Naval warfare in Europe, c. 1330-c. 1680

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Introduction

This chapter considers the question of how war at sea changed during the late-medieval and early-modern periods, and whether these changes constitute a 'naval revolution'. It is now recognised by historians such as Carlo M. Cipolla, Jan Glete, John F. Guilmartin, and Geoffrey Parker that, during the period roughly between 1500 and 1650, war at sea underwent a fundamental technological transformation.[1] This transformation was of great importance both for warfare at sea and for its organisation. Thanks to the fiscal means of the modern state, permanent, professional, and complex naval organisations became a general phenomenon in Europe. However, at the beginning of the early-modern period, permanent war fleets in most cases did not yet represent anything more than a small core of ships, in itself of limited military importance.[2]

All the same, many of the characteristic features of naval organisation, such as arsenals, admiralties, and standing navies, had come into existence in the Middle Ages. Both the arsenals of Venice and Aragon–Catalonia dated from the beginning of the thirteenth century. Admiralties appeared as institutions around the office of admiral, which originated in Sicily in the twelfth century and became permanent there in 1239. In the fifteenth century Admiralty Courts appeared in Brittany, Normandy, and Guyenne, to mention but a few. Sicily possessed a permanent war fleet in the thirteenth century; Venice established one in

[1] Cipolla, *Guns*; Glete, *Navies and Nations*; Glete, *Warfare at Sea*; Guilmartin, *Gunpowder* (citations are to the 1974 edn throughout the chapter); Guilmartin, *Galleons*; Parker, *Military Revolution*, 82–114.
[2] Glete, *Navies and Nations*, 1, 102, 125–7, 129–31, 146. Venice represents one of the major exceptions: see the next paragraph.

1301. England may have had a permanent squadron during the reign of Richard I, 'the Lionheart' (1189–99) but it was Henry V (1413–22) who actually developed something like a royal navy in the modern sense.[3] The question is, then, to what extent a divide exists between medieval and early-modern European naval warfare.

Because most of the typical institutions of naval warfare, or naval organisation, originated in the Middle Ages, it seems appropriate to look at how technological change influenced the conduct of naval warfare. As the introduction of heavy guns at sea or, more specifically, the introduction of gun-ports happens to have taken place around the year 1500, it will be possible to examine whether a divide exists between 'medieval' and 'early-modern' naval warfare. This is not to imply that naval institutions like arsenals, admiralties, or standing navies were immune to change, or that they would not influence the conduct of warfare. It seems however that the influence of technological change on naval warfare is more visible and perhaps more relevant to the question as to whether a divide exists between medieval and early-modern naval warfare than the influence of organisational change.

Naval historiography has had a tendency to focus on major battles such as that of Lepanto in 1571,[4] major fleets such as the 'Invincible Armada' of 1588,[5] or certain ships such as the *Mary Rose* (built in 1510–11, rebuilt in 1528 or 1536). The *Mary Rose* was not exceptional but has drawn a lot of attention because of her chance survival and her excavation.[6] This is not only understandable because of human interest in the exceptional or in the exceptional survival of evidence; it also reflects the fact that technological change reveals itself most clearly on those occasions, such as the attempted French invasion of England in 1545, when all the stops are pulled out.

J. F. Guilmartin has argued that 'changes in technology generally had their most significant impact upon the conduct of warfare at sea as a result of quantitative, not qualitative, factors'.[7] In other words, it is not the introduction, but the extent of the application of new

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[3] Doumerc, 'Republic', 153, 155; Mott, 'Power', 107–8; Gertwagen, 'Contribution', 144; Rodger, *Safeguard*, 51, 53, 116; Rose, *Warfare*.

[4] E.g. Lesure, *Lépante*; Pigaillem, *Bataille*.

[5] E.g. Martin and Parker, *Armada*.

[6] Mollat du Jourdin, 'Mer', 300. In recent years much of the archaeological evidence of the *Mary Rose* has been reassessed. Conclusions have been revised often in a more cautious way, and so are open to more than one interpretation (e.g. Vine and Hildred, 'Evidence', 15–20). The older literature on the *Mary Rose* and references to it should therefore be used with caution: McKee, *Mary Rose*; Rule, *Mary Rose*; Loades, *Tudor Navy*, 49–50.

[7] Guilmartin, *Gunpowder*, 254.

technology that is decisive for the effectiveness of the changes in the conduct of warfare at sea. From this perspective the present paper will focus on the consequences of the introduction of heavy guns at sea and of the innovations in sailing-ship technology related to this introduction. Two important, successive changes will be considered: the introduction of heavy guns on galleys[8] and their introduction on sailing vessels, and their respective consequences for war at sea in Europe. This means that the focus will be more on ships rather than on naval organisation.

Emphasis in this chapter will be put on the continued importance of galleys in the Mediterranean on the one hand and of merchantmen for naval warfare in northern waters on the other. It should be noted that galleys also had sails to save human power whenever possible, but they were generally poor sailers unless in light breeze.[9] The 'return' of the galley in north-western and northern European naval warfare in the sixteenth century has received relatively little attention in the existing historiography, but may be considered as one of the most striking features of sixteenth-century naval warfare. The medieval north-western European way of naval warfare – that is, transforming merchantmen temporarily into warships – continued to be common practice into the seventeenth century. It will be argued that the introduction of the gun-port and heavy guns on board did not necessarily entail the development of specialised or purpose-built warships. It will also be argued that improvements in sailing-ship technology made possible the rise of the sailing ship in naval warfare in the Mediterranean.

The introduction of heavy guns at sea and of the innovations in sailing-ship technology had tremendous consequences for all European maritime powers, whether public or private, large or small. Space does not allow systematic discussion of these consequences to their full extent for all those involved; three important limitations have been made. First, references to individual powers will only be made in an exemplary way. If a certain prominence is given to the Low Countries in the selection of these references, it is merely a consequence of the author's familiarity. Second, European expansion overseas will only be considered tangentially.[10] Finally, this chapter will focus on warfare at sea determined and paid for by a public authority; hence 'naval

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[8] Gertwagen, 'Characteristics', 547.
[9] Pryor, *Geography*, 71–2.
[10] This is not to deny of course the tremendous impact of gunpowder for power projection overseas. See for example Glete, *Warfare at Sea*; Trim and Fissel, *Amphibious Warfare*.

warfare', which means that privateering, filibustering, and piracy will largely be excluded.[11]

This last limitation needs some further explanation, as medieval and early-modern naval warfare until at least 1600 – and to a great extent until around 1650 – was largely fought with means bought or hired from the market, either voluntarily or by force: that is by arrest or requisition. War fleets directed and paid for by public authorities consisted for the majority of merchant vessels that had been transformed for the occasion.[12] This is not to say that kings or countries could not possess warships of their own or that they could not have been built or transformed for war purposes only. Several countries, like France and England, did create permanent war fleets, although even these often consisted of converted merchant vessels, like the standing fleet of Emperor Charles V at Veere in the Netherlands between 1550 and 1561.[13] However, the ships making up these permanent forces represented only a minority or nucleus of the entire naval forces in wartime. Therefore public authorities depended for naval expeditions on the owners of merchant vessels. As a sea-going ship could be easily transformed into a warship – by putting superstructures called 'castles' fore and aft[14] and, after the introduction of the heavy gun, by temporarily adding gun-ports and strengthening the hull and masts[15] – merchant fleets were of great military importance and crucial for the execution of sea power. The merchant fleet of a town, a region, or a country thus represented a military interest of great importance. A merchant fleet had maritime or naval potential; indeed, it is more accurate to consider a merchant fleet in a military context as a versatile or flexible fleet, a multi-purpose fleet useful both in times of war and peace.

Contemporaries were very well aware of this reality. In 1522 Margaret of Austria, regent of the Netherlands, received an instruction from Emperor Charles V that mentions the intention to make the Netherlandish towns equip ships '... to be used in war when the

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[11] In reality all kinds of mixed forms of state and non-state violence existed. Thomson, *Mercenaries* offers an applicable theoretical framework that is useful to make at least some distinctions.

