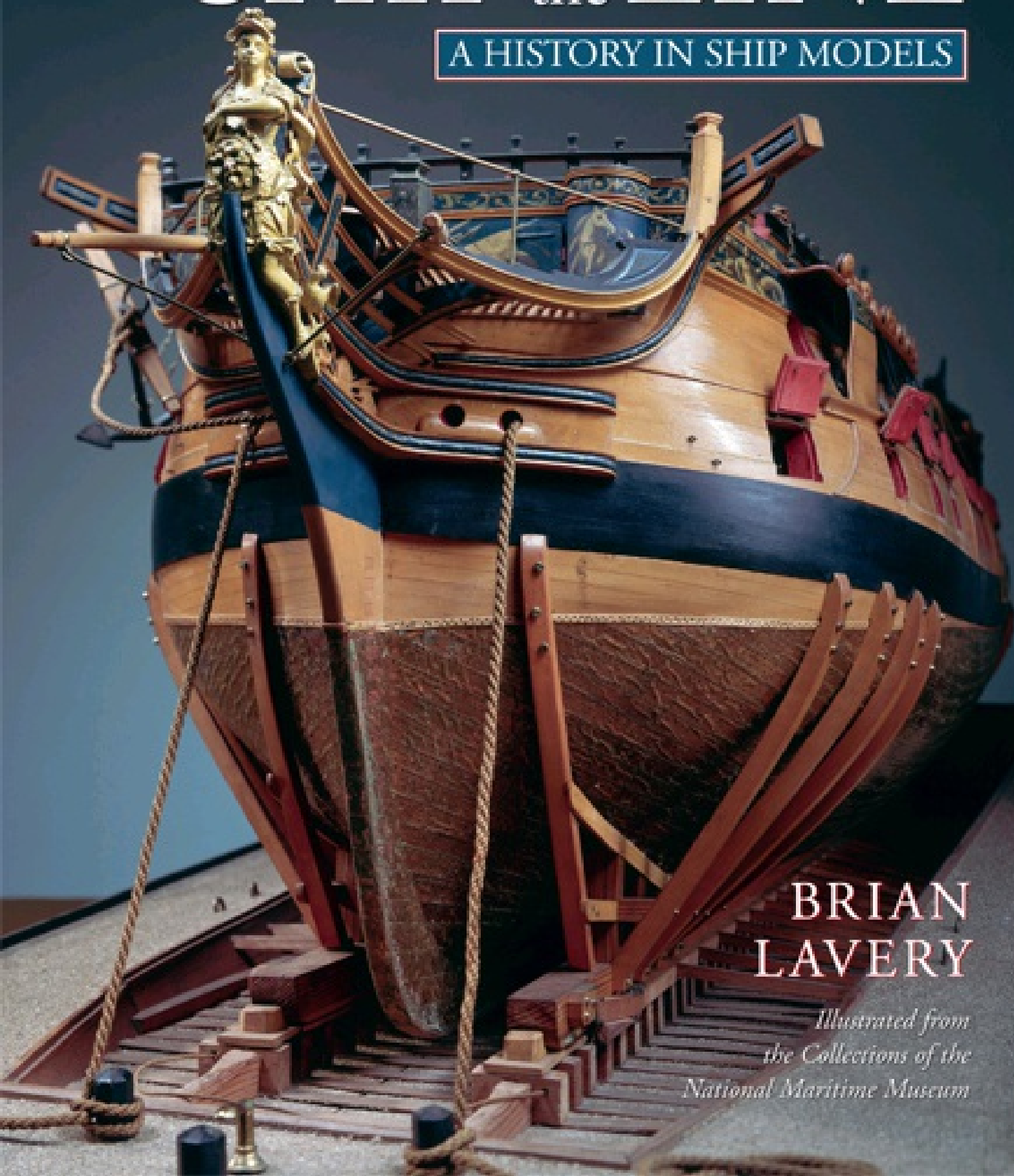


The SHIP of the LINE

A HISTORY IN SHIP MODELS



BRIAN
LAVERY

*Illustrated from
the Collections of the
National Maritime Museum*

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An unidentified
74-gun ship of about 1800.

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Additional illustrative material came from the Ashmolean Museum, Oxford; Magdalene College, Cambridge; and Wilton House.

References

Models in the National Maritime Museum collection are catalogued by SLR number, and in this book these are quoted at the beginning of each caption to one of these models. Further details of these models can be found on the Museum's Collections website at:

<http://collections.rmg.co.uk/collections.html#!cbrowse>

Searching by SLR number will turn up a full description of the model and any available photographs.

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1: The Origin of the Ship of the Line

By definition, a ship of the line was one that was big and powerful enough to stand in the line of battle against anything the enemy could put alongside it, and as a ship is long and narrow, and if it is to carry a heavy armament, most of that armament must be mounted mainly on the broadsides. Therefore gun armament is essential to the whole concept. The idea of disposing ships in a single line when going into battle seems so obvious with our hindsight that one wonders why it was not instigated until ships had carried heavy guns for a century and a half. But it must be remembered that in the early days the heavy gun was not necessarily the main weapon, and at first the broadside was not supreme.

Ships had been fitted with light guns of some kind since the 1460s, but the first generation of real gun-armed warships only came with the invention of the gunport around 1500. That allowed a heavy gun to be mounted low in the ship without raising the centre of gravity, but it could be protected from enemy gunfire and rough seas by closing the ports. This generation is represented most dramatically by the remains of the *Mary Rose* on display at Portsmouth, and the thirty-year service of the ship tells us much about the growing importance of guns and the tactics associated with them. Her first armament list dates from 1514 when she carried a total of 78 guns, but only 5 of these were heavy. The Mediterranean galley was the first type to deploy great guns effectively armed, mounting heavy ‘basilisks’ in the bows to fire forward. Though they rarely had ideal conditions to operate in more northern waters, they did make a great impression on the English fleet in 1513. According to Edward Echyngham, ‘6 galleys and 4 foists came through part of the King’s navy, and they sank the ship that was Master Compton’s, and strake through one of the King’s new barks, which Sir Stephen Bull is captain of, in seven places, that they was within the ship had much pain to hold her above the water.’

Sailing ships could not hope to match the manoeuvrability of the galley in light winds, but one answer was to fit more heavy guns to defend the ship from any

direction, especially from ahead. In 1545 naval officials had resisted Henry's attempt to fit yet more forward-firing guns to the ageing hull of the *Mary Rose*. Already she had 'over the luff two whole slings lying quarter-wise', that is, firing forward from the castle in the bows. In addition, there were two culverins at the 'barbican head' or the break of the quarterdeck firing forward past the forecastle, plus two sakers on the deck above. It would not be possible to fit any more forward-firing armament without 'the taking away of two knees and the spoiling of the clamps that beareth the bitts, which will be a great weakening to the same part of the ship.' The guns were apparently not fitted and the *Mary Rose* sank while engaging French galleys in the Solent, though from accident rather than enemy action.

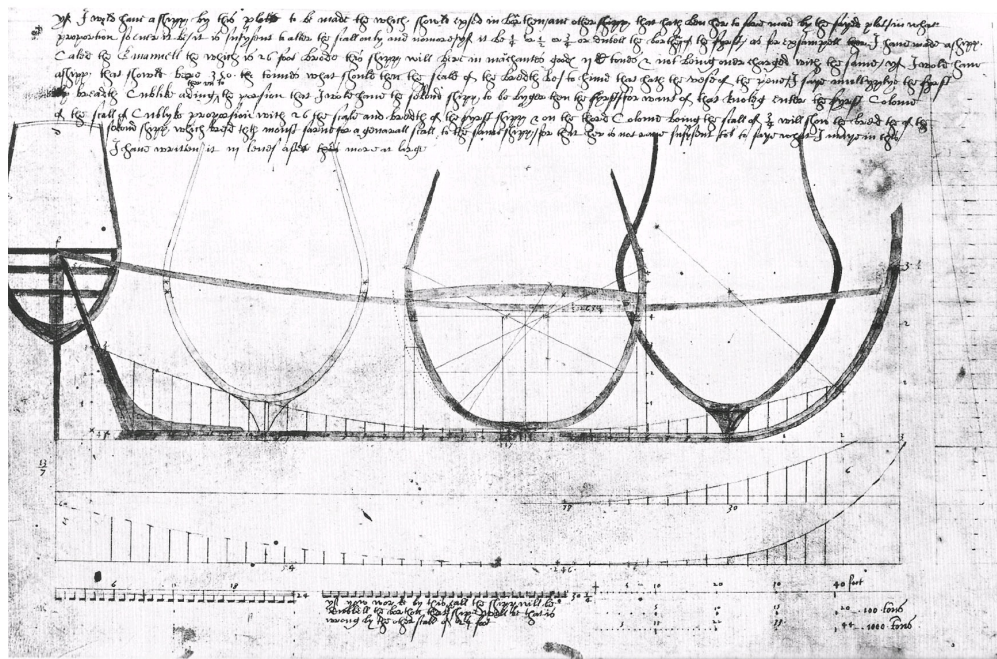


When she was built in 1509 the guns of the *Mary Rose* were probably regarded as auxiliary weapons to support boarding, but she had extra ones added, especially in the latter years of her long career which covered three wars. This drawing, by Anthony Antony, the surveyor of the ordnance, is part of a series depicting the whole of Henry VIII's fleet and is the only known contemporary picture of her. The rigging is not very accurate, with the yards apparently set on the wrong side of the mast and shrouds. The ship is heavily decorated with paint and flags but shows little sign of any carvings. It shows heavy guns pointing from the stern and even across the waist. As it is drawn from astern as was common at the time, it does not show the forward-firing armament installed in the 1540s to give all-round protection against galley attack. The excessive weight of guns was almost certainly a major factor in her loss in 1545.

Magdalene College, Cambridge

The English adopted galleys but were never entirely happy or successful with them. Meanwhile, the Venetians developed the galleass, with the oars of a galley and a castellated superstructure fitted with guns. They had great success against the Turks at Lepanto in 1571, and also led to the Spanish galleon, a ship with good gun armament and sailing qualities. Soon they fell into the temptation of building their ships too high, while the English, under the leadership of Sir John Hawkins, produced the 'race-built' galleon with lower superstructure and better sailing qualities.

This generation is represented by the drawings of Matthew Baker, the leading Elizabethan shipwright. The 'quarter frame' system as represented by the *Mary Rose* is still in use, as one plan shows the classic five stations: the midships frame, two quarter frames, the stern frame and the curved stempost forward. These could be constructed and then joined by battens on the building slip so that the shapes of the other frames could be found. However, Baker has added rising lines, narrowing lines of the floor and maximum breadth which were used to draw the frames in between, rather than having to rely on battens during the actual construction. Despite the emphasis on speed, Baker's ships tend to have fuller bows than the *Mary Rose*, for they were intended to carry a heavier armament forward.



Matthew Baker's plan of a galleon of about 1586 represents the 'race-built' ships which fought the Spanish Armada. It shows the system of 'quarter frames', with (in order from the left) the stern frame, the after quarter frame, the midships frame, the forward quarter frame and the stempost, which together can be used to form the shape of the hull. It also shows the next stage in the evolution of design, with the rising and narrowing lines of floor and breadth marked on the plan. These could be used to draught the intermediate frames on paper or in a mould loft, so that the shape of the hull was draw out more precisely before construction. This would also have made it easier to make a true scale model, although no examples survive from the period. Another drawing in the series suggests that a fish form was ideally used in design, though it is not likely that would have helped the builder very much.

Magdalene College, Cambridge

So far the model had played no part in warship development, and Britain had no tradition of 'votive' models as placed in churches in many European countries. It would have been difficult to find adequate information to make one to scale when much of the design work was carried out on the building slip rather than the drawing office. Nevertheless, in 1572 William Bourne, a maritime writer and bitter rival of Matthew Baker, recommended the use of one-twelfth scale models to measure the displacement of a ship under construction.

For every foot in length, make the mould [model] in timber an inch in length; and for the breadth in like manner, make every foot make the other an inch, and also for every foot in deepness, that the ship swims in the water. And so consequently every part and place both of the run and way, and floor, with the quarters of the ship, to cut the mould for every foot, or part of a foot, an inch, with those parts, even as the work or mould of the ship doth run, in all points.

After that the model should be hollowed out and weights placed inside to make it float at the right level. It should be placed in a tank filled to the brim with water, and the amount displaced could be scaled up to measure the displacement of the ship. There is no evidence that such methods were used in practice.

It was Hawkins's and Baker's race-built ships which did much of the fighting against the Spanish Armada as it sailed up the English Channel in 1588. The English were reluctant to indulge in the traditional tactic of boarding, if only because the Spaniards were high-sided and full of soldiers. Instead they relied on gun power at quite long range. Reports are very short of any tactical detail, though there is an oblique reference to an engagement in which Drake 'gave them his prow and his broadside; and then kept his luff ...'. This is not unlike a style of attack advocated by Captain Nathaniel Boteler in 1634. After getting alongside the enemy, 'you are to fire your bow pieces upon her, then your full broadside; and letting your ship fall off with the wind, let fly your chase pieces, all of them, and so your weather broadside. The which being done, bring your ship about, that your stern pieces may be given also.' Boteler believed firmly that 'It is requireable also that the bows and chases of these ships be so contrived that out of them as many guns as possible may shoot right forward.'

But in 1588 this proved less devastating than some expected, and Drake's apology was lacking in his usual bluster. 'If I have not performed as much as was looked for, yet I persuade myself his good Lordship will confess I have been dutiful.' The Armada was dispersed by fireships off Calais, then fled round the north of Britain, where many ships were lost in storms.

Models were an essential part of the work of Phineas Pett, the great shipwright of the early Stuart era. As early as 1596 he made a small one for the Lord Treasurer, Lord Burghley. Three years later he made one for his friend John Trevor, 'being perfected and very exquisitely set out and rigged.' In 1607, while building the great ship *Prince Royal* for King James I, he made a model for the latter's eldest son, Prince Henry, with his own hands. It was 'most fairly garnished with carving and painting, and placed in a frame arched, covered, and curtained with crimson taffety'. It was presented to the Lord High Admiral, who approved and took it to the prince, who had it installed in a private room in Richmond Palace. The King himself came to see it there and was 'exceedingly delighted with the sight of the model, and spent some time questioning me the divers material things concerning the same, and demanding whether I would build the great ship in all points like the same'. Unfortunately, nothing of the model has survived, and we are reliant on paintings for our knowledge of the *Prince Royal*, which was launched in 1610 as the pride of James's fleet. The only surviving model from this period is one in the Ashmolean Museum in Oxford. It has six guns per side and two each in the bow and stern, with a long beakhead. It is not truly to scale and is probably of a small merchant ship of 1605–30, beneath the dignity of Phineas Pett.

Pett continued to use models to keep up his relations with the Royal Family after Charles I came to the throne in 1625. In 1634 he made 'a little ship, being completely rigged and gilded, and placed upon a carriage with wheels resembling the sea'. It was given to the four-year-old Prince Charles, the heir to the throne, who 'entertained it with a great deal of joy, being purposely made for him to disport himself withal.' Perhaps it was the origin of Charles II's famous love of the sea and the navy. Four days after the presentation of the model, on 26 June, King Charles came to the dockyard at Woolwich to see the ship *Leopard* under construction. Inside the unfinished hull of the new vessel he pulled Pett aside and

acquainted him with 'his princely resolution for the building of a great new ship, which he would have me undertake'.



The ship model in the Ashmolean Museum, Oxford, is perhaps the earliest English example, though its nationality is far from certain. It is not a true scale model in that it does not pretend to show the hull shape accurately and has something in common with the votive models placed in churches in some countries such as the Netherlands. It has been suggested that it was one of the models made by Phineas Pett in 1596–9, but that seems unlikely as he had the use of plans and would have produced a more accurate hull shape with greater detail. It has a low, long beakhead, which was typical of the late sixteenth and early seventeenth centuries, and a decorated open gallery on the stern. The bow above the beakhead is round, while the gun armament is shown mainly at the stern, with prominent aft-firing guns, which was probably rather old-fashioned by the time the model was made.

Ashmolean Museum, Oxford

Trinity House, the main authority on navigation, protested at the plan. The ship would be too big for any port; her anchors and cables would be too heavy to manage; she would be unstable, and probably sink ‘as did the Mary Rose in King Henry the VIII’s time at Portsmouth’. In summary, ‘neither can the wit of man build a ship well conditioned and fit for service with three tier of ordnance.’ But that did not affect the resolution of a king confident of his divine right to rule, and fully aware of the great ships built by his rival monarchs in Denmark, Sweden and France. Three months after the meeting in the bowels of the *Leopard*, Pett had a ‘model’ of the great ship carried to Hampton Court for the King to look at. It was ‘placed in the Privy Gallery, where, after his Majesty had seen and thoroughly perused, he commanded us to carry it back to Whitehall and place it in the Privy Gallery till his Majesty’s coming thither ...’ It ended up in Pett’s house in Woolwich when Peter Munday visited in 1635–7.

... we saw the model or mould of the said ship, which was shown to his Majesty before he begun her. The said model was of admirable workmanship, curiously painted and gilt, with azure and gold, so contrived that every timber in her might be seen and left open and unplanked for that purpose ...

This is the first mention of the ‘Navy Board’ style of open-framed model.

The *Sovereign of the Seas* was a new concept in naval warfare, by accident as much as anything else. It was necessary to cram as many guns as possible into the hull to reach the magic figure of 100, and this could only be done by fitting the maximum number on the broadsides as there was no room for any more on the bows. Her great size also meant that she was not suitable for the ‘turning and boarding’ battles of the past, for as Captain Boteler put it, large ships could not turn to use the other broadside, but ‘can never use save one, the same beaten side’. Unwittingly, he had discovered the germ of the ship of the line, in which ships would have to stand and fight.

This was made possible by new developments in gunnery. The English were casting guns in iron rather than the much more expensive brass, and mass production of a kind became possible. Now they were nearly all mounted on ‘truck’ or wheeled carriages that could recoil or be hauled in for reloading.

Gunports were much wider than in the days of the *Mary Rose*, so the guns could be aimed over a greater area. A very simple device, the train tackle, was now fitted at the rear of the carriage. It was hauled tight when the gun was inboard, to stop it running out by itself during reloading. This was no longer left to the professional gunners and more men were allocated to the gun crews in action; in 1617 it was decreed, 'in case we shall be set upon by sea, the captain shall appoint sufficient company to assist the gunners.' Increased breadth tended to create more space for the operation, so as a result of all these factors it was now possible to build a ship with a large number of guns, which could stand and fight rather than retreat to reload.

Ships like the *Sovereign of the Seas*, and the 'great ships' of 800–900 tons which made up the bulk of the English fleet, were designed for battle as well as show, and they made up a 'a royal fleet destined to meet with another of the like'. They did not solve the growing problem of piracy on the south coasts of England and Ireland, with a flotilla of thirty Barbary corsair ships appearing off Plymouth in 1625, culminating in the attack on Baltimore in Ireland in 1631 when 120 people were enslaved. Charles built the 'whelps' which were intended as light patrol vessels, but the shipbuilders of Dunkirk, then nominally under Spanish control, had evolved a much faster type known as the frigate. As Captain Joshua Downing wrote in 1625, the Dunkirkers built ships 'without galleries ... or any overcharging weight to hinder their sailing.' They were of 300 tons or less and carried 20 or 25 medium calibre long-range guns, culverins or demi-culverins.

The English Parliamentary forces began to feel the effects of such ships during the Civil War, which began in 1642. The Navy supported Parliament against the King, but the *Sovereign of the Seas* and the great ships were useless to prevent Royalist privateers and gunrunners. Some of the Dunkirk-style ships were acquired by capture or purchase, including the *Swan of Flushing*, which was surprised while attacking a Scottish ship, and the *Nicodemus*, which was described as 'the most absolute sailer in the world. She runs from every ship like a greyhound from a small dog.' The first English frigate was the *Constant Warwick*, built by Phineas Pett's nephew Peter in 1645–6. Originally it was intended as a privateer, funded by a syndicate of nine men who mostly held high office in the Navy. Her crew

revolted in favour of the Royalists in 1649, but surrendered and the ship was taken into the Parliamentary navy where she proved highly successful. Later, Pett's tombstone bore the words, 'He invented that excellent and new ornament of our navy, we call a frigate; formidable to our enemies, to us most useful and safe ...' Frigates were long and narrow and it was only natural that most of their gun power was mounted on the broadside.



BHC2949

Peter Pett, who built the *Sovereign of the Seas* to his father's design, is pictured with the elaborate stern of the ship. According to an account by Thomas Heywood, 'The master builder is young Mr Peter Pett, the most ingenious son of so much improved a father, who before he was five and twenty years of age, made the model, and hath since perfected the work ...' The decorations of the ship cost £6691, a tenth of the total cost and the price of a typical 40-gun ship of the period. The upper part of the stern is dominated by the figure of Victory supported by Jason and Hercules; the lower part includes the royal coat of arms and the Prince of Wales's feathers. The fighting function of the ship is represented by the regular rows of brass guns protruding from each side. As Commissioner at Chatham during the Dutch raid of 1667, Pett later claimed he was justified in rescuing his ship models, as 'He did believe the Dutch would have more advantage of the models than the ships, and the King had greater loss thereby.'

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Many more frigates were built during the Civil War. In December 1645 the Committee of the Navy ordered its commissioners 'do confer with the master shipwright and his assistants appointed to build the three frigates, for a model of them severally to be presented to the Committee of Admiralty.' However, the term probably referred to a plan rather than a three-dimensional model. There was a tendency for them to become larger and to acquire upperworks. Three ships of 1646, all built by the Pett family, were of 340 to 394 tons. Four completed in the following year were of 414 to 474 tons, and in 1650 Christopher Pett built the *Speaker* of 727 tons, more than twice the size of a traditional Dunkirker. In 1650 the Navy Board agreed that 'forecastles would add very much to their strength', and gave orders for one to be fitted on a new one building by Pett, presumably the *Speaker*. There was even a 'great frigate', the *Antelope* of 828 tons, but she was soon wrecked, whereas the *Speaker* provided a prototype for many years of future development. By this time the frigate was not much smaller than the 'great ships' of around 900 tons which had dominated the Stuart navy. These ships too were more committed to gun power than before. The *St George* had carried 42 guns in 1622, 56 in 1647 and would eventually carry 70. It was becoming increasingly clear that the broadside was now the main tactic. In 1649 the *Adventure* of 32 guns fought a French ship. 'After an hour she came up with the French ship again, broadside to broadside, near two hours before she struck, but so battered that the French ship sunk to the bottom of the sea two hours after she was taken.'

After the execution of Charles I in 1649, the new English republic became increasingly isolated and fought wars with Ireland, Scotland, France and Spain. The fleet continued to expand to cope with this. At the start of the Civil War it had forty-two ships. Despite losses (including twenty-five ships which revolted to the Royalists), it had risen to a total of 102 ships by March 1652. The *Sovereign of the Seas* still carried the 100 guns she had been designed for. The *Prince* was now renamed the *Resolution* and carried 85, compared with 55 in 1624. There were ten of the old great ships, mostly armed with 50 to 60 guns, alongside three of the larger frigates, plus more building. There were two-dozen ships of 30 guns or more, mostly of the frigate type, which might serve as heavy ships if needed, plus smaller vessels for scouting and convoy escort. They were ready to serve in a very

intense and almost purely maritime war against the Dutch, the leading sea power of the time.

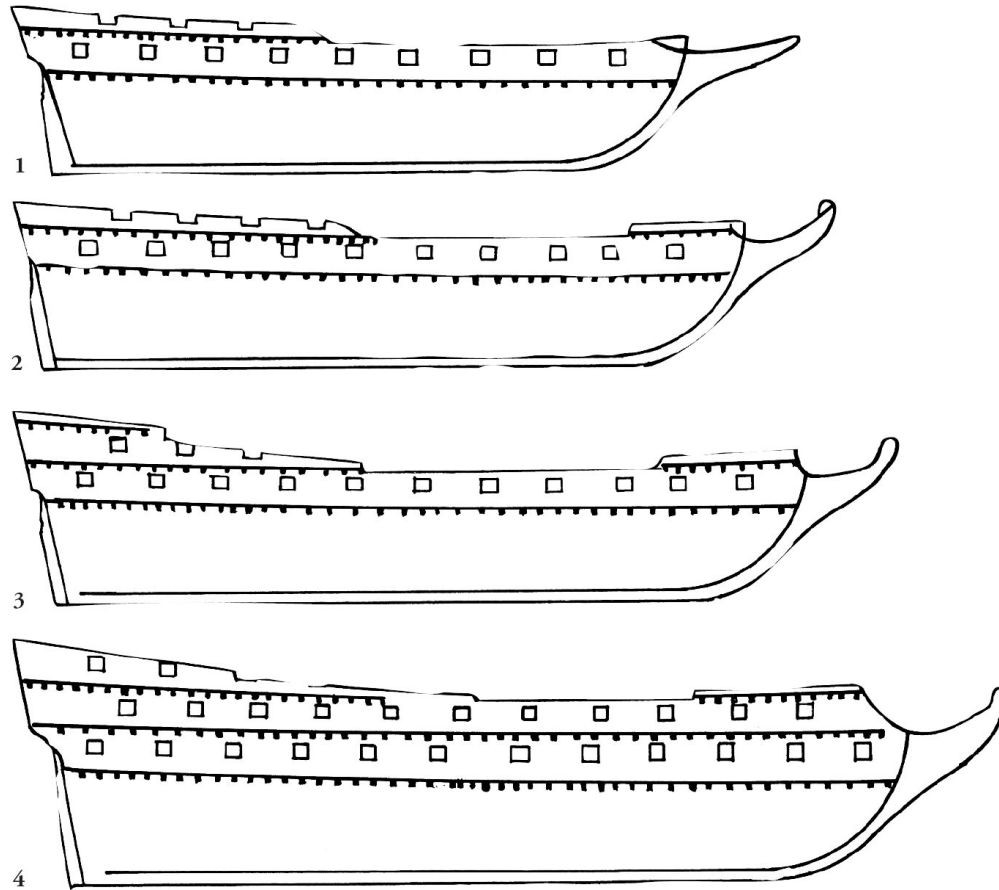


SLR0217

This model, alongside the ones in the Annapolis collection, can claim to be one of the first British scale models. Its dimensions match the Third Rates of the 1650s, but it carries a royal coat of arms, which suggests a period after the Restoration of 1660. It is possible that the coat of arms was added later, as many guns, for example, had their commonwealth decorations replaced. It is also possible that it is a preliminary model for the Third Rates ordered in 1664, which were based on the dimensions of the 1650s but were expanded during construction. It is clearly built to scale from a draught, with each individual frame cut out. The planking is only represented by the thicker pieces, the wales. The capstan is of the old type in which the bars passed right through the barrel, so that they all had to be set at different heights. The gunports are surrounded by square wreaths, which was quite common at the time. Those in the waist are very small and the wreaths are arranged very tightly around them.

2: The Wars with the Dutch 1652-1674

The three Anglo-Dutch wars between 1652 and 1674 produced very intense conflict and rapid development in ship design and tactics. There were numerous and very heated battles, unrivalled in any other age. The *Speaker* alone (renamed the *Mary* at the Restoration of the monarchy in 1660) was in twelve fleet battles and three minor actions between 1652 and 1673. The wars were mostly fought in a very restricted region, the southern end of the North Sea, so there was little need for scouting, and the Dutch did not favour commerce-raiding as a tactic, which meant that there was less need to protect convoys. They were wars of great battleships rather than small frigates. In 1674, not long after the end of the wars, there were 151 ships in the King's navy. Less than half were small ships below the Fourth Rate, and fourteen of these were yachts of little or no fighting value. The large ships, on the other hand, were fitted out in great numbers and it was not unusual to find a hundred of them on each side in a battle. The Dutch economy was totally dependent on foreign trade so they had to break the English blockade to survive – there was no question of avoiding battle as the French were to do, for good strategic reasons, in the next century. The wars were a formative experience for the English navy, and in the middle of the next century Captain Augustus Hervey wrote of 'these Dutch wars where so many valiant commanders' praises are sung down to us'.



Stages in the evolution of the mid-seventeenth century frigate:

1. An early English frigate as copied from the Dunkirk ships in 1646–8. It has a single deck, with a quarterdeck but no forecastle
2. The ships built from around 1648–9 had forecastles added to improve seakeeping and accommodation
3. A small poop was also fitted on some classes in 1649 to improve the officers' accommodation aft
4. With the *Speaker* and 'great frigate' classes of 1649–50, the frigate became a fully-fledged two-decker, and potentially a ship of the line, though it tended to retain something of the narrow and sharp hull of the original frigates. The *Speaker* class set the pattern for all the two-deckers that would follow, down to the nineteenth century. The *Speaker* herself, renamed *Mary* at the Restoration, fought in more than a dozen fleet battles before being lost on the Goodwin Sands in 1703

The importance of the broadside was confirmed in the first action, off Dover in May 1652. 'When Tromp came up amongst the *Old James*' starboard side (as near as he could) fired his whole broadside into her. This and above a dozen broadsides more, the *Old James* received before she could load and fire her starboard guns twice.' English gunnery was not yet supreme against the skills of the Dutch, who were fine seamen and brave fighters, but their ships were largely converted merchantmen and smaller than the English ones. The first great fleet battle was near the Thames Estuary sandbank of Kentish Knock in October that year, when about sixty-five ships were engaged on both sides. The English attacked in three squadrons and their superior gun power led to a narrow victory. They suffered a defeat when attacking a convoy off Dungeness in December and in February to March 1653 the two sides fought off Portland, when the English captured eleven ships and lost only one.

That spring two army commanders, Richard Deane and George Monck, were given joint command of the fleet with Admiral Robert Blake. The new 'generals-at-sea' were used to strictly disciplined soldiers fighting in line and were horrified at the situation with the Navy. In May they produced fighting instructions that demanded stricter organisation and put the fleet into a single 'line of battle' for the first time. Rather than fighting in squadrons, each ship was to 'endeavour to keep in line with the chief' and every ship was to 'bear up in his wake and grain [that is, to be directly astern or ahead of the admiral] upon severest punishment.' This made sure that one ship or squadron did not get in the way of another and broadside power was to be deployed to the full.

It was not long before two fleets of more than a hundred ships each met off the Gabbard Bank in the North Sea. A Dutch report said:

It was (for the most part) with the ordnance, the ships of either side coming seldom within musket shot of each other, of the English, having the wind and more and greater guns, made use of these advantages, plying the Dutch only with their ordnance. And when the Dutch, finding the great disadvantage they were at, endeavoured to get the wind that they might come nearer, the English, by favour of the wind, still prevented them, so as they could do little hurt to the

rebels ...

There was one more battle but the Dutch were clearly defeated and made peace on English terms in 1654. The broadside was now supreme over the old style of turning and boarding fight, and the concept of the 'line of battle' was fully established for the first time.

During the war the English built eleven new ships of the two-decker *Speaker* class and about fifteen smaller two-deckers. They continued afterwards, for they were never entirely at peace, fighting wars with France and Spain. The frigate grew to meet the new needs, with the addition of a forecastle, higher decks, enlarged scantlings, fuller bows and increased armament. According to Sir Anthony Deane, 'the former sailed primely well, but wanted most of the accommodations for men-of-war. The latter have much more accommodation for men-of-war, and yet sail nearly as well, if equally taken care of.' The three-decker, as established by the *Sovereign of the Seas*, was also developed during this period, mainly as a fighting ship rather than a royal glory, for it had shown its value in battle. Samuel Pepys said later, "'Twas the great old ships that did the service against the Dutch, built by His Majesty's father Charles I.' The Commonwealth built the *Naseby* of 80 guns, slightly smaller than the *Sovereign*, but maintaining the principle of three decks of guns. They also built three smaller three-deckers of 64–70 guns.

The English Commonwealth did not long survive the death of Oliver Cromwell in 1658, and in 1660 the son of the executed king was invited to return from exile to take up the throne as Charles II. He came back in the *Naseby*, which was promptly renamed the *Royal Charles*, and all republican symbols were removed during the voyage. The two-decker *Speaker* was renamed the *Mary*. Among the passengers on that passage was the young Samuel Pepys – a cousin of Admiral Edward Montague, who was given the title Earl of Sandwich for his role in the Restoration and allowed to nominate Pepys for the post of Clerk of the Acts to the Navy Board. As a token of his friendship, Sandwich lent Pepys a ship model, and in October 1661 he recorded, 'stayed at home all afternoon, putting up my Lord's model of the *Royal James*, which I borrowed of him long ago to hang in my room.'

