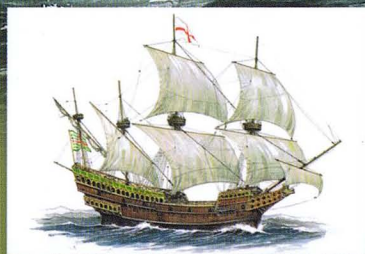
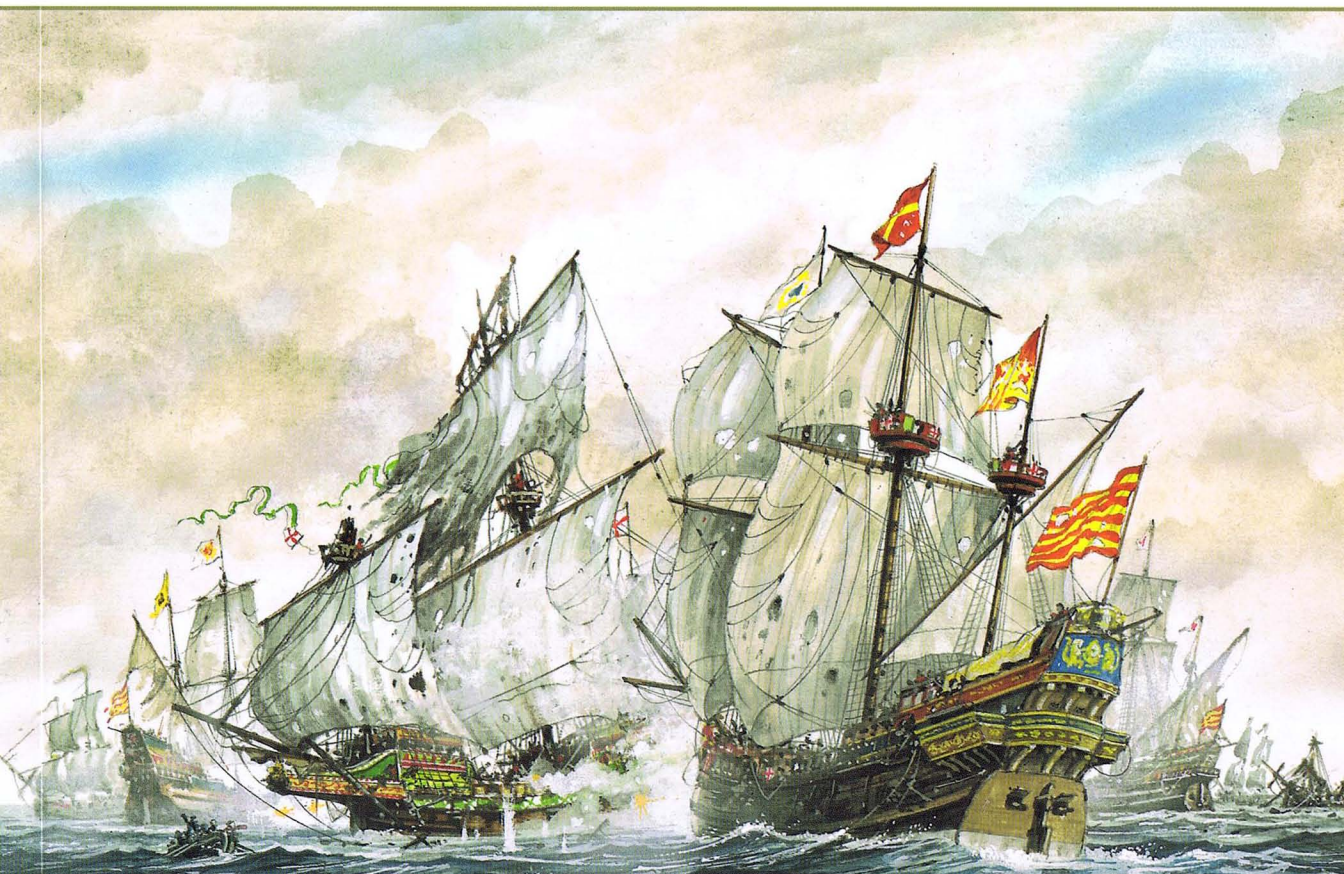