[12] Hutchinson, *Ships*, 149, 153; Unger, 'Conclusion', 257; Stradling, *Armada*, 165; Phillips, 'Galleon', 104; Fritze and Krause, *Seekriege*, 37–8, 54, 223. Kowaleski, 'Warfare', 235 has recently argued that this could be a profitable enterprise for medieval ship-owners.

[13] Hutchinson, *Ships*, 149, 153–6; Sicking, *Neptune*, Chapter 6.

[14] See for example Runyan, 'Cog', 47–58.

[15] Friel, *Ship*, 156; Sicking, *Neptune*, 381–4. Archaeologists excavating the wreck of a sixteenth-century ship, possibly used for warfare, that was recently discovered at the bottom of the Westerschelde near Flushing, found its hull had been strengthened; Vos, *Standaardrapport*.

opportunity arises; and in times of peace they will be able to serve the same towns to transport their merchandise …'.[16] The examples could be multiplied.[17] The point is clear: any study of European naval warfare in the medieval and early-modern periods has to take into account the continued importance of the merchant fleet for naval warfare.

Only by choosing a long-term approach, starting in the Middle Ages, is it possible to assess continuities and changes in European warfare at sea while gunpowder was introduced. The first explicit evidence of a gunpowder weapon used for the defence of ships dates from 1337, although many scholars believe that those weapons appeared aboard ships even earlier, that is shortly after they began to be used on land. Throughout the fourteenth and fifteenth centuries the use of gunpowder weapons at sea increased. By 1450 they were commonplace on ships both in the Mediterranean and in the Atlantic.[18] Thus when the gun-port was introduced by 1500, gunpowder had been used in maritime warfare for more than one-and-a-half centuries. The rising interest in medieval naval history in recent years will help to bridge the divide between medieval and early-modern naval history.[19] For reasons of clarity the dividing line between the medieval and early-modern periods will be drawn in the year 1500, which is somewhat arbitrary but fits well with the already mentioned introduction of the gun-port, usually dated around that year.[20] Thus 'medieval' in this chapter means pre-1500 and 'early-modern' indicates post-1500.

Rowing for war

Until the twelfth century, warships were mostly oared vessels both in northern waters and in the Mediterranean, but from then on, oars were gradually replaced by sails –– initially along the Atlantic coast.[21] Galleys nevertheless remained popular as warships for a long time, not only in the Mediterranean. In 1120, for instance, the bishop of Santiago de Compostella hired a Genoese shipwright to build two bireme galleys for service against Muslim pirates. The galley remained the preferred warship in the Atlantic well into the fourteenth century, and it was the

[16] Sicking, *Neptune*, 206.
[17] E.g. Elias, *Vlootbouw*, 5. For examples from the fifteenth century, see Jongkees, 'Armement', 71–87; Bakker, 'Het bijeenbrengen', 3–20; Sicking, 'Les transports'.
[18] DeVries, 'Effectiveness', 389–90. Compare Cipolla, *Guns*, 75–6.
[19] E.g. Rose, *Warfare*; Hattendorf and Unger, *War at Sea*.
[20] Cipolla, *Guns*, 81–2.
[21] Fernández-Armesto, 'Warfare', 235–6.

primary combat vessel in all of the naval battles fought between Castile and Portugal during the 1300s.[22]

Height was a crucial factor in naval encounters. The naval experts of Aragon–Catalonia were well aware of this. In the late thirteenth century they designed galleys with particularly high forecastles and poops to accommodate and protect the 'deadly accurate' Catalan crossbowmen. This enabled the Catalan–Aragonese fleet to defeat the Angevin fleet, which used galleys with low bulwarks, in the battle of Malta (1283) during the War of the Sicilian Vespers (1282–1302).[23]

The introduction of the heavy gun on board:the advantage of the galley

Galleys were the first ships to take advantage of the use of heavy artillery; from the start of the sixteenth century all major galley fleets were so armed. Galleys mounted a single large gun forward in the bow of the vessel. Originally iron breech-loaders were used, but soon Mediterranean galleys were armed with more formidable bronze muzzle-loaders, which could fire either stone shot, or the heavier iron balls of 30 to 50 lb or more, with hull-smashing capacity. The Venetians were able to shoot at a distance of more than 450 m. By the beginning of the sixteenth century sliding carriages were used to absorb the shock of the recoil and thus to avoid damage to the hull of the ship. With the heavy gun the low galley could inflict serious damage on the high-sided hull of a large sailing ship, whereas before the higher sailing ship had held the advantage when attacked by galleys with infantry weapons. The galley was also vulnerable to gunfire, but with its low hull it was more difficult to hit than a high sailing ship.[24]

The galley with a heavy gun mounted in its bow could thus fire forward and be used in the standard line-abreast formation, which was practically the most frequently used tactic of warfare at sea as well as on land. The fact that only one heavy gun could be mounted in the bow of each galley was not an important disadvantage as long as heavy guns were scarce and sailing ships were unable to mount such a gun in their bow.[25] The only firearms that could be used from sailing ships in the same formation were small arms.[26] The fact that galleys, thanks to their

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[22] Mott, 'Power', 105–6, 111.
[23] Hutchinson, *Ships*, 147; Mott, 'Power', 107.
[24] Rodger, *Safeguard*, 207–8; Guilmartin, *Galleons*, 114; Glete, *Warfare at Sea*, 22, 27–8.
[25] Glete, *Warfare*, 28.
[26] Rodger, *Safeguard*, 208.

oars, could be manoeuvred independently from the wind enabled them to fire with more precision than sailing ships. Unlike sixteenth-century sailing fleets, galleys could also manoeuvre in large formations where fleet and squadron commanders might exercise control and command. At Lepanto, the greatest naval battle of the age, more than 200 galleys fought on each side. Both as gun-carriers and as units of large fleets they were eminently suited to contemporary disciplined warfare with formalised tactics.[27]

There were certainly disadvantages to galleys mounting heavy artillery. They had a tendency to dig their bow into the slightest head sea, but shipwrights – those from the Venetian arsenal were probably the first – compensated for the weight of the artillery by designing hulls that were fuller at the bow and finer at the stern, resulting in a fish-like shape below the water surface.[28] They also became much heavier and thus needed more oarsmen.

But in spite of these inconveniences, from around 1500 until around 1580 galleys had gained a major advantage relative to sailing ships.[29] For centuries, galleys had been vulnerable to the high sides and decks of ships, but thanks to the heavy gun they could now stand off and sink them with impunity. As a result the galley gained importance for warfare at sea in the Mediterranean, in the waters of north-western Europe, and in the Baltic. In the Mediterranean there had been few permanent galley forces before 1500, but now the number of galleys increased dramatically. Thanks to the introduction of the heavy gun, the cannon-armed galley became the basis of a Mediterranean system of warfare that reached its apogee between 1520 and 1580 and was to dominate the middle sea until the 1630s.[30]

Although the galleys of the Mediterranean powers varied according to differences in strategic goals, resource availability, organisation, and social structure, differences in design and construction were marginal. They mainly involved fighting superstructures that could be quickly added or removed.[31] This was not only the case for the ordinary (war) galleys, which by 1290 had adopted the optimal rowing system – with three men per bench each having an oar – that was to remain dominant for two-and-a-half centuries. Next to these ordinary triremes the heavier merchant galley could be converted for war, thus becoming a

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[27] Glete, *Warfare*, 28, 35.
[28] Guilmartin, *Galleons*, 115.
[29] Glete, *Warfare*, 27.
[30] Rodger, *Safeguard*, 208; Guilmartin, *Gunpowder*, 59; Guilmartin, *Galleons*, 118; Glete, *Warfare*, 27.
[31] Guilmartin, *Galleons*, 119–20.

gallee grosse, or great galley. These great galleys (which were sometimes purpose-built for military transports) were the tactical backbone of late-medieval galley fleets.[32] They could 'with astonishing agility' be turned into a warship in an emergency. In this way Genoa, Venice, and Aragon–Catalonia were able to use their merchant fleet for military purposes.[33] Their flexible galley fleets had enabled both Italian city-states to build maritime Empires stretching across the Mediterranean, the Black Sea, and the Sea of Azov, controlling the major sea-lanes.