Pepys's post on the Navy Board carried a good deal of patronage and Anthony Deane, then assistant master shipwright in the dockyard at Woolwich, was not the first to use a ship model to attract the attention of the naval authorities. In August 1662 he visited Pepys and promised him a 'model of a ship, which will please me exceedingly, for I do want one of my own.' It arrived at the end of September and Pepys was pleased: 'it so exceeds my expectations that I am sorry almost, he should make a present to no greater person ...' He soon saw to Deane's advancement, as a friend and also as a counterbalance to the dominant shipbuilding family – he was 'able to vie with others, especially the Petts.'



This model in the Sjöhistoriska Museum in Stockholm is one of the earliest examples of a 'Navy Board' style model with open framing joined by wales, and showing a certain amount of decoration on bow, stern and sides. It is sometimes associated with Cromwell's 80-gun three-decker *Naseby* of 1655, which became the *Royal Charles* on the Restoration of the monarchy in 1660. It is more likely that it was made by the emigré shipwright Francis Sheldon as a model of an 86-gun ship he built for the Swedes, but perhaps based on the *London* of 1656, on which he had worked before leaving England. It has a complex deck arrangement aft, with a 'coach' under the raised deck forward of the normal quarterdeck, to provide dining accommodation for an admiral and his staff and guests. It shows the 'tumblehome', or inward slope of the sides above the waterline, which was very pronounced at this period but gradually reduced over the next two centuries. Modern restoration work on the bow and stern is marked by lighter coloured wood.

Sjöhistoriska museet, photo by Johan Jonson

It was not just Pepys's tidy mind which divided the miscellaneous collection of warships into 'rates', for that process had begun earlier. The rate of a ship was not an indication of quality, as later ages tended to assume, but of quantity. It was used to assess the pay of the captain and certain officers, but also gave an indication of its fitness to stand in the line of battle. In 1660 there were three First Rates, comprising the old *Prince* and *Sovereign of the Seas*, and the *Naseby*, now *Royal Charles*. The twelve ships of the Second Rate included the old 'great ships' and a few new-built small three-deckers. The Third Rate included fifteen ships, mostly the larger frigates of the *Speaker/Mary* class. The Fourth Rate was the largest group with forty-five ships, a combination of medium-sized frigates and older vessels. Though most of them were considered large enough for the line of battle, some were quite small with as few as 32 guns, but most had 38 or 40. The smaller rates, the Fifth and Sixth, numbered thirty-seven and forty-one respectively, and were scouting vessels, yachts and fireships.



Pepys was a superb administrator and revelled in the attentions of Charles II, who had once played with a model made by Phineas Pett. According to Pepys, Charles was a king 'who best understands the business of the sea of any prince the world ever had.' Indeed, Gilbert Burnett later thought that his technical knowledge was 'rather more than became a prince'. The King's brother James, Duke of York, became Lord High Admiral and was not just a figurehead, taking command of the fleet at sea on occasion. Two new ships were ordered soon after the Restoration, the *Royal Oak* of 1021 tons and 76 guns and the *Royal Katherine* of 1108 and 84. Pepys could not but help being 'amused' when the latter ship, built by Christopher Pett, proved unstable.

Another war with the Dutch was looming by 1664, and new ships were needed, as the Dutch had not been idle. This would be the first programme since the inception of the line of battle and it offered an opportunity to incorporate the experiences of the last war, but at first it was conservative. Four Third Rates were to be built 'about the size and dimension of the *Mary* frigate', ignoring the fact that she had proved rather unstable and had been 'girdled' (having her breadth increased). Shipbuilders were paid by the ton and to a certain extent it was in their interests to make the ships a little bigger than the contract – as a result Jonas Shish's *Cambridge* was of 881 tons rather than the 727 of the *Mary*, Castle of Deptford's *Defiance* was of 863, Phineas Pett II's *Monmouth* was of 856 and Anthony Deane's *Rupert* was of 791. Pepys exulted in the performance of his protégé's ship, 'the King, Duke, and everybody saying it is the best ship that was ever built.' The new ships carried 64–70 guns and proved very effective ships of the line. Another, the *Warspite*, was ordered at Blackwall.

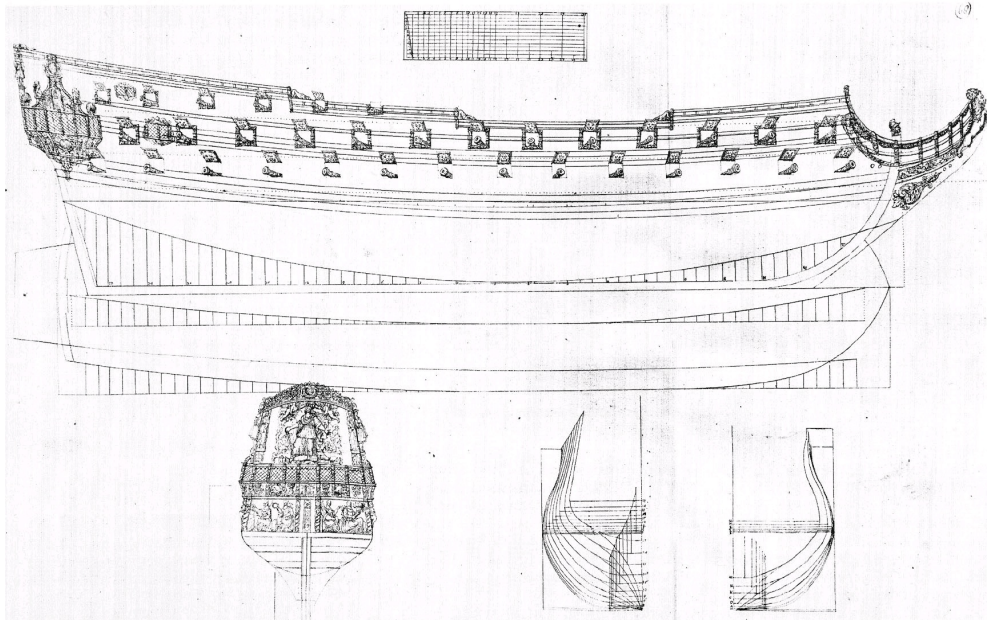
The hostilities began in November 1664 and Parliament voted £2½ million to prosecute it – not nearly enough, and three-fifths of it had been spent by the end of the month. This set the pattern for the rest of Charles's reign: high naval ambitions and potentially skilful direction, undermined by political, religious and personal rivalry, corruption, a desperate lack of money and the mistrust of Parliament. Meanwhile, the Dutch had indeed built up a new fleet and they had learned to fight in line of battle like the English. James, Duke of York, adopted many of the Commonwealth's rules on the line of battle and strengthened them, allocating

individual stations to ships, dividing the fleet into three squadrons and reinforcing rules against breaking out of the line to take prizes. He led the fleet to engage the Dutch off Lowestoft in June 1664. The English had 109 ships and the Dutch had 103. The two fleets passed one another in line, firing cannons, turned round and repeated the process until they had carried out four passes, after which the English attacked more directly and the Dutch fled. The English pursued across the North Sea, but during the night one of James's courtiers came on deck with mysterious instructions to abandon the chase. This increased mistrust of the Lord High Admiral, who was already becoming increasingly unpopular because of his autocratic tendencies and his move towards Roman Catholicism, which was regarded as almost treasonable by many of his subjects.

In 1666 King Louis XIV of France declared war on England. His navy was still small but Prince Rupert took twenty ships into the Channel to deal with it, while Monck (now the Duke of Albemarle), was left with eighty to meet the Dutch. As a result he was outnumbered when he met de Ruyter's fleet on 11 June off Dunkirk. During four days of fighting the two fleets passed one another at least ten times, firing as they went. The English lost seventeen ships, including the *Royal Prince*, while the Dutch lost six; again the failure was attributed to treachery which caused the division of the fleet. However, the two fleets met again on 4 August, St James's Day, and this time they were evenly balanced with about ninety ships each. The English forced the Dutch to retreat with the loss of several of their commanders, and now they had control of the sea. One tactical innovation, ordered by James in July 1666, was for the fleet to tack as soon as their leading ship had passed the end of the enemy line – this would avoid the passing battle and put the English fleet opposite the enemy and sailing in the same direction, creating a more intense conflict. However, the St James's Day Battle was probably too chaotic to apply this, as it quickly descended into a melee.

The English had suffered by the Great Plague of London in 1665 and the Great Fire in the following year, but by the spring of 1667 they were riding high at sea. They demanded stiff peace terms for the Dutch, but Parliament did not vote the money to put a large fleet to sea, so many ships were decommissioned. The Dutch seized the chance with a daring raid on the main English base in the Medway,

during which the flagship *Royal Charles* (ex-*Naseby*) was captured. Peter Pett, now commissioner at Chatham, was accused of saving his own possessions rather than moving the ships further up-river inside the protective boom. He defended himself, claiming, 'he used never a boat till they were all gone but one – and that was to carry away things of great value, and these were his models of ships.' His interrogators suggested that he might be better saving the ships rather than the models, to which he replied, 'He did believe the Dutch would have more advantage of the models than the ships, and the King had greater loss thereby.' Samuel Pepys, not an unbiased witness, noted, 'this they all laughed at.'



Anthony Deane's plan of a Third Rate of 70 guns from his *Doctrine of Naval Architecture*, produced for Samuel Pepys in 1670. The sheer plan or side view shows wales, gunports and decorations, with the curved shape of the rising line of floor below, just above the keel. Below that, the 'narrowing lines' of the maximum breadth and floor are drawn out in a different plane. These could be used to construct much of the shape of the hull forward and aft of midships. The body sections are shown on the bottom right, with those of the stern on the left and the bows on the right. Construction lines of the various 'sweeps', or arcs of circles which formed the shape, are also shown. The stern decoration does not match any known ship, and it is more like a merchant ship than a naval vessel. The square wreaths on the gunports would be rather old-fashioned by that time, and were usually replaced by circular wreaths. In dimensions it is close to Deane's *Resolution* of 1667, as represented in a famous painting by Van de Velde. A plan like this, with every second frame drawn in, would make it easier for a modelmaker to produce the lines of a ship accurately.

Magdalene College, Cambridge

A second shipbuilding programme for ‘ten new ships or frigates, whereof none to be under the Third Rate’ had been started in 1666, but was reduced due to severe financial restraints. However, three new 100-gun ships, the first since the *Sovereign* thirty years earlier, were completed in 1670–73. They were joined by four ships of 90 to 96 guns including the *St Michael*, which were completed in 1668–70, along with two new Third Rates of 70 guns, Anthony Deane’s famous *Resolution*, and the *Edgar* built by Francis Bayley in remote Bristol. Charles’s navy now had the makings of a large and modern fleet with well-designed and purpose-built ships of the line.

Early seventeenth-century draughts of ships are either of small or experimental vessels or are fragmentary, so it is not clear when it became common to draw out the shape of the hull in full, rather than form it on the building slip. An anonymous manuscript of around 1625 clearly recommends that the shipwright should ‘draw the bends fore and aft’, for which he must ‘find the measures of each part arithmetically’. On the other hand, as late as 1664 Edmund Bushnell described a system in which a sheer draught was produced with the appropriate rising and narrowing lines, but the actual body sections were only drawn out full size on the mould loft floor – in ‘some house that hath some room or other broad enough to demonstrate the breadth of the vessel, and height enough for the top of the poop in the length of the room ...’ This was not much help to the modelmaker and probably applied mainly to small merchant ships, but already it was common to draw out the body sections of larger ships on the plan: for example, on the Danish *Christianus Quintus* of 1665. By 1670 Anthony Deane’s *Treatise on Naval Architecture*, produced at the instance of Samuel Pepys, showed how to draw out every second frame using the system of sweeps and rising and narrowing lines, and implied that this was necessary in order to have ‘the ship’s draught completed in every part’. Even then there were still old-fashioned shipwrights who resisted new methods – Francis Bayley of Bristol still worked by hand and eye in the 1660s, ‘never pretending to the laying down of a draught’.

Plans of individual, identified ships are still extremely rare in the archives, but the general principle of drawing them can be understood clearly from Deane’s work. The period also saw the birth of British maritime painting, when the Van de

Veldes, father and son, were recruited from the Netherlands in 1673. Their beautiful, detailed and accurate drawings and paintings give us the most graphic picture of any fleet up to that date and, combined with the growing number of scale ship models, they reveal most of the technical detail as well as the beauty of King Charles's fleet.

The three elements of our knowledge are not unconnected. The Van de Veldes are known to have used models to aid their painting and, conversely, their drawings can be used to identify models. And the practice of drawing out the hull form in full offered two advantages to the ship designer.

First, it gave him the material to measure out the underwater area at each frame and from that he could work out the expected displacement and level of flotation. Pepys claimed that his friend Deane was 'the first that hath come to any certainty beforehand of foretelling the draught of water of a ship before she is launched', though there is evidence that the method had been in use for some time before that. It might explain why the sections of some of the thirty ships of 1677 were drawn on squared paper, which would be useful in measuring the area of each section. It is probably not a coincidence that this was the first golden age of ship models. If the modeller could get hold of the set of plans, he could easily transfer the shape to the frames of his model, perhaps by pricking through the plan onto the wood.

Second, the drawing out of the body shape allowed the shipwright to join points at a particular level on the plan to make horizontal waterlines to check if the hull was 'fair'. According to Deane, this should be done at two-foot intervals, starting at the true waterline at which the ship would float in normal condition. It would ensure that 'all those lines go fair, making neither swell nor cling'. As well as improving practice, in the longer term the use of waterlines would provide another ready-made tool for the modelmaker, so that he could make his model in an entirely different way, using the horizontal rather than the vertical divisions of the hull – he could cut out pieces of wood to the shape of each waterline, glue them together in a system known today as 'bread and butter', then trim them to shape.

This period saw the development of true scale-model building in England, though all four of the earliest surviving examples are highly ambiguous. The clearest one is perhaps the so-called *Naseby*, which was probably taken to Sweden

by the English shipwright Francis Sheldon in 1659. It was often said to represent the three-decker 80-gun ship named after Cromwell's great victory over the Royalists in 1645, but its dimensions do not match that ship. A model of a Fourth Rate of 56 guns in the collection at Annapolis is also conventionally dated to about 1650 and shows nothing of the Royalist style, but it is too big for a merchant ship, so it seems to represent one of the ships of the Commonwealth navy, perhaps of the *Speaker* class. In the case of another model in the same collection, the hull is almost entirely the work of restoration of a worm-eaten relic, but the decorations are said to be original. They show Royalist symbols, including the coat of arms on the stern.

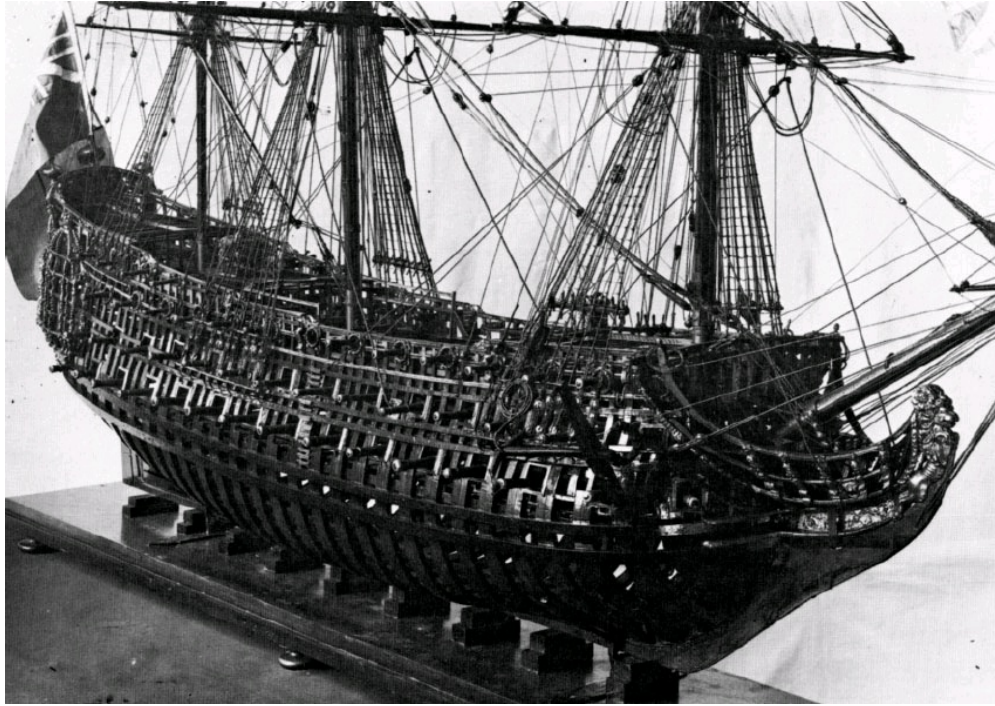
The dimensions of the model in the National Maritime Museum match a frigate of around 1650, but the royal coat of arms on the stern contradicts this. It is sometimes suggested that it was added later and, indeed, the restored monarchy was very anxious to remove republican symbols from ships, guns and buildings and replace them with their own. But these were all in public view in one way or another, and it would have been less urgent in the case of a ship model; moreover, the model shows no obvious signs of having been tampered with. Another possibility is that it represents one of the ships ordered in 1664. These were similar to the Commonwealth frigates as originally conceived but gained breadth and length during construction. The same might apply to the second of the Annapolis models.



SLR0372

This model is usually associated with Anthony Deane, because it is the only known example, apart from one of the plans in his *Doctrine of Naval Architecture*, of a ship with triple lower wales. It is of a three-decker of around 1670, but has never been identified with an individual ship, as Deane built three 100-gun ships around that time: the *Royal James* of 1671, which was lost at the Battle of Solebay in 1672; the *Royal Charles* that replaced the ship taken by the Dutch; and another *Royal James* which was eventually renamed *Victory*. By this time the modelmaker has added planking to the space between the upper and middle wales and above the upper wales, though the space between the middle and upper wales is still left unplanked. The frieze at the level of the upper deck is painted very effectively, but the quarter galleries are only represented by a skeleton structure.





The possible *Loyal London* model, located in Trinity House, London, and destroyed by bombing in 1941. The identification is not certain and is derived from the coat of arms of Sir Jeremy Smith who sailed in the ship and is known to have commissioned a model from Jonas Shish, the master shipwright at Deptford. In addition, the stern has a carving that may represent the dagger of the City of London; but on the other hand, it has features which could be associated with the *Charles* of 1668. The structure of the model seems to be rather heavy and it is unplanked except for the wales, but it has the lion figurehead which was becoming standard, as well as a royal coat of arms on the stern.

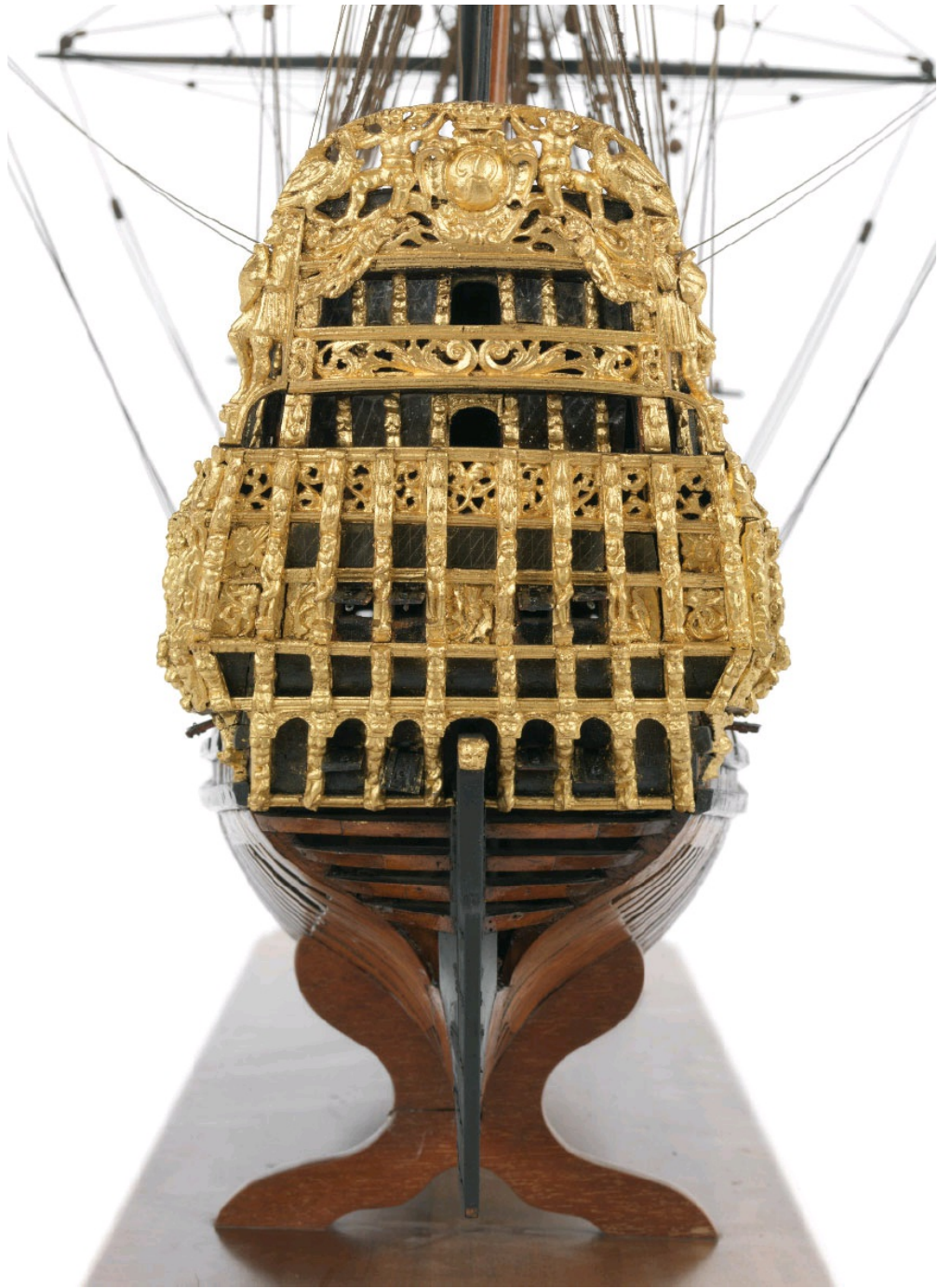
Country Life

If these models can really be dated to c1664, then the style of modelmaking developed rapidly over the next few years.

One was made of the *Loyal London*, a new three-decker sponsored by the city in 1664. The ship was burnt in 1667, the year after London itself suffered its Great Fire. By startling coincidence, a plan of it in the Danish Archives was destroyed in a fire in the nineteenth century, and the model was lost during the London Blitz in 1940. It was unplanked apart from the wales but had much more elaborate decoration than earlier models. The earliest identified ship model is of the *St Michael* of 1669. Its decorations match those of Van de Velde drawings very closely. It too was heavily decorated but it introduced the new feature of planking of the upper hull and painting of the lower wales, upper hull and decorations. This was a style which was to become standard over the next few decades.

A new war with the Dutch began in 1672, but this time it was far less popular, as the increasing authoritarian power of the Catholic Louis XIV looked far more dangerous to the English public. In fact, Charles was in alliance with him and hoped for a quick defeat of the Dutch, which would restore his prestige after the Medway Raid and greatly widen his freedom of action. The first fleet battle took place in June 1672 when the joint Anglo-French fleet was anchored in Sole (or Southwold) Bay off the coast of Suffolk. They were not quite ready for battle when the Dutch attacked. Lord Sandwich counter-attacked but was lost when his ship the *Royal James* was destroyed by a fireship, much to the distress of Pepys. After that, the Dutch fought largely in the shallows off their own coast as the allies threatened invasion. Battles were mostly indecisive but there was a growing mistrust between the English and the French. Charles's war was ill-conceived and unpopular, and he was forced to withdraw in 1674, leaving Louis of France to fight on. With his government more unpopular than ever and short of money, Charles II's great fleet was soon in danger of falling into decay as those of King John and Henry V had done in past ages.





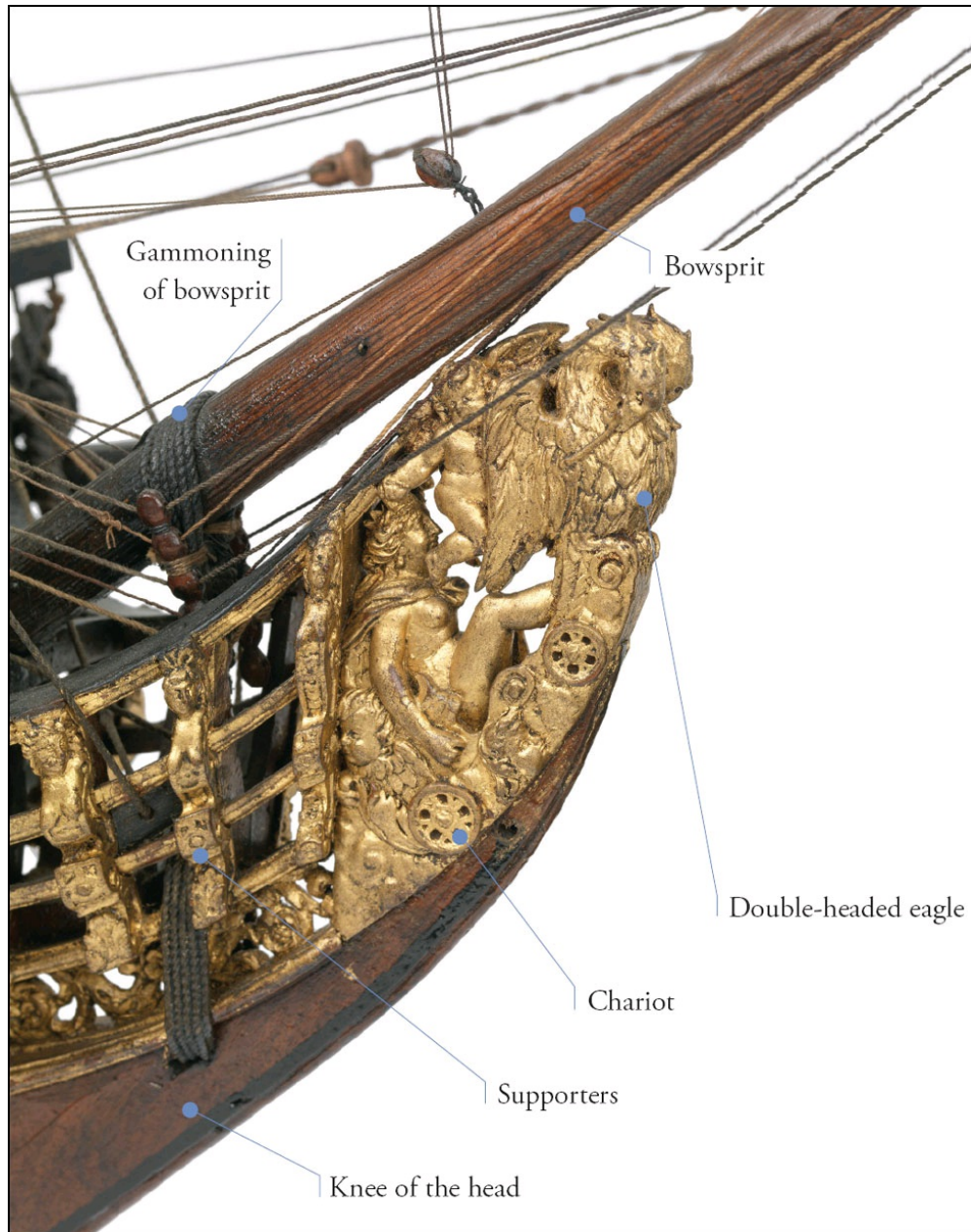


SLR0003

A 90-gun ship of the later 1670s. It may represent a design proposal for one of the 90-gun ships built in the programme of 1677. It shows the hull fully planked above the lower wales, except for a space between the middle wales. It is heavily decorated with the characteristic 'bottle'-shaped quarter galleries of the period and the lower masts and the circular tops are believed to be original, though the rest of the rigging is restored. There is no frieze on the side at upper deck level as in other models, but it is painted black instead, to contrast with the gold of the decorations. The entry port at middle deck level is decorated and gilded. The figurehead is of a cherub on a chariot drawn by a double-headed eagle – it was common for three-deckers to have individual heads, but it does not provide enough information to identify it with a particular ship.

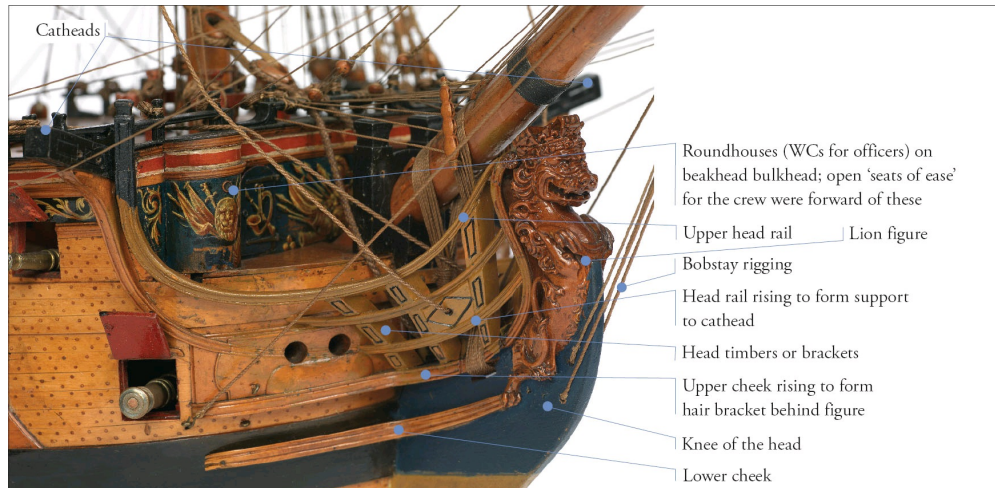
DECORATION: THE FIGUREHEAD

Today we see the figurehead as the symbol and almost the embodiment of a ship, but that was not always the case. Most British warships up to about 1740 had a generic lion figurehead, though that varied in style over the period, especially in the second half of the seventeenth century. Even with First Rates of that period, it is not always easy to link the figurehead with the name of the ship. Even when individual figureheads were fitted to practically all ships of the line in the later eighteenth century, the symbolism is not always obvious. The figurehead was supported by the beakhead, an elaborate structure based on its knee, which was a continuation upwards and forward of the keel. The rails of the head were formed in elegant curves but had no real practical function; nevertheless they were regarded as essential in anything more prestigious than a small merchantman. The area above them, however, was used as the crew's toilet accommodation.



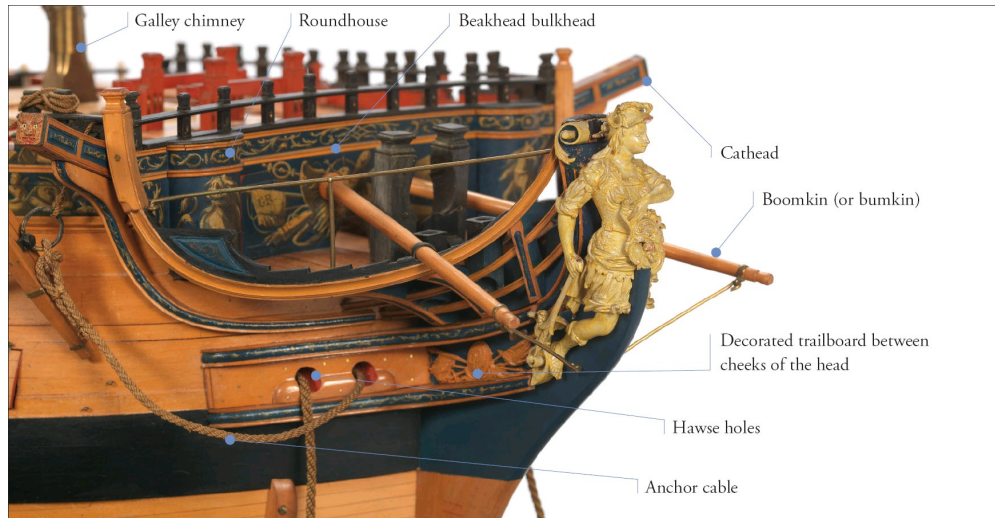
SLR0002

The head of the *St Michael* of 1669, used to identify the model by comparing it with a Van de Velde drawing – the oldest British model that can be identified with an individual ship.