TUDOR WARSHIPS (2)

Elizabeth I's Navy



ANGUS KONSTAM

ILLUSTRATED BY TONY BRYAN

ABOUT THE AUTHOR AND ILLUSTRATOR

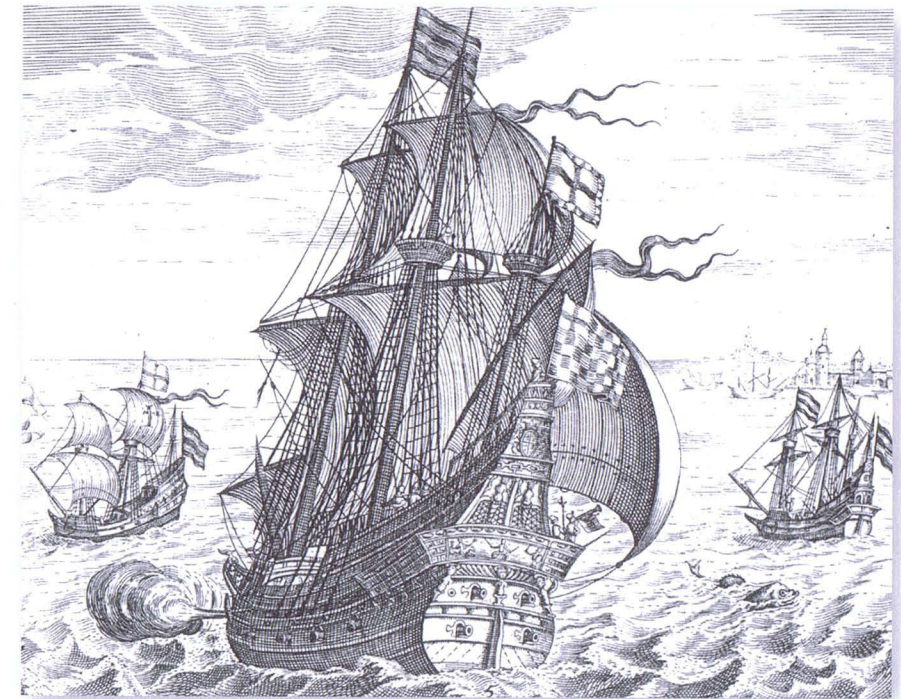
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EDITOR'S NOTE
For ease of comparison between types, imperial measurements are used almost exclusively throughout this book. The following data will help in converting the imperial measurements to metric:
1 mile = 1.6km
1lb = 0.45kg
1 yard = 0.9m
1ft = 0.3m
1in. = 2.54cm/25.4mm
1 gal = 4.5 liters
1 ton (US) = 0.9 tonnes

GLOSSARY

<i>Bowsprit</i>	A large spar projecting out over the bow (or stem) of the vessel.
<i>Forecastle</i>	Pronounced fo'c'sle, this refers to the castle-like structure built over the bows of the ship, used to house soldiers or weaponry during a battle. The name reflects their perceived value as defensive redoubts if a ship was attacked.
<i>Keelson</i>	An internal keel (or stringer), bolted to the top of the keel to provide additional strength and support to the hull.
<i>Lateen-rigged</i>	A lateen sail was a narrow, triangular sail, first developed in the Mediterranean, the forward end of which pointed to the ship's deck, and the other end terminated in a high peak. A lateen-rigged mast was one fitted exclusively with a lateen sail.
<i>Mainmast</i>	The main mast of the ship.
<i>Mizzen</i>	A mast sited behind the mainmast on a sailing ship. In some Tudor ships this was the aftermost mast on the ship, while on some larger vessels another even smaller mast – the Bonaventure mizzen – was set behind it.
<i>Mothballed</i>	A modern naval phrase, reflecting the situation when a ship was stripped of its rigging, guns and stores. In this condition it was kept at anchor and maintained by a skeleton crew. In effect it was being kept in storage, or 'kept in mothballs'. A more contemporary phrase was that the ship was being kept 'in ordinary'.
<i>Sterncastle</i>	The after version of the forecastle, situated behind the waist of the ship.
<i>Topsail</i>	The topmost sail on a mast.
<i>Transom Stern</i>	A name given to the flat stern of the ship, taking its name from the horizontal timbers bolted to the sternpost of the ship to produce this flat stern.
<i>Tumblehome</i>	The inward-sloping curve of a ship's hull, where the sides of the ship are brought inwards towards the centreline of the vessel, from the widest point of the ship's beam – which is usually along the waterline. This made the width of the main deck narrower than that of the lower decks.