The introduction of the heavy gun, however, reduced the importance of the heavy merchant galley for war. For two centuries merchant galleys had been the perfect solution for the transport of high-value commodities and for their protection against piracy. By 1520 the small fleets of four to five great galleys, which had assured the overseas trading connections of Venice, no longer offered effective protection. The speedy war galley had become the favourite galley for battle, and the war fleets of the large states in the Mediterranean – the Ottoman Empire, Spain, and France – outsized the small fleets of Venetian merchant galleys. The first line of Venice's trading network to feel the effects was the fleet trading with Romania and the Black Sea, partly as a consequence of the threat of Turkish guns both on the heights of the Golden Horn, near Constantinople, and on galleys at sea before the end of the fifteenth century. Fear that the English king Henry VIII might requisition Venetian merchant galleys to use them against France in the Channel contributed to the end of these 'galleys of Flanders' in 1533.[34] As a consequence the overseas trading network of Venice declined.

Both Venice and Genoa had established their maritime Empires thanks to their flexible fleets of convertible galleys that could be used for both commerce and warfare. Now they had to spend extra money for purpose-built galleys, which became more and more expensive for reasons that will be explained below. This separation of Mars and Mercury[35] in the Mediterranean gave an advantage to great powers like the Ottoman Empire and Spain, which could eventually concentrate more purpose-built war galleys than Genoa or Venice, although Venice showed a remarkable ability to enhance its fleet of war galleys. In response to rising sea power, mainly of the Ottoman Empire, Venice built up a reserve fleet rising from 50 galleys in the late fifteenth century to more than 100 after 1540. For the campaign of Lepanto in 1571 the Venetian arsenal turned

[32] *Ibid.*, 112–13; Rodger, *Safeguard*, 66.
[33] Balard, 'Genoese Naval Forces', 145; Rose, *Warfare*, 10–11.
[34] Lane, *Venice: A Maritime Republic*, 348–52.
[35] This expression was used in connection with Dutch maritime commerce by Bruijn, 'Mars en Mercurius'.

out 100 galleys within two months, which represented about half of the Christian galley fleet.[36]

When the merchant galley disappeared as a cargo carrier around the middle of the sixteenth century it was redesigned into a hybrid warship, the galleass, with auxiliary oars, being able to carry much more heavy armament fore and aft than a regular war galley. Although these vessels greatly impressed contemporaries they would prove to be ineffective against the oarless 'ship-of-the-line'.[37]

The return of the galley in northern waters

The advantage galleys acquired over sailing ships resulted in what could be called the export of the 'Mediterranean system of armed conflict at sea'[38] or the return of the galleys to northern waters, between roughly 1520 and 1580. France and England began to use galleys and galleasses in the Channel, while Sweden (1540) and Denmark–Norway (1565) introduced galleys in the Baltic.[39] France seems to have been first in using war galleys with heavy centre-line bow-guns in northern waters. In 1513 off Brest, a French galley fleet under the command of Prégent de Bidoux, which had been built by the Genoese and the Venetians, shot its way through an English war fleet sinking one ship. The English, who tried to retrieve the situation with a bold attack that failed, were shocked by the superior firepower of the French guns – almost certainly bronze 'basiliks' – from Bidoux's galleys. This was 'an entirely new way of waging war at sea'.[40]

From 1517, the French king Francis I (1515–47) and his successor, Henry II (1547–59), used galleys in the Channel from their newly built naval base, Le Havre.[41] They represented the cream of the crop of French naval forces along the Atlantic. Thirty-seven galleys were intended to play an essential role in the maritime tactics envisaged by France in the Channel in 1545. The French armada of 1545, the greatest invasion force ever seen in north-western Europe until then, which posed the most serious threat to England since 1066, contained in addition to the galley force of, according to various estimates, between 125 and 300 sailing ships, which made it comparable in size to the Spanish

[36] Lane, *Venice*, 362–4.
[37] Glete, *Warfare*, 31; Lane, *Venice: A Maritime Republic*, 357–8, 373–4; Oudendijk, *Ridder*, 77.
[38] Guilmartin, *Gunpowder*, 265.
[39] Glete, *Warfare*, 27; Guilmartin, *Gunpowder*, 59.
[40] Guilmartin, *Galleons*, 116 citing Rodger, *Safeguard*, 170–1.
[41] Knecht, *Renaissance Warrior*, 367. On the origin of Le Havre see most recently Lardin, *Tradition*.

Armada of 1588.[42] French expertise provided the way for Henry VIII of England to build new types of oared vessels, after he had begun construction of the *Galley Subtle* and tried in vain to obtain ten galleys from Charles V. The result was the construction of galleasses, and of eighteen light, fast, and very manoeuvrable rowing barges that proved highly effective during the sea combats between the French and the English near the Isle of Wight in 1545. When the English admiral Lord Lisle met his French counterpart Claude d'Annebaut in 1546, he told him that England was now well equipped 'having made 8 or 10 new galleasses … besides sundry light vessels, as swift with oars as their galleys'.[43] The French, however, were far more troublesome to England than the other way around.[44]

Unlike sailing ships in this period, galleys could safely operate close to the coast, enabling them to disembark troops and artillery or to serve as floating siege batteries close to the walls of seaside fortresses and towns. Heavy guns could smash their thin medieval walls.[45] When French galleys entered the estuaries of the River Scheldt and harboured in the roadstead of the island of Walcheren in Zeeland – outport of the Antwerp metropolis – in 1546, they caused great panic and fear amongst the inhabitants. A year later, the coastal fortress of Rammekens, the first fortress built in the Netherlands with bastions, had been completed. French galleys, seeking to use the natural harbour of Walcheren only as a temporary anchorage, had caused the island to become the 'bulwark of the Netherlands', in the words of contemporaries.[46]

Other examples of serious invasion efforts – in which galley fleets were considered essential – include, in the Mediterranean, the Turkish campaign in Apulia in 1537; and, in the Baltic, the Swedish effort in 1555 to take the Russian fortress of Nöteborg, on the River Neva, by an amphibious attack with a fleet of around twenty galleys and numerous other vessels.[47] In 1588 Spanish commanders involved in the preparation of the 'Invincible Armada' felt they needed at least twelve galleys because of the

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[42] Mollat du Jourdin, 'Mer', 289; Loades, *Tudor Navy*, 131. Williamson, *Channel*, 175 mentions 150 ships; Roncière, *Histoire*, III, 416 mentions 150 sailing vessels and 25 galleys. According to the eyewitness du Bellay, the French armada of 1545 included 235 ships in total; Bellay, *Mémoires*, 553. Brewer *et al.*, *Letters and Papers*, XX, Part I, lvii suggest that 300 ships, 25 galleys, and 5 galleasses were involved.

[43] Bennell, 'Oared Vessels', 37.

[44] Brewer *et al.*, *Letters and Papers*, XX, Part I, lx.

[45] Guilmartin, *Gunpowder*, 265; Guilmartin, *Galleons*, 118; Trim and Fissel, *Amphibious Warfare*, 442–3.

[46] Sicking, *Neptune*, 303 n. 58, 304–6.

[47] Glete, 'Naval Power', 226; Glete, 'Amphibious Warfare', 128; Guilmartin, *Gunpowder*, 264.

amphibious nature of the operation.[48] Although none of the four galleys that eventually sailed with the Armada actually reached the Channel, it is clear that the galley gained importance in warfare at the northern seas during most of the sixteenth century.