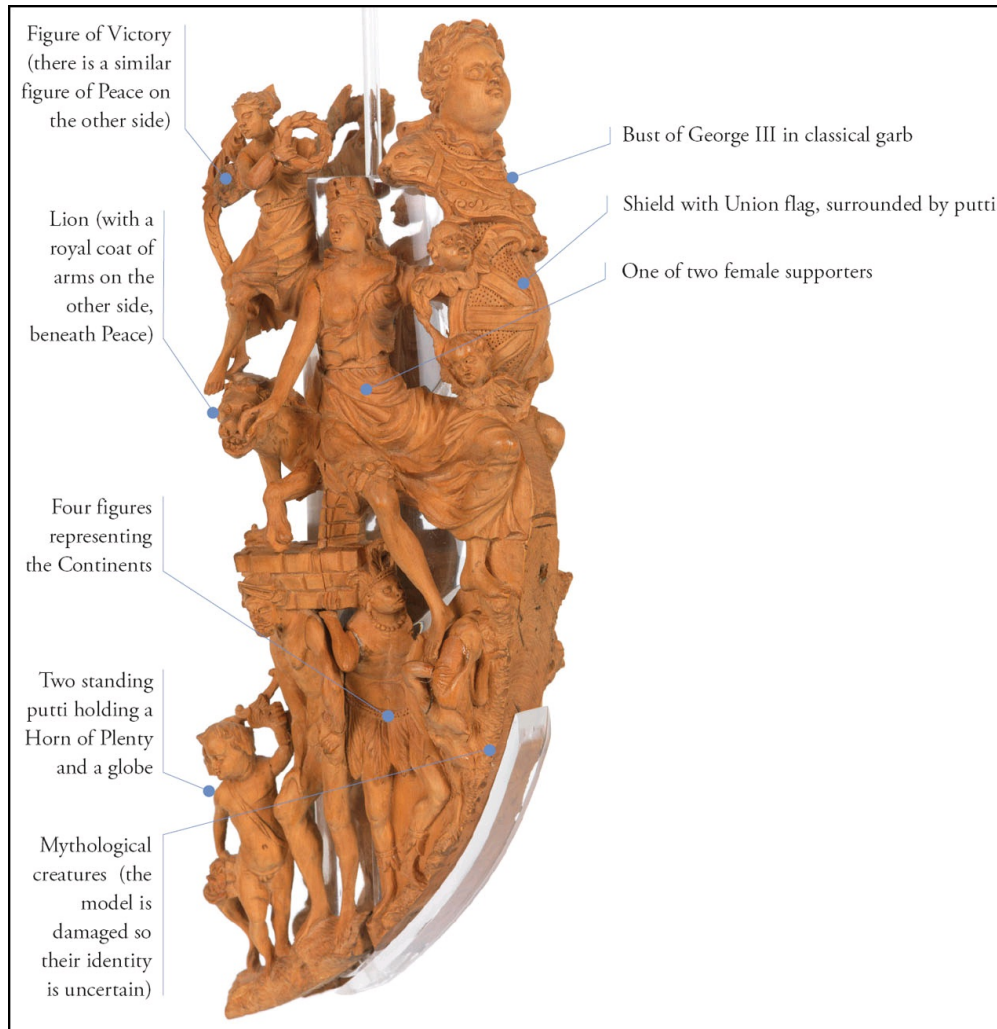
SLR0442

A standard lion figurehead of the early eighteenth century, from a model of the 60-gun *Centurion* of 1732.



SLR0338

The head of the *Bellona* (74 guns of 1760) is an individual design relating to the ship's name, the Roman Goddess of War.



SLR2530

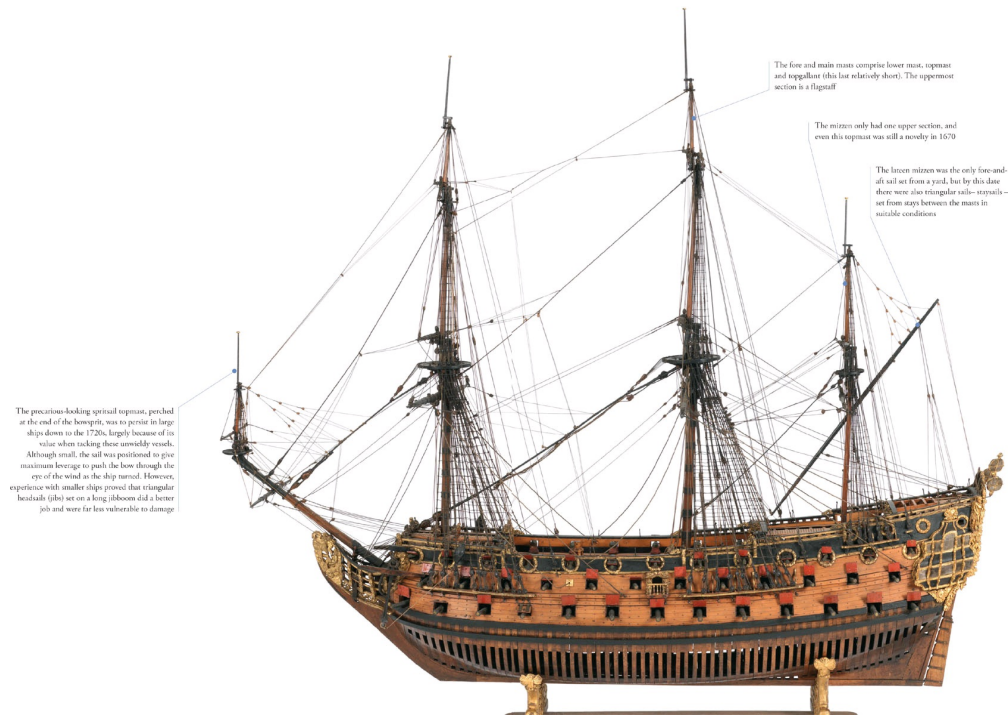
A model of the elaborate head borne by the *Victory* of 1765 in her early years.



SLR0778

In the nineteenth century the figure became simpler, and usually only a bust, even on First Rates like the *Queen* of 1839 shown here. During much the same time-frame, the bow was streamlined by carrying the stem up to the top of the forecastle, eliminating the beakhead bulkhead, and reducing the cheek pieces and head rails to little more than decorative mouldings.

RIGGING ABOUT 1670: *ST MICHAEL*



SLR0002 Ships' plans of the seventeenth and eighteenth centuries rarely show any rigging, apart from the stumps of the masts and the locations of the channels which held the shrouds. Rigging is of course delicate and easily damaged, so few models survive with it intact. Many more were restored using the best historical sources. This is not difficult, as naval ships were rigged according to standard formulae, and experts such as R C Anderson and James Lees did a fine job; but restored rigging is not a primary source so it needs to be treated with a certain amount of caution.

The ship of the line was invariably square rigged and had three masts and a bowsprit. The 'bonaventure mizzen' of the Tudor period had disappeared by about 1600, and the four-masted ship did not return until the great merchantmen in the second half of the nineteenth century. This model of the *St Michael* shows the standard layout of masts in 1669. The fore and main masts are each made in three sections with flagstaffs above that; the mizzen has two sections plus a flagstaff. The spritsail topsail is fitted at the head of the bowsprit. The model shows the standing rigging which supported the masts – stays from forward and shrouds and backstays from behind and from the sides.

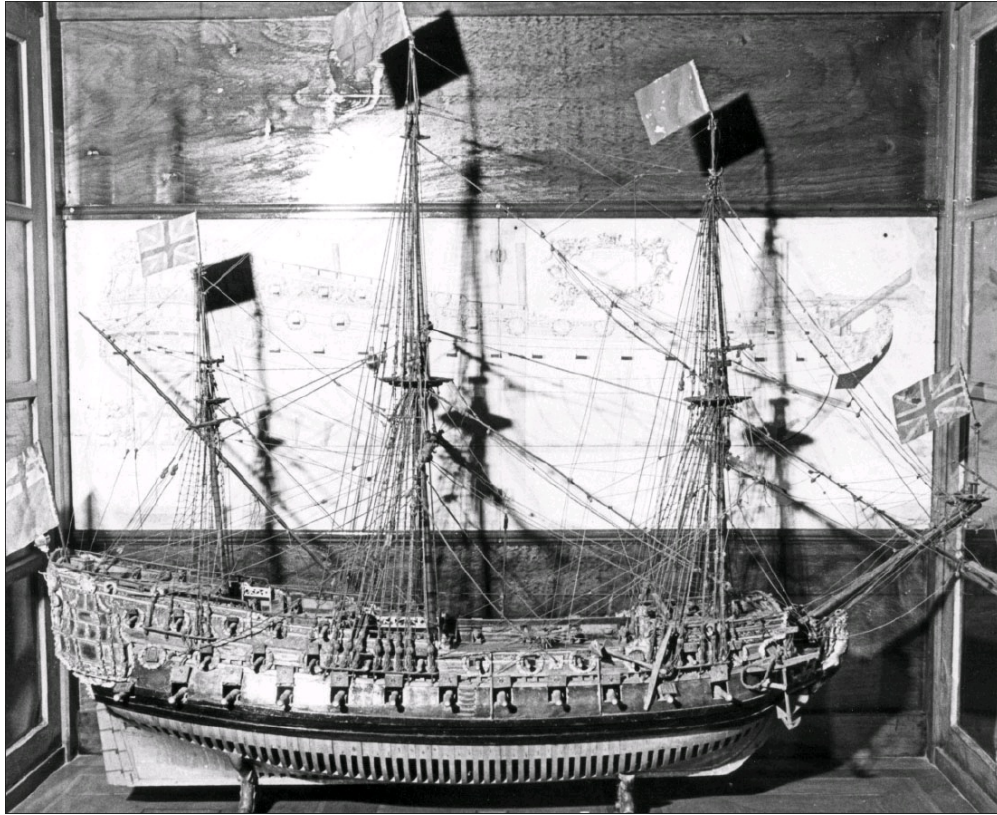
3: French Wars in Europe 1674-1714

The English navy remained stagnant after the withdrawal from the Third Dutch War, but the French and Dutch continued to expand theirs. As early as 1673 Pepys was aware that the French had fifty-nine ships of 50 guns or more, the Dutch had eighty-six and the English only had forty-eight. King Louis employed English and Dutch builders and launched the great three-deckers *Royal Louis* and *Soleil Royal*, while the Dutch, though confined by their shallow waters, built three-deckers for the first time. Samuel Pepys, now promoted to Secretary to the Admiralty and Member of Parliament for the naval borough of Harwich, planned to rectify this. Cash was shorter than ever, but in 1676 and 1677 he asked a deeply mistrustful Parliament for money to build thirty new ships of the line.



By the time Samuel Pepys persuaded Parliament to spend £600,000 on thirty new ships in 1677, the practice of scale-model building was well established, though models survive of only a few of the ships – one of the only First Rate, the *Britannia*, apparently shows her after she was repaired in 1701, though it was probably based on an original hull which was contemporary with, or pre-dated, the building of the ship, and it matches her dimensions very well. The quarter gallery of the model seems to have been enlarged to represent the work done during the repair, and as a result it partly covers the after gunports on the middle deck, and the rail of the head partly covers a forward port. The name (misspelt *Britania*) appears on the break of the poop. Her transom has a carving of fighting horsemen with enemies being trampled underfoot. The figurehead is of a horseman.

HHR6 US Naval Academy Museum, Annapolis, Maryland



This model of a 70-gun ship is displayed in Wilton House, the home of the Earl of Pembroke, whose ancestor, the eighth earl, became First Lord of the Admiralty in 1690, and was later the last person outside the royal family to hold the title of Lord High Admiral. It is in a contemporary case with a great deal of detail and its original rigging. The draught behind it is extremely rare for the period and is probably made for display, rather than for work in the shipyard. It has the initials of John Shish, who built three of the 70s at Deptford. It is usually identified as the *Hampton Court*, though in some ways it is closer to the *Lennox* and *Stirling Castle*, which had similar stern decoration, and the *Stirling Castle* had a similar gun arrangement; but unfortunately there is no indication of the name on either draught or model. It shows the capstan fitted with its bars, and the anchor hung from the cathead ready for dropping.

Wilton House

Pepys was moving towards a concept of the Navy as a national institution rather than the King's personal property, and this came out in parliamentary debates. One member went so far as to suggest 'what we give, we give not to the King, but for our own defence', while Pepys told the House, 'All our safeties are concerned in it'. When members suggested a reduced programme, government speakers were contemptuous: 'To have said abroad, "You will build twenty ships", 'twill be laughed at.' The final bill was highly prescriptive and even set the tonnage and gun power of the ships to be built: one First Rate of 100 guns and 1400 tons, nine Second Rate three-deckers of 90 guns and 1100 tons, and twenty Third Rates of 70 guns and 900 tons. These were all smaller than the tonnages that Pepys had asked for, which in turn were based on the largest ship of the type in service. If taken literally, the new ships would all be too small to meet current needs. Eventually, Parliament passed an act to raise the very precise sum of £584,978. 2s. 4½d 'for the speedy building of thirty ships of war'. Pepys wrote, 'the bill (blessed be God) is ... passed this night by the king.'

The problems were not over: the ships had to be designed, and there was a serious shortage of suitable timber. The programme was discussed by the Admiralty Board and the King himself agreed that the tonnages be increased whatever the expense. 'His Majesty was pleased graciously to add that if such increase of charge should nevertheless be excepted against by Parliament ... he would rather choose to make it good out of his own purse than hazard the wronging of the ships for want of it.' This would alarm anyone who was familiar with Charles's promises about money, but the programme went ahead.

It was the largest shipbuilding programme and conducted in peacetime, so it offered an opportunity to standardise design, fitting and armament; Pepys wrote of avoiding 'the many inconveniences every day met with in time of action from the disproportions and unsizeableness of the old fleet'. Detailed specifications were drawn up for each of the three classes of ship: the First Rate was to be of 1550 tons instead of 1400, and eventually this ship, the *Britannia* built by Phineas Pett II at Chatham, was of 1739 tons. There would be similar increases for the 90s and 70s, as the administration still paid by the ton for ships that were slightly larger than contracted for. The affair created a precedent by which Parliament felt it had a

right to interfere in ship design, of which it knew very little. It worked well in this case because the King took personal charge, so that the ships were actually larger and better than in the act. But it was to prove dangerous for the future. The 1677 shipbuilding programme tended to stabilise ship design, but led eventually to the 'Establishments', which froze it.



This model of a 70 is believed to be *Grafton*, which was built at Woolwich in 1679. It was lacking bow and stern decorations before it was heavily restored during the early twentieth century, when the rigging was added and new stern and bow decorations were put on. The quarter galleries and ports wreaths, however, are believed to be original. It may represent a preliminary design rather than the completed ship. It has been identified by a medallion at the break of the quarterdeck bearing the arms of Lord Dartmouth, who used the ship as his flagship in 1683–4, while the positions of the gunports and wales correspond very well with Van de Velde drawings of the ship.

HHR32 US Naval Academy Museum, Annapolis, Maryland

Pepys considered that one of his greatest achievements was to steer through the ‘solemn, universal and unalterable adjustment for gunning and manning of the whole fleet’ – an Establishment for the guns of all the ships, and not just the new ones to be built. Up till then the ships had usually been gunned according to what was available, rather than what was needed. There was a general tendency for ships to carry an increased weight of guns over the years, though that was beginning to slow down by the Third Dutch War, as most ships were reaching the limit of their capacity. Pepys first suggested a regular Establishment in 1674, and discussions took place among the Navy Board and admirals, though the Ordnance Board, which supplied the guns, was excluded. With so many ships built at different periods and to different concepts it was not an easy task. In general, Third Rates and above were given slightly higher armaments, while those of Fourth Rates were slightly reduced. But the new Establishment had only just been passed when the Ordnance Board stated that it was ‘impossible that the said Establishment as to guns be strictly put into execution, in that the Office of Ordnance cannot gun His Majesty’s Ships otherwise than as the natures and weights of guns His Majesty is at present master of will admit.’ Few ships were fitted out for sea during the next few years as the Navy fell into decline, and a new Establishment was put in force by 1685, so it is possible that no ship was ever fitted out to the ‘solemn, universal and unalterable’ Establishment.



This is the only surviving model of a three-decker from the 1677 programme, apart from the repaired *Britannia*. It bears the monogram of King James II on the quarter galleries, which suggests it was completed after his accession in 1685, so it is identified as the *Coronation*, the last ship of the programme to be launched. It is believed to have been made for Isaac Betts, the master shipwright at Portsmouth who built the ship, and seems to be to an unusual scale of 1:51 instead of 1:48. The rigging was added early in the twentieth century. The model is in a darker shade of pear wood than normal, giving a golden-brown appearance. The mizzen chain-wales are set in an unusually low position, and the scuppers are decorated with gargoyle-like lions, but in other ways it follows the standard style of the period. The guns are mounted on simplified carriages with no ‘trucks’ or wheels.

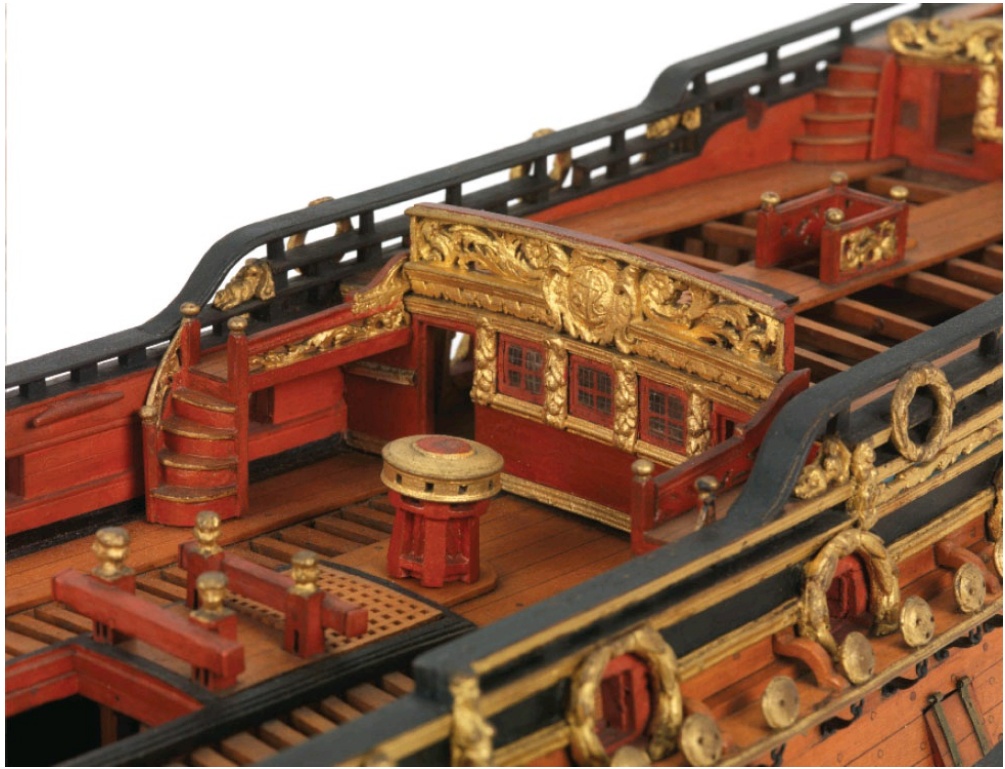
Kriegstein Collection

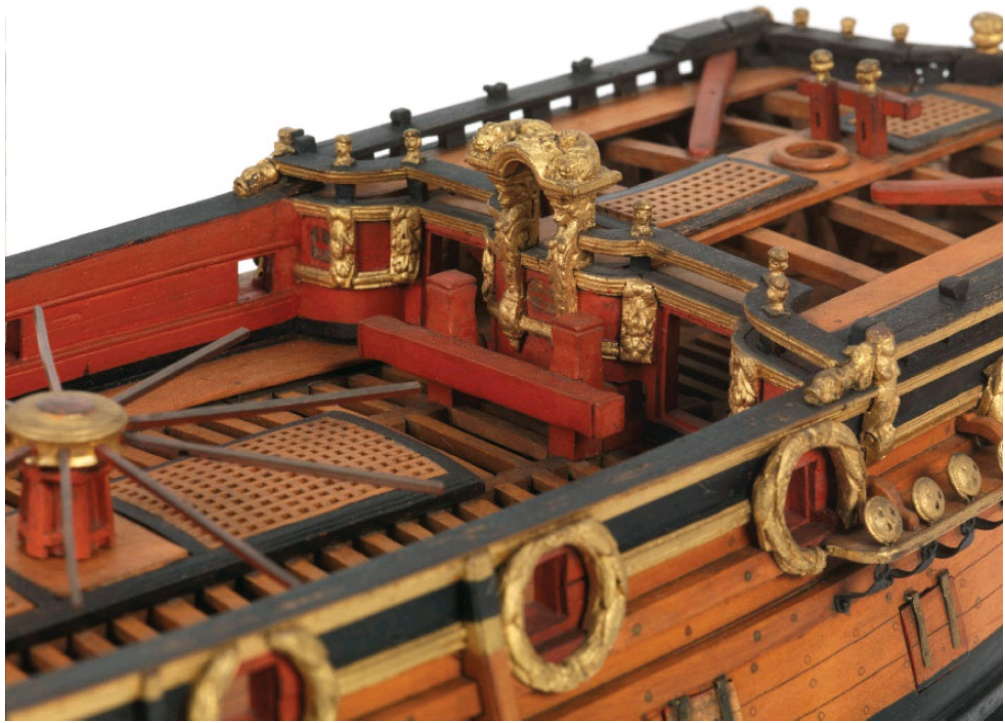


SLR0004

This model is identified as the *Mordaunt* of 1681 by the coat of arms of Lord Mordaunt at the break of the poop – he headed a syndicate which built the ship as a privateer at Deptford, but she was bought into the Navy two years later to serve as a 48-gun Fourth Rate. The Admiralty badge is featured at the break of the quarterdeck and it may have been added after the ship was taken over. The most unusual feature is that the main capstan and the riding bitts for securing the cable are on the upper deck, whereas they would be lower on a ship built for the Navy. Such small vessels could still serve in the line in the late seventeenth century, though they would gradually be supplanted over the years to come. The ideal of a medium-sized warship that could double as a line of battleship or a cruiser as the situation demanded was never very practicable.

There were more political problems long before the ships were finished. During the 'Popish Plot' scare of 1679, Pepys and Deane were accused of treason and it was suggested that the latter had taken large ship models to France to give the secrets to King Louis XIV. Pepys suggested this was impossible, as they were not 'portable without being exposed to view'. The naval administration was dismissed and Charles appointed members of the opposition. By the time the last of the 1677 ships, the *Coronation* of 90 guns, was launched at Portsmouth in 1685, the Navy had fallen into serious decay. Pepys, never one to understate his case, wrote, 'The greatest part ... of these thirty ships (without having ever yet looked out of harbour) were let to sink into such distress ... than has usually been seen upon the coming in of a fleet after a battle; that several of them had been newly reported by the Navy Board itself, to lie in danger of sinking at their very moorings.' Pepys was appointed to a commission to restore the fleet.





Charles died in 1685 and was succeeded by his brother James, who soon became increasingly unpopular through his apparent attempts to force Catholicism on England. In 1688 his cousin and son-in-law William of Orange launched an expedition to overthrow him. James's great fleet, built with the experience of three intense wars and recently repaired by Pepys's commission, was unable to stop them due, it was claimed, to contrary winds. William took power jointly with his wife, Queen Mary, and a pamphlet of 1689 described *Gloria Britannica or the Boast of the British Seas, the Royal Navy of England*. It had nine First Rates of 90 to 100 guns headed by the *Britannia*, with the old *Sovereign* of 1637 still in service after several rebuilds. The Second Rate, augmented by nine ships of 1677, now included sixteen vessels, though some, such as the old *Unicorn* of 1633, were very weak with only 64 guns. The thirty-eight Third Rates were the core of the fleet including, of course, the twenty new 70s. Finally, in the ships considered fit to stand in the line of battle, there were forty-four Fourth Rates.

Pepys was retired and took his collection of ship models with him. When he died in 1703 he left it to his former clerk Will Hewer, to be 'preserved for the public benefit'. They were seen by John Aubrey in Hewer's house at Clapham just outside London, but they were not mentioned in the sale catalogue of Hewer's heir, Hewer Edgeley Hewer, when his 'household furniture and other valuable effects' were sold by auction in 1729. Perhaps some of them had already been sold, or passed on to another naval official and model collector, Charles Sergison, who was married to Hewer's cousin.

The new regime in the Navy was inexperienced and often weak in both tactics and administration. The combined Anglo-Dutch fleet fought the French off Beachy Head in the English Channel in 1690. The allies were not well co-ordinated and only the Dutch squadron was fully engaged. The English Admiral Torrington decided to disobey his orders to fight at all costs and instead to keep his 'fleet in being' – to become a famous phrase in naval strategy. He recognised that a great force of ships of the line could not be improvised from arming merchant ships as in the past, and it would take many years and a great consumption of scarce timber to build a new one. The Royal Navy was now weaker than the force assembled by Louis XIV and its ships were also smaller. The administration followed the

example of 1677 by approaching Parliament for money to build new ones. This time there was little guidance from the naval administration and Parliament tried to provide bigger ships by demanding seventeen of 80 guns each on 1100 tons, and at the same time to make up the numbers by ordering ten 60-gun ships of 900 tons. These were simply the 1677 figures scaled up and down, but it had escaped their notice that the ships as built were somewhat bigger than that. William of Orange had none of Charles II's passion for the Navy and was too preoccupied with land wars in Ireland and Europe to pay much attention, so this time the ships were built more or less as Parliament demanded. The Navy Board sent the dimensions out to the master shipwrights to produce more concrete designs and clearly Lawrence of Woolwich was unhappy: 'to make her a good man of war she ought to have 16 inches more breadth than I have given her.' Eventually the Surveyor of the Navy, Sir John Tippetts, produced his own scheme, with a hull slightly bigger than the 70s of 1677, but extra guns crammed onto the quarterdeck and forecastle to make the number up to 80.

In 1692, at the age of forty-one, Edward Dummer had succeeded his former master Sir John Tippetts as Surveyor of the Navy, in charge of shipbuilding. He was an excellent draughtsman, and Pepys once wrote that he was 'an ingenious young man, but said rarely to have handled a tool in his life'. Dummer supervised the 1691 programme and ended the practice by which builders produced slightly oversized ships for extra payment. He was 'the first that brought the proportions to exact standards, sending each builder with his warrant for building a new ship, the length on the lower deck, breadth extreme and depth in hold'. He tried to compensate for the ignorance of some of the rural shipbuilders by sending them draughts to build by. This was not always successful in the short term. He complained of Winter and Wyatt who built the 80-gun *Lancaster* at Bursledon near Southampton: 'there is not one individual foot of her answerable to my draught ...'

Dummer produced some beautiful drawings of ships, including a First Rate of 100 guns, as did Captain Thomas Phillips, with a section of a First Rate. Plenty of models were made of ships during this period, which is useful, as otherwise accurate sources are hard to come by. The Van de Veldees were less active, a new generation of maritime painters had barely started, and ships plans for identified

vessels are still very rare.

In the meantime, the Navy fought another battle with the French, off Barfleur on the coast of Normandy. On 29 May 1692 eighty-eight English and Dutch ships fought forty-five French and chased them towards La Hogue and Cherbourg, where fifteen of them were boarded and destroyed by fire. Ex-King James watched from the shore as the ships he had largely been responsible for building eliminated his hopes for a return to the throne. The new 80s and 60s were largely redundant before they were commissioned, for the first 80s had only been launched that month. Soon there were problems with them, for they were overloaded with guns. The *Sussex*, built in Chatham Dockyard, foundered in the Atlantic in 1694 while carrying the payroll for the Spanish army. Dummer reported, 'the new ships of 80 guns were very much affected by the slender service of the summer cruise, and were found to strain, reach, and become very loose in their strong works by means of the same.' The problem was that with so many guns crammed in towards the bow and stern and with little buoyancy to support them, the ships would tend to 'hog' or droop at the ends. It was decided to build the last four of the 80s with three decks to strengthen the structure and spread the load, but that created problems of its own.



SLR0006

The *Boyne* of 1692 was one of the unsuccessful two-decker 80-gun ships ordered as part of the 1691 programme. The model was clearly identified by a scroll at the break of the poop reading 'Ye BOYNE Bt By Mr HARDING DEP SA'. Fisher Harding was the master shipwright at Deptford at the time. It is not clear if he made the model personally, but that was not unusual. It shows the guns crowded together on the quarterdeck to make up the numbers, with seven taking up the same space as five on the upper deck. There are lighter guns on the poop, all of which made the ship difficult to design and tended to increase hogging by adding too much weight to the stern. The framing of the model is more open than most as only half the usual frames are fitted, giving a clearer view of the lower interior. It has two tiny cabins at the aft end of the poop deck for trumpeters, and the inboard works are painted red.

The models on pages 36 to 41 are from the Sergison collection which eventually found their way to the United States Naval Academy at Annapolis in 1938 after their purchase by the railroad magnate Henry Huddleston Rogers. Charles Sergison was a naval administrator of the generation after Pepys who amassed a number of fine models of the ships of his era. The *Britannia* model shown on also belongs to this collection.



The *St George* of 96 guns, rebuilt from the old *Charles* at Portsmouth in 1701. Its monograms represent the change from one reign to another, with RWR for William III on the stern and AR for Queen Anne (who succeeded in 1702) on the quarter galleries. It is the only surviving model from the Sergison collection in which the original rigging is intact. It shows a tall flagstaff at the stern and a long mizzen yard. No guns are fitted but the gunports and their lids are shown. The upper quarter gallery on each side is open, with a walkway round them and connected by the stern gallery. The figurehead represents St George and the dragon. The stern lanterns are now hexagonal instead of the spherical ones characteristic of the late seventeenth century, but the elaborate decoration on bow, sides and stern is retained, with carvings instead of a frieze at quarterdeck level, in the spaces between the port wreaths.

HHR1 US Naval Academy Museum, Annapolis, Maryland

Charles Sergison, who took over Pepys's old job as Clerk of the Acts to the Navy Board in 1689, was an avid collector of ship models. When he died in 1732 his will included the condition that a new house be built on his estate at Cuckfield Park in Surrey, including one or two rooms which should be 'applied to the accommodation of my models and books which shall be handsomely placed in them as they are now'. His heir was to ensure that 'my naval collections shall be taken care of all together, as they now are.' Eventually many of them were bought by the American railroad magnate Henry Huddleston Rogers in the 1920s. They included an unrigged model of the First Rate *Britannia* of the 1677 programme, probably when she had a 'great repair' in 1701, as well as the *St George* of 96 guns of 1701, a two-decker 80 of 1692, a 70-gun ship of around 1710, a 60 of around 1707 and two Fourth Rate 50-gun ships, all made in the classic Navy Board style.

The British faced a strategic dilemma in that, after the French were defeated in a fleet battle in 1692, they switched their efforts to commerce-raiding. The Royal Navy had not yet evolved a suitable cruising ship and tried to remedy this by building thirty-four ships of 50 guns, which it was hoped would be equally useful in both roles – but in fact they were ideal for neither. In essence, the building policy of the 1690s was a throwback of at least forty years – the new three-decker 80s were reminiscent of the old 'great ships' of Charles I and the 50s went back to the idea of the Commonwealth frigates.



An unrigged model of a 70-gun Third Rate ship of around 1710. Wooden pegs or trenails are shown on most of the hull, though they seem to be closer together just above the main wales. Wreaths are no longer fitted to the upper deck gunports, and those on the quarterdeck are plain circles rather than the more ornate designs used on older ships. The stern decoration is also comparatively simple, perhaps reflecting greater economy in the naval administration, but the overall effect is surprisingly elegant. The gunport lids in the area of the channels open from the side rather than the top, perhaps to avoid fouling the shrouds. There are more vertical skid beams than usual on the side of the waist. They were intended to protect the hull when hauling up boats or casks. The ship has a steering wheel, which was standard by that time, and the belfry and galley chimney can be seen near the break of the forecastle.

HHR7 US Naval Academy Museum, Annapolis, Maryland

Peace was made in 1697, with the British victorious at sea and the French on land. William was determined to keep the fleet ready for any future war and told Parliament, 'it is necessary for the interest and reputation of England always to have a great fleet at sea', and he was allowed £700,000 for the upkeep of the Navy. Many of the older ships were 'rebuilt' in more modern form, though it was observed that the *Victory*, first built in 1620, was 'monstrous in shape', and it would have been cheaper to build a new ship. William died in 1702 and was succeeded by his sister-in-law Queen Anne, just as the war he had expected was about to begin.