AUTHOR'S NOTE
Unless otherwise noted, all images are from the Stratford Archive, a private photographic collection held in trust by a group of historians.

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THE TUDOR WARSHIP (2)

ELIZABETH I'S NAVY

INTRODUCTION

When most people think of Elizabethan warships, they imagine the sleek, fast Tudor vessels that took on and beat the Spanish Armada of 1588. The popular image is one of David and Goliath, where the smaller, nippier English ships outmanoeuvred, outgunned and outfought a foe set on invasion and conquest. While elements of this perception are true, few people realize that some of the English ships were far larger than many of their Spanish opponents, or that however good their gunnery might be, the English were unable to halt the Spaniards' progress down the English Channel, or to break their battle formation.

What is true is that the fighting strength of the English fleet centred around a handful of royal ships, whose experienced captains knew that they had the best tools at their disposal to defeat the Spanish. These were the so-called 'race-built' Elizabethan galleons, which had been purpose-built to combine speed and manoeuvrability with firepower. Such vessels represented a new kind

of warship, one that incorporated a number of innovations that would transform naval warfare. In effect, these Tudor warships were the prototypes of the powerful ships-of-the-line that would appear during the century that followed. The men who fought in them developed doctrines of naval warfare that would stand their ancestors in good stead.

Inevitably, a concise history such as this lacks the space for an exhaustive examination of the subject. This limitation, however, means that we can cut to the heart of the topic, while the detailed artwork compensates for the brevity of the text. In this case, we hope to strip away the popular myths of the Elizabethan age, and leave behind a lean but substantial core of fact.

DESIGN

The Evolution of the Elizabethan Warship

The fleet inherited by Henry VIII's daughters Mary and Elizabeth was essentially a modern one, where the main fighting force – in effect the 'battleships' –

were the 'great ships' or *carracks* that were similar to the ill-fated *Mary Rose*, which sank off Portsmouth in 1545. However, the last great ship to be built in England was the 450-ton carrack the *Pauncy*, which entered service in 1543. During the last few years of his reign Henry VIII concentrated on rebuilding his existing ships in order to allow them to carry modern ordnance rather than building new major units from scratch. The most significant of the refits was the rebuilding of the 800-ton *Great Galley* as the 500-ton *Great Bark*, the second Tudor ship to bear the same name. This policy of refitting rather than rebuilding was then continued by Henry's young son Edward VI, who reigned from 1547 to 1553. Thus at the accession of Mary I in 1553 the Navy Royal was a relatively up-to-date force, albeit an ageing one.

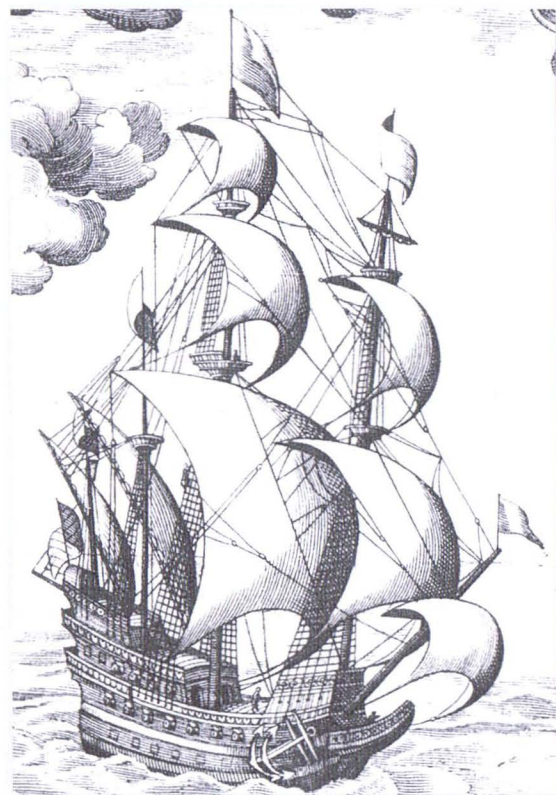
As a Catholic, Mary allied herself with Spain, and consequently English warship designers and shipwrights were able to study Spanish ship design at first hand. While in general the Spanish royal warships resembled those of other northern European maritime powers, a new ship type – the *galleon* – was beginning to appear in the Spanish royal fleet. Put simply, the galleon represented a new evolutionary step in Iberian ship design, drawing on characteristics of the carrack (known as the *nao* to the Spanish) and also the *carvel*, the archetypal ship of discovery during the late 15th and early 16th centuries. Compared to the carrack, the galleon was often characterized by a longer hull, a lower forecastle and a square-tucked stern. In effect they were longer, leaner and more stable than the Spanish ships that preceded them, a fact that runs contrary to the commonly accepted view of Spanish galleons. While large 1,000-ton Spanish galleons existed, the majority displaced less than 300 tons.