The continued importance of galleys in the Mediterranean and the Baltic

The tactical logic of galley warfare dictated a constant increase in the amount of forward-firing ordnance. Flanking pieces were put alongside the main centre-line gun. By the 1530s a second, smaller pair of guns was put at the bow. The weight of artillery aboard Mediterranean galleys grew steadily, and with it the displacement of the ships: up to 200 tonnes for an ordinary war galley around 1550, and 300 tonnes around 1650. In order to keep up speed under oars, the increased weight entailed disproportionate numbers of additional oarsmen. Venetian experiments in the 1520s with a quinquereme, having five men and five oars to each bench, showed that a 50 per cent increase in displacement required a 100 per cent increase in oarsmen if speed was not to be compromised. In a period of rising prices and salaries it became more and more difficult to fulfil the growing demand of skilled and motivated oarsmen. This resulted in a change in the galley rowing system. Alongside and instead of free, professional oarsmen, slaves and convicts began to be used. Individual oars gave way to a single large oar for each bench. A single oar was less efficient than individual oars pulled by skilled oarsmen: four men – one skilled oarsman and three slaves and/or convicts to an oar – were needed to equal the speed of a trireme with three professional oarsmen per bench, each with an oar of their own. Contrary to the former free oarsmen, slaves could not engage in fighting. Therefore additional men were needed to fight and to guard the slaves under oars. Besides this reduced efficiency, the advantage was that only one skilled oarsman per oar was needed, which reduced the dependence on skilled oarsmen and enhanced the flexibility to add or remove oarsmen according to the tactical situation.[49] Spain, whose galleys seem to have carried a greater weight of ordnance than any other Mediterranean power, introduced the new rowing system first, in the 1550s. Venice, whose maritime artillery was relatively light, was the last to abandon the old system, at the end of

[48] Martin and Parker, *Armada*, 121–2.
[49] Guilmartin, *Galleons*, 120–1. For further details: Alertsz, 'Architecture'; Bondioli, Burlet, and Zysberg, 'Mechanics'. On the Venetian quinquereme, built on the initiative of a professor of Greek: Lehman, *Queeste*, 40–4.

the sixteenth century.[50] As a result of the increase in manning density caused by the new rowing system the strategic radius of action of galleys decreased because they had to land more frequently to recharge water and food.

Galleys continued to grow larger and more powerful in the seventeenth century, but the number of galley fleets declined, as well as the number of galleys per fleet.[51] However, galleys retained their tactical utility and remained in use, first of all in the Mediterranean. Inspired by Colbert, according to whom 'There is no power which marks better the greatness of a prince than that of galleys' (1665), Louis XIV built the greatest galley fleet of the Mediterranean, counting 40 ships at the end of the seventeenth century on which 12,000 oarsmen, 3,000 officers and 4,000 soldiers served. Galleys played a significant role in the Venetian–Ottoman wars for Crete (1654–69) and the Morea (the Peloponnesus) (1694–8), albeit in conjunction with, and usually secondary to, sailing warships.[52] Spain and France operated small galley squadrons in the Channel around 1600 and at the time of Louis XIV respectively; the Dutch built some galleys to counter the Spanish ones.[53] When the latter were destroyed in 1603 they were not replaced. In the Baltic both Sweden and Russia used galleys in the Great Northern War of 1700–21.[54] Inspired by the Turks, the Russians built more than 400 galleys during the eighteenth century.[55] In sum, galleys remained important for warfare at sea mainly in the Mediterranean and in the Baltic during the early-modern era.

Sailing for war

From the twelfth century onwards, sailing vessels gradually became more important for warfare. Thanks to more masts and sails and the application of rudders 'fitted to stern-posts rising from the keel' instead of 'tillers dangled from the starboard towards the keel', the manoeuvrability of sailing vessels increased. These now became an alternative to oared vessels. Ships were thus freed from the economic and logistic burden of great numbers of oarsmen. Oar-powered vessels dominated Baltic warfare until 1210, when the crusading order of the Sword Brothers switched to cogs.

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[50] Guilmartin, *Gunpowder*, 268.
[51] Guilmartin, *Galleons*, 125, 211.
[52] Zysberg, 'Galères', 123; Zysberg and Burlet, *Gloire*, 82–3; Rowlands, 'French Amphibious Warfare', 265, 268, 276–7. 'Il n'y a point de puissance qui marque mieux la grandeur d'un prince que celle des galères' (Zysberg and Burlet).
[53] Lehmann, *Galeien*, 95–103.
[54] Guilmartin, *Galleons*, 212; Lehman, *Galeien*.
[55] Zysberg and Burlet, *Gloire*, 127.

The French at the battle of Sluys in 1340 used both the royal galleys and 170 sailing ships, of which many were certainly intended for the fray. In England, not until around 1400 did the fighting vanguard become almost entirely sail-driven, oared craft forming only a small part of its navy.[56]

Ships that did not need to be propelled by oars could have higher freeboards, offering them an important advantage in a time when height was a crucial tactical criterion. As a result, oarless craft played a growing – albeit slowly growing – role in Mediterranean warfare too.[57] The raids carried out by cogs from Bayonne in the Mediterranean in 1304 impressed the Genoese, Venetians, and Catalans who had started to build *coches* or cogs themselves.[58] Medieval sailing ships were equipped with superstructures fore and aft – castles – which allowed for attacking the enemy. In time these castles became higher and higher, making the ships top-heavy and causing them to look like floating fortresses. As a result it was almost impossible for a galley crew successfully to board and enter a sailing ship.[59] The attack on the Venetian Levant convoy by a Genoese fleet of eighteen galleys in 1264 offers a good illustration. The Venetian convoy, consisting of twelve single-decked sailing vessels of about 150 tons' displacement; half-a-dozen smaller craft; and a single large, round ship of 750 tons (the *Roccaforte*), although outnumbered by the Genoese, managed to resist for hours. When the Venetians finally retreated aboard the *Roccaforte*, the Genoese were unable successfully to assail the vessel.[60] Almost 200 years later, in 1453 during the Turkish siege of Constantinople, 150 Turkish boats gathered around four sailing vessels in the Bosporus but were unable to capture them. By the 1420s the Genoese were building carracks of 600 to 900 tons' displacement. Such vessels, prestige state warships, were 'essentially immune to attack by galleys'.[61] In the fifteenth century the Venetian state, too, commissioned large sailing warships for operations against corsair galleys.[62]

The introduction of the heavy gun on board: the slowly developed advantage of the sailing vessel.

From a medieval perspective, the introduction of the heavy gun at sea was yet another, but important, phase in the development of gunpowder

[56] Fernández-Armesto, 'Warfare', 236. Rodger, *Safeguard*, 473. Friel, *Ship*, 147–150.
[57] Fernández-Armesto, 'Warfare', 236.
[58] Runyan, 'Naval Power', 60–1; Gertwagen, 'Characteristics', 554; Runyan, 'Cog', 47–58.
[59] Fernández-Armesto, 'Warfare', 236.
[60] Guilmartin, *Galleons*, 114.
[61] Fernández-Armesto, 'Warfare', 236.
[62] Guilmartin, *Galleons*, 114; Lane, *Venice: A Maritime Republic*, 412.

weapons in naval warfare. Originally used as anti-personnel weapons, gunpowder weapons increased in size and numbers on warships in the fifteenth century. Three technological innovations in the fifteenth century encouraged the rise of gunpowder weapons in naval warfare and remained of importance in the sixteenth century. The first was the addition of a swivel to the base of a small gun that could be used from the side of the hull or castle, or from the bow or stern of a galley. The second was the hand-held gunpowder weapon, allowing for more mobile gunfire, which began to be used on ships. The third was the large shipboard gun, which could be loaded with both the ball and the powder from the rear.[63]

Whereas the first two weapons could only be directed against opposing personnel, the third allowed for larger guns with hull-smashing capacity to be mounted on the sides of ships. The latter is confirmed by Philip of Cleves' treatise, *Instruction de toutes manières de guerroyer tant par terre que par mer*, which he wrote around 1516, and which is one of the few sixteenth-century treatises to deal with the fitting out of warships in a more or less systematic way. Philip states that two cannon and a big culverin on wheels should be placed between the mast and the forecastle on each side.[64]

The gun-port offered an alternative means to mount heavier guns as it enabled cannon to be placed below the deck. Ships could thus carry more and heavier artillery without becoming unstable. Traditionally dated to 1501, when a French shipwright is supposed to have invented the gun-port, there is evidence that gun-ports had already appeared in the late fifteenth century.[65] It is not well known, however, how exactly the broadside location of guns in the hull of sailing vessels developed. Philip of Cleves' treatise explicitly refers to the use of watertight gun-ports. The fact that the gun-ports needed 'hatches that can be raised by ropes when necessary in order to fire the cannons' indicates that they were located low down near the waterline. Philip added that these hatches could only be opened and the cannon behind them used if the weather permitted.[66] New technology is one thing; the successful application of it is another. This was to be dramatically illustrated thirty years later when the *Mary Rose*, the vice-admiralship of Henry VIII, overloaded with men and guns, heeled over with the wind and was flooded by

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[63] DeVries, 'Effectiveness', 394–5; Hutchinson, *Ships*, 149.