The wars with France were harder on ships than wars with the Dutch, as large amounts of time had to be spent in the inhospitable waters of the Atlantic. Many of them had shown signs of strain during the longest war of the century, which had been compounded by over-gunning. A new Gun Establishment was agreed in 1703, by which First Rates carried demi-cannon or 32pdrs on the lower deck instead of full cannon or 42pdrs. Third Rates, including both the old but successful 70s and the unstable 80s, were to have 24pdrs instead of demi-cannon. Sixties were to have culverins of 18pdrs and 50s had 12pdrs. The sea-keeping of the ships was greatly improved, but only with a great reduction in gun power.

That was not as serious as it might have been, as the French did not put a major fleet to sea in this war and concentrated on land campaigns and commerce-raiding. The only fleet battle was off Malaga in 1704 when a Anglo-Dutch force of fifty-one ships of the line fought against a roughly equal French fleet. Both sides maintained their line of battle and fought a long-range artillery duel, in which casualties were quite heavy but no ships were lost. The British had a strategic victory, in that their capture of Gibraltar was secured.

The naval administration became increasingly conservative. In 1705 the Lord High Admiral, the Queen's husband, Prince George, asked the Navy Board to consult on the proper dimensions for the Second Rate *Barfleur*, which was about to be rebuilt, and added as an afterthought that they should give their opinion on 'what proportions of like natures may be most proper for ships of 80, 70, 60, 50, 40 and 30 guns'. The result was an increase in breadth for most classes of new ship, but otherwise very little change. This was the first Establishment which was not linked

to a particular shipbuilding programme, but was intended to be permanent. It was the first to cover all classes of ship, except First Rates, which were presumably considered rare enough to merit individual treatment, and the 20s which were small enough to experiment on. The Establishment of 1706 ushered in a new age of static ship design. But already there were signs that the French fleet, though small, was becoming more innovative. When six French ships were captured at Vigo in 1702 they were found to be 'well contrived, as well for sailing as other good qualities in the sea', and the Lord High Admiral ordered that they should be surveyed carefully. One of the earliest known block models was made of one of these ships, the *Triton*. There were some minor reforms in ship design. Decorative carving was restricted to the bows and stern and the circular port wreaths which had been a distinctive feature of Restoration warships were abolished. The channels, which spread the shrouds of the lower masts, were raised by one deck, and the structural strength of ships was generally improved. The Royal Navy, and especially its great battle fleet of 131 ships of the line, was never fully tested during the War of Spanish Succession, but Britain gained bases in Gibraltar and Minorca and greatly expanded influence in the Caribbean and America. It still needed a great fleet to protect and develop its trade and empire.







A model of a Fourth Rate of 60 guns of around 1707, with restored rigging. This type originated with the 1691 shipbuilding programme, and gradually replaced the 50 during the 1720s and '30s. This example is unnamed. It has elaborate carvings on the upper stern but quarter galleries only at upper deck level, not on the quarterdeck. Port wreaths are restricted to some of the quarterdeck ports but there is a painted frieze in the area instead – a practice which became increasingly common during the first half of the eighteenth century, on models if not on actual ships.

HHR5 US Naval Academy Museum, Annapolis, Maryland



SLR0381

A model of a 50-gun ship, a common type in the 1690s as it was hoped it could serve as a ship of the line or a cruiser as required. This is too broad for any known individual ship, but it has the monogram of William III, who reigned alone from 1695 to 1702, after the death of his wife Mary. It is unusual in having walnut veneer to represent the planking between the lower and upper wales. Again, the rigging is not original but was restored in the National Maritime Museum in 1937 using contemporary evidence. It shows a short mizzen mast typical of the period, and the spritsail topmast above the end of the

bowsprit, which would soon disappear in smaller ships. It has a good example of the standard type of lion figurehead.



SLR0382

One of the earliest known block models, this is of the French *Triton* of 1697, one of the ships captured at Vigo in 1702. The British soon understood that they could learn something from foreign practices, especially French. Special efforts were made to study the lines of ships captured on that occasion, and this may be part of that process. Block models were easier to produce now that shipwrights drew waterlines on their draughts as a matter of course, and these were useful in ‘bread and butter’ construction where the shape was formed horizontally rather than vertically as in the Navy Board style model. This model, like many others of this construction, was probably painted later and its style, with solid black-painted lower wales, suggests the middle rather than the early eighteenth century. The original painting probably showed waterlines and other design features to assist in interpretation. There is no sign of any decoration, either carved or painted, which suggests that the model was purely functional.



SLR0386

A 96-gun ship from around 1702, to an unusually small scale of 1:60, which cannot be linked to a particular ship but illustrates some of the changes taking place around the turn of the century. It has a large amount of carved decoration on the bow, stern and sides, which suggests it was made before the order of 1703 that restricted such work and effectively began the decline of port wreaths, but it bears the monogram of Queen Anne, who came to the throne in 1702. In addition, the channels of the fore and main masts are fitted above the middle deck gunports, a custom which dated from 1702. On its upper deck it has a windlass set fore and aft and used to control the tiller and rudder, probably a step towards the steering wheel, which appeared soon afterwards. It is also unusual in that every third frame is made from a lighter coloured wood, perhaps indicating the body sections that would have been drawn on the draught.

THE RATING SYSTEM



SLR0408

The *Royal William*, a First Rate, 100 guns of 1719 – three decks and galleries, ‘double equestrian’ figurehead.

The year 1710 is a good point at which to review the system of rating, partly because most of the anomalies created by rapid change in the previous century had been tidied up by then. Also, it a golden age for ship models, made in a common style, to illustrate the rates. The First and Second Rates were the most closely defined, comprising 100- and 90-gun three-deckers respectively. The Third Rate was the most varied of all, since it included two- and three-deckers, and ships ranging from 64 to 80 guns – though in this period practically all new ships had a round number ending in zero, which might suggest that order was favoured over experimentation. The Fourth Rate was also made up of two-deckers, of 50 or 60 guns. Ships below that, of the Fifth and Sixth Rates, were not used in the line of battle but for scouting, convoy escort and miscellaneous duties; however, the Navy had not yet evolved a satisfactory type for these roles.



The *Marlborough*, a Second Rate of 90 guns of 1706.

Kriegstein collection

THIRD RATES



SLR0391

The 80-gun Third Rate was the smallest and least successful type of three-decker, represented here by the *Chichester* of 1706.



SLR0220

A Third Rate 70-gun two-decker of around 1717.

FOURTH RATES



SLR0389

A Fourth Rate of 60 guns of about 1705.



SLR0396

A Fourth Rate of 50 guns, 1710 – the smallest type that was considered fit to stand in the line of battle at that time.

4: Stagnation 1714-1739

After peace with France and the advent of the Hanoverian regime in 1713–14, the Navy settled down to a period of complacency and stagnation, during which the Establishments were regarded as the last word in ship design. A new Establishment of 1719 was similar to that of 1706 in the major dimensions but gave far more structural detail, down to the size of the wooden coamings which surrounded the hatches in the deck of each type. There was a much greater similarity in proportions between ships of different classes. In the past different types still showed traces of their disparate origins, but by 1719 a 90, for example, was more like a scaled-up 50 in its main dimensions. The Establishments were not the only factor tending towards stagnation. Old and decayed ships were ‘rebuilt’, a highly ambiguous term which might range from minor repair to a completely new ship – by 1715 it almost invariably meant the latter. When the ‘serviceable remains’ of the *Boyne* were reused in 1734, they consisted of nine ‘loads’ of timber out of a ship which would have required about 1500. The third factor was the direct replacement of every ship, whether rebuilt or new-built following a loss, by one of the same number of decks and guns ‘in the room of’ the lost ship – the only exception was that many of the old 50s were replaced by 60s during the 1730s. This policy meant that unsuccessful types such as the three-decker 80s were kept in service for many years. Ships of the line were now three-deckers of 100, 90 or 80 guns or twodeckers of 70, 60 or 50. The figures are suspiciously round and suggest that the naval administration was far more interested in order than in progress.



SLR0412

This model of a 60-gun ship of around 1720 is a very early example of what later became known as the 'Georgian' model. With the block model becoming established, it was a natural step to plank it to give a much more natural appearance, and add details such as wales, carvings and gunports. The lower hull is usually hollowed out, and the decks are largely left unplanked to show the details of their construction, with beams, carlines and ledges to support the planks – this was the only way to show anything of the interior as the method of construction did not allow viewing through the lower hull. Deck features, such as capstans, steering wheel and belfry are all fitted. Decoration is now confined to the bow and stern and no port wreaths are fitted. The 60 was a common type in the first half of the eighteenth century and some were built to replace 50-gun ships.

At the beginning of this period there was a significant change in the structure of ships by orders of 1715 after the experience of the long wars, with a different system of framing. The futtocks which made up each rib were now arranged in pairs rather than 'floating', and the lower ones met over the keel. Timbers towards the bow and stern were now 'canted' in that they were angled increasingly forward towards the extremities. Until this time, apart from the interventions of Edward Dummer, the actual plan of a ship had been seen as entirely the prerogative of the master shipwright involved, whether in a royal dockyard or a private yard. There was no more private shipbuilding for the Navy for decades after the war with France ended, but in June 1716 the Navy Board ordered the royal dockyard master shipwrights who were building new ships or rebuilding old ones to send in 'a draught ... of your design ... agreeable in dimensions to the present Establishment, and plans of each deck with descriptions of the several useful accommodations both on the decks and in the hold.' This was the foundation of the great plans collection in the National Maritime Museum, and it means that nearly every ship built for the Royal Navy since that date, and many of those hired or captured, is represented by a scale plan.

The same order demanded that the master shipwrights send in 'a solid or model shaped exactly by the same with the load waterline, the height of decks and wales, the channels, chain plates, ports, galleries, etc., marked thereon ...' It is often assumed that these were to be Navy Board style models, which did indeed become prolific during this period, but there are good reasons for believing otherwise. The use of the term 'solid' is not very descriptive of the Navy Board model – it is far more like a block model. It would not be necessary to mark on the features mentioned on a Navy Board model: they would already be there. And the evidence suggests that Navy Board models took some time to make, and that would delay the start of work on the real ship. The block models were made in the 'bread and butter' style that had become possible as shipbuilders began to use waterlines on their draughts. Daniel Eldridge, a joiner in Woolwich Dockyard, worked from 1724 to 1741, 'being frequently employed on solids for comparing ship's bodies'.

Sometimes the reaction to these models is reflected in the documents. In July 1717 the master shipwright at Deptford produced two alternative 'solids' for the

rebuilding of the *Nottingham* of 60 guns. One model had a 'square tuck' or transom stern, the other had a 'round buttock'. The Navy Board examined them and concluded that 'the round buttock is the strongest, best in the sea, or in riding at anchor, being little subject to draw dead water in great ships.' They also looked at a solid for rebuilding the *Revenge* at Woolwich and approved it. The practice continued throughout the 1730s, and references to draughts and 'solids' are frequent in the Navy Board papers – for a new ship in the room of the *Tilbury* in March 1730, a replacement for the *Worcester* in June 1733, and a ship in place of the *Elizabeth* in January 1734, to give a few examples. There was a flurry of activity on the eve of war in 1739. The draught and solid for the rebuilding of the *Preston* were sent from Woolwich to London in July, for the new *Stirling Castle* from Chatham in August, and for a rebuild of the *Captain* from the same yard in September.



SLR0401

A First Rate of 100 guns. It seems to be to an unusual scale of 1:42.6, which has been calculated from the draught marks on the bow and stern. It does not match any individual ship, with the beam of a 90-gun ship and the length of a 100-gun ship; in some ways it is close to the *Royal George* of 1715, though the middle and upper wales are solid, which might suggest a date after 1715. It carries the arms of the Montague and Buccleuch families, which suggests it was made for presentation purposes and is perhaps an imaginary ship. Much of the rigging from the topmasts downwards is original; the rest was restored in the National Maritime Museum workshops. Deck detail, such as capstans and hatchways, is generally lacking. The figurehead is of the upright 'double equestrian' type, which was often used for First Rates and the stern carving is quite elaborate.



SLR0410

The *Britannia* as rebuilt at Woolwich in 1719 from the flagship of the 1677 programme. By that time the term 'rebuilding' was changing in meaning, so that little, if any, timber from the old ship was used in the new one, which was therefore built to the current establishment and should be regarded as a new ship. This block model was presumably part of the design process and agrees closely with the plans of the ship, although the stern is damaged and it does not show the old-fashioned port

wreaths on the quarterdeck. The ship saw no active service as there was no major war during her heyday, and was converted to a hospital ship in 1745 before being broken up in 1749.



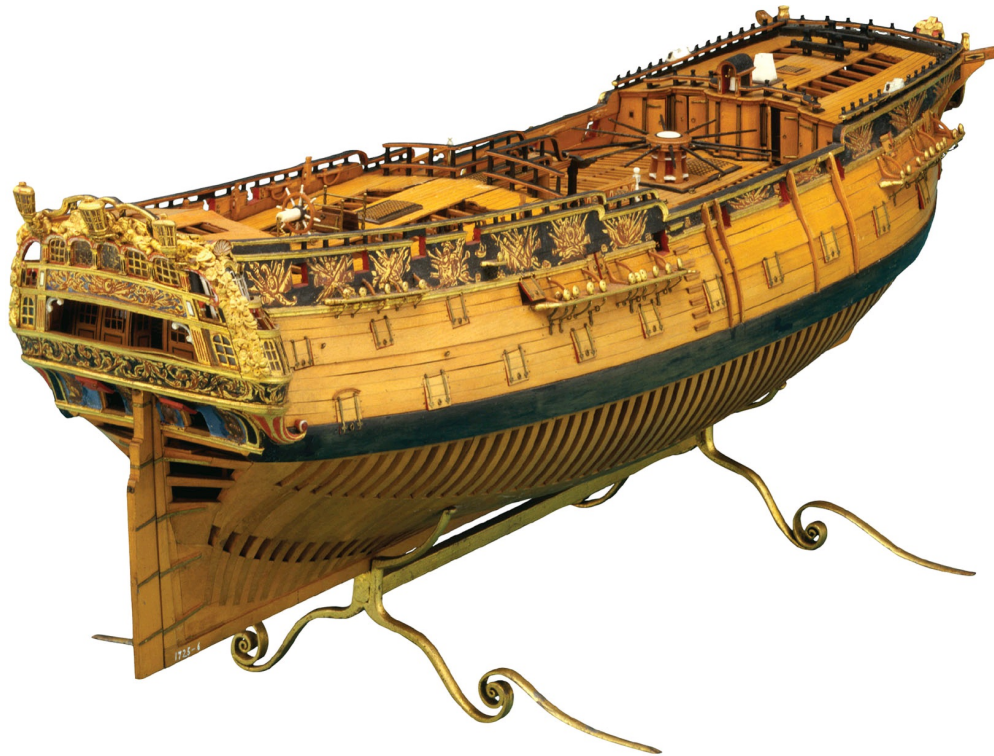
If the dimensions were not affected by a new Establishment, the yards might well reuse existing designs: for example, the solid for the *Nassau* was proposed for the *Stirling Castle*, and that of the *Devonshire* for the *Cumberland* in August 1740.

There are around thirty-five surviving block models of ships of the line from the period 1715–50 and the evidence suggests that they spent all their lives in public hands, unlike Navy Board models. However, they do not match the 1715 specification in having ‘the load waterline, the height of decks and wales, the channels, chain plates, ports, galleries, etc, marked thereon’ – in fact, most are far more elaborately decorated than that. In 1735 Henry Turner was paid ten shillings (50 pence) each for painting ‘blocks or models’ at Deptford, and asked for a similar sum for painting twenty-two of them at Woolwich. He or his employees, as well as supplying Deptford yard with paint, carried out very elaborate jobs such as painting the panels of the *Royal Caroline* yacht, including ‘the panels of the state room and the panels of the outside of the awning room of the said yacht with several land and sea pieces in the manner of basso relievo.’



SLR0424

A 70-gun two-decker Third Rate from around 1725. These ships were perhaps the best of the age in terms of their good sailing qualities, but they carried only 24-pounder guns on the lower deck, which made them weak against newer Spanish and French ships that were encountered after war began in 1739. This model reverts to the more traditional Navy Board style with its open framing. Its dimensions match a ship of the 1719 Establishment, of which fourteen were built, but the channels to spread the shrouds of the fore and main masts have been raised above the level of the upper gundeck ports, which suggests a later date. It has the lion figurehead that was standard for ships below the First Rate by this time, and an open gallery on the stern at quarterdeck level. The sides are decorated only with a frieze. Gunport lids are fitted, but not the guns.



SLR0354

Another model in the old-fashioned Navy Board style, a 50-gun ship of around 1725. It is to an unusually small scale of 1:64, but is very well detailed in carvings and deck fittings nevertheless. Its dimensions do not match the 1719 Establishment in that it has the same beam but greater length. It is too narrow for the 1733 proposals, but it might have been made to demonstrate a suggestion for them. By this time the 50 was often considered too weak for the line of battle and too slow for a frigate, so it was going out of fashion. Old 50s were often broken up and replaced by 60s, the only major change in the composition of the battle fleet in the 1720s and '30s. The unusual curved crutches supporting the model are believed to be original. The channels are in the lower position, below the level of the upper deck gunports.

Turner also painted the decorations on actual ships, including the 90-gun *Namur* and 60-gun *Windsor* rebuilt at Deptford and launched in 1729. He was paid 'for 117 yards of frieze and trophies on board the *Namur*, and 101 yards on board the *Windsor*, and for 12 Roman figures on board the *Namur*, and the same number on board the *Windsor*, 10s [50p] each figure.' His workers were certainly capable of painting the block models to a standard later described by John Franklin as 'remarkable'. 'The hull framing on the *Centurion* is painted in subtly different shades of ochre to distinguish the heels of top timbers from floors and futtocks, with the spaces between being black. Cant frames are shown at bow and stern.' The decoration of bow and stern was painted on flat surfaces, which created a rather strange appearance in models where the quarter galleries were not shaped.



SLR0431

Another 50-gun ship of roughly the same period as the previous model – again the beam matches the 1719 Establishment but the length is two feet more, suggesting that it too was a design proposal (perhaps modelmakers or their clients preferred to exaggerate the length of the ships). Though the Georgian style was becoming increasingly common, the older open-frame model was still flourishing in the 1720s. The hull is comparatively plain without the friezes that appear on some models. Though the lower hull is unplanked, the upper planking is shown in some detail, including some indication of the wooden trenails which fixed the planks in place. It has the single wales that were now being used instead of the double ones – though, as they are left unpainted, it is difficult to pick them out. Like most models of the period, it is unrigged but it carries poles in the spaces for the masts. These would be used to fly flags during the ship's launching.

BLOCK MODELS

Block models tend to be less attractive than those made in the Navy Board or Georgian style, even when painted in a highly decorative manner, so they have often been neglected by historians and modellers – though in many ways they are closer to the design of the real ship than more stylised models, and it is perhaps not surprising that a higher proportion of them can be identified with actual ships. They were mostly painted over with decorations in later life, which makes them more eye-catching but conceals waterlines, buttock lines and other features which might give some insight into the mind of the designer and reveal the model as it appeared when it was shown to the Admiralty and Navy Board at the time. Perhaps a research project or technical advance will reveal this eventually.



SLR0451

SLR0550

Contrasting styles of sterns on the block models of the *Elizabeth* of 1737 and the *Royal Sovereign* of 1786. In the case of the *Elizabeth*, the quarter galleries were not fully moulded in three dimensions, which created difficulties later when the model was painted.



SLR0227

The *Centurion* of 1732 is an exceptionally well-painted model, presumably because it was Lord Anson's most famous ship.



SLR0473

The *Blenheim* of 1745, with the quarter galleries formed and the open gallery represented.



SLR2719

A Third Rate of 70 guns from about 1740, with the basic shape carved out and many decorations added later – though the figurehead and quarter galleries have apparently been lost.



SLR0436

While the Royal Navy stagnated in the age of the establishments, the French and Spanish were building bigger and better ships. In style this model of a Spanish ship has much in common with British practice, and British shipwrights were employed in the Spanish dockyards, especially Irish Roman Catholics who were forbidden employment under the British crown. The decoration however is rather different, with a horse as figurehead and a heavy carving on each quarter of the stern. This model cannot be positively identified but it bears an eagle and snake on the stern, from the coat of arms of Mexico. It may be the Spanish 60-gun ship *Nueva Espana*, built in Havana in 1740. It has oar ports between the lower deck gunports, a feature only found on much smaller British ships, but one which might have proved useful in the lighter winds of the Mediterranean, where it might still be necessary to fight galleys in calm weather.

By the 1730s the French Navy was beginning to revive under Count Maurepas. He knew that there was no hope of outbuilding the British, whose King, Parliament and people were now united in the desire to maintain a strong navy. Instead they adopted the classic strategy of the weaker naval power, to make each individual ship as good as possible. Both nations now had extensive empires in North America, the West Indies and India, and sea power was essential to defend them. Maurepas wanted a force that could strike anywhere in the empire, or land in the British Isles to support Irish or Jacobite rebels. Unlike the Royal Navy, it started from a clean sheet with no preconceived ideas and it gave a free hand to excellent shipwrights like Blaise Ollivier, Pierre Morineau and François Coulomb – though, despite popular myth, it was no more ‘scientific’ in practice than the Royal Navy; both sides had their talented amateur scientists who were held at arm’s length by the professionals. The French began to build new ships of the line, all twodeckers with a heavy lower deck armament and good sailing qualities.

By 1732 the British were getting wind of this and in December the leading shipbuilders were called to the Admiralty in order for them to consider increasing the Establishment for each rate. They could reach no agreement but in the following year Jacob Ackworth, as Surveyor of the Navy, added to the breadth of each class slightly to increase stability, and reduced the ‘tumblehome’, or inward slope of the sides above the waterline. It was a small change in view of the much more radical ideas across the Channel, but forty-four ships of the line would be built to the 1733 proposals over the next few years.

In modelmaking, the use of bread and butter construction and then adding features such as wales and decoration led to another short step. The ‘Georgian’ model has a bread and butter hull, but covered with planking, and with the decorations added in solid form. It had already begun to appear by 1715. One of the finest examples is a model of the three-decker *Victory* of 1737.



SLR0440

A Third Rate of 70 guns, arranged to split open at the level of the lower deck to show some of the internal detail. Features on the lower deck include, from left to right: the stump of the fore mast; the two bitts used to hold the anchor cables; a hatchway; the base of the fore capstan; another hatchway; the pumps round the main mast; a hatchway; the main capstan; a hatchway and ladderway; and the mizzen mast. There were no fixed cabins at this level but the aftermost part was often partitioned off as the gunroom for midshipmen. The view under the upper deck shows the deck beams which formed the main structure, sometimes curved to avoid hatchways and mast partners; the lighter pieces known as carlines, which ran fore and aft between them; and the even lighter pieces known as ledges, which ensured the weight of a gun carriage truck would never be supported by the deck beams alone.

Instructional models were quite rare in Britain, as learning at sea was almost universally preferred. The main exception was the Naval Academy, which was founded at Portsmouth in 1729 for the training of a minority of potential officers. In 1734 the yard commissioner Richard Hughes asked the master shipwright for a model ship about 6ft long for instruction. This was approved by the Navy Board in 1736.

It was not entirely successful; in 1742, six 'young gentlemen' at the college complained, 'the model of the *Victory* is so small, her rigging so slight, that we cannot learn anything from it, neither do we know anything of rigging or the stowage of anchors or cables, we are quite ignorant of everything that belongeth to sails.' The issue recurred in 1749 when the Navy Board turned down a proposal to allocate a two-masted yacht for training on the grounds that 'it will be better to instruct them in the art by using the present model of the *Victory*'. Indeed, the model was enhanced in 1751–2 when William Smith was paid 100 guineas (£105) for 'very curiously cut' work in making the 'the stern complete as it was in the ship, which was not thought of when directions were given for carving the head, taffrail and quarter pieces'.



SLR0442

The 60-gun *Centurion* of 1732 became one of the most famous vessels of the age as the flagship and only survivor of Anson's round-the-world voyage in 1740–44. This model was made by Benjamin Slade for Anson and passed through his family to Lord Litchfield. Slade's cousin Thomas eventually became Surveyor of the Navy under Anson, and one of the navy's most successful ship designers, whose work included Nelson's *Victory*. In the model, the channels are above the upper decks ports, a practice which became common in 1745, confirming that the model was made after Anson's return – they were probably lower during the voyage. The model was re-rigged in 1936 using the original masts and yards. It is unusual for models of the period in that guns are fitted, shown run out ready for firing. The underwater hull is painted white like most models of this style. White lead was used in the tropics and it was visually more attractive than the composition of 'black stuff' used in temperate regions, which is never seen on models.

This was the great 100-gun ship built by Joseph Allin at Portsmouth. Technically a rebuild of a ship burnt in 1721, she spent eleven years in the dry-dock before being launched in 1737. She was unique in having four galleries at the stern, including three open ones. The French shipwright Blaise Ollivier noted, 'her capacity is very great, yet her upperworks are scarce suitable for her lower body, for she is deep-waisted with much sheer.' Sir Jacob Ackworth, the cantankerous Surveyor of the Navy, rebuked her builder about 'her height abaft, treble balconies etc, which I was much surprised to hear of. Our ships were too heavy, too loose and too high without these additional encumbrances, which I am sure cannot add beauty, but must be in every respect disagreeable.'

The Navy Board also ordered its own model of a 100-gun ship in 1735, with 'masts, yards, rigging and blocks, guns and carriages and a proper case for it to be set in the Board Room of the Navy Office.' Perhaps one of these models gave the Admiralty Board the idea to order another in June 1740. Nearly three years later the Navy Board had to explain why it was still not ready, and by February 1745 the officers of Woolwich wrote that rigging and fitting were 'matters of a curious nature and tedious to be performed'. They reported, 'hull complete, guns and carriages made, cordage for the rigging spun; part of the blocks made and the rest in hand, the masts and yards so nearly finished that the rigging may be begun.' Three men were sent from Deptford to help with the work. It was delivered in May 1745 but the ship had sunk in a storm in the English Channel in October 1744. It seems likely that the Admiralty model, which is fitted with guns, ended up with Lord Cawdor, who was a Lord of the Admiralty at the time, and is now on display in Cawdor Castle. The Naval Academy model is probably the one in the National Maritime Museum; the fate of the Navy Board model is unknown.

Captain Robert Jenkins produced his notorious ear before the House of Commons in 1738, claiming it had been cut off by a Spanish officer. This began a war fever and it was believed that the vast but declining Spanish empire would give up its riches easily, for there had been two easy victories against them in the Mediterranean in the last twenty-five years. War was declared in 1739, to the delight of the public. Sir Robert Walpole, the peace-loving prime minister, wrote: 'They now *ring* the bells, but they will soon *wring* their hands.' On the face of it

the fleet was strong, with seven First Rates of 100 guns, thirteen Second Rates of 90 and sixteen Third Rates of 80, all with three decks. In addition there were twenty-four two-decker Third Rates with 70 guns, thirty Fourth Rates with 60 and thirty-four of 50 guns, all considered fit to stand in the line of battle. A keen observer might have noticed that it was strangely similar to the list of 1714, except that many of the 50s had been replaced by 60s. Deeper enquiry might reveal that some of the 'ships' were merely piles of old timber in the dockyards, for the Admiralty had a policy for rebuilds that 'the names and rates of such ships should be continued in the general list of the Royal Navy until time and opportunity will admit of their being rebuilt.' The size of individual ships had increased only slightly and there had been no radical ideas in ship design. Soon the deeply conservative policies of the last quarter century would be tested in war.



SLR0449

An earlier *Victory*, launched in 1737, had high sides and a unique quadruple gallery on the stern. This was the opposite of the French movement towards longer and lower ships with better sailing qualities and it perhaps contributed to the *Victory*'s loss in 1744. There is no evidence for the common belief that the model was made for an enquiry into the ship's loss, but there is some correspondence which suggests the model took at least four years to make. It does not quite match the description of the model ordered for the Admiralty Board Room, but it might have been intended for the Navy Board, or for the Royal Naval College at Portsmouth. It shows a move towards very elaborate figureheads for First Rates, with Neptune supporting the royal coat of arms. The model is fully rigged and still carries the spritsail topmast rising vertically from the bowsprit – a feature which had long disappeared from smaller ships. It is not fitted with guns, and the key parts of the sides are simply painted black without any friezes.



SLR0449

The stern of the *Victory* of 1737 showing the four galleries, three of them open with stern walkways. From the top, they illuminate cabins: for the first lieutenant and master; the captain; the admiral; and the wardroom officers. The stern lanterns are shown well; these were important in a flagship so that other ships could follow at night. Though it is an extreme example, it shows many decorative features that became common in the middle of the century. The two lower open galleries have mock balustrades, while the upper one has a more abstract design. There is a row of carved figures forming the corner between the stern and the sides of the quarter galleries, with more figures on the taffrail, which forms the top part of the stern. Gallery doors are left open to give some view of the interior. Below that are four ports

for after-firing guns – not normally fitted with guns, but they could be moved into place during a chase. The model also gives a clear view of the rudder and its fittings.

RIGGING ABOUT 1730: *IPSWICH*



SLR0434

The 70-gun *Ipswich* model shows much of the running rigging which supported the yards and other spars, and was used to control the sails. Each mast section had its own yard, eg main topsail yard on the main topmast, main topgallant yard to the main topgallant mast, and so on.

All were set square across the line of the ship in the neutral position, except the mizzen yard, which was used to carry a lateen sail. The lifts and halyards (not seen in this view) raised the centre of the yard, while the parrels and trusses held it against the mast, allowing it to be turned to match the wind, or to be raised and lowered. The lifts, shown here, kept the yard level while the braces controlled its angle to the wind. The rigging attached to the sails, such as reefing lines, buntlines and so on, was largely used for furling a sail or reducing its area by reefing; these are not shown well on models, which rarely have accurate sails.

The most visible change in the spar plan since the 1670s was the replacement of the [sprintsail topmast](#) with an extension to the bowsprit called the jibboom. A square sail could still be set from the sprintsail yard below the bowsprit, but the principal headsails were now triangular fore-and-aft sails called staysails or jibs. The upward pull of these sails was offset by the introduction of a bobstay, which for the first time secured the bowsprit from below, being attached to the stem.

The other changes to rigging practices since the 1670s were not as obvious or radical as those affecting the bowsprit, but they were numerous and amounted to significant improvement to the handling of ships of the line. The more important are summarized here.

Sails. The employment of staysails was extended, improving performance to windward. Studding sails – usually called stunsails – were temporary fair-weather canvas rigged on booms set from fore and main lower and topsail yardarms to help the ship ‘ghost’ in light airs. The section of the lateen mizzen sail forward of the mast tended to be cut off and its forward edge, the luff, then secured to the mast; this simplified tacking.

Sail-handling. This was made easier by the introduction of footropes beneath the yards, while reef-points sewn into the sails made shortening sail quicker and more efficient. Previously, sail was increased by lashing extra canvas, called ‘bonnets’, to the foot of the sail, and they had to be laboriously removed in order to shorten sail.

