced this form of conscription. The Dutch Republic, on the other hand, relied mostly on wages and on artificially limiting opportunities to merchants during war.

This should not be taken to imply that all sea contests were between battle fleets in line-ahead formations. Since these contests were in essence slugging matches, the side with the larger fleet and heavier broadside tended to emerge victorious provided the opponent deigned to resist. If fleets were roughly matched, engagements tended to be inconclusive. The British who generally held the advantage tended to prefer to come from the windward gage while weaker fleets usually engaged from the leeward gage, which limited their movements but at least allowed them to flee if the battle went wrong. The French soon developed doctrine to do precisely that whenever their commanders felt that the odds were not favorable. They would maintain their distance, shoot down the rigging of the British ships, and disengage in order to conserve their forces for use locally whenever the British battlefleet was not around. In fact, merely keeping one's battlefleet intact and safe at port could exert influence on the opponent during war because of the threat it represented. This *fleet in being* could always sail when conditions were favorable, forcing the opponent to take account of that possibility and dissipate his forces in guarding against it.

Although the fleet in being could threaten the enemy, it could not be used to support land operations, let alone achieve command of the seas. For active engagement, one's ships had to sail and if they could not hold their own against the enemy's line, then an indirect strategy had to be devised. One obvious choice here was commerce raiding — *guerre de course* — whose goal was to cripple the opponent's merchant marine and disrupt his logistical lines. This is what the privateers under the letters of marque were precisely designed to do. When the opponent depended critically on overseas supplies, like the Dutch who needed access to their naval stores and fisheries, the Spaniards who needed the uninterrupted flow of silver from the New World, and indeed the British who also needed their naval stores and, later,

trade, such a strategy could be quite effective. It helped the British emerge victorious from its contests with Spain and the Dutch Republic, and it also drove home the notion that to avoid their fate Britain itself had to develop a navy powerful enough to command the seas.

France, however, proved a tougher nut to crack because it was a land power that was mostly self-sufficient. It could not be brought around by mere naval action, especially when its fleet refused to leave port to engage. During the first half of the reign of Louis XIV, the French navy grew in both numbers and sophistication, and from its base in Brest, which gave it potential access to the Baltic threatening Britain's main supply of timber from Sweden and even a jump-off point for invasion of the home isles, it offered a clear and present danger that no line of battle could defeat. When France found itself at war with great powers around it, however, the fiscal demands of the army immediately put the navy on the back burner, and the great fleet was allowed to deteriorate so it could no longer contest the seas with the British. The French, therefore, relied heavily on the *guerre de course*, which forced the Royal Navy to provide *convoy*s for its merchant marine. The French were so successful, in fact, that the government forbade merchants from sailing unescorted.

The convoys enabled Britain to remain aloft during war, but could not really defeat France. For this, land power was necessary, which in practice meant that Britain would have to subsidise France's opponents on the continent and provide naval support for amphibious operations and logistics (and, on occasion, send its own army there). If Britain got tangled up in land warfare on the continent, it could quickly find the fiscal pressure intolerable as well. For instance, during the Nine Years War (1688–97), France had invaded the Netherlands. William of Orange, the recently installed King of England, was of course also the Stadtholder of the Dutch Republic, and as such was keen to commit land forces to protecting his homeland. The English navy was required to support these operations instead of launching attacks against ports that supported French privateers. With its commitment to protecting the absolutely vital stores (North Sea and Baltic), the Royal Navy was stretched too thin, and as a result could not play much of a role in this war (or the next for that matter). In the end, what helped Britain attain command of the sea during the 18th century was not merely the governments continuing investment in the Royal Navy, but also its recognition that it had to stay disengaged from land rivalries on the continent and the chaotic state of French finance that crippled its main rival, preventing it from contesting the sea while simultaneously fending off land opponents.

The full implementation of *guerre de course* is to interdict as much as possible of supplies and materiel that the opponent needs for his war effort; i.e., to implement a *blockade*. The navy would patrol enemy ports, bottling up any forces that might venture out in support of the cargo vessels, while simultaneously intercepting anything that tries to make its way to the enemy's ports. An effective blockade would require patrolling the entire relevant coastline, stretching the resources of anyone but the largest navies. It would have to defend itself from enemy fleets (or those of their allies), forcing it to stretch its resources quite thin (which works to the advantage of smugglers). Finally, it might also need to extend the patrols during the winter season, a time that had traditionally been mostly free of naval activity on account of the dangers of bad weather. Thus, blockades were essentially out of reach for just about any power except the British, and even then only if circumstances were particularly favorable.