[64] Oudendijk, *Ridder*, 122. The Warwick Roll (*c.* 1485) offers an example of this location; DeVries, 'Effectiveness', 394.

[65] Cipolla, *Guns*, 82; Friel, *Ship*, 154; Hutchinson, *Ships*, 160–1; DeVries, 'Effectiveness', 396.

[66] Oudendijk, *Ridder*, 122; Paviot, *Philippe*, 43.

water entering through the lowest gun-ports, which had been left open after firing.[67] Clearly, in spite of all the risks that gun-ports close to the waterline entailed, they were considered of great importance in order to optimise the chance of hitting the hulls of the enemy ships.

The challenge sailing ships were facing was that they could not fire forward to the same extent as galleys. Sailing vessels could fire nothing but small arms when they were attacked by a galley fleet in standard line-abreast formation.[68] A solution to this major tactical problem was only gradually found. Initially, there seems to have been a tendency to put the heavy artillery in the aft of sailing ships. Amongst the above-mentioned cannon behind hatches, Philip of Cleves explicitly included two cannon aft, one on either side of the rudder. Philip goes on to mention that on the first floor of the aftercastle – that is, one level higher than the above-mentioned cannon behind gun-ports with hatches – 'two great culverins should be put, one on either side of the mast, which shoot forward as they cannot be turned to be used on broadside because of their length'.[69] At the same level in the aftercastle two great cannon (*bastons*) should be placed, again one on each side of the rudder, to shoot from behind. Thus at least four great cannon were put in the aftercastle protruding from the stern of the ship. It seems that the largest guns were used aft originally, and the broadside guns below deck soon after.[70]

As the size (and number) of gunpowder weapons on ships increased, it became necessary to strengthen the ship's hull both to enable it to withstand the increased recoil of its own weapons and to protect it against hull-smashing balls from the enemy.[71] The introduction of the heavy gun at sea thus stimulated the development of purpose-built sailing warships. King James IV of Scotland's *Great Michael*, built between 1506 and 1512, was about 1,000 tons and revolutionary in design, as she was designed from the first to carry a main armament of heavy artillery.[72] King Hans of Denmark (1481–1513) built some of the largest warships in the world, like *Engelen* (*c*. 1510), whose size was probably around 1,500 to 2,000 tonnes' displacement.[73] The English king Henry VIII launched his *Henry Grace à Dieu* or *Great Harry*, carrying 186 guns, in 1514 in the presence of the court and the papal and

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[67] McKee, *Mary Rose*, 65–8; Parker, *Military Revolution*, 91.
[68] Rodger, 'Development', 303.
[69] Oudendijk, *Ridder*, 122.
[70] Rodger, *Safeguard*, 207–9. Compare Sicking, 'Philip', 129.
[71] DeVries, 'Effectiveness', 394–5.
[72] Rodger, *Safeguard*, 168–9. See Macdougall, 'Greatiest scheip' for further details.
[73] Glete, 'Naval Power', 221.

imperial ambassadors. Francis I of France followed in 1521 with the *Grande Françoise*. This 1,500-ton ship, equipped with a chapel, a tennis court, and a windmill, was 'the most triumphant thing that any sailor ever saw'.[74] The Portuguese and Swedish kings respectively launched the *Sao João*, which is said to have carried no fewer than 366 guns, in 1534, and the *Elefanten* in 1555.[75]

'Great ships' like these were but a small minority of all ships available for naval warfare; they were also built as much for reasons of prestige and reputation as for their tactical value. They seem to have been lost more often through accidents, lack of money, or simple inability to sail, than through the effects of gunfire. The *Engelen* accidentally burnt at Santander in 1518 after the ship had been loaned by Hans' successor, Christian II, to his brother-in-law, Charles of Habsburg, to serve as flagship for his coronation voyage to Spain.[76] In the war of 1512–14, the *Great Michael* was sold to France because Scoland could not afford to maintain such a large ship.[77] The *Grande Françoise* proved to be what a Venetian visitor predicted: 'so magnificent that it looks as though she will be incapable of putting to sea'. Her draft was so deep that she could not leave the harbour.[78] And as already noted, the loss of the *Mary Rose* was due to instability, rather than to French fire.

These ships probably all carried heavy guns behind gun-ports. In order to mount as many guns as possible they were floating fortresses rather than manoeuvrable weapons of war.[79] However, the ability of ships to carry heavy guns behind gun-ports did not originate only in the above-mentioned ships of royal prestige. Sailing ships from Genoa and Lübeck, and privately owned English ships, which had been bought for the English navy around 1512–14, all carried heavy guns.[80] In the Netherlands, too, ships mounted heavy guns below deck in the 1510s and 1520s.[81] These examples represent different European traditions of the same ability to carry heavy guns.

New ship designs were developed to utilise heavy guns as effectively as galleys. One of these designs was the aforementioned galleass. The galleass had the bow of a galley able to mount a heavy gun, and carried guns on the broadside on a deck under which banks for oarsmen were located. Another, more frequently used ship type that developed was

[74] Rodger, *Safeguard*, 204, 547 n. 3.
[75] Cipolla, *Guns*, 82.
[76] Glete, 'Naval Power', 221.
[77] Rodger, *Safeguard*, 172; Macdougall, 'Greatiest scheip', 56–7.
[78] Rodger, *Safeguard*, 204 (citation). Knecht, *Renaissance Warrior*, 367.
[79] Cipolla, *Guns*, 83
[80] Carr Laughton, 'Ship-Guns', 242–85.
[81] Sicking, 'Philip'.

the galleon, which combined the fore-part of a galley with the after-part of a sailing ship. It connected the military advantage of the galley with the seaworthiness of sails. The importance of the galleon and its focus on heavy gunnery in the bow until the end of the sixteenth century are explained by the fact that the galley remained the galleon's most important enemy. Although the word 'galleon' indicated a kind of ship, its precise meaning varied from country to country. Whereas the Portuguese *galeão* was practically a purpose-built warship, the Spanish *galleón* designated both warship and armed merchantman.[82] As the Spanish galleon had to be fit for war and trade, it will be discussed in the section on converted merchant vessels. The events of 1588 had shown that English galleons had an advantage over their slower Spanish counterparts thanks to a distinctive design technique of 'whole-moulding', which produced fast and weatherly hulls.[83] The superiority of the English galleons continued to be acknowledged in early–seventeenth-century Spain.[84]

The introduction of cast-iron guns around the middle of the sixteenth century made it economically possible to arm ships on an unprecedented scale, as guns of cast iron were much cheaper than bronze. At the same time important improvements were made in truck-carriage design and foundry practice. Cast-iron guns were considerably heavier than bronze pieces, which threw the same weight of ball, but cost only about a third or a quarter as much. The disparity increased in time until the cost of iron ordnance had fallen to an eighth of that of bronze in England in the 1670s.

A massive international trade in cast-iron guns developed, in which the Dutch played a particularly important role. In the words of contemporaries, the United Provinces became 'the arsenal of the world' thanks to the development of an important arms industry, which managed to assure and regulate the supply of raw materials, like iron from Sweden and saltpetre from the Indies, and which produced not only for the Dutch market but also for export. By 1650, cast-iron ordnance had become the standard means of defence afloat, although bronze ordnance did not entirely disappear.[85]

Thanks to broadside gun-ports and cast-iron guns a ship could carry far more guns. Depending on its size, the gun-armed sailing ship that developed in the seventeenth century had one, two, or – exceptionally – three complete battery decks. Besides, guns continued to be mounted under the quarterdeck and in the forecastle. When guns became

[82] Guilmartin, Galleons, 158–9; Phillips, 'Galleon', 103; Domingues, 'Forces', 195.
[83] Rodger, *Safeguard*, 212–13, 217–20; Phillips, 'Galleon', 104, 106.
[84] Martin and Parker, *Armada*, 11–12; Goodman, *Spanish Naval Power*, 114.
[85] Guilmartin, 'Guns', 149–50; De Jong, *'Staat'*.

cheaper, gun-ports were placed closer to each other so that even more artillery could be mounted on sailing ships. This stimulated the trend towards big and heavy ships.