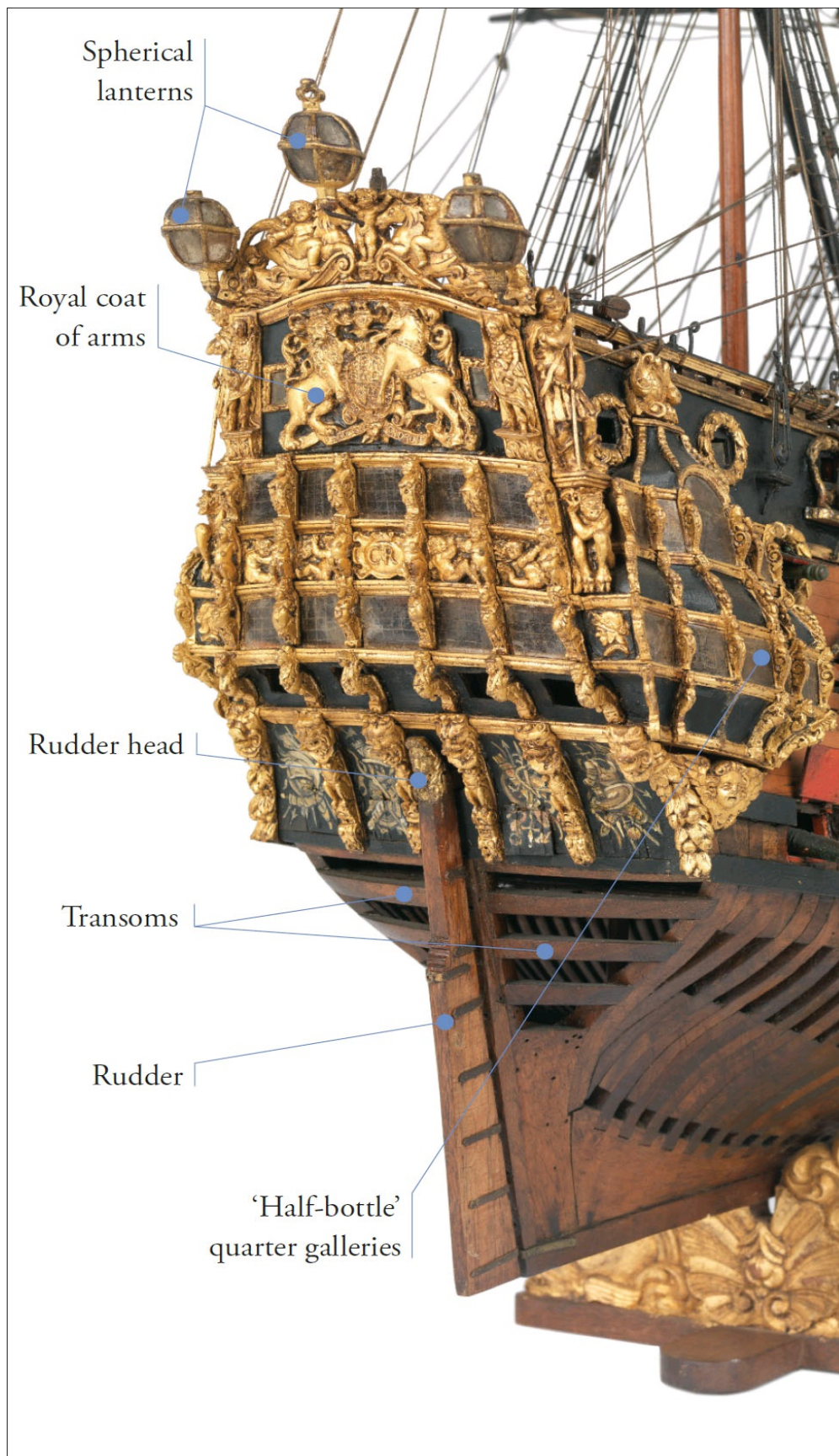
Standing rigging. The security of the masts was improved by the introduction of standing backstays, while the fore and main stays were ‘doubled’ by the addition of preventer stays. The shape of the tops went from round to flat-sided, enhancing the effectiveness of the topmast shrouds, while details like the introduction of yard tackles, or running the yard lifts to the heads of the masts instead of under the tops, made the top hamper more resilient.

Running rigging. In general, the rigging was much simplified, the elaborate ‘crowsfeet’ arrangements of the seventeenth century disappearing. The aggregate effect was fewer blocks, and less weight and windage aloft.

DECORATION: THE STERN

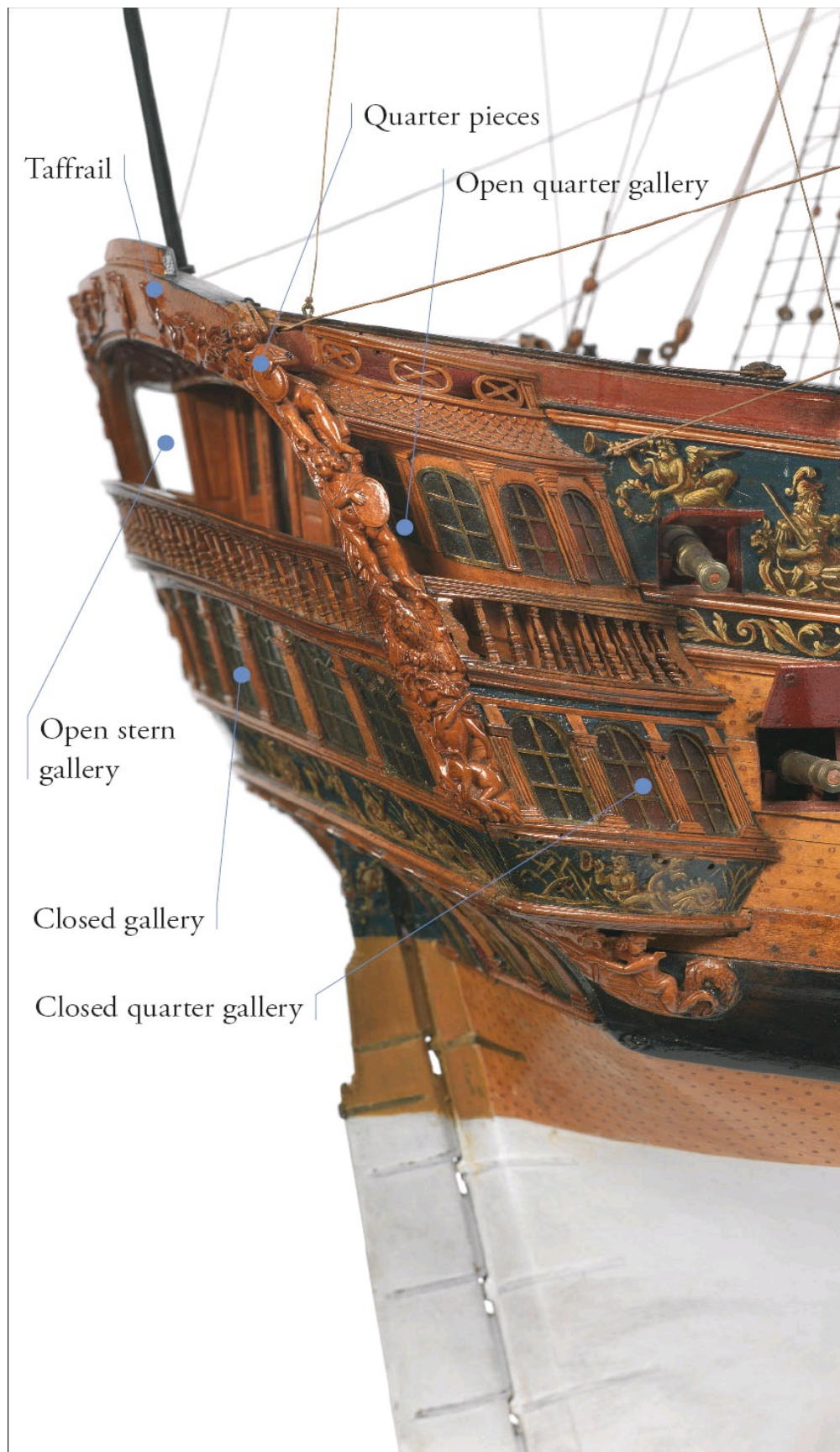
Figureheads are much better known as examples of maritime art – perhaps because they were still employed well into the nineteenth century and many of them survive to this day, or perhaps because a ship has only one and it represents the ship's character more than anything else – but for most of the age of the ship of the line, the decoration of the stern was far more elaborate. In Stuart times the royal coat of arms was a major feature, perhaps because of the insecure nature of the monarchy. The general emphasis of the flat of the stern is vertical. The 'half-bottle' shaped quarter galleries on each side were perhaps more decorative than functional, as accommodation within them must have been very restricted, except at middle deck level on a three-decker.

One reason for change was that the captain began to use the quarterdeck cabin so that he could have immediate access to the steering wheel which began to appear early in the eighteenth century, so better facilities were demanded at that level. Open galleries were added to the stern, changing the emphasis to horizontal. By the 1790s the expense of these features was attracting criticism and they were severely restricted, though decoration began to creep back in the early 1800s.



SLR0002

The stern of the *St Michael* of 1669.



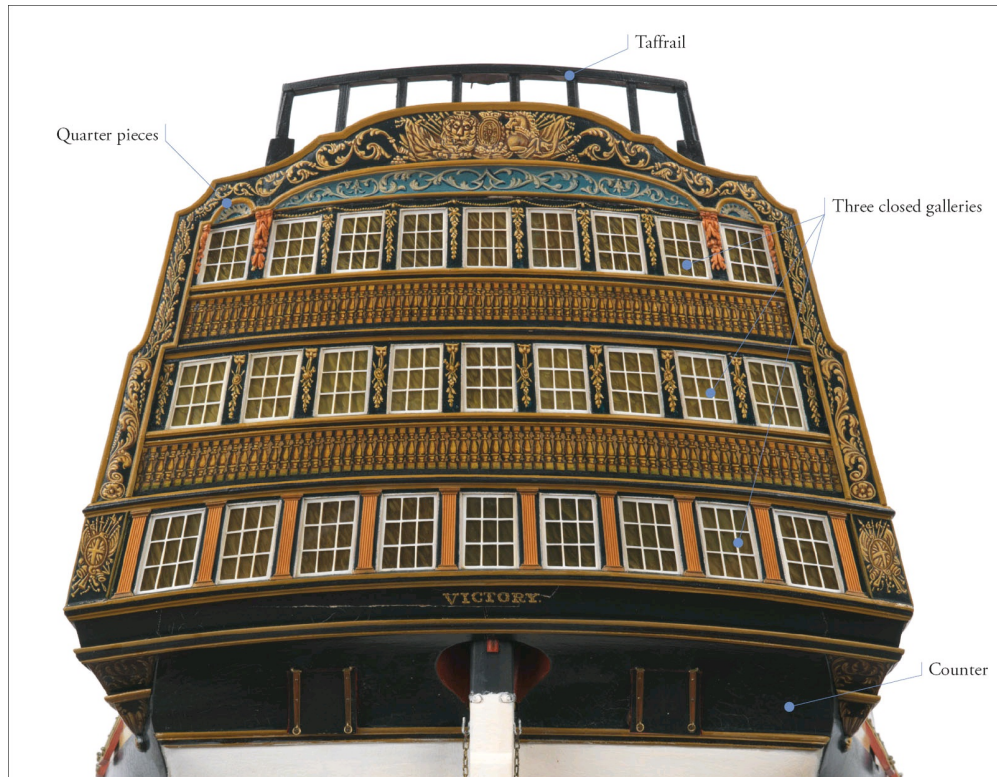
SLR0442

The *Centurion* of 1732, showing the characteristic open upper gallery of the period, including the quarter galleries.



SLR0512

The stern of the *Royal George* of 1756, a typical mid-century three-decker.



SLR0513

A representation of the closed stern of the *Victory* as she was rebuilt in 1803.

5: World Wars 1739-1782

From 1739 the Royal Navy spent twenty-two of the next forty-three years in oceanic wars with Spain, France, and eventually the rebel American colonists. They began with the ‘War of Jenkins’ Ear’ in 1739. Admiral Edward Vernon boasted to Parliament that he could capture the Spanish base at Portobello with six ships and he duly did so with a force of two 70s, two 60s and two 50s.

The first real test was in April 1740 when three 70-gun ships, the *Kent*, *Lennox* and *Orford*, took six hours to overcome the Spanish *Princessa*, of nominally equal gun power, in 1740. This started a good deal of rethinking about British ship design and to demands for a new Establishment of dimensions. The old ships had been designed mainly for the North Sea, English Channel and Mediterranean, but now larger and more robust types were needed.

Although sometimes described as an Establishment, the proposals of 1741 were never fully ratified. They offered a slight and rather inadequate increase in dimensions, but a slightly more substantial reorganisation of the gun establishment. The old three-decker 80 was retained, but two-decker Third Rates now had 66 or 64 guns. More than thirty ships of the line were built to the new dimensions, nearly half of them 50s as the type enjoyed a revival. Meanwhile, the policy of rebuilding collapsed, for it demanded the long-term use of dry-docks which were in great demand in wartime. In April 1740 four ships were due for rebuilding, but the Admiralty informed the Navy Board that ‘the docks at His Majesty’s yards cannot be spared for the repair of them, or slips for rebuilding them, without interrupting the works of other ships.’ They were to have four replacement 50-gun ships built by private contractors.

The three-decker 80 was subjected to severe criticism. Admiral Vernon claimed they were ‘not the men of war they ought to be’. From the Mediterranean, Admiral Mathews wrote that most of them ‘can scarce haul up a [gun]port. The *Chichester* hauled up her two aftermost, but was soon obliged to lower them; as

for the rest of her ports, they were caulked in when she was fitted out, and have never been opened since, nor will they ever be, except in a mill pond.' Though France was not yet officially at war with Britain, Mathews engaged a joint Franco-Spanish fleet off Toulon in 1744. He was let down by his second-in-command, Lestock, who failed to engage, and the result was indecisive. At the subsequent courts-martial, Lestock defended himself on the grounds that Mathews had not formed a line of battle, so it was the senior admiral who was dismissed the service. The line of battle was more rigidly enforced than ever, which made a decisive result increasingly unlikely.





SLR0453

An 80-gun ship of the 1730s or '40s, though the dimensions do not match either the 1733 or the 1741 proposals exactly. The name *Barfleur* is painted on the stern, though it was not common to display names at that time, and the model does not match any ship of that name – the nearest was a ship rebuilt in 1716 which was rather smaller – so it was presumably added later. The model shows how the type had evolved into a full three-decker since the 1690s. It has three complete decks of guns, though the quarterdeck is only lightly armed with six 6pdrs and the forecastle is unarmed. It also suggests the

poor proportions of the type: too high for its length and with a tendency to instability. The figurehead is of a human figure rather than a lion, which was normal by the 1740s. The lower wales are single and painted black; the upper wales are double in the older style.



SLR0454

This model is believed to represent the *Yarmouth*, one of the 64-gun ships built on the Establishment of dimensions proposed in 1741; they were a little larger than an old 70, but with 32pdrs instead of 24pdrs on the lower deck, with slightly reduced numbers of guns to increase seaworthiness. It is to a small scale of 1:60. Most of the standing rigging supporting the masts of the model is original; the rest was restored. Some of its features, however, are rather old-fashioned – there are no gangways in the waist linking the quarterdeck and forecastle, the channel are in the lower position, and the lower wales, painted black, are of the double or ‘open’ type. It has the long mizzen yard extending well before the mast, though by that time the lateen sail itself was usually cropped short with the luff now secured to the mast – the yard could also serve as a spare for the fore or main mast.

The British were becoming ever more aware of the new ships built by the French, including two-decker 74s and 64s that carried the maximum gun power on well-designed hulls. Mathews pointed out that the French 74s had guns of up to 40lbs on the lower deck, 'which makes them better ships of war than our 80-gun ships that cannot make use of their lower tiers, which they will be very seldom able to do.' Even if the lower guns could be used, another officer pointed out that 'the general discharge of an English 80-gun ship is 1312lbs; a French 74 is 1705lbs.' There was no ideal ship in the British line. The 100s and 90s were too big, difficult to man and poor sailers. The faults of the 80s were all too evident. The 70s were probably the best; they usually sailed well but as the battle with the *Princessa* showed, their main armament of 24pdr guns was too light. The 60s and 50s were even weaker, and there was a move to remove the smaller ships from the line of battle. Much of the blame was put on the ageing Surveyor of the Navy, Sir Jacob Ackworth, and Vernon called him 'a half experienced and half judicious surveyor'. There were half-hearted attempts to emulate the French 74s, as when the *Culloden*, an 80 under construction to the 1741 dimensions, was altered on the stocks, but she was later described as 'a remarkable bad sailer'.



SLR0456

A ship of 60 guns, perhaps a suggestion for the proposed Establishment of 1741. It is a Georgian-style model and has an open stern and quarter gallery at quarterdeck level. By the 1750s this was the smallest type of ship of the line, though it was very weak compared with French and Spanish equivalents by that time. The stern of the model has been restored at some period, with much simpler shapes to form the taffrail and quarter pieces. The forward underwater planking is in a lighter wood, which suggests that it too was restored. Some of the gunports in midships are missing or closed, but their 'shadows' can be seen above them. Otherwise it is a typical 'Georgian' model in many ways, with bone used to form parts such as the stanchions of the rails and the pilasters of the stern decoration – a practice which was becoming increasingly common by this time.

Commodore George Anson set off on a raid on Spanish America in 1740, and discovered a great deal about the faults of British warships as he carried out a four-year circumnavigation. The only one to complete the voyage was the largest, the 60-gun *Centurion*, built in 1732 and a very rare deviation from the 1719 Establishment, with a foot of extra breadth. Anson became extremely rich with the capture of a Spanish treasure galleon and from the mid-1740s he was the most influential member of the Board of Admiralty. Benjamin Slade, the master shipwright at Plymouth, made a model of the *Centurion* and this brought a leading shipbuilding family to his notice.

In 1745, not long after Anson's appointment to the Admiralty, the board set up a committee to improve ship design, noting that 'the ships ... heel so much in blowing weather that they cannot open their lee ports, and at the same time the ships of other nations go upright, with their batteries open and ready for action.' However, they did not intend to abandon the system of Establishments, but rather to strengthen it, as 'the ships of the Royal Navy are not new built to any certain uniform system or establishment; but as every particular ship has been built or rebuilt according to different proposed dimensions.' The master shipwrights met in the mould loft at Deptford Dockyard and disagreed amongst themselves, but they defended the 80-gun ship, having 'observed on many occasions the advantage which 80-gun ships with three decks have over those with two and a half.' A new Establishment was drawn up, with greater increases than ever before, but still well behind foreign construction. The Admiralty enforced it by an Order in Council, with authority only short of an Act of Parliament; and for the first time the actual draught of each type was laid down, not just the dimensions.



SLR0230

The 70-gun *Royal Oak* of 1741. This time the name on the stern is credible, as the model matches the dimensions of 1741 to which the ship was built, as well as the plans in the National Maritime Museum collection. However, it was not common practice to paint up such names until the 1770s. Examination of the interior shows that the model was modified at some stage, which might have been when the name was painted. The model is still mounted on its original baseboard. The rigging is largely original but saw some restoration in the 1970s. The ship had been ‘rebuilt’ three times from one of 1674, but it is unlikely that any timber or design features survived the later rebuilds, and she was in effect a new ship. It has old-style open wales, and the channels are in the lower position. The insides of the gunports are painted in red, which is quite conventional, but have decorations in gold, which is less common.



SLR0328

This model is traditionally identified with the *Medway*, 60 guns, of 1742, though there is no certain evidence for the name. The plans and dimensions, however, are very similar to the fifteen ships built to the 1733 proposals – the largest number of any type from that period, as the 60 seemed to offer a compromise between economy and gun power. This, along with the *Ipswich*, is one of the most useful rigged models of the period in that most of it is contemporary with the ship. It is also equipped with a full complement of anchors and their gear. The white bottom indicates the composition used in tropical waters, for modelmakers preferred it to the less attractive ‘black stuff’ used at home. However, the *Medway* did serve in the Indian Ocean. The vertical spar rising from the bowsprit is just a flagstaff, not a fully-fledged mast as on earlier ships. The model is mounted on its original veneered baseboard.



SLR0472

This model of a 60-gun ship was made by John Hancock of Deptford Dockyard, a rare example where the modelmaker can be identified. It remained in his family until 1895, when it was presented to Greenwich Hospital. The *Windsor* and *Deptford* were built in Deptford Dockyard to the 1719 Establishment, and the *Augusta* to the 1733 proposals, but it is difficult to tie it down to an individual ship. It is made in the Georgian style and has 'open' wales, picked out in black, which suggests a date before 1730; but, on the other hand, its channels have been raised above the upper deck ports, which suggests a date after 1745, and has gangways along the sides of the waist connecting the quarterdeck and forecastle, which also suggests a later date, so like many models it is difficult to identify with a particular ship. The model also has the lion figurehead. The rigging was restored in 1938.

Anson was still a fighting admiral and in May 1747 he led a force of seventeen ships of the line against a French troop convoy bound for India, escorted by five ships of the line. Admiral La Jonquière tried to deploy his East Indiamen as part of the line of battle but the merchant captains soon retreated. This allowed Anson to exploit a loophole in the fighting instructions and order a headlong attack, during which the French ships were dispersed or captured and the best of all the French 74s, the *Invincible* of 1744, was taken. Five months later, in the same area off northwest Spain, Rear Admiral Hawke led fourteen ships of the line against nine French which were guarding a convoy. The battle was stiffer this time, but six French ships of the line were captured, while the convoy escaped. The two battles off Finistère showed that there was life beyond the line of battle, though only with numerical superiority and the enemy in disorder. They also brought about the recurring stalemate, with the British victorious at sea and the French on land. A compromise peace came into effect in 1748 after nine years of war.

Anson became First Lord of the Admiralty in 1751. Meanwhile, the new ships of the 1745 Establishment were coming off the stocks and their captains 'represented that they do not steer so easy, not sail so well, as was expected.' The Admiralty had to go to the Privy Council in the early 1750s to have changes made. By this time the sides were shaping up for another war, and unofficial conflict had already broken out in India and North America. Admiral Boscawen was sent out with a squadron with his flag in the *Torbay* (another attempt to copy the 74 by cutting down an old 90) to intercept French reinforcements for North America. He captured two ships, which did not do the French any serious damage, but gave them a pretext for further action.



SLR0479

A late 50-gun ship of the line on the 1745 Establishment. It is unusual for the Navy Board style in that the planking is continued below the lower wale, and in some ways it is quite realistic in showing trenails and the joins in each strake of planking. However, the workmanship is slightly below the normal standard, in that the quarter galleries are very plain, which suggests it might be a model of a ship built by contract rather than in the royal dockyards. Four of the seven 50s built to the 1745 establishment were built in private yards: the *Assistance*, *Tavistock*, *Severn* and *Greenwich*. The figurehead was restored badly in the nineteenth century, and replaced by a block in 1944. The model shows the high-sided appearance of the 50, similar to the three-decker 80, which made it a poor sailer compared with the frigates the French were evolving.

Anson was clearly disillusioned with the 1745 Establishment and its variants, and determined to build new ships without having to deal with the Privy Council or the traditional master shipwrights. In August 1755, in a fortunate coincidence, the Surveyor Sir Joseph Allin became ill and 'disordered in his senses'. Anson's modelmaking protégé Benjamin Slade had died in 1750, but his cousin Thomas Slade had stepped into his shoes. He and his colleague William Bateley arrived at the Navy Board armed with a warrant to take over as joint Surveyors. Though he had never designed a ship before, apart from a yacht, within three weeks Slade had produced a draught for 'two ships of 70 guns each to be set up and built at Deptford'. In fact, anyone who counted the gunports on the draught would soon discover that they were really 74s, and they were measured at 1547 tons compared with 1427 for the latest 70s. It was a moderate increase but it made it clear that the age of the Establishment was over, and that Anson felt free to build the ships that he and the new Surveyors considered were best for the Navy. Seven ships of the *Dublin* class were ordered, followed by others which were slightly larger.

War had still not been declared when Minorca was invaded by the French in 1756. Admiral Byng was sent out to recapture it, but his force was given low priority compared with the Atlantic and the English Channel. His fleet was undermanned, and it included a high proportion of the outdated ships built to the older Establishments. His flagship *Ramillies* was a 90-gun ship to the 1741 dimensions. The faults of the cut-down *Culloden* were well known. The 70-gun *Captain*, also on the 1741 dimensions, was 'a very complaining ship, always leaky, always sickly'. The *Deptford* was even older, a 60 on the 1719 Establishment, cut down to 50 but still inclined to heel in a wind – so much so that on one occasion her lower deck guns had to be hauled in to prevent flooding.

When he did meet the French, Byng suffered from one of the major faults of the ship of the line – that it could not advance at the same time as firing. After tacking to bring his line alongside that of the enemy, he found that most of his ships were too far off to be effective. He tried 'lasking', bringing his ships forward at an angle, but the signal book did not allow him to make corrections and his instructions were misunderstood. The leading ships approached at too obtuse an angle and their guns were unable to bear while meeting the full force of the enemy.

Several were damaged in the rigging and Byng decided to withdraw to Gibraltar for repairs. This was unfairly interpreted as cowardice and he was executed by firing squad as a political sacrifice. It led to a political crisis in which Lord Anson was forced out of the Admiralty for a time, while the great war leader William Pitt joined the cabinet as Secretary of State.

After his return in July 1757, Anson ordered some new 74s from Slade: the *Bellona* class of 1603 tons. When they were launched in 1760 they proved very good sailers and gun platforms and showed that British warship design had reached a plateau. Slade and Bateley also designed the first 'true frigates' based on a French concept to give the Navy its best cruising ships since the 1650s, and in 1759 Slade designed his masterpiece, the 100-gun *Victory*.

What made the 74-gun ship so successful? Like any ship it was a compromise, between fighting power, speed and sea-keeping. British ships needed to be robust because of Anson's policy of employing a 'Western Squadron' off the French port of Brest, where they might endure the worst of the weather over many weeks. Slade's ships were strong enough to cope with this, while their French opponents were usually designed for a quick exit in weather of their choosing. One constant factor in his ship design was the height between decks, and a long ship with a given number of decks was likely to be a better sailer than a short one – as the naval architect Marmaduke Stalkaart put it, 'the 74-gun ship will require little more topside than that of 44 guns in comparison with the difference in their dimensions, and therefore it must be rationally expected that the 74-gun ship will work as easy as the 44-gun ship; and she must sail faster, because she will bear the greater pressure of canvas.' The other limitation beyond the control of the shipbuilders was the nature of the timber. A ship that was too long for the given number of decks was likely to hog badly, so it was not easy to build much bigger than Slade did. Finally, the 74 carried a suitable battery of guns. Experiments by the scientist Benjamin Robins showed that the largest gun in common use, the 32pdr, was the most effective in terms of range and penetrating power; the 74 was the smallest ship that could carry a full battery of 32pdrs without ruining her sailing qualities. Stalkaart summed it up: the 74-gun ship 'contains the properties of the First Rate and the frigate. She will not shrink from an encounter with a First Rate ship on

account of superior weight, nor abandon the chase of a frigate on account of swiftness.'



SLR0336

The famous model of the 100-gun *Royal George* of 1756. It was commissioned by Lord Sandwich for King George III as part of a campaign to increase his interest in the Navy, which included the models of the royal dockyards made in 1772–4, as well as royal reviews of the fleet. One side was left open to show much of the interior detail. The planked side is shown here and the ship has the ‘solid’ lower wales in black, the channels raised to upper deck level and three stern galleries. It is probably more accurate and less stylised than many models of the period – it even has glass windows set in the gunports of the officers’ cabins near the stern. However, it shows the ship as she was in the 1770s, rather than the late 1750s when she was built. It gained a good deal of poignancy when the ship herself was lost along with hundreds of men, women and children in 1782. The model remained in the royal family until it was presented to Greenwich Hospital by King William IV in 1830.



SLR0502

A 90-gun ship of around 1760, perhaps the *Sandwich*, *Ocean* or *Blenheim*. It is possibly intended to demonstrate a new type of 90, with more guns on the lower, middle and upper decks and only two guns each on the forecastle and quarterdeck. The style is somewhere between Georgian and block model – the decorations and figurehead are simple blocks and the lower hull is left unplanked, but many of the side and deck features are shown. The lack of a figurehead makes it more difficult to identify, as the three possible ships probably had individual heads at that period. Possibly it was a generic model to demonstrate the class, or left unfinished for some reason. The Second Rate 90-gun ship was establishing a role as a squadron flagship, or for the commander-in-chief on an overseas station, where First Rates were never sent. Later ships of this type had more guns fitted on the quarterdeck to make them 98s, though with much lighter guns than a 100.

Not everyone was complacent about British ship design. The Royal Society for the Encouragement of Arts, Manufactures and Commerce was formed in London in 1754 and in 1760 it advertised for ship models to test in a stretch of water known as Peerless Pool (formerly the Perilous Pool) near Old Street in London, and later in the Great Pond at Snaresbrook a few miles outside the city. A 74-gun ship and a frigate were asked for, to the usual quarter-inch scale. Each was to be hollowed out and ‘worked nearly to the same scantling or thickness of which the timbers and planks together of ships of such burthen respectively usually are.’ They were to be rigged to test the effect of the winds, but only with fore and aft sails rather than the far more complex square sails carried by real ships of these sizes. They were hauled through the water at regular speeds by an instrument designed by the great engineer John Smeaton for testing water wheels, and tried in various conditions of smooth and rough water. But no conclusions were reached and in any case the experimenters did not have an adequate theory to understand the various forces acting on a ship, or the problems of scaling up the results.

In 1759, the ‘year of victories’, the tide turned decisively in Britain’s favour. Quebec was taken from the French by a fleet including seventeen ships of the line that sailed up the St Lawrence River, guided by James Cook. In November Edward Hawke’s fleet, including seven 74s which played the leading part, chased the French into Quiberon Bay in Brittany and put a dozen of them out of action, in the most decisive sea victory yet against the French. Significantly, the line of battle played no part in this action. The British were supreme on the seas, capturing Havana and Manila from the Spanish. But the new King George III, who succeeded in 1760, was anxious to end what he believed was an ‘expensive and bloody war’. Peace was made in 1763 with Britain supreme in North America and India. Anson had died in 1762 and a new era of conservative ship design began with an order to build new 74s to the dimensions of the *Bellona* class and 64s to the *Essex* class, ‘which bear the character of excellent ships of their class’. In a sense, it was a return to the thinking of the Establishment era, but with much better ships.



SLR0503

One of three models of the 74-gun *Bellona*, in many ways the prototype for two-decker ships which followed. They are all done in different styles: Georgian, block and, in this case, frame.

The frames are shown in some detail, with part of the planking put on, including a method of interlocking the sections of the lower wales known as 'hook and butt'. The bottom planking has also been started, which may have been the normal method. Alternative systems of framing are shown on each side of the model; this port side shows the more conventional one, perhaps intended as a 'before' for a new system which was never adopted. The ribbands which held the frames at the right distance apart are shown in place; these would be removed as the planking progressed. The stern decorations, figurehead and channels would not normally have been fitted at this stage in construction, and the stern panel looks rather out of place without the quarter galleries to support it.

DOCKYARD MODELS

The models of the Royal Dockyards commissioned by the Earl of Sandwich in 1772–4 are, of course, invaluable sources for the buildings and facilities of the yards themselves. However, collectively the models also show the various stages in the building of a ship. This aspect of them has often been neglected in the past because the ship models are so small – just a tenth of the normal scale of Navy Board models, for example. Nevertheless, they were made on site by dockyard workmen, who knew what they were trying to depict and had plenty of reference points – especially George Stockwell, an experienced ship modeller who made the ships for the Sheerness model. Modern photography reveals the tiny models, often at more than life size and shows some of the intricate detail, as well as revealing shipyard procedure: for example, how the floor timbers were crossed first, and the rest of the frames were erected on the dockside. These details from the models show the stages in the building of a ship of the line.



SLR2149

At Plymouth, the two building slips on the right are unoccupied, but have the blocks in place to receive the keel. On the left, the keel has been laid, part of the curved stempost erected, and some of the floor timbers are in place across the keel.



SLR2905

Building slips at Woolwich. In the left, the keel has been laid, the stempost erected and a few of the floor timbers put in position – they were not necessarily erected in order, but as the pieces became available. To the right, a frigate is in frame. Scaffolding poles are erected round both slips.



SLR2151

A ship at Chatham, with the stern assembly – consisting of stern post, transoms and fashion pieces – in place. This was usually assembled beside the ship then raised.



SLR2904

At Deptford, the futtocks have been assembled into frames beside the ship, and each will be hoisted into place with its opposite number on the other side, to create balance.



SLR2151

A two-decker in frame at Chatham, with all the timbers and gunport cills in place. The deck beams have not yet been inserted and spalls are used to keep the timbers the right distance apart, while battens are fitted on the outside of the hull until the planking is fitted.



SLR2148

A 64-gun ship in frame at Sheerness, with the lower wales added. This is the most detailed of the 1774 models; each frame has been made individually despite the very small scale of 1/480.