The British were able to impose the first successful blockade during the Seven Years War

after the Royal Navy inflicted a major defeat on the French at Quiberon Bay on November 20, 1759. But the British also failed to blockade the rebellious American colonies just two decades later, both because the Atlantic coastline offered way too many harbors where smugglers could put to shore, and because the resurgent French navy, later joined by the Spanish and the Dutch, proved to be quite adept at harassing the British and moving supplies to the rebels. During the war, the Continental Navy managed to build only one ship-of-the-line against the British, who had commissioned 120 ships-of-the-line and 222 frigates. The Americans could only hope to wage *guerre de course* with the assistance of privateers under letters of marque, but this could be no more of a nuisance to the British. The balance changed when three naval powers friendly to the Americans (or, more correctly, hostile to the British) intervened. In 1778 France entered with 80 ships-of-the-line, followed a year later by Spain with another 60, and another year later by the Dutch Republic with another 20, fatally weakening the blockade and effectively bringing British command of the seas to a (temporary) end.¹⁰

3 The Armored Navies

Although steam power had entered industrial use in the second half of the 18th century, it would not affect warship design significantly until after the middle of the 19th when the steam-propelled armored ship, the *ironclad*, was developed.

The French launched the first ocean-going wooden ship-of-the-line powered by steam in 1850, and although the Second Empire managed to add another eight over the next decade, the British quickly outpaced them. The steam engine overcame one of the most important limitations of the sailing ship: it allowed ships to operate at higher speeds irrespective of wind conditions.

The time of the wooden warship, however, was drawing to a close. Despite the voluminous broadsides fired during a fleet engagement using ships-of-the-line in formation, it was rare for battered ships to actually sink. The cannon balls simply could not do enough damage to the structural integrity of the hull, which is one of the reason that boarding was necessary to take control of disabled enemy vessels. In 1823, however, the French introduced a naval gun that fired explosive shells. Although incendiary shells had been used by armies for a long time, it had been necessary to fire them at steep angles and relatively low velocities to prevent them from bursting. Both of these requirements had made these shells unsuitable for ships, whose guns had to fire at relatively low angles at high velocity. But the potential military utility of explosive shells against wooden ships could not be overlooked: incendiary shells could cause fires and spread the damage unlike cannonballs that could only deliver kinetic force to the point of impact (or, if red-hot and the shot was lucky enough, an explosion of the opponent's ammunition store). The new gun was quickly adopted by other navies, irrevocably endangering the wooden warship.¹¹

This increased vulnerability could only be countered by more protection, in this case iron armor. The French led the way again when they launched the first steam-powered armored ship in 1859, and again the British soon outpaced them, first by introducing iron hulls

¹⁰Addington (1994, 15).

¹¹Up to this point, the only way to threaten warships with total destruction had been with a *fireship*.

(instead of armored wooden ones), but especially after the Royal Navy decided to move to an all-armored battle fleet in 1861. The iron hull provided more strength than wood and solved the structural bottleneck that had prevented sailing ships from becoming longer and larger.

As an early industrializer, Britain also had the advantage of ready access to iron, and since the industry was private, the government was relieved of having to maintain the Royal Dockyards for shipbuilding; private contractors could not build the ships for the nation. On the other hand, since the skills required for industrialized warfare were not the same as those required for working on a merchant vessel, the navy could no longer rely on recruitment from the merchant marine. Instead, permanently commissioned sailors would have to be maintained.

The ironclad was the combination of steam-power with an iron hull and heavy armor, and it immediately proved itself superior to wooden sailing ships in battle. This introduced some chaotic experimentation with tactics, and for a while even ramming was revived — after all, a ship propelled by steam at top speed was maneuverable enough and had sufficient momentum to deliver a punishing blow to an opponent. The discussion of these tactics and their effects on navies, however, takes us past our cut-off point, and will not be pursued here.

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Figure A: Galleons versus galleys: Dutch Ships Ramming Spanish Galleys off the Flemish Coast in October 1602 by Hendrick Cornelisz Vroom, 1617.



Figure C: The French *Redoubtable* simultaneously engaged by *Victory* and *Temeraire*, with *Tonnant* taking position at stern during the Battle of Trafalgar. Louis-Philippe Crépin, 1807.



Figure D: The French and British lines during the Battle of the Capes during the American Revolutionary War, September 5, 1781 by V. Zveg (Wladimir Zwegintzoff), 1962. <http://www.history.navy.mil/photos/images/h73000/h73927kc.htm>, accessed April 13, 2014.