At the same time initiatives were taken to build faster and more manoeuvrable ships. In Portugal, the caravel of between 150 and 180 tons with two covered decks, four masts, and narrow hull (to be distinguished from its smaller namesake, which had been used for discoveries in the fifteenth century), was probably mainly developed for naval purposes in the sixteenth century.[86] In England in the 1570s the so-called 'race-built' ship was introduced. This new design involved a reduction in the castles, sleeker lines, and a longer gun-deck. The reduction of the castles meant that less priority was given to optimising the use of anti-personnel weapons, the majority of which were traditionally used from these castles. The sleeker lines led to a faster and more manoeuvrable ship, whereas the longer gun-deck permitted an increase in the weight of the guns' broadside. Several English warships were built and rebuilt according to this race-built design.[87]

Developments in Flanders around 1600 led to a ship design that was to have a broader and longer-lasting influence on European warships: the frigate. Although the origins of this ship design are still being debated, it combined speed and manoeuvrability with hitting power thanks to a fine, shallow hull and a great spread of sail. Frigates had a low and almost even outline, into which the former castles had more or less been integrated; continuous decks allowed the placing of most guns amidships.[88] They were faster than any English ship and could '[run] rings round them', as English captains reported in the 1620s.[89] It has been suggested that the Flemish frigate represented 'the first generation of specialist fighting-ships in the West outside the Mediterranean'.[90] In the 1620s the Dutch also started to build and use frigates against their opponents.[91] England, and from the 1660s France too, used these mobile, purpose-built warships. Typically the shift that entailed the introduction of frigates was indicated in France as a shift in the warship from a *forteresse flottante* to a *forteresse mobile*.[92]

The development of ship design, concentrating on the strength of the hull, speed, and manoeuvrability, contributed to several ship types or, more precisely, broad categories of ship: a clear indication that

[86] Domingues, 'Forces', 194–5.
[87] Parker, 'Dreadnought Revolution', 270–2, 281.
[88] Stradling, *Armada*, 165–9.
[89] Rodger, *Safeguard*, 390.
[90] Stradling, *Armada*, 168.
[91] Bruijn, *Verleden*, 82–3.
[92] Parker, *Military Revolution*, 100, 102, 215.

early-modern European states were keen on optimising the effective use of the heavy gun at sea on sailing vessels in order to withstand and surpass the galley, which had originally held the advantage. The purpose-built sailing warship was developed along various lines and forms; its design and specification differed 'from country to country, from shipyard to shipyard and even from ship to ship'.[93] Moreover, it should not be forgotten that, simultaneously with the introduction of heavy guns with hull-smashing capacity, boarding remained an import-ant tactic in maritime warfare well into the seventeenth century. As a consequence, ships with both a fore- and aftercastle, and equipped with anti-personnel weapons and anti-boarding netting, continued to be much desired.[94]

The return of the sailing vessel in the Mediterranean

Perhaps the most spectacular consequence of the slow and difficult but eventually successful adoption of broadside artillery on sailing ships was the return of the sailing vessel for warfare in the galley-dominated Mediterranean. Venice well represents this development. In 1499 the government-owned war fleet of Venice, which was maintained by the state in times of peace, had included a few very large sailing ships designed for war by shipwrights of the Venetian arsenal. But in the sixteenth century the building of such vessels had stopped; the arsenal then built only galleys. Next to its own galleys the Venetians also hired converted merchantmen. In 1618 they hired them for the first time from the Dutch and the English, who since the end of the sixteenth century had entered the Mediterranean for commercial ends.[95] It soon became routine for both Venice and the Ottoman Empire to lease Dutch and English ships for their wars – a clear indication that these ships were now considered sufficiently effective for warfare next to gal-leys in the Mediterranean. In 1667 the Venetian arsenal built its first ship-of-the-line using an English warship as a model. During the next fifty years, sixty-eight ships-of-the-line issued from the arsenal. Even so, the republic's Captain General of the Sea was still obliged to use a galley for his flagship as late as 1695, when the Turkish admiral used a ship-of-the-line.[96]

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[93] Stradling, *Armada*, 164.
[94] Glete, *Warfare at Sea*, 30; Friel, *Ship*, 150, 156.
[95] Bruijn, *Verleden*, 31; Geyl, *Christofforo*, 224–69. On the Dutch and English presence in the Mediterranean see Braudel, *Méditerranée*, II, 315–20, 325–9, 341, and more recently for the Netherlands, Engels, *Merchants*.
[96] Lane, *Venice: A Maritime Republic*, 412, 414.

The continued importance of flexible fleets of merchantmen converted for war

In spite of the development of purpose-built sailing warships, the practice of converting merchant vessels for war, which had been an important characteristic of medieval naval warfare, remained important until around the middle of the seventeenth century.[97] The introduction of the heavy gun at sea did not end the phenomenon of the flexible fleet in the case of sailing vessels as it had in the case of galleys. On the contrary, the development of the sailing ship from the full-rigged ship of the fifteenth century – the three-master, which combined the Atlantic and northern square sail with the triangular lateen sail of the Mediterranean – to the 'relatively homogeneous type of seventeenth century sailing gun-armed ship', gave new opportunities for combinations of cargo-carrying and fighting power.[98] The maritime potential of Spain and the Netherlands was a major tool for naval warfare to these powers.

Spain had to support large galley fleets to counter Turkish incursions in the western Mediterranean from 1479 – when Castile and Aragon were joined in a personal union under Ferdinand and Isabella – until the truce with the Ottoman Empire in 1580. However, while these fleets absorbed the bulk of Spanish funds for naval warfare, Spain continued to lease armed merchantmen for the protection of the New World trade and for naval operations against French and English privateers in the Caribbean. Because it was in the government's interest that merchant ships be suitable for naval warfare, it tried to influence the merchant community to build larger ships by giving loading preferences at ports to larger ships from 1511, and by direct royal subsidies from the 1560s. The merchant community, however, preferred smaller vessels, because they were easier to unload and they handled better in the shoal waters of the Netherlands and the North Sea.[99]

After the truce with the Sublime Porte in 1580 the Spanish monarchy could invest more money in building galleons suitable for Atlantic naval warfare. The reforms of Philip II after the disaster with the Armada of 1588 were designed to standardise the construction of galleons to ensure that they could serve for war at sea. The result was a revitalised fleet consisting of huge galleons in the beginning of the seventeenth century.

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[97] E.g. Stradling, *Armada*, 165; Fritze and Krause, *Seekriege*, 54. It is revealing in this connection that in the late Middle Ages the French word *naveye* referred to a body of ships. Depending on the context it might mean the whole merchant fleet of a country; Rodger, *Safeguard*, 117.

[98] For a description of this development see Glete, *Warfare at Sea*, 28–31.

[99] Mott, 'Power', 111–14, 117. Phillips, 'Galleon', 104.

Until the 1630s it was a formidable force that repelled, for instance, an attack on Cadiz by a combined Anglo-Dutch fleet in 1625.[100] Yet these ships still had to be fit for trade as well. In 1601 King Philip III gave instructions to his superintendent of construction to build ships 'suitable for both commerce and the armada'.[101] A certain amount of speed and agility continued to be sacrificed for carrying capacity to meet the needs of the Spanish Empire for multi-purpose vessels.