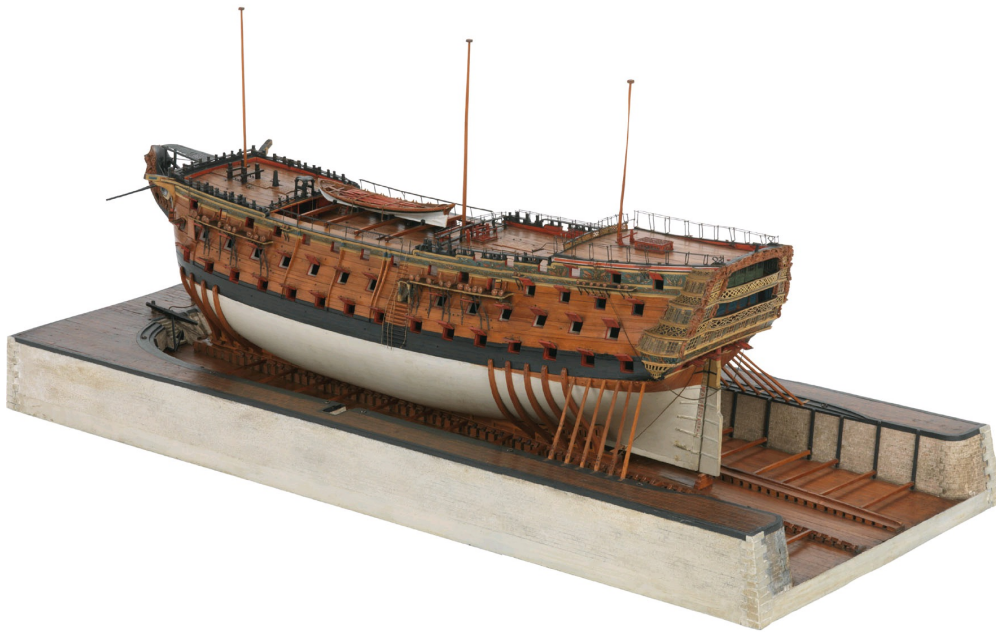


SLR2905

A two-decker at Woolwich, with the wales and lower planking in place. This is a block model and is much simpler than the Sheerness example.

**SLR2151**

A three-decker preparing for launch at Chatham. Though the launching flags are flying, the cradle which will support the hull during the launch has not yet been fitted.



SLR0512

Nelson's 100-gun *Victory* as she was first built in 1765, with open stern galleries and a very elaborate figurehead. The model provides an informative view of a ship just before launching, with cradles supporting the bow and stern, placed on top of the launching ways down which the ship will slide – although in fact First Rates were invariably floated out from a dock, in this case No 2 Dock or the Old Single Dock at Chatham. She looks very different from the ship preserved today at Portsmouth, for she had been rebuilt twice by the time of Trafalgar and her appearance had changed greatly, though it seems that her hull form and good sailing qualities were retained. The model shows a bow without a hollow, which is characteristic of Slade's designs. It has an early example of removable beams between the gangways on each side of the waist. A barge or pinnace is shown on them in this case, but other boats could also be stowed there.

Around this time we begin to learn the names of some of the ship modellers, partly due to their custom of leaving them on slips of paper inside their creations. They never appear as modellers in the dockyard muster books, but as shipwrights or joiners. Daniel Eldridge of Woolwich yard, who had been ‘employed on solids’ since 1724, was working on the model for the Admiralty Board Room by 1741. George Stockwell was born in 1729, the son of a humble well-digger in Faversham, Kent. At the age of fifteen he was apprenticed to William Jury, a shipwright in Chatham Dockyard, but there is strong evidence that he spent most of his time making models, including the *Bristol* of 1774 and the *Leopard* of 1787. In 1779 the *Kentish Gazette* carried an advertisement for ‘a sober lad with an ingenious turn of mind’ to be apprenticed to him. The well-known model of the 74-gun *Bellona* on its launching ways was made by Thomas Burkett, who was born around 1727, finished his apprenticeship as a shipwright in 1750, and was still single at the age of fifty-two. He was assisted by William Thompson, a foreman joiner born in 1716, who finished his apprenticeship in June 1735, lived in nearby Rochester, and was widowed with four children by 1779.

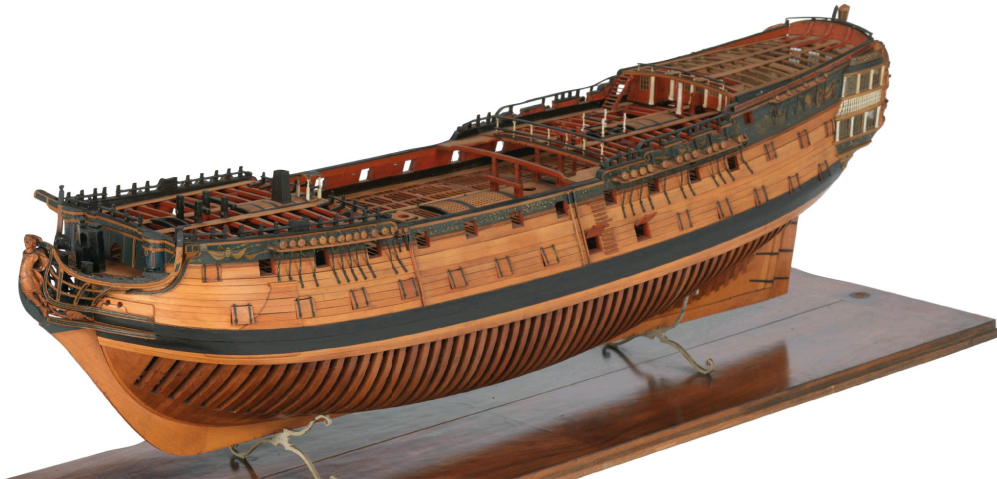
As First Lord of the Admiralty from 1771 to 1782, the Earl of Sandwich went to some lengths to get King George III interested in the Navy, arranging dockyard visits and naval displays for him. During a visit to Plymouth Dockyard, Sandwich was shown a model of the yard made by the foreman, and soon a plan emerged to commission model of all six dockyards to present to the King. Two men were chosen in each yard to do the work at a common scale of 1:480, a tenth of the scale used for normal ship models. All were beautifully made, especially Deptford and Sheerness, which includes horse teams and tiny human figures as well as the 64-gun *Polyphemus* in frame, made by George Stockwell. Ships in the Woolwich model are less intricate as they had to hurry towards completion and used block models to save time. Another result was the classic model of the 100-gun *Royal George*, with the planking of one side left off to show elaborate interior detail. An unplanked model was also made of a 64-gun ship, probably the *Intrepid* of 1770, with all its timbers ‘marked with their proper appellations’. There is no way of knowing what effect the campaign had on the King, but it left a beautiful and informative legacy in the form of the models.

When the American colonists began their revolt in 1776, the ship of the line seemed almost irrelevant, as smaller vessels were needed to patrol the coasts, land troops, and fight off commerce-raiders such as John Paul Jones. The old ships of the Establishment era had largely gone from the battle fleet. By 1777 there were 131 ships of the line, including fifty-five of 74 guns and thirty-five of 64. The old 50-gun ship had finally been removed from the line of battle in 1755. From 1771 the three-decker 90 had its guns increased from 90 to 98, though there was still a much bigger gap with the 100-gun First Rate than might be expected, because the larger ship carried 42pdrs on the lower deck and 24pdrs in the middle deck, compared with 32 and 18 in the 98. The two-decker 64 was essentially a cut-price 74 with only 24pdrs for the main armament. This type flourished more in peacetime as naval power had to be spread thinly over a great empire.



SLR0338

The well-known coppered model of the *Bellona*, made by Thomas Burkett and William Thompson, which is said to have been instrumental in persuading the King to back the huge expenditure involved in coppering the fleet.



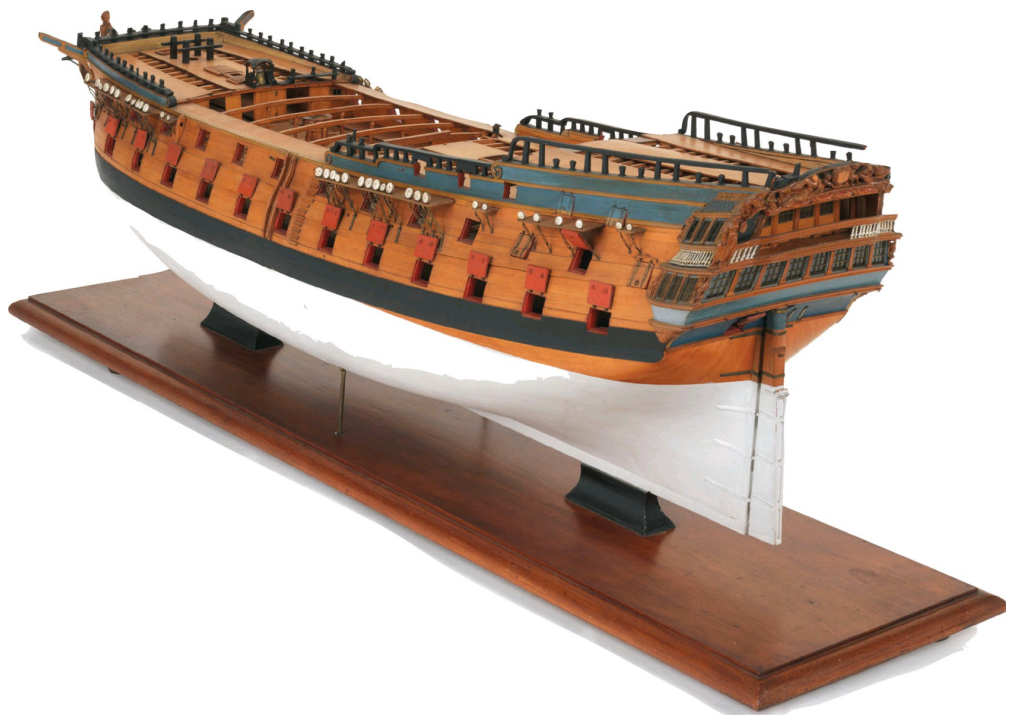
SLR0311

This model of the 74-gun *Ajax* of 1767 is very old-fashioned, as the Navy Board modelling style had become rare by the time she was built. It also shows an open waist with no gangways down the side. The model can be separated at the level of the gundeck, another feature that was not common by the 1760s. The decks are almost completely unplanked to show some of the interior. Gunports are closed and there is no sign of any guns. The model is made in boxwood, which was common throughout the eighteenth century, with some of the details in bone. The 74 was a standard type of ship by the late 1760s, and there were forty-seven of them on the list in 1767. The *Ajax* was one of two ships built to a design by William Bateley, but she was sold in 1785 after less than twenty years of service.

The situation changed after the French entered the war in support of the colonists in 1778, followed by the Spanish in 1779 and the Dutch in the following year. Now the Royal Navy faced a potentially lethal combination of the three next greatest naval powers. The first test came off the French Atlantic island of Ushant in 1778, when Admiral Keppel fought an indecisive action which resulted in more courts-martial and division within the Navy. In the following year the French and Spanish failed to exploit their numerical advantage and control of the Channel, while in 1780 Admiral Rodney chased and defeated a Spanish fleet off Gibraltar and captured six ships. After that, the sea war switched to the other side of the Atlantic with yet more indecisive battles. In September 1781 the British fleet under Admiral Graves failed to dislodge the French force from the mouth of the Chesapeake, so that the British land forces in Yorktown could not be relieved. They surrendered a few weeks later, ending British hopes of reconquering the American colonies. But there was still much to fight for, as the Spanish tried to regain Gibraltar and Minorca, while the French set their sights on the highly profitable West Indian islands, including Jamaica.

With their backs against the wall, the British turned to two new ideas to restore their naval power. One was the carronade, a short, fat gun invented in the Carron Iron Works in Scotland and firing a very heavy ball. The original version was particularly short and supported by the conventional trunnions on either side. It was fitted to the poops, quarterdecks and forecastles of many ships of the line, initially in addition to the 'long guns' mounted there. The carronade would eventually offer a great advantage in close-range combat, as its ball was approximately four times the weight of that of a long gun which might occupy a similar space. The second idea was to copper the ship's bottoms to solve two long-standing problems. Ships in tropical waters were much affected by shipworm, or *Teredo navalis*, which could eat its way along the planks and timbers and reduce a ship to a very dangerous condition; and ships in any waters were likely to be fouled with weed and barnacles, which would reduce their speed unless their bottoms were cleaned every four months or so. Both these problems were particularly acute in a war fought a long way from the dockyards, and largely in the West Indies. The Admiralty and Navy Board had looked at dozens of ideas over the years and in

1761 the bottom of the frigate *Alarm* was covered in copper sheeting. This had the twin effect of sealing out the shipworm and creating a surface which was inimical to marine growth, though it created another problem, in that the copper would react with the iron bolts of the ship to create an electrolytic reaction which would destroy both metals. This was to be solved, in the short term at least, by placing tar and sheets of paper under the copper. Charles Middleton of the Navy Board was convinced that this would greatly increase the range and mobility of the hard-pressed fleet and persuaded his superior, Lord Sandwich. But coppering the whole fleet would be very expensive, at £1500 per ship of the line, and they decided to seek royal support to raise the money. Sandwich and Middleton went to Buckingham House (as it then was) to persuade the King. There is no certain proof that they took the model of the *Bellona* made by Thomas Burkett and William Thompson with them as a visual aid, but the model is certainly of the right period and quality, coppered and fitted with carrying handles. In any case, they were successful in initiating a programme of coppering. The method of keeping the metals apart was sufficient to last the duration of that war at least.





SLR0534

The 64-gun ship enjoyed a period of popularity in the 1760s and '70s, mainly as a cheaper version of the 74, though it was far less powerful with only 24pdrs on the lower deck, and it was less well-proportioned so its sailing qualities were probably slightly inferior. This model also shows the combination of Georgian and block model styles. This example has not been identified with any individual ship, but is believed to date from around 1775 when more than thirty of them were built, many of them to designs by Sir John Williams. Slade also designed two classes. It has a female figurehead which does not match any of the names of ships built between 1765 and 1782, except perhaps the *Ruby* of 1776. After that the 64 tended to fall out of favour, though five were converted from East Indiaman in the 1790s, and they were still in the line of battle at Trafalgar.

Meanwhile, there was great dissatisfaction with the long litany of indecisive battles. John Clerk of Eldin first became interested in the sea from a model owned by some of his schoolfellows in Scotland. He acquired and built some of his own and sailed them on a pond in his father's estate, but he was forbidden to go to sea by his family. He soon began to develop theories of naval tactics and did not hesitate to demonstrate them during dinner parties in Edinburgh in the golden age of the Scottish Enlightenment: 'it was my practice to make animadversions, and criticise them, by fighting them over and over again, by means of ... small models of ships, which I constantly carried in my pocket; every table furnishing sea-room sufficient on which to extend and manoeuvre the opponent fleets at pleasure'. His biggest idea was that an admiral should not obsessively seek the weather-gage on the approach to battle – it was not necessary to gain the upwind position as the British fleet had strived for in the last few centuries. Instead, the leeward fleet should be ready to break through the enemy line, either as individual ships or in squadrons. He was the first original British writer on naval tactics, and the first to see it as a matter of attacking the enemy, rather than naval evolutions.

The first edition of Clerk's *Inquiry into Naval Tactics* was restricted to fifty copies in 1782, but one of them was in the possession of Admiral George Rodney as he met the French fleet off the Saintes between Martinique and Dominica in April 1782. Rodney was not an original thinker, but he was urged on by his chief of staff, Sir Charles Douglas, who spotted gaps in the French line. Rodney's ships broke through in three places and captured five of the French including the flagship *Ville de Paris*. It was the first great victory in a line battle for nearly a century, as distinct from chasing actions such as Finistère and Quiberon Bay. There was great controversy about how much difference Clerk of Eldin's work had made in practice. Douglas denied that it had any effect but Eldin's supporters, especially in Scotland, made extravagant claims. Sir Walter Scott wrote that his name was 'never to be mentioned by Britons without respect and veneration, since, until his systematic *Essay upon Naval Tactics* appeared, the breaking of the line (whatever professional jealousy may allege to the contrary) was never practised on decided and defined principle.' But in any case the victory secured the British position in the West Indies and greatly enhanced their negotiating position when a peace treaty

was signed to end the war.



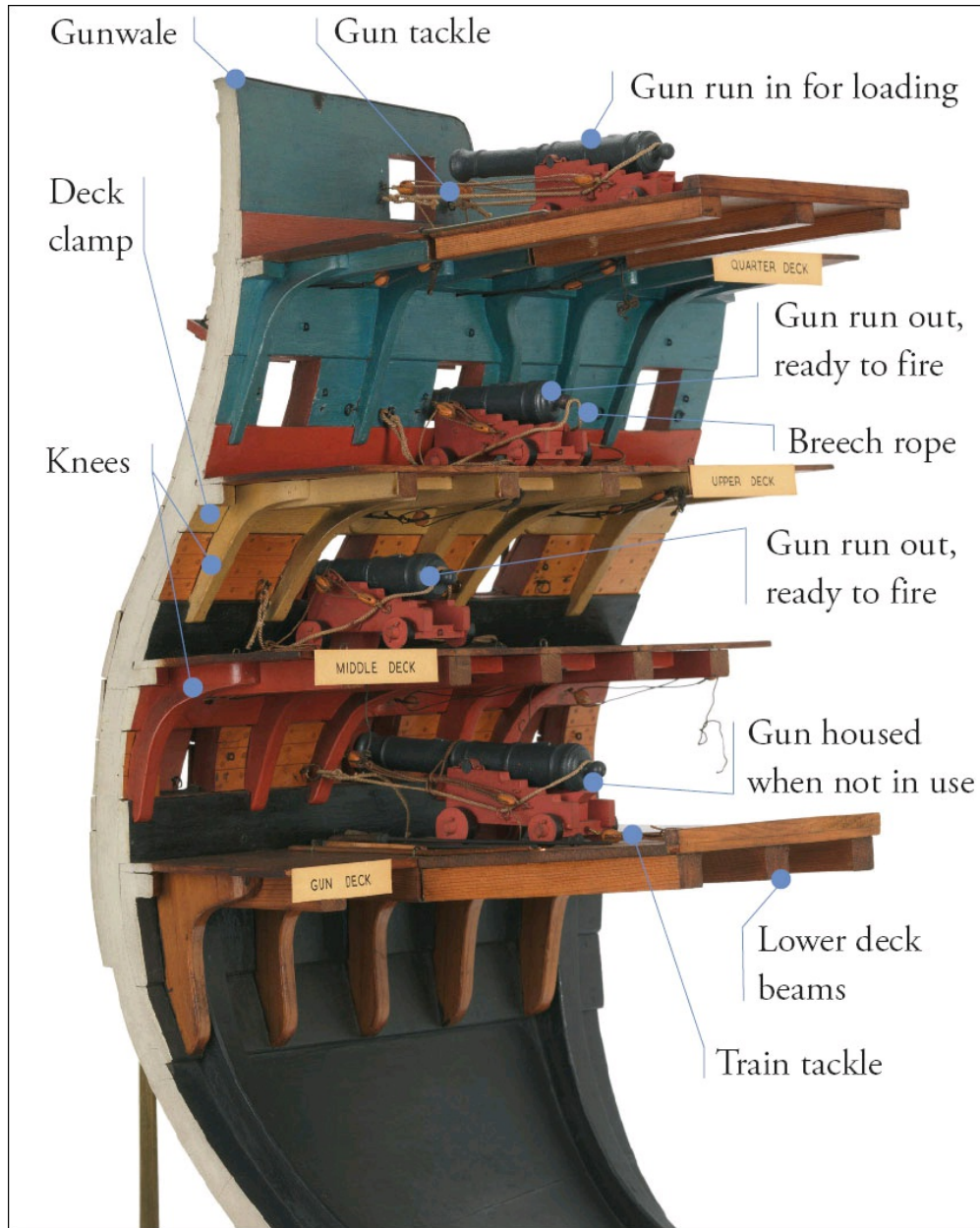
SLR0313

Another 64 of around 1775, with the rather backward-looking Navy Board style framing, and the upper parts planked in the usual manner – the lion figurehead is also very old-fashioned.

The rigging was fitted in 1930 by the pioneering naval historian R C Anderson, using the original masts and spars, and is generally believed to be accurate. He presented the model to the National Maritime Museum in 1949. The baseboard is also original. The model shows the long lateen mizzen yard, though by this time only the part aft of the mast was used to carry a sail, and it would soon be replaced by a gaff which would not go forward of the mast. Typically for the period, the upper gallery is open but the balcony does not go round the quarter galleries as was common earlier in the century. The decoration is quite elaborate, except that the tops of the quarter galleries seem comparatively plain.

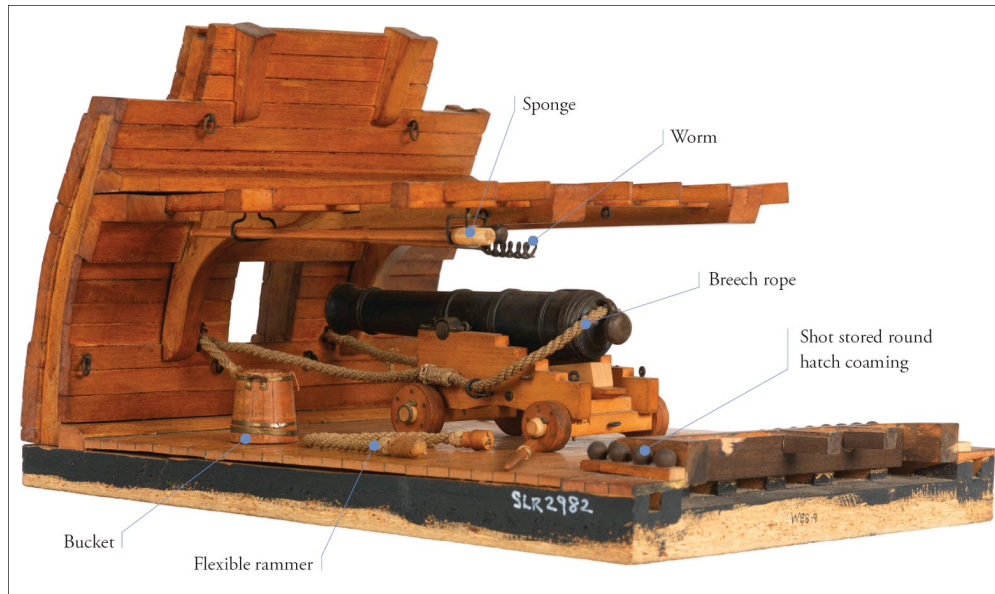
GUNS AND CARRONADES

The gun was the basic unit of naval warfare and it was good training in rapid fire that was perhaps the biggest single factor in British success in the age of sail. Guns were of course the *raison d'être* of the ship of the line. Its main function was to fight in a fleet battle, in comparison with frigates and smaller ships which often carried out their duties best by avoiding battle. There are many surviving examples of guns from the period, but much less remains from the carriages and tackle which were essential in their operation. Most ship models are not fitted with guns, and if they are represented, the cannon and their mountings are often rather lacking in detail or greatly simplified and misleading. Some models were, however, made specifically to demonstrate the guns and their operation, especially from the mid-eighteenth century onwards when it was felt necessary to demonstrate the principles, or to promote new weapons such as the carronade.



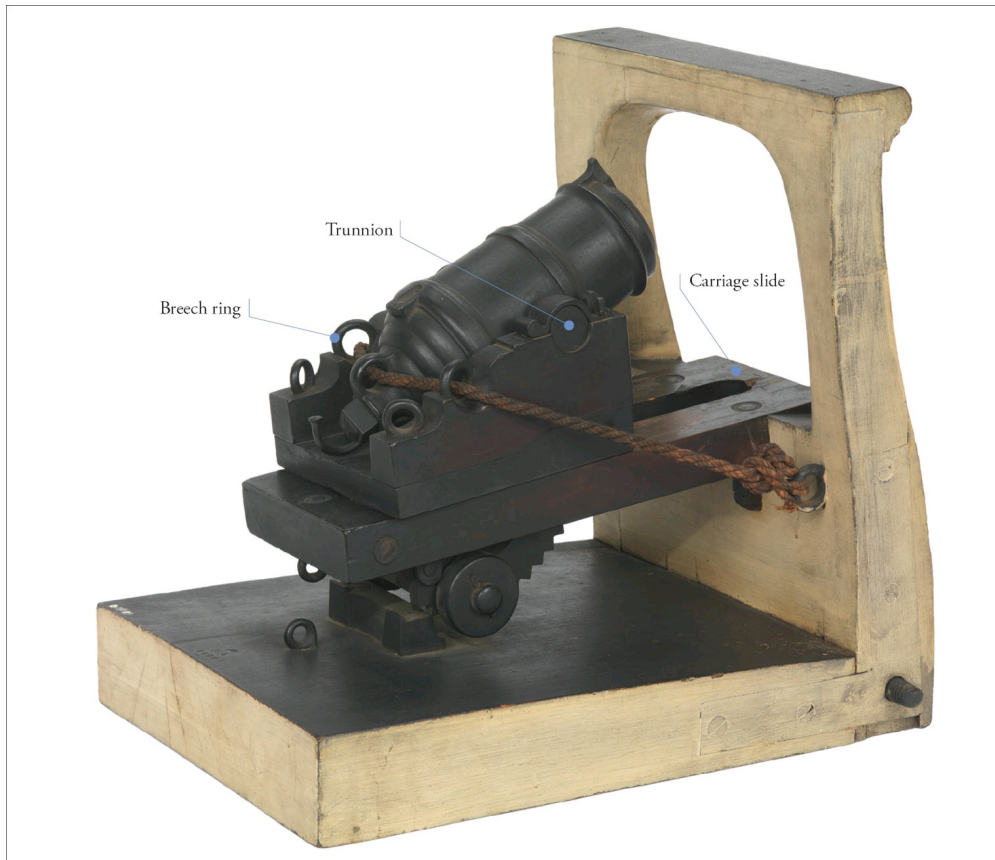
SLR0497

A section of the hull and decks at the break of the quarterdeck of the *Royal George*, showing the layout of the guns in a three-decker.



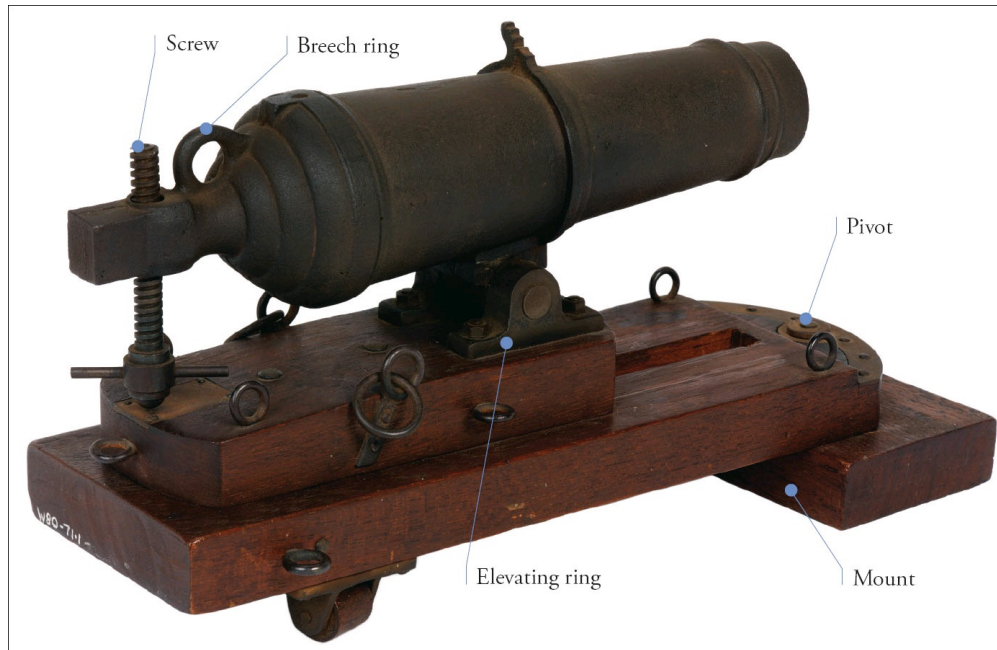
SLR2982

A typical gun and its implements, about 1800, with the gun run in for loading. Apart from the breeching, none of the tackles are shown.



SLR2915

An early pattern carronade, with trunnions, about 1780. At this stage the slide was fixed in the cill of the gunport and could not traverse. The arched gun-port can be found on some early carronade-armed ships; it was intended to allow high-elevation fire against masts and rigging.

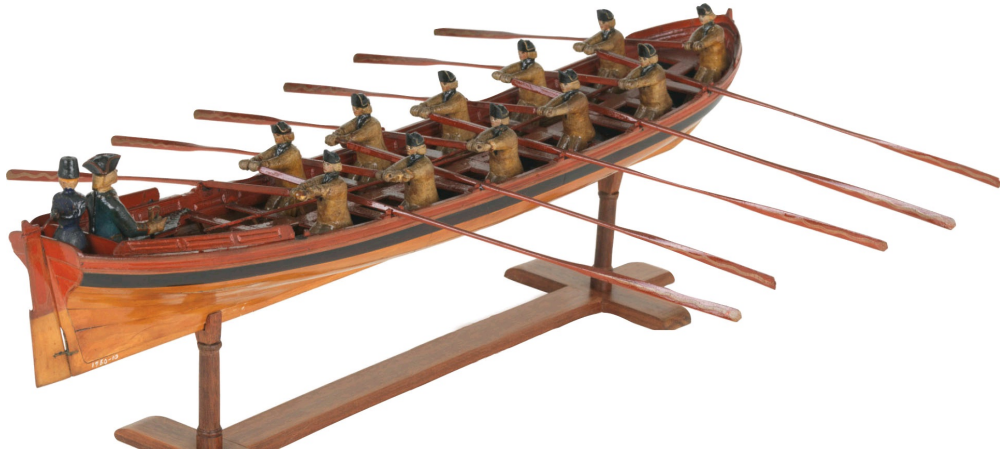


SLR2923

A later pattern carronade, from about 1800, mounted on a loop beneath the longer barrel, with elevating ring and screw elevation. The traversing slide carriage allowed a limited arc of fire through the port, but if the pivot was mounted inside the bulwarks, it allowed the mounting to be swung parallel to the side to be secured in heavy weather.

SHIPS' BOATS

Ships' boats were not usually designed as lifeboats until the late eighteenth century, and only rarely then. Instead they fulfilled a great variety of functions almost undreamed of today. They could tow the ship in a calm, but it was more common to lay out a kedge anchor ahead, or to attach a rope to a fixed point and haul it up using the capstan – boats were needed for all these processes. Since ships of the line rarely came alongside a quay or jetty except for docking, boats were essential for carrying goods and passengers between ships, and to and from the shore. They could land troops on a hostile shore. Most could be either sailed or rowed, though with different priorities.



SLR0332

An admiral's barge from around 1750, showing the narrow hull combined with bluff bows for meeting rough seas. There are eleven oarsman and a helmsman, who stands behind the admiral himself.



SLR0330

The longboat of the *Medway* of 1742, showing its gaff rig with bowsprit, its capacious interior and a windlass for shifting anchors and heavy loads.

Ships' boats came in three main groups. Longboats and launches were for heavy work, such as moving anchors or carrying water in casks. Barges and pinnaces were slim craft mainly for rowing officers. Cutters, yawls and jollyboats were broad enough to carry a good sail and were mostly clinker-built. In the early period long-boats were mostly towed behind the ship, but it became increasingly common to stow them, and other boats, on spare spars or beams in the waist. Straight wooden davits appeared over the quarters in the late eighteenth century, along with stern davits overhanging the cabins.



SLR0710

A cutter of 1824 carrying a gun underneath, for the use of landing parties. It was regular practice for the larger boats to carry underslung loads, but this proposal by John Cow, the master boatbuilder at Woolwich, introduced watertight trunks amidships to make the rope lashings easier to rig and more secure.



SLR0770

The outfit of boats for a First Rate in 1838, showing a jollyboat, cutter, pinnace and several launches of different sizes; some of them have diagonal skin construction which was replacing clinker and carvel by that time.

6: Revolutionary Wars

By 1786 the Royal Navy had an unprecedented total of 149 ships of the line, though, as usual, that included those under construction. The major shipbuilding programme of the American War had come too late.

Thirteen ships of the line were still building in the royal dockyards when the war ended, and twenty-nine more in merchant yards. With no urgent need to get them into service, some were left to ‘stand in frame’ on the stocks to allow the full seasoning of their timbers. The last to be launched, the *Illustrious* of 74 guns, took to the water at Buckler’s Hard in Hampshire in 1789. According to Sir Charles Middleton, it was ‘a time of profound peace, when the navy is so complete in the number of ships that it would be the height of extravagance to build another for at least ten years to come.’ The most immediate problem was the state of those that had served, as the long-term effects of coppering were felt. The only solution was to develop a copper alloy to replace the iron bolts in the ships’ bottoms. Over a ten-year programme, each ship had every iron bolt driven out and replaced by alloy when it came in for routine dry-docking. At the same time the carronade was redesigned with a loop under it instead of trunnions, and a longer body. It began to replace the guns on the upperworks rather than just supplement them. By 1797 it was ordered that carronades should form the main armament on forecastles, quarterdecks and poops of ships of the line.

When war with Revolutionary France began in 1793, the task seemed easy, as the allies were supreme on land and sea. That did not last long, as the French armies deployed their revolutionary vigour to defeat the forces of the old regime. The war was to produce an unprecedented number of decisive fleet battles, often won against long odds. As Clerk of Eldin had remarked in 1782, ‘when single ships have encountered one another, or when two, or even three, have been engaged of a side, British seamen, if not victorious on every occasion, have never failed to exhibit instances of skilful seamanship, intrepidity, and perseverance.’ Now this superiority had to be translated into success with fleets. This was greatly

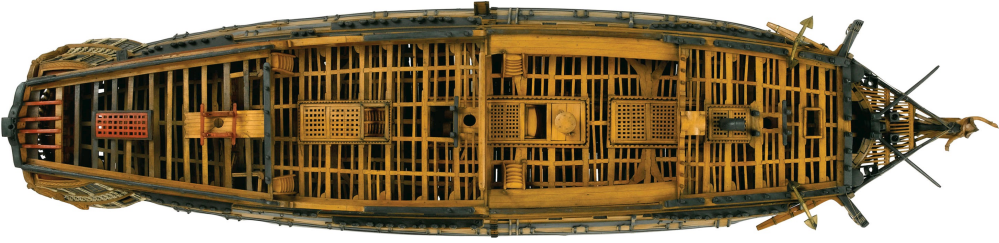
helped by the state of the French navy. Aristocratic officers had mostly fled the guillotine and it was not possible to improvise a new corps as was done with the army. Merchant ship captains were trained to get from A to B with minimum cost and damage, promoted petty officers lacked the vision and navigational skills, and political appointees were ignorant of all naval matters.





SLR0555

The *Queen Charlotte*, a First Rate ship of 100 guns, was designed by Sir Edward Hunt and, with her sister *Royal George* (replacement for the ship which sank in 1782), she was the first ship to be substantially larger than the *Victory*. She was built at Chatham in 1789 and served as Lord Howe's flagship at the Battle of the Glorious First of June in 1794, before being accidentally destroyed by fire off Leghorn with heavy loss of life in 1800. The decorations of this model are to a very high standard, including the figurehead, which represents the queen under a canopy. It is made in typical Georgian style with planks on a bread-and-butter hull, but without any signs of guns or rigging. Decorations on ships as well as on models of this type were both to be cut down for economy reasons during the 1790s, so it is a late example of both.





SLR0558

The differences between French and British ship design were reduced by the 1790s compared to the middle decades of the century, as the British built new 74s and frigates which followed the French pattern but were independently designed. Nevertheless, there was a fashion for copying French hull forms in the mid-1790s. This model is believed to represent a French 74. Its hull is framed with an almost solid assembly of futtocks (correctly scarphed together, as in the real ship, not in Navy Board style of open framing) and a ribband is shown in place in the lower hull. The planks below the wales are shown and are of interlocking or 'anchor-stock' construction for strength – though it was an expensive method and in general French ships were less strongly built than British ones. The structure of the knee of the head, below the figurehead, is also shown realistically. The purpose of the model is not clear, though it has been suggested it was made for demonstration purposes.

The main fleets met for the first time at the end of May 1794 as a French force of twenty-six ships of the line covered a vital grain convoy from America. Lord Howe had an equal force with his flag in the *Queen Charlotte* of 100 guns. On the 29th he ordered his ships to break the French line but only a few did. There was little fighting over the next two days, but on 1 June the fleets met and the British ships attacked. The French priority was to protect the convoy, so they had to stand and fight, losing seven ships. Six of them were put on show in Portsmouth, a great boost to British morale when the land war was going very badly. The British began to call the battle the Glorious First of June – the first battle with a non-geographical title since the Dutch wars, because it was the only one fought a long distance from land.

The young Horatio Nelson began the war in command of the 64-gun *Agamemnon*, which he delighted in after five years on the beach. It was ‘the finest 64 in the service, and has the character of sailing most remarkably well.’ Until that time he had mostly served on small ships and in special missions, so he was never broken into the discipline of the line of battle as most officers were. He was involved in an unsuccessful attempt to take over the great French base at Toulon in co-operation with French royalists, and in May 1795 he had his first contact with the French fleet while serving under the notoriously cautious Admiral Hotham. On his own initiative Nelson pursued some enemy stragglers and captured two of them, but Hotham let the rest escape. Nelson stormed on board the flagship and remonstrated with the admiral, who told him, ‘We must be contented, we have done very well.’ Nelson wrote to his wife, ‘had we taken ten sail, and allowed the 11th to escape when it had been possible to have got at her, I could never have called it well done.’ Sir John Jervis took command of the Mediterranean Fleet at the end of 1795. He was much more to Nelson’s taste as a commander, though he withdrew the fleet from the Mediterranean after Spain declared war. In February 1797 Jervis’s force of fifteen ships of the line met a Spanish one of twenty-seven, including the huge four-decker *Santissima Trinidad*. Like the French in 1794 they had to protect a convoy. Jervis’s approach was slow and Nelson, anticipating orders, saw a chance to break out of the line with his ship, the 74-gun *Captain*, followed by his friend, Cuthbert Collingwood, in the *Excellent*. This turned the

tide of the battle, and Nelson revived an old practice by boarding the Spanish *San Nicolas* through a stern window. He went on to board the *San Josef*, 'Nelson's patent bridge for boarding first rates', as it was later called. Initially, Jervis took much of the credit and was raised to the peerage as Earl of St Vincent for the success, but it was Nelson who had won the battle with his aggression and tactical initiative.

Nelson was perhaps unusual in his pleasure with the *Agamemnon*, for the 64-gun ship was out of favour elsewhere. In 1795 it was written, 'There is no difference of opinion respecting 64-gun ships being struck out of the rates. It is a fact that our naval officers either pray or swear against being appointed to serve on board them.' With only 24pdr guns and weaker scantlings, a 64 was vulnerable if it came up against a heavy enemy ship in the line of battle, but with many enemies and a limited number of ships it was necessary to keep them in service. In 1797 Admiral Duncan was charged with containing the Dutch fleet and in October he found them trying to evade him by sailing close to their own shoreline at Camperdown. His own flagship, the *Venerable*, was a 74, as were six of his other ships. The rest of the fleet included seven 64-gun ships, including three which had been converted from East Indiamen during construction. In addition there were two antiquated 50s. It was the Navy's 'second team'; the best ships were in the Mediterranean and Channel fleets. Duncan was not deterred by that, or by any emphasis on conventional naval tactics. He formed his ships into two lines to sail straight at the enemy, but even that was too orderly for Captain Inglis of the *Belliqueux* who was confused by the admiral's signals, and exclaimed in his Scottish dialect, 'Up wi' the hel-lem and gang into the middle o' it.' There was a hard battle in which nine Dutch ships were captured and the rest fled. The Scottish press claimed some of the credit for Clerk of Eldin. 'It is a most remarkable instance in the history of Admiral Duncan that he has lived himself to illustrate the truth of the doctrine of his early friend, Mr Clerk', reported the *Edinburgh Evening Courant*.

It was widely believed that French ship design was superior, mainly because French ships tended to be faster in light winds. This was reinforced by naval officers such as Captain Edward Brenton who claimed, 'the ships of France and

Spain were generally superior to those of England, ... outsailing them in fleets, and often in single ships.' There were several miscarriages which were attributed to poor ship design: for example, when Admiral Cornwallis retreated from a superior French force in the Channel in 1795, but was slowed by two of his 74s. A more detailed examination shows that nearly all of these problems were caused by peculiar circumstance; for example, in Cornwallis's retreat, the *Bellerophon* and *Brunswick* were normally good sailers, but were 'quite out of trim'. But the naval administration became convinced that larger ships were needed. They ordered two 80-gun ships to a new style, with two decks instead of three and based on French principles. Several larger 74s were ordered with 176 to 181ft on the gundeck, compared with 168ft which had been standard since the days of Thomas Slade. The *Ajax* and *Kent* were built to the lines of the *Invincible*, captured in 1747, but with an extra 11ft added. An old Second Rate, the *Prince*, was taken apart and lengthened by 17ft, which greatly improved her sailing qualities.

This was not a golden age for ship models, as the Georgian style fell into disuse and nothing appeared to take its place as a display item, but models of one form or another found other uses. The amateurs of the Society for the Improvement of Naval Architecture were led by Colonel Mark Beaufoy and believed that it was 'an undeniable truth, that the safety, the prosperity, and even the existence of its commerce, must very much depend on the excellent construction of the ships in service', but it was 'too well known to all who have any skill in Naval Architecture, that the theory is not so well understood as it deserves; and that the Swedes and French actually surpassing the English in this most important art, the French have derived many advantages from their experience in time of war.' His answer was to conduct a long series of experiments by towing objects through the water in Greenland Dock on the Thames near Deptford. The objects in question were not ship models in any sense of the term, but various shapes. The conclusions were often surprising and not very relevant to ship design. The addition of a cylinder in the middle of a form seemed inexplicably to reduce its resistance; a cone moved faster with its apex forward than with its base; and the greatest breadth of a body should be placed two-fifths from its bow. Many years later, the naval architect John Fincham remarked, 'It might seem a defect in these extensive

experiments, considering the assiduous care and labour with which they were conducted, that so large a portion of attention was devoted to such as could but little exemplify the resistance to which the different forms of bodies used in Naval Architecture are subject.' However, one quote attributed to Beaufoy would be made use of some decades later. 'The bottom of a floating solid should be made triangular, as in that case it will meet with the *least* resistance when moving in the direction of its longest axis, and with the greatest resistance when moving with its broadside foremost.'



SLR2723

The *Caledonia* was the first ship built for the Royal Navy to carry 120 guns, following French and to a certain extent Spanish practice in moving towards bigger First Rates – unlike two-deckers, the limits of this class had not yet been reached. The *Caledonia* had been preceded by the several ships of 110 guns, and eventually had three sisters to the same design, though none were ready until the wars with France had ended in 1815. The ship was designed by Sir William Rule. The model shows the ship as designed when laid down in 1805, although as completed the beakhead bulkhead was replaced by Seppings' round bow.

In 1798 Nelson was sent back into the Mediterranean to find out what was happening with a great French force assembling at Toulon under the young general Napoleon Bonaparte. After many ups and downs he found the French fleet of thirteen ships of the line anchored in Aboukir Bay at the mouth of the Nile. He had a similar number of ships, but no three-deckers or frigates. Thomas Foley led the attack in the *Goliath* and passed round the head of the enemy line between them and the shore. It was a devastating attack in which twelve of the enemy ships of the line were destroyed or captured. The balance of power in the Mediterranean changed overnight and a new coalition against the French began to form. Of Nelson's thirteen 74s, eight, including his flagship *Vanguard*, had been built according to the designs of Sir Thomas Slade, in some cases after his death. Two had been designed by his colleague Bateley, two to more recent designs, and only one on the lines of a captured French ship, the *Courageux*. In view of this, it seemed that larger ships had no particular use. St Vincent, now in command of the Channel Fleet, believed 190ft was the '*ne plus ultra*' for the gundeck length of a 100-gun ship, and that 74s should not exceed the 172ft of the *Courageux*. The current surveyor, Sir John Henslow, noted in 1800 that 'there ... appears to be an inclination to return to our former size of 74-gun ships, in particular'.

Nelson fought his next battle at Copenhagen in 1801. Under the command of Sir Hyde Parker, who stood some way off, he led his fleet of two-deckers and frigates into the narrow channel off Copenhagen. As at the Nile, the enemy was at anchor, but he had incorporated floating batteries and shore forts into the defensive line. Some of Nelson's ships, including the *Agamemnon* and *Bellona*, failed to make it to their planned positions and the enemy fire was intense. For a time it looked as if Nelson might for once be defeated, when Hyde Parker ordered a withdrawal, and Nelson famously put his telescope to his blind eye and claimed not to see the signal. A truce was arranged, largely for political reasons, while the issue of the battle was still in doubt. Yet again the French were victorious on land and the British at sea. A new government in London signed the Treaty of Amiens and St Vincent, now First Lord of the Admiralty, was convinced that the peace would last. He began a programme of dockyard reform rather than shipbuilding.



SLR0686

A 74-gun ship of around 1815 on its launching ways, complete with the standard array of launching flags on poles. By that time the black and white colour scheme had replaced the yellow ochre of the 'Nelson Chequer' that became very popular at the time of Trafalgar. The black and white colouring was to remain standard for the rest of the age of sail in the Royal Navy, and it was copied by merchant sailing ships even after that. The model is quite simply made, though more realistic than most in that it does not show any stylised features. It is reasonably accurate, and shows Seppings' round bow introduced in 1810, but not the round stern which came in later in the decade. By this time the beams across the waist have become more permanent and are fitted under the gangway planking. The figurehead is quite small, reflecting the economy of the period, and the rest of the decoration is restrained. The four gunports on the poop are for carronades, as are most of those on the forecastle.

St Vincent was wrong, and the fleet was mobilised again in the spring of 1803. Most of the ships of the line had been laid up 'in ordinary' near the dockyards and they were manned and fitted for sea as quickly as possible. The correspondent of the *Naval Chronicle* marvelled 'to see Britannia's bulwarks, so lately commissioned, towering in all their native pride', as five ships of the line were made ready at Plymouth. The main threat was of a French invasion across the Channel in light rowing craft based in Boulogne, but ships of the line had to be employed to blockade the main French battle fleet in Brest. Nelson's role was more distant, in command of the Mediterranean Fleet, whose main task was to blockade Toulon. He made one contribution to the appearance of ships, by having the sides painted in the 'Nelson chequer', ochre on the sides with black paint on the gunports and the bands between them. After two years, Napoleon realised that he would never gain the superiority he needed in the English Channel unless he lured the main British fleets away. Admiral Villeneuve escaped from Toulon while Nelson's fleet was off station, and headed for the West Indies. Nelson lost a month after he guessed, wrongly, that the French were going back to Egypt, but he made it up by the fast sailing of his fleet across the Atlantic. By May the two fleets were about a hundred miles apart, the British at Barbados and the French at Martinique, when Nelson was diverted south by a false report. In fact, Villeneuve was heading back to Europe and Nelson sent a brig with a message for London. On the way, it spotted the French in the distance and realised that their course was too far north for the Mediterranean. They were planning to join a concentration in the Channel. Charles Middleton, now Lord Barham and First Lord of the Admiralty, made a masterly disposition with a force under Sir Robert Calder to meet Villeneuve off Cape Finistère. The two sides fought a desultory battle in bad visibility in which two French ships were captured – it was a measure of changed attitudes since Hotham's day ten years earlier that Calder was censured rather than praised for this. But the action had the desired effect: Napoleon abandoned his plans for invasion of Britain, and moved his army east to fight Austria.

French and Spanish forces began to gather in Cadiz and Nelson took command of a fleet to blockade them. Though Villeneuve had a superiority of thirty-three ships of the line to twenty-seven, he was rash in coming out of harbour, for

Nelson's men were much more practised at sea. He had developed a new plan of action in which his ships would attack in two columns to cut up the Franco-Spanish line, which was badly formed in any case. The leading ships in each column – Nelson's *Victory* and Collingwood's *Royal Sovereign* – suffered most during the approach in light winds; but once they reached the enemy, each ship passed through the line, raking those on either side of him, then turned round to engage his target. The melee battle which ensued suited the British very well and by the end of the day they had captured seventeen ships and destroyed one – though Nelson was fatally wounded. It was the supreme moment of the British ship of the line, now liberated from the tactical restrictions of the past.

But it did not end the war: the French still had the potential to revive, with shipyards in the Netherlands and Italy in their hands as well as those on their native soil. As one captain put it, 'Another navy, as if by magic, sprang forth from the forests to the sea shore.' The British fleet, on the other hand, was ageing, for there had not been a major shipbuilding programme since the American War – the larger 74s of the 1790s had only been built in small numbers. A new class of 74 was designed by the Surveyors of the Navy in 1806, but they were unimaginative in concept and disappointing to sea officers who later called them 'the forty thieves'. Improvement would come in another way.

Though George Stockwell's apprentice of 1779 was expected to be of 'an ingenious turn of mind', there are signs that other shipwrights made models, especially during their apprenticeships. Robert Seppings began his apprenticeship to John Henslow, master shipwright at Plymouth and future Surveyor of the Navy, in 1782. One of his first efforts was a model of the fore part of a ship of the line which he made as an apprentice. With such a start, he was likely to rise high in the royal dockyard and was assistant master shipwright at Plymouth by 1797. He developed a system for lifting a ship onto blocks in dock and became master shipwright at Chatham at a young age in 1804. Nelson's headlong approach at Trafalgar had shown the weakness of ship's bows, in which the heavy timbers ended at the level of the upper deck. Seppings devised a simple solution in which the frames were carried a deck higher, known as the round bow. This was an obvious solution, but his next major innovation proved more controversial.

Seppings was well aware that the pieces of timber and plank which formed a ship were nearly all at right angles to one another, violating the principle, 'well known to the meanest mechanic', that a triangle is much more rigid than a rectangle.

Seppings devised a four-part system with diagonal braces in the hold, scraps of timber to fill the spaces between the frames in the lower part of the ship, crossed timbers between the gunports and diagonals between the deck beams.



SLR0677

The *Cornwallis* was one of an increasing number of Royal Navy ships built in India to use the supplies of teak to be found there. Later it became common to build one ship while cutting the frames of another, and sail the first ship to Britain carrying the frames of the other, to be erected there. The model was made by the son of the builder, a member of the Wadia family of Bombay. It is to a very large scale of 1:16 and was largely re-rigged after being presented to the National Maritime Museum in 1963. Teak proved very suitable for shipbuilding as is shown by the longevity of the ships built with it. The *Cornwallis* survived long enough to be converted to steam in 1855, and take part in the Crimean War. Later she served as a jetty at Sheerness before being broken up in 1957. The model shows the ship's boats stowed on the beams in the waist, and the stowage for the crew's hammocks in racks round the decks. It is unusual in showing a few figures on deck.



6

NR 61.DIV 2
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Made by
Sir Robt Seppings,
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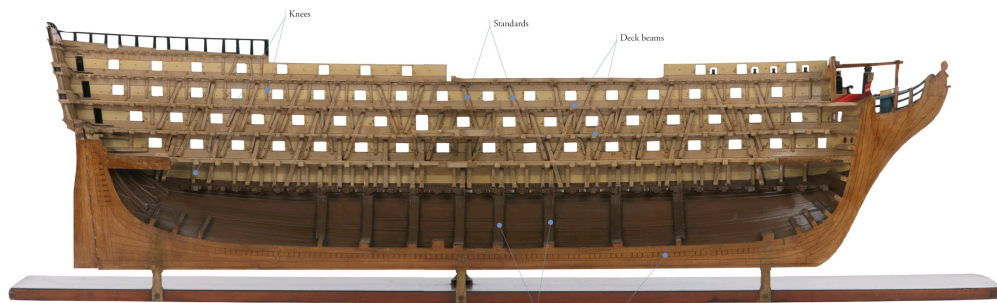
SLR2179

The model of the structure of a ship of the line's bow made by Robert Seppings during his apprenticeship at Plymouth Dockyard in 1780, as described in the inscription. From right to left, it shows: the curved stempost; the hawse pieces, so called from the circular holes for the anchor cables which are shown piercing them – they point directly forward and are parallel to the keel when seen from above; next come the cant frames, which are progressively angled forwards towards the bows. The model stops short of the main framing of the ship, at right angles to the keel. The 'harpin' which is inscribed is a continuation of the ribbands, but carved to shape rather than bent, to form the crucial underwater shape of the bows. In later years Seppings would use models to demonstrate his improvements in shipbuilding, including the 'round bow' that replaced the structure shown in the model.

He was given a chance to test it when the 74-gun *Tremendous* of 1784 was repaired at Chatham in 1811. It was considered very successful, though more traditional officers objected that the frames took up too much space in the hold, and a certain amount of flexibility helped the sailing qualities of a ship. To meet this opposition, Seppings constructed several very large models to show its principles on one side, with the older method on the other. His arguments prevailed and the Seppings system became standard, preventing hogging of the hull and allowing much larger ships to be built in the following decades. Seppings set up the Model Room in the Navy Board headquarters in Somerset House, the first step towards a national maritime museum.

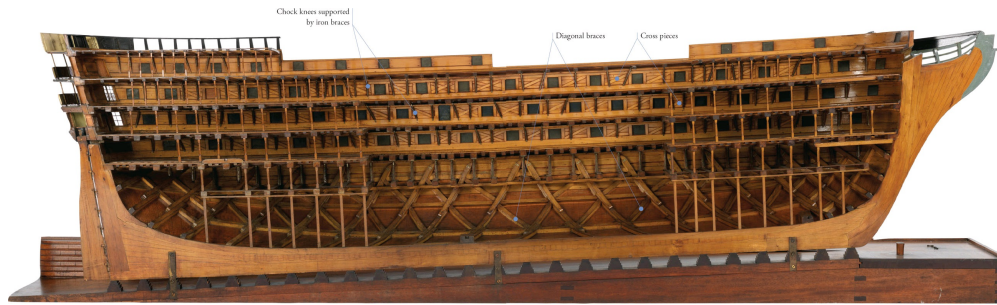
SEPPINGS' BRACES

Sir Robert Seppings' structural changes, centered on his system of 'diagonal bracing', were perhaps the most radical innovation during the age of the wooden fighting ship. They were less visible than his other changes, such as the round bow and circular stern, but they made longer ships possible, and increased the lives of those already afloat. Fortunately for historical research, Seppings had a habit of making 'before' and 'after' models to show the scope of the improvements, and the former are often among the best visual sources for the old system. Otherwise we might be short on information about the internal structure of ships, especially in the hold area, which is rarely seen in Georgian models. Since a major part of its job was to convince fellow shipwrights, Seppings' models tended to be naturalistic, not stylised like Navy Board and Georgian models, and because of their nature and the deep knowledge of their makers they can be regarded as very reliable sources.



SLR0120

The interior of a model of a First Rate showing the old system of construction.



SLR2908

The Seppings system as shown on a model of the *Caledonia* of 1808.

The war was back in its 'elephant and whale' stage, with one side supreme on land and the other at sea. Bonaparte, now crowned Emperor of France, tried to ruin the trade of the 'nation of shopkeepers' by imposing the Continental System in which European ports were closed to British trade. The British replied by blockading every port which operated the system. This demanded a fleet of small ships rather than great ships of the line, and by 1812 the Royal Navy had reached a peak of a thousand ships.

Cracks began to appear in Napoleon's system when Portugal and Spain revolted against it. Land operations in Europe began seriously when HMS *Alfred* of 74 guns landed a scratch force of marines at Figuera on the Portuguese coast in 1808 in support of a local revolt. Sir Arthur Wellesley's army arrived in transport ships soon afterwards, and British involvement in the Peninsular War began. The Duke of Wellington, as Wellesley became, recognised that 'it is our maritime superiority gives me the power to maintain my army while the enemy are unable to do so.' There were more naval operations in 1812 when Sir Home Popham in the north led a squadron headed by the 74s *Venerable* and *Magnificent*, raiding the north coast of Spain, supporting the Spanish guerrillas and diverting the French from Wellington's army at Burgos.

Ships of the line also found new roles at the opposite end of Europe. Nelson's *Victory* was repaired after Trafalgar and recommissioned in 1808 as the flagship of Sir James Saumarez in the Baltic. He used his ships of the line to blockade ports which operated the Continental System and his diplomatic skills to wean Sweden away from the French and towards Britain. This encouraged the Russians, and the Swedish government told him, 'you were the first cause that Russia dared to make war with France.' That led in turn to Napoleon's disastrous invasion and the retreat from Moscow. Wellington's army eventually crossed the Pyrenees while the Russians, Prussians and Austrians advanced into northern France to force the emperor to abdicate. He escaped from Elba and began the 'hundred days' of his second rule, before being defeated by Wellington at Waterloo. He surrendered to the 74-gun *Bellerophon* of 1786, a veteran of the Glorious First of June, Cornwallis's Retreat, the Nile, and Trafalgar.



SLR0680

A relatively simple model of the 120-gun *Nelson* of 1814, one of a trio of ships named after admirals, alongside the *St Vincent* and *Howe*. They were built too late to see active service in the Napoleonic Wars. Designed by the surveyors Sir William Rule and Henry Peake, they were uninspired and were considered to be inferior to the earlier *Caledonia* class, which served as a model for post-war construction. Large ships like these formed a greater proportion of the fleet after 1815. The ship was fitted with an engine in 1859 with a reduced armament of 74 guns, then given to the colony of Victoria as a training ship in 1867, where she served until almost the end of the century and was not broken up until 1928. *St Vincent* became the main training ship for boys in Portsmouth Harbour before being broken up in 1906 and giving her name to the shore base.



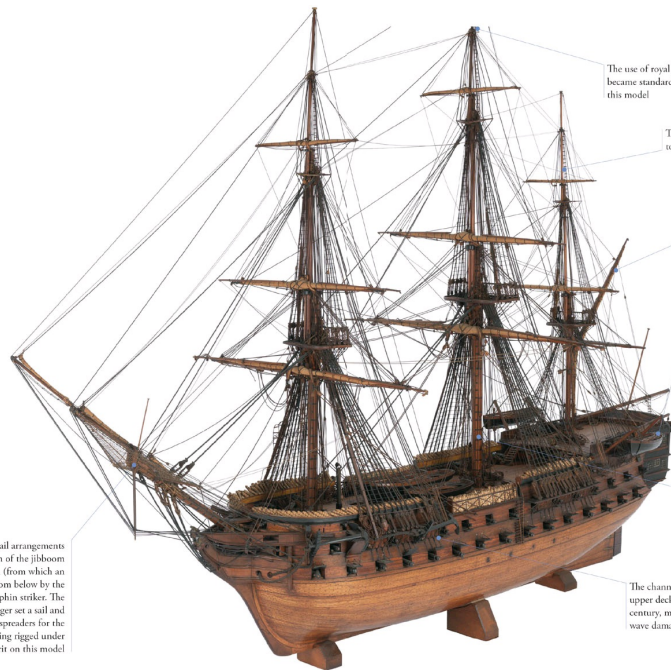
SLR0660

A projected four-decker known as the *Duke of Kent*, as planned by Joseph Tucker, the master shipwright at Plymouth, in 1809 – though the date is far from certain as it, and a plan in the Science Museum in London, show the round bow and stern which were only introduced later. The ship has no poop, presumably to save in topweight, but above the four decks the quarterdeck and forecastle are virtually united by the almost closed waist – though no guns were mounted there. No ship of this type was ever built, though the Spanish *Santissima Trinidad* had four full decks by the time she was lost after Trafalgar in 1805. The Seppings system made it easier to build ships longer rather than higher, while the post-war practice of fitting a uniform armament of 32-pounders also tended against extra decks, so this remains a curiosity. It is difficult to believe that such a high-sided ship would have sailed well.

RIGGING ABOUT 1815: UNIDENTIFIED 74-GUN SHIP

Rigging tended to change only gradually over the years despite the many opportunities to test it in operational conditions. The main innovation, from about 1780, was that the fore part of the mizzen yard was abandoned and it became a gaff, with its head attached to the lower mizzen mast. A spanker boom was added below to spread the foot of the sail more efficiently. The tops at the head of each lower mast became squarer over the years. The ropes supporting the bowsprit from below were now spread by the dolphin striker. More generally, the gap between the fore and main masts remained much larger than that between the main and the mizzen. This prevented the main from masking the mizzen too much when the wind was from aft, and it stopped the yards of the two masts from clashing when they were set in opposite directions during the process of tacking.

Since 1730 (see pages 64–65) the headsail arrangements had been improved by the extension of the jibboom with a spar called the flying jibboom (from which an extra jib was set). This was braced from below by the rigging of the downward-facing dolphin striker. The spritsail yard, therefore, could no longer set a sail and was gradually transformed into spreaders for the bowsprit shrouds. Note the safety netting rigged under the bowsprit on this model.



The use of royal sails above the fore and main topgallants became standard, although the yards are not shown on this model.

The mizzen now carries a topgallant mast.

The most visible change since 1730 was the replacement of the lateen yard with a gaff-headed spanker from the 1780s; this soon had a boom added at the foot of the sail.

Sea-boats on davits over the quarters became common around 1800.

The rope woodings strengthening lower masts were replaced by iron bands when stronger composite 'made-masts' took the place of single-piece spars.

The channels were raised above the upper deck ports in the mid-eighteenth century, making them less vulnerable to wave damage.

ROUND AND ELLIPTICAL STERNS

The shape of the stern was one of the most controversial issues on ship design for a large part of the early nineteenth century. The weakness of the old type was revealed in melee battles such as Trafalgar, and Seppings tried to repeat his success with the round bow by abandoning the old structure of transoms, fashion pieces, counters and so on. But the new round (or circular) stern was far less convenient than the old for the officers who lived there. It was generally regarded as ugly, despite the echoes of seaside architecture of the time. More seriously, it was difficult to protect the head of the rudder. Various other solutions were proposed, including the elliptical stern which produced a much flatter surface and had its quarter galleries on either side, so it looked much more like the older type of stern. Again, models were widely used to demonstrate proposals.



SLR2272

The 'elliptical stern', a compromise between the round and square sterns, as fitted to the *Vanguard* of 1835.



SLR2908

The stern of the *Caledonia* of 1808, showing the old system of closed square stern to the right and the new round stern to the left.



SLR2267

A block model of the round stern of the *Queen Charlotte* as fitted during her Great Repair of 1825–31. It demonstrates how the heavy framing of the side was, in effect, carried around to the stern, leaving only apertures not much larger than gunports instead of large areas of glass and thin transoms.



SLR2236

When the closed stern was introduced towards the end of the eighteenth century, flag officers lost the privilege of a private sternwalk outside their cabin, but this perquisite was re-introduced with the round stern in the form of a wrought iron balcony tacked on to the outside of the structure. This was equally applicable to the elliptical stern, as shown in this model of the screw-propelled *James Watt* of 1858. So strong was the attachment of admirals to this feature that the sternwalk survived on British battleships until the Second World War.

7: The Long Peace

There was no way of knowing that the peace of 1815 was any more permanent than those which had followed past wars, and the Navy continued to plan for the future. Unlike other periods of peace, new ships continued to be ordered for several reasons. First, the recent War of 1812 with the United States had raised new fears. The Americans had not put any ships of the line in service during the war, but their big and well-built frigates had given the Royal Navy a considerable shock, and they were building ships of the line which promised to be as good as the frigates. Second, the Navy had begun building ships in India from 1802, using skilled labour employed by the East India Company and plentiful supplies of teak, a harder and more durable timber than the traditional oak. The first ship of the line, the *Minden* built in Bombay, was not completed until 1810, but the process accelerated after 1815. Three ships of the 80-gun *Canopus* class were built in Bombay and the frames of others were cut out and stowed in the hold for the voyage to Britain, where they were assembled in the dockyards. These ships proved amazingly durable: the *Ganges* and *Asia* lasted into the twentieth century.

Third, the new Seppings system allowed much bigger ships with a given number of decks. The two-decker 80 had appeared occasionally on the Navy Lists through native building or foreign capture but it was only after 1815 that it became standard. Eight of the *Canopus* class, based on a ship captured by Nelson at the Nile, were ordered from 1816 to 1819 and another in 1825. First Rates had been expanding beyond the traditional 100 guns since 1788, when the 110-gun *Ville de Paris* was ordered, followed by the *Caledonia* of 120 guns built from 1797 to 1808, and five more 120-gun ships by 1812. Six more ships of the *Caledonia* class were ordered in 1819–25 and the type was on the way to becoming standard. Seppings designed the first 90-gun ship on two decks, and the *Rodney* was ordered in 1827 with two sister ships soon afterwards. The appearance of the ships was gradually changing over the years. By now they had far less sheer, or upward curve

towards the bow and stern. Tumblehome, the inward sloping towards the centre as seen in a cross-section, was also much reduced. Ships were now painted in a black and white version of the 'Nelson chequer'.

In 1816 the rating system was reorganised so that carronades were now listed among the guns, and more realistic figures were used for each individual ship. Few of them were now called '74s', as most were re-rated as 72s, 76s and 78s. Since there was a wholesale scrapping of 121 older ships of the line after the war, the dominance of the 74 was no longer obvious. The boundaries of the rates were rearranged so that the new 80s, reclassified as 84s, were part of the Second Rate. The remaining Second Rate three-deckers moved up to become First Rate while the Third included only the former 74s, as the 64s were finally scrapped.