Like Spain, the Habsburg Netherlands also continued the medieval tradition of providing war fleets by using merchantmen. This tradition remained common practice during the Habsburg–Valois wars, fought between 1521 and 1559. The placing of heavy artillery on board began to determine the choice of the ships as well as the way in which they were rebuilt. Hired merchant ships were modified to make them fit for war: gun-ports were added, the castles were modified, the hulls were strengthened as well as the masts to enable ships to use more sail. A comparison between Spanish and Netherlandish ships by a contemporary witness writing in 1552 reveals the emphasis put on the ability to carry heavy artillery: 'The ships from here [i.e. the Netherlands], especially the hulks, are sturdier and can carry larger and heavier artillery than the Spanish ones.'[102] Several initiatives were taken in the Dutch republic to develop new ship types suitable for naval warfare in the shoal-filled home waters – essential during the Dutch Revolt – as well as for the open sea, which resulted in a nucleus of specialised warships around 1621;[103] the majority of ships in Dutch war fleets continued to be transformed merchant vessels until shortly after the middle of the seventeenth century.[104]

In 1536 the States of Holland claimed explicitly that it was thanks to the large merchant fleet of Holland that Emperor Charles V had more ships than the kings of Portugal, France, and England put together.[105] Holland's fleet expanded rapidly in the remainder of the sixteenth century to become the largest merchant fleet in Europe and possibly in the world in the seventeenth century, surpassing that of Spain. Thanks to this enormous 'naval potential' and to the establishment of an inland arms industry, the Dutch were not only able to equip war fleets for the defence of their territory, their maritime commerce, and their fisheries

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[100] Phillips, 'Galleon', 104; Mott, 'Power', 114–15.
[101] Goodman, *Spanish Naval Power*, 115.
[102] Sicking, 'Naval Power', 203. For more details see Sicking, *Neptune*, 370–3, 378–81; citation on p. 379.
[103] Jong, *'Staat'*, 64–70.
[104] Bruijn, 'Mars en Mercurius', 97–106; Bruijn, *Verleden*, 97; Snapper, *Oorlogsinvloeden*, 38.
[105] Sicking, *Neptune*, 359–60.

in Europe, but also to effect overseas expansion despite having to compete with larger powers such as Spain, England, and France. Besides this, the Dutch potential for turning merchant ships into warships had not reached its limits, for it was not only used for Dutch naval warfare but also for the naval warfare of foreign powers. Between the 1610s and the 1660s the Dutch and the English hired out armed merchantmen with guns and crews to Venice, France, Portugal, Denmark–Norway, and Sweden. This happened mostly in periods of war when it was crucial to mobilise as much naval power as possible. Thus, converted merchantmen continued to be of importance for these states. They were often used as a temporary extra force in combination with permanent navies.[106]

From a Dutch perspective the first half of the seventeenth century seems to have been the apogee of the converted merchantman for naval warfare. The Admiralties sold many of their purpose-built 'frigate-styled' warships during the peace negotiations with Spain in the 1640s. It is revealing in this connection that a plan developed by the Dutch admiral Maarten Harpertszoon Tromp in 1648, to build a strong war fleet to be maintained in peacetime, came to nothing. It was thought that in case of need the Dutch republic could always fall back on the old practice of hiring armed merchantmen.[107]

As England lacked any major long-distance trade in the sixteenth century,[108] the country could not rely on merchantmen for war at sea to the same extent as Spain and the Netherlands, but this rapidly changed in the first half of the seventeenth century when both the English and Dutch navies 'were run by merchants, for merchants, and largely made up of armed merchant ships'.[109] Denmark–Norway and Sweden did not have a large merchant marine.[110] Nevertheless, both Scandinavian countries gave customs preferences to armed merchantmen in order to create reserve fleets that might augment the permanent navy in time of war.[111]

In sum, European governments generally tried to use the merchant fleets of their own citizens or, if possible, of others, for war at sea and to enhance their effect to that end.[112] Sailing merchant vessels armed

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[106] Glete, *Warfare at Sea*, 31; Bruijn, *Verleden*, 31.
[107] Bruijn, *Verleden*, 83–4.
[108] 'Lacking any major long-distance trade, the English had no need of the carrying capacity the Spanish needed, and could afford to sacrifice it to make a more effective, more specialized man-of-war.' England 'came late to oceanic voyaging, late to gunfounding, and late to carrying heavy guns at sea'. Rodger, *Safeguard*, 220.
[109] Rodger, *Command*, 12.
[110] Guilmartin, *Galleon*s, 100.
[111] Glete, *Warfare*, 31–2.
[112] Phillips, 'Galleon', 104.

for the occasion remained, in numbers at least, of prime importance – along with the introduction of the heavy gun at sea – for naval warfare in Europe, as soon as the sailing vessel was capable of fighting the gun-armed galley. Like their purpose-built counterparts, armed merchantmen carried more and more heavy guns. As long as specialised or purpose-built sailing warships represented a minority within the naval forces of a state, the size of a state's merchant fleet, or its ability to hire or capture those fleets from others, remained of crucial importance for its sea power. Even when purpose-built warships came to dominate the naval forces of the European powers in the seventeenth century, merchant ships continued to be of military importance, albeit in an auxiliary and diminishing way.

The adoption of the line-ahead: a tactical revolution?

The flexible use of sailing merchantmen for war was gradually reduced, as it became clear around 1650 that merchantmen were no longer fit to fight wars. The three Anglo-Dutch wars (1652–4, 1665–7, 1672–4) induced its participants to naval reorganisations. These resulted in the universal application of the most effective use of the heavy gun at sea, thanks to continuous broadsides fired from ships-of-the-line formed in line-ahead.[113] This tactic was the best practical solution to the problem that the ship-of-the-line moved along one axis captive to the wind, but discharged its cannon along another. Its adoption has been called a 'Military Revolution afloat'.[114] The line-ahead formation was, however, neither sudden nor systematically adopted by the European maritime powers. Boarding and entering were the tactics of preference, and the line-ahead was considered a defensive expedient until halfway through the first Anglo-Dutch war.[115] Moreover, the adoption of the line-ahead did not exclude converted merchantmen from war fleets, at least not immediately.

   This became apparent when the Dutch were probably the first to apply line-ahead tactics against the Spanish at the Downs off the English coast in 1639. The Dutch admiral Tromp led his squadron, consisting of purpose-built warships and converted merchantmen, in amongst the Spaniards (despite the presence of the English fleet, trying to keep the combatants apart) and sank forty of their fifty-three ships, which were mostly galleons and merchant vessels. Tromp had used the formation,

[113] Glete, *Warfare at Sea*, 39.
[114] Palmer, 'Revolution', 123–49.
[115] Guilmartin, *Galleons*, 210.

however, in a defensive way in difficult circumstances. For the *coup de grâce* he used fire ships and mêlée tactics: that is, fighting ship against ship. In 1645, when a Dutch squadron closed in on the Portuguese off the coast of Brazil, they chose a line of battle combining warships and converted merchantmen.[116]

The English were the first to adopt the line-ahead tactics *more systematically* during the first Anglo-Dutch war. Thanks to a successful adoption of line-ahead, the English, with 100 ships, defeated the Dutch, with about the same number under the command of Admiral Tromp, who stuck to the traditional boarding tactics. Off Gabbard Shoal at the mouth of the Thames in June 1653 the English sank twenty Dutch ships. The result was disastrous for the Dutch republic, as the barely damaged English fleet blockaded the coasts of Holland and Zeeland within a week. On 10 August at the battle of Ter Heide, in which Tromp was killed, the English sank another thirty Dutch warships. They were victorious thanks to their successful adoption of the line-ahead formation, which had made the fighting power of their fleet more effective.[117]

The first lesson the Dutch learned from their defeats was the ineffectiveness not of their tactics, but of their ships. They now realised that they could no longer continue to fight wars at sea with converted merchantmen. The result was that before the war was over two building programmes were launched for sixty purpose-built warships in total. In January 1654 the States-General took the unprecedented decision that none of these new warships were to be sold 'without unanimous consent' of the United Provinces.[118] Merchant vessels were no longer rented from private ship-owners; Mars and Mercury were separated. The merchant fleet now practically lost its military importance, although the Dutch East India Company (VOC) would for one last time deliver ships for the Dutch naval forces during the second Anglo-Dutch war. The possibility of using merchantmen as a flexible force in warfare at sea was gone, in European waters at least.[119]

It was not until after the first naval encounter of the second Anglo-Dutch war, off Lowestoft on 2 June 1665, that the Dutch embraced line-ahead and the three-squadron order, albeit in a somewhat modified

[116] Boer, *Tromp*, 2, 72, 75, 91–2, 132; Rodger, *Command*, 13; Parker, *Military Revolution*, 100–1. The painting of Willem van de Velde the Elder on p. 101 is revealing. See also Braunius, 'Oorlogsvaart', 330; Guilmartin, *Galleons*, 199, 203.