SLR0742

In the 1820s and '30s the French began to rebuild their navy with larger ships, as did the Americans, making a British response necessary. The *Rodney* was the first British two-decker mounting 90 guns to be laid down – though her sisters *Nile* and *London* were launched before her. Ships of greater length were possible with Seppings' new system of construction, though Seppings had been supplanted by the time she was launched in 1833. It has the controversial round stern as favoured by Seppings but disliked by many naval officers. The *Rodney* was not regarded as a good sailer,

perhaps because Seppings was more interested in her construction than her lines, and this was later used as an argument in favour of new systems of design. The model is made in bread-and-butter fashion with stump masts and has the rather austere appearance of the age – little sheer or curve in the hull, black and white painting and very moderate decoration.

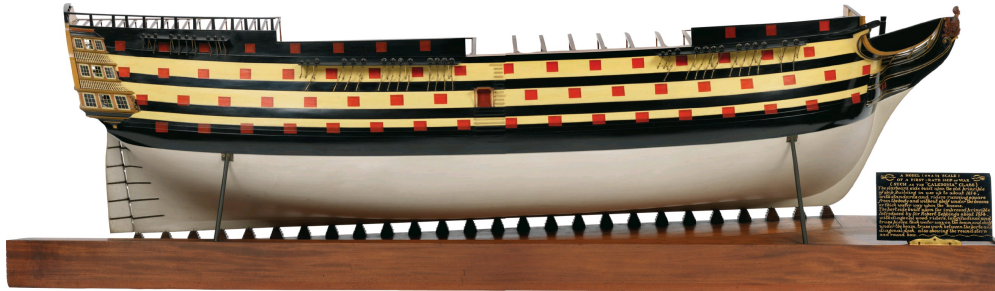
Much more profound was the change in the arming of ships. For centuries ships had carried guns of heavy calibre such as 32pdrs on the lower deck, 24- or 18pdrs on the middle and upper decks and much lighter guns such as 9- and 12pdrs on the forecastle and quarterdeck, until they were largely replaced by carronades. There was a growing tendency to fit 32pdrs of one kind or another on all decks, with conventional long guns on the lower decks, shorter versions on the middle and upper decks, and carronades on the upperworks. It was difficult to apply this to older ships, but the *Rodney* class had an all-32pdr armament, apart from two even larger carronades, and the revived *Caledonia* class was close to it. This was combined with a much greater interest in the techniques of gunnery after the shock of the War of 1812. HMS *Excellent*, the old 74 in which Collingwood had followed Nelson at the Battle of St Vincent in 1797, was set up as the gunnery school at Portsmouth.

There was no great naval war in the decades after 1815, but in 1816 a fleet under Edward Codrington bombarded the corsair city of Algiers, which provided some lessons in gunnery. There was only one naval battle, at Navarino in 1827, when a British-French-Russian force destroyed a much inferior Turkish one. Perhaps because of the shortage of real experience, controversies over ship design became more intense than ever before.

Seppings was well aware that the stern of a ship of the line, built with a very light structure and pierced with windows for the comfort of the officers, was even weaker than the old-style bows. It had not mattered much during the days of the rigid line of battle, but with the general policy of breaking the line it might become a serious weakness. He devised a 'round stern' in which the main structure was continued around and across the stern, with only small holes for doors and windows. This proved far more controversial than any of his other innovations, partly because it interfered with the comforts of the officers and was regarded as ugly. Seppings made a number of models to help promote the round stern. It might have succeeded better in wartime, but during the long peace, comfort and beauty were easier to sell.

On the whole, Seppings was more interested in the structure of the ships than their underwater lines and sailing qualities. His *Rodney*, which was finally

launched in 1833, was regarded as 'a fine warlike ship, but not a very superior sailer'. Meanwhile, according to the late nineteenth-century American naval strategist A T Mahan, 'The naval officer came to feel more proud of his dexterity in managing the motive power of his ship than of his skill in developing her military efficiency.' This was especially true in a long period of peace when speed was easier to measure than fighting qualities. Sir William Symonds, a naval officer himself, challenged orthodox naval architecture with a wedge-shaped, wide-beamed hull section which allowed greater speed. He had used it in his yacht *Nancy Dawson* while stationed in Malta in the early 1820s, and in 1825 the Admiralty was persuaded to build the corvette *Columbine* to his design. Symonds gained royal patronage from the Duke of Clarence, later King William IV, and political support from friends in the Whig party which came to power in 1830. He was allowed to build the 50-gun frigate *Vernon* in 1831.



SLR2908

This is the exterior of the *Caledonia* model that splits apart to demonstrate the system of diagonal bracing on one side, creating a far more rigid hull. While the model was used to establish the principle of diagonal bracing, the ship herself was a highly successful design that formed the basis of most of the three-deckers built after 1815. The *Royal George* was built to her design, while five more ships were built to a broadened version between 1819 and 1829 – a large number of First Rates considering the restricted budgets of the time, but reflecting a general move towards larger ships. The *Caledonia* herself became the hospital ship *Dreadnought* moored off Greenwich in 1856 and served in this role until she was broken up in 1875.

After the Great Reform Act of 1832 there was a general desire for change, which reached into the naval administration. The old Navy Board which had run shipbuilding and the dockyards since the days of Henry VIII was hated by naval officers and was abolished. Seppings was removed as Surveyor of the Navy and replaced by Symonds, the first nonshipwright to hold the post since the days of Charles II. Orthodox naval architects regarded it as an attack 'not only upon the professional naval architects, but upon the profession of naval architecture itself.' But Symonds employed the naval architect John Edye to execute the details of his designs.

Symonds' first ship of the line was the 80-gun *Vanguard*, ordered in 1832 and completed three years later. She was followed by eight more 80s and the 90-gun *Albion* launched in 1842. The largest ship completed to his designs was the 110-gun *Queen* of 1839. Symonds and his supporters collected testimonials to the sailing qualities of the ships. The commander of the *Vanguard* wrote, 'I am unable to do justice to all her good qualities as a man-of-war, I never saw a ship so perfect in every respect.' The captain of an accompanying ship confirmed, 'the *Vanguard* hauled out of the line just like a cutter, and went away to windward of the whole squadron, and was six miles on our weather beam in 3½ hours.' The ships were tested many times against rival designs in the English Channel and the Mediterranean over the next decade.



SLR0738

The *Vernon* was rated as a 50-gun frigate and was William Symonds' first large ship – at 2080 tons she was almost as big as a three-decker of the mid-eighteenth century such as the *Victory*. She carried most of her guns on a single deck in true frigate fashion, with more on the forecastle and quarterdeck. With a wide beam and triangular midship section below the waterline, she set the pattern for larger ships that were to follow, including two- and three-deckers. However, at the time it was suggested that a large frigate like the *Vernon* would make smaller ships of the line, including 74s, obsolete. However, she was built too quickly and soon deteriorated. She eventually became well known as the torpedo training ship at Portsmouth, a name that survived until late in the twentieth century. The model follows the established pattern of bread-and butter construction with a rather plain appearance.

Symonds' designs were highly divisive, both in the Navy and in politics, and the controversy became increasingly bitter. His supporters accused his enemies of 'falsehoods and calumnies', and wrote of the 'venomous reptile' of conventional naval architecture. It was claimed Symonds was 'the Luther of naval architecture, the great reformer of our naval marine', though the anonymous author of *Sir William Symonds' Principles of Naval Architecture Vindicated* also wrote with slightly more modesty, 'I do not pretend that he has carried the art of ship building to the point where improvement stops.'







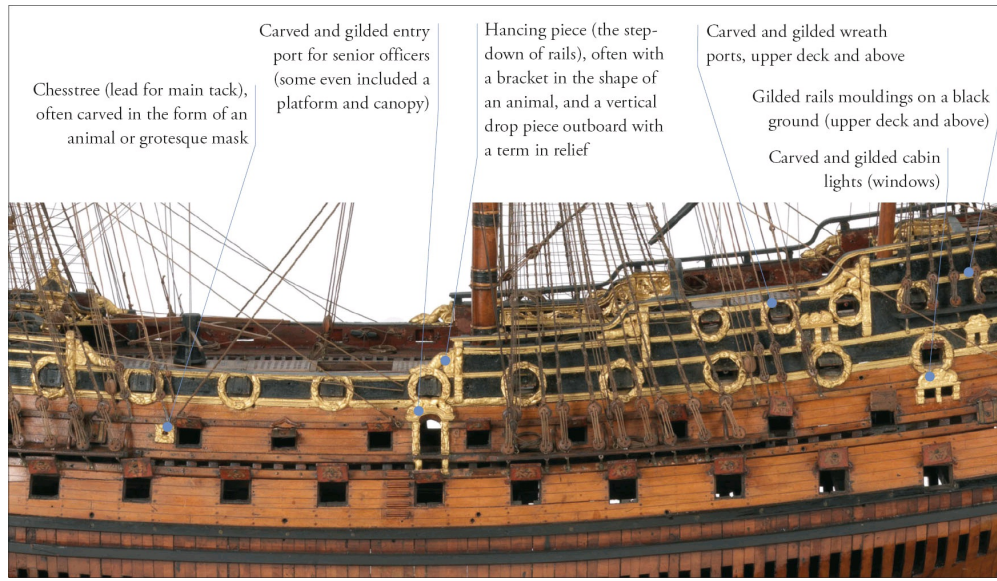
SLR0750

The *Vanguard* of 1835 was Symonds' first ship of the line, carrying 80 guns on two decks, but with the Seppings structural system she was much more successful than the ships of the 1690s. She soon became known as the fastest ship in the Mediterranean Fleet, though very sensitive to alterations in trim and hold stowage. Like most Symonds designs, she had excessive stability, which meant that she recovered from a roll too quickly and was not easy to use as a gun platform. Nine ships of this

class were built between 1833 and 1848, the largest number to any Symonds plan for a ship of the line. It was on the way to becoming the standard ship of the line before Symonds was replaced just as steam took over. The *Vanguard* herself was never converted to steam but seven of her sisters were. It is characteristic of the period that the black and white stripes were carried forward over the head on the model, though the small figurehead is picked out in gilt. The stump masts are also conventional for this period.

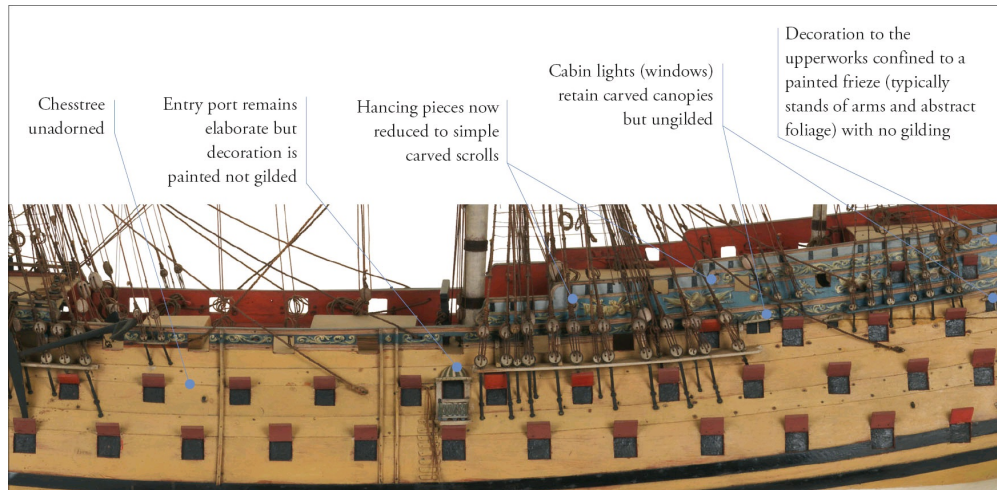
DECORATION: THE BROADSIDE

As the decoration of warships was reduced over two centuries, the broadside suffered a more rapid and radical decline in artistic attention than either the bow or the stern, where the instinct to embellish survived longest. The most significant watershed was an order of 1703 greatly reducing the amount of carving, reinforced by later restrictions until in 1796 the dockyards were instructed to ‘explode carved works altogether’. The frequency of such orders suggested they were not followed to the letter, but nevertheless the trend was for ever-more austere topsides.



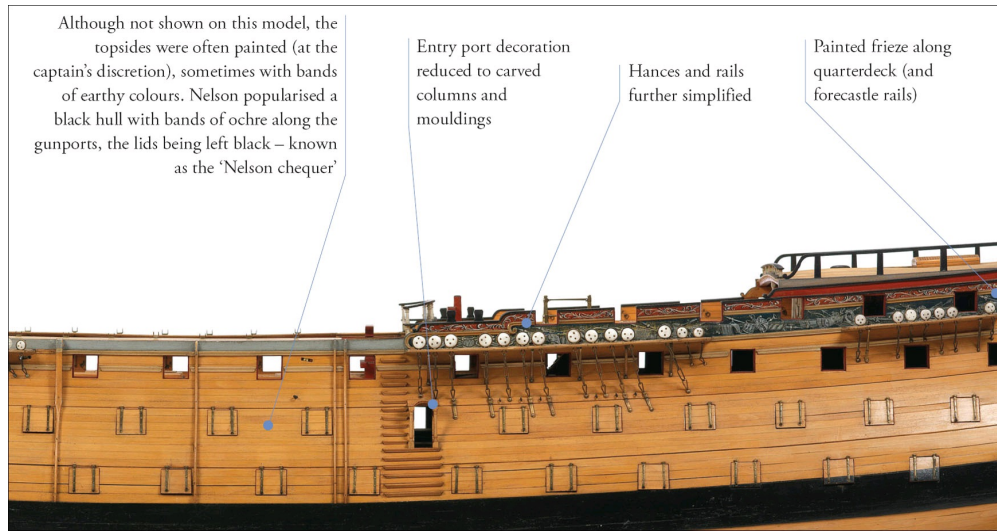
SLR0003

90-gun ship of 1675



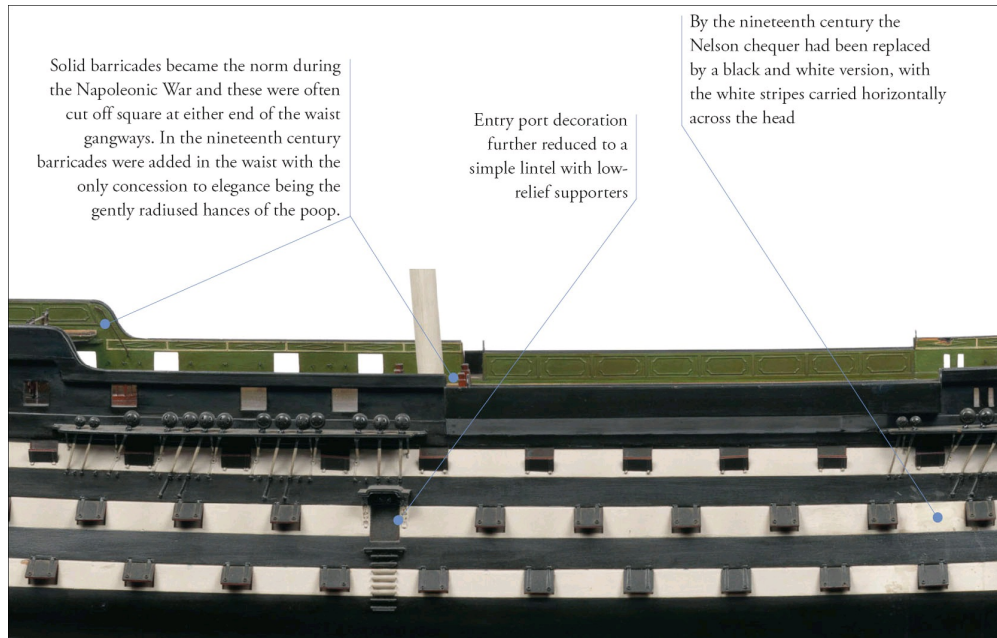
SLR0401

100-gun ship of about 1719 – the effects of the restrictive order of 1703



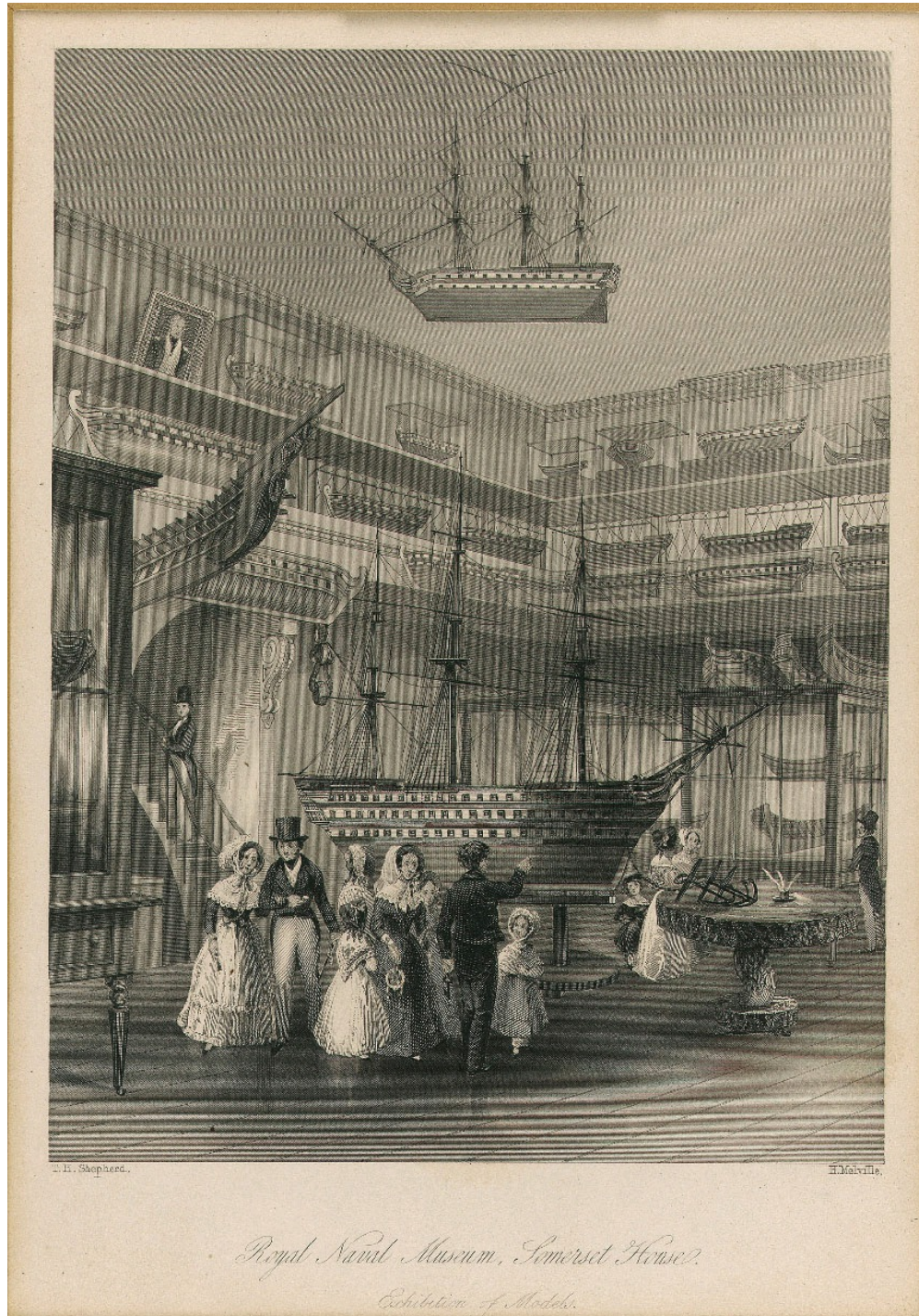
SLR0555

Queen Charlotte, 100 guns, 1789



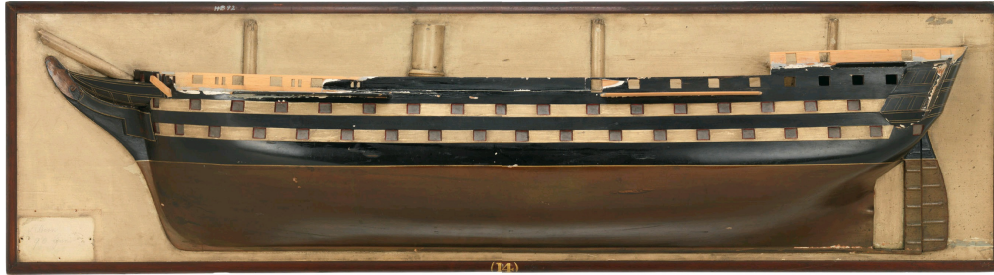
SLR0778

Queen, 110 guns, 1839



The Model Room at Somerset House, as drawn by Melville and Shepherd and published in 1842 during the Symonds era. Most of the visitors are women and girls, though the young man on the far right might be a prospective midshipman. A uniformed warder holding a key shows them around. The model in the centre is Symonds' *Victoria*, although the ship herself was still being built. There is at least one Navy Board model, and some sectional models, though the artist does not have much feel for the shape of a ship and it is difficult to identify them. The main function of the Model Room by this time was to show the value of Symonds' designs,

though for most visitors the message was probably lost among a plethora of objects. (© *National Maritime Museum PAI8820*)



SLR0805

HMS *Albion* of 90 guns, launched at Plymouth in 1842, represented by a typical 'half-block' model of the type hung on the walls of the Model Room at Somerset House. This was a style that became common not just in the Navy but also with commercial shipbuilders and shipping lines of the time, as it was economical of labour, materials and space. It did not allow much opportunity to show deck details and it was usually viewed from a distance so even the exterior details are rather basic. The *Albion* was Symonds' first very large two-decker, but by that time officers were more aware of the difficulties caused by 'deep and quick rolling', and she was even more difficult to ballast well than other Symonds ships. Political changes ensured that projected sister ships were heavily modified, and then they were fitted with steam. The *Albion* herself was converted in 1861, by which time the concept of the wooden ship of the line was rendered obsolete as the ironclad *Warrior* was launched.



SLR0514

A model of Nelson's *Victory* in her original state of 1765, as shown for historical purposes in the Model Room. According to the catalogue it was in the main gallery, displayed 'under glass cases with stands, round the gallery'. It was presented by the Duke of Northumberland, a well-known sponsor of lifeboat design, in 1828. It shared the case with seven other models, including one of the *Sovereign of the Seas* of 1637 commissioned by Seppings, a 64-gun ship of 1760, several frigates and a sloop, for at this time the *Victory* had not yet achieved her great fame, despite her role in the Battle of Trafalgar. It is similar to the model that misleadingly depicts the ship on her launching ways, including the scale of 1:60; it may be a nineteenth century copy of it, including the elaborate figurehead. It is shown on a launching cradle but the launching ways are not present.

The Model Room at Somerset House was founded by Seppings, but as Symonds' biographer wrote, 'Sir William Symonds may claim to be its real founder; and he continually manifested a strong and lively interest in its progress.' It exhibited vast collections of timber samples collected by Symonds, models of ships' fittings and many other items, but at its heart was a vindication of his principles. 'Among the models of ships, which number altogether about *three hundred*, are models of all the Surveyor's best ships, the *Queen*, *Vanguard*, *Albion*, *Vernon*, *Pique* &c. The *Queen* is shown fully rigged, and she and others are also given in sections, showing their internal fittings, the form of the bows, stern, &c.' The central room was dominated by a huge model of the 110-gun *Victoria*, sister ship to his masterpiece, the *Queen*. It was made to 1:24 scale, twice the normal size – the ship was building in Pembroke Dock, but was not completed until 1858 after being fitted with a steam engine and renamed *Windsor Castle*. Symonds commissioned a dozen models of 'British ships of the old class', including Nelson's *Victory*, the 120-gun *Caledonia* and the 80-gun *Foudroyant*. Alongside them was a case of eleven 'British Ships by Sir William Symonds', including the *Victoria* of 110 guns, *Albion* of 90 and *Cumberland* of 80. Full use was made of half-block models, which took up less space and could be displayed round the walls. Symonds' name appeared throughout the catalogue of the gallery. Seppings was mainly represented by his structural improvements, not his ship design. These included models of the unpopular circular stern, so the message was not entirely in his favour. There was only one traditional Navy Board style model in the museum, but about two dozen seemingly original block models from the eighteenth century.

In the past, modelmakers had been largely hidden from history, but now they began to feature in the official records. From 1814 'solid makers' were recognised as 'single stationed men' in the dockyards, and at Chatham they worked in one of the guard towers in the dockyard wall. Sometimes they were sent to London to help with the Model Room, and in 1839 David Harvey was appointed modelmaker at Somerset House, where Edward Elgar was employed as model painter. The models themselves, however, were generally less stylish and more functional than the old Navy Board or Georgian models, reflecting the plainer style of the ships

themselves. They were a step towards the builders' models used by the shipyards in the second half of the century to attract custom.



SLR0778

The *Queen* of 1839 was Symonds' only three-decker and he regarded it as his masterpiece. The ship's performance attracted praise from many commanders, but it was the subject of even more political controversy than his other designs. He commissioned many models of it, including this full hull version to the conventional scale of 1:48, a half-block model (SLR0071), the round bow, which was perhaps used to design the figurehead (SLR2193), and a later design of 'elliptical' stern which was a compromise between the old pattern and the unpopular round stern (SLR2252). It has one side shown planked with quarter galleries, while the other has the form of the various timbers indicated in paint. The ship took part in the Crimean War and was damaged in the Bombardment of Sevastopol in 1854. That affair confirmed that ships should not be sent into action without steam and another model shows her converted in 1859 (SLR0779), though that was not part of Symonds's plan and he had been replaced by that time.

Symonds was only one of the ship designers who tried to find a suitable replacement for Seppings' round stern. His 'elliptical stern' was partly a return to the old appearance, while trying to retain as much of the strength as possible. Other designs were produced by shipwrights such as John Tucker, joint Surveyor of the Navy with Seppings, and most were backed up with a variety of models.

Eventually, both political and naval factors turned against Symonds. The Tories (soon to become the Conservative Party) returned to power and his influence was reduced. Meanwhile, the ships reacted too quickly to waves and winds, and rolled uncomfortably. According to Admiral Napier, the old 120-gun *St Vincent* rolled 60 times an hour with a maximum of 12 degrees to leeward and 4 degrees to windward. Symonds' beloved *Queen* rolled 201 times, 14 degrees to leeward and 11 to windward. Such movement would make a ship a very unsteady gun platform and greatly reduce her fighting qualities. Some were modified against Symonds' wishes and he was retired in 1846. A much greater change in warship design was already in hand.

The steam engine was greatly improved by James Watt after he worked on a model of an old-style Newcomen engine at Glasgow University in 1764, and had the idea for the separate condenser which doubled efficiency. The paddle steamer became practicable when Henry Bell's *Comet* plied the River Clyde in 1812. The Navy was not nearly as obstructive about the steamship as legend suggests, and there were good reasons for not applying it to the ship of the line in the early days. Engines were bulky and tall, they would take up a good deal of space in the centre of the ship, and would be damaged very easily in battle, while creating a serious fire risk in a wooden ship.

Moreover, the only known way of transmitting the power was by paddle wheel, which would constrict perhaps half of a ship's broadside and totally destroy its function as a gun platform. Steam tugs could pull ships in and out of harbour and perhaps take them into battle, and paddle frigates were built from 1821 onwards, but the ship of the line had to await a new form of propulsion. This came with the screw propeller, invented separately by Francis Petit Smith and the Swede John Ericsson in the 1830s. A famous test between the paddler *Alecto* and the screw ship *Rattler*, of equal size and engine power, was used to show that the

screw was superior. In 1846 the first ship of the line to be fitted with steam power was the *Ajax*, launched in 1809 as the first of the 'forty thieves'. She was intended originally as a floating battery for harbour defence, but the Crimean War of 1854–6 showed that sailing ships were no longer useful even for shore bombardment, unless taken into place by a steam tug. Soon even greater changes were afoot with iron and then steel hulls, guns in turrets, shells instead of solid shot, armour plate and the abandonment of sail power in battleships. The age of the ship of the line was over.

Apart from HMS *Victory* at Portsmouth, the collection of models in the National Maritime Museum at Greenwich is the best representative of the period when the Royal Navy dominated the seas with the ship of the line.



SLR0104

With a length of 245ft and a beam of 61ft, the *Marlborough* was one of the largest wooden ships to serve in the Royal Navy. During construction she was lengthened and broadened from an original Symonds design in order to accommodate a steam engine. She was intended for 131 guns and her long regular rows of ports look almost industrial, lacking the romance of the *Victory* of 100 years earlier. The steam engine was still only an auxiliary to sail and her two-bladed propeller was designed to retract upwards when not in use to improve sailing. She represents the end of the old sailing navy, and the start of even bigger changes which were to come with the introduction of iron and then steel, rifled shell-firing guns and armour plate. She ended her seagoing service when she became an engineering training school in 1877, and later sank in 1924 while being towed to the breaker's yard.

Further Reading

The primary source for the early seventeenth century is *The Autobiography of Phineas Pett*, edited by W G Perrin and published by the Navy Records Society in 1917. The origin of the line of battle is discussed in a pioneering article by L G Carr Laughton, 'Gunnery, Frigates and the Line of Battle', in *The Mariner's Mirror*, Vol XIV (1928). This helped to inspire my own paper, 'The Revolution in Naval Tactics', delivered at the Sorbonne in 1984 and published in Martine Acerra and Jean Meyer (eds), *Les Marines de Guerres Européennes* (Paris 1985). That in turn had some influence on Nicholas Roger's 'The Development of Broadside Gunnery', *The Mariner's Mirror*, Vol 82 (1996). The theme is reflected in his more general naval histories, *The Safeguard of the Sea* (London 1997) and *The Command of the Ocean* (London 2004).

The ships of Charles II's navy are described and beautifully illustrated in Frank Fox, *Great Ships* (Greenwich 1980). I attempted to cover the whole history of the ship of the line in *The Ship of the Line* (2 vols, London 1983-4). Since then the story has been supplemented by David Lyon's *The Sailing Navy List* (London 1993), which goes beyond the title and includes draughts of all the major classes and important individual ships; and in Rif Winfield's *British Warships in the Age of Sail 1793-1817* and *1714-92* (Barnsley 2005 and 2007), *First Rate: the Greatest Warships of the Age of Sail* (Barnsley 2010) and *The 50-Gun Ship* (London 1997).

For the hull design of ships in the early period, see Richard Barker, 'Cradles of Navigation', in *Limites do Mar e da Terra* (Cascals 1998), 'Many May Peruse Us', in *Revista da Universidade de Coimbra*, Vol 34 (1989), and *Portuguese Shipbuilding: From Genoa to Goa via Geometry. Deane's Doctrine of Naval Architecture, 1670* (ed Lavery, Greenwich 1981) is the earliest complete text on the subject and helps to show how draughts could be used for modelmaking. The later story is taken up in the aforementioned *Ship of the Line*, Vol 2, [Chapter 1](#).

SHIP MODELS

Many books have been published on the techniques of ship modelling, and the subject is covered in the volumes *Model Shipwright* (1972 to the present). The study of ship models, however, does not command more than a tiny fraction of the work devoted to maritime painting. One of the first tasks, early in the twentieth century, was to catalogue the contents of the major collections. The Science Museum's collection was described by G S Laird Clowes in *Sailing Ships, their History and Development*, 2 vols (1932). The extensive National Maritime Museum collection was first catalogued by R C Anderson in *Catalogue of Ship Models* in 1952, and the earlier part was described more extensively by A H Waite in *Ships in the Western Tradition to 1815* (1980). The collections of the City of Liverpool Museums (now part of Merseyside Maritime Museum) were listed by E W Paget-Tomlinson and R B Smith in 1967. The Annapolis collection is covered by United States Naval Academy Museum, *Henry Huddleston Rogers Collection of Ship Models* (Annapolis 1971). More recently, Arnold and Henry Kriegstein have published *17th and 18th Century Ship Models* based on their own collection, and Simon Stephens has catalogued and described ship models in the Thomson Collection in the Art Gallery of Ontario (2008).

R C Anderson was perhaps the first to use ship models as a research tool and he published his work in many articles in *The Mariner's Mirror*. In *Navy Board Ship Models 1650-1750* (London 1989) John Franklin described twenty-six models, nearly all ships of the line, in some detail and with a great deal of insight from his experience as a modelmaker, supplemented by research in the archives. Brian Lavery and Simon Stephens, *Ship Models: Their Purpose and Development from 1650 to the Present* (London 1995) is based on the National Maritime collection but attempts to put it in context and look at the general history of ship models. Robert Gardiner's, *The Sailing Frigate*, in the same series as this volume, uses the models to tell a story.