[117] Bruijn, *Verleden*, 94; Palmer, 'Revolution', 134–5, 143 where the battle indicated as the battle of Scheveningen and is dated, according to the English (Julian) calendar, on 31 July. Rodger, *Command*, 17–18.

[118] Quoted in Bruijn, *Verleden*, 97.

[119] See Bruijn, *Verleden*, 97; Enthoven, 'Mars en Mercurius', 40; Snapper, *Oorlogsinvloeden*, 114; Nurmohamed, 'VOC'.

form. At Lowestoft the Dutch lost 32 of 100 ships but their tactics were partially linear; they still had not fully embraced the line-ahead formation. The new tactics were issued by Johan de Witt in August 1665. During the third Anglo-Dutch war, when both sides used line-ahead tactics, the more numerous Anglo-French fleet proved unable to achieve major successes against the Dutch.[120]

The great nineteenth-century naval historian Julian Corbett characterised the tactical orders issued by the English in 1653 as 'nothing less than revolutionary'.[121] If that is correct, and if the Dutch (and the French) were slow to follow, then it must be borne in mind that the English had also been slow to adopt the tactics that dependence on broadsides logically entailed – the larger English warships, in particular, had been functionally ships-of-the-line from the 1630s onwards.[122] In comparison, the successive formation of a standing fleet of purpose-built warships by the Dutch in 1654, and their adoption of line-ahead tactics in 1665, seems to be a process as gradual as the English creation of a fleet of ships-of-the-line, and its adoption of the line-ahead tactics.

Although eventually line-ahead tactics would be most effectively executed by purpose-built ships-of-the-line, this was not the result of a sudden introduction but of a gradual process. Not only the Dutch example illustrates this. In fact, the English, having adopted line-ahead tactics during the first Anglo-Dutch war, were using converted merchantmen during the second Anglo-Dutch war in 1665, more than a decade after the Dutch had decided to build a major standing navy.[123]

As line-ahead tactics remained a central element in the operations of European navies for a period of almost 150 years – that is, until the Industrial Revolution and the development of steam-driven ships with turreted guns – they can be considered as the last of a series of major changes in European naval warfare. Perhaps because they represented a last major change in warfare at sea, and because they occurred at the same time as linear tactics were adopted on land, line-ahead tactics have been accorded a prominent status in representing the 'naval dimension' of the military revolution.[124]

[120] Palmer, 'Revolution', 139, 146.
[121] Corbett cited in Harding, *Evolution*, 75.
[122] Guilmartin, *Galleons*, 210.
[123] Palmer, 'Revolution', 128, 138; Rodger, *Command*, 69.
[124] Palmer, 'Revolution', 128, 145, 148–9.

Conclusion

The introduction of gunpowder weapons at sea, the full-rigged ship, the heavy gun, the galley mounting a heavy gun in its prow, the gun-port, the galleon combining the prow of a galley with the sailing capacities of the full-rigged ship, the cast-iron gun, the broadside placement of guns, the frigate, the ship-of-the-line, and finally the adoption of line-ahead tactics – all represent important technological and tactical changes. Most of these changes have been designated as revolutions in their own right.[125] Their adoption occurred in a period ranging from the 1330s to the 1660s. None of these technological changes was adopted immediately or systematically across Europe. Their adoption depended generally on pragmatic considerations by different powers with different interests in different areas in different periods of time. This resulted in these technological changes being combined in a wide range of ways, which allowed for several continuities, bridging the divide that humanists – and historians following in their wake ever since – have constructed between the Middle Ages and the early-modern era. These include the continued importance of war galleys, armed merchantmen temporarily converted for war, and the traditional tactics of boarding and entering. It also allowed for 'reappearances', such as the return of the galley for war in northern waters and the return of the sailing vessel for war in the Mediterranean.

This wide variety of continuity and change related to naval warfare has influenced the different destinies of Europe's maritime powers. It is impossible to analyse this complex process in its entirety here but some remarks can nevertheless be made. First, the slow adoption of the heavy gun at sea should be emphasised again. If the years around 1500 can be considered as a turning point in this perspective, with galleys mounting a heavy gun in their bow and with the introduction of the gun-port, it had taken more than one-and-a-half centuries since gunpowder weaponry had first been used afloat.

Second, it took another one-and-a-half centuries for permanent navies consisting of purpose-built warships entirely to dominate European naval warfare. In spite of what has sometimes been suggested by scholars, the introduction of the heavy gun aboard ships did not immediately necessitate new types of purpose-built warships. On the contrary, the medieval warship *par excellence* – the galley – reached its apogee in the Mediterranean in the early-modern era. Equally, the sailing merchant vessel remained important for naval warfare. In the short run, the

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[125] E.g. Guilmartin, 'Revolution'.

sailing vessel temporarily declined in military importance; the effective application of the heavy gun aboard sailing vessels, including the development of the optimal tactics for broadside gunnery, took much longer than the effective application of the heavy gun aboard galleys. In the long run, however, the sailing merchant vessel regained the precedence it had temporarily lost to galleys to become an important instrument in the execution of the naval policies of states until around 1650.

The sailing merchant vessel kept its military importance much longer than the merchant galley. When the war galley began to dominate Mediterranean warfare at sea around 1520, the merchant galley, which for over two centuries had served to create and maintain the sea lines of the overseas Empires of Genoa and Venice, survived for a few more decades in the military role, but only in the redesigned form of the galleass with its formidable armament. The fact that the war galley superseded the merchant galley in the Mediterranean in its original, flexible form, which had made it useful for both commerce and warfare, represented a first separation between Mars and Mercury, which presaged the end of the overseas Empires of Genoa and Venice.

The *return of the galley* in northern waters, in which France went ahead spectacularly in 1513, was, with hindsight, short-lived, except in the Baltic; but it was impressive, not least in the eyes of contemporary eyewitnesses. During the short period that galleys and galleasses were considered advantageous for warfare in northern European waters, they never constituted the bulk of war fleets. As a result, they could not have the same impact upon the conduct of northern maritime warfare as upon the conduct of Mediterranean maritime warfare.

The adoption of broadside gunnery by sailing vessels eventually made possible the *return of the sailing vessel* for war in the Mediterranean. Venice showed that it could effectively operate against the Turks when it enhanced its galley fleet with hired merchantmen converted for war during the first two-thirds of the seventeenth century, and subsequently by building ships-of-the line.

The continued (on the Atlantic side) or renewed (in the Mediterranean) use of transformed merchant vessels for war was not a simple sign of conservatism; rather, many simply continued to consider it as the optimal combination of effectiveness and cost-efficiency for power-projection at sea. The Dutch pushed the cost-efficient use of flexible merchant fleets to the ultimate limits of military effectiveness in an era when the English were to teach them the tough lesson that the future of naval warfare would be determined by purpose-built ships-of-the-line – more expensive than converted merchantmen, but more effective. The first Anglo-Dutch war announced a second separation of Mars and Mercury, although even

during the next Anglo-Dutch war Indiamen and armed merchantmen still represented a minority of the Dutch and English fleets respectively. By then money, in the form of state fiscal means, and not technology became the critical element of change in European naval warfare.

It thus took a long time before expensive permanent navies consisting of purpose-built warships entirely replaced the cost-efficient flexible fleets. One of the implications of this conclusion is that the tendency of some early-modern naval historians to measure naval power by counting purpose-built warships does not make much sense before *c.* 1650 if they do not include merchant fleets in their calculations.[126] Another implication is that continuities – such as the Dutch and English use of merchant ships, and the Venetian and Turkish use of galleys – in European warfare at sea in the seventeenth century should not too easily be overlooked, or dismissed as historical anomalies. In warfare at sea in the period from 1330 to 1660 there is as much continuity as there is change.

When one contrasts the European navies of the late seventeenth century with those of the fourteenth century there are very great differences. These were, however, the product of many bigger and smaller changes that took place next to and in interaction with existing continuities. In light of the duration of more than three centuries between the appearance of gunpowder weapons at sea and the domination of warfare at sea by permanent navies of purpose-built warships, it seems more accurate to speak of a naval transformation, rather than a 'naval revolution' or 'military revolution afloat'.

[126] See for instance Modelski and Thompson, *Seapower*; and Glete, *Navies and Nations*.