The first galleons appeared during the 1520s, and they were primarily used to transport specie from the New World to Spain. By 1554, however, when the Anglo-Spanish alliance was cemented by the marriage of Mary of England and Prince Philip (later Philip II) of Spain, Spanish galleons formed part of the main Spanish royal fleet. It was inevitable that English shipwrights

One of several depictions of the engagements of the Spanish Armada campaign, this view shows the English fleet harrying the rear of the Spanish formation on 4 August 1588. 'Dunne Nose' is now called St Catherine's Point, on the Isle of Wight. Engraving by Claes Visscher.

The elder Queen Elizabeth I (1533–1603), from an engraving produced in the 1580s. Following her accession in 1558, she embarked on a 'Cold War' with Spain that would last for almost three decades before it turned into open war.





An English galleon of the 1550s, reproduced in Wilhelm Dilich's *Kriegsbuch* (Frankfurt, 1610). With its high but elegant sterncastle and pronounced beak, the vessel depicted is similar to the three galleons built on the order of Mary I (Author's collection).

would learn what they could from these Catholic visitors. During her five-year reign Mary ordered the construction of three English-built galleons, the first real departures from the great ship or carrack designs constructed under the orders of her father. These ships, the 550-ton *Philip & Mary* (1554), the 600-ton *Mary Rose* (II) (1556) and the 600-ton *Golden Lion* (1557), represented a new phase in English warship construction. The importance of these vessels has long been overlooked by historians, largely due to a combination of Elizabethan propaganda and English national pride. The truth is, the English race-built galleons associated with Drake, Frobisher and Hawkins were all developed from prototypes which followed the designs of warships built for the Spanish.

The great advantage of the galleon design over that of the carrack was that the former had a more pronounced tumblehome, which moved any guns the vessel carried closer to the ship's centreline. This not only increased stability, but in theory it also allowed larger guns to be carried. The second main difference was in the height of the superstructure. We can see from the *Anthony Roll* of 1546 just how high the superstructure was on Henry VIII's major warships. The *Anthony Roll* was a visual

representation of the Tudor fleet drawn up by Anthony Anthony, a clerk in the Ordnance Office. While archaeological evidence from the *Mary Rose* suggests that this superstructure might have been over-emphasized by the artist, it is widely accepted that the ships that immediately followed these English carracks into the Tudor Navy Royal had a lower superstructure.

Another instantly recognizable feature was the bow. In the majority of carracks depicted in the *Anthony Roll*, a high forecastle extended far beyond the stempost, a little like the fighting platforms seen on late medieval ships. Galleon forecastles, by contrast, ended at the stem. A lower but pronounced beak, fitted to the bowsprit, then extended forward from the stempost and provided a working space for crewmen manning the sails. The sail plan itself remained the same, with a foremast and mainmast fitted with square sails, and a mizzen mast and possibly a fourth smaller Bonaventure mizzen mast behind them, carrying fore-and-aft rigged or lateen-rigged sails.

It has been suggested that the three galleons built during Mary's reign drew upon English as well as Spanish influences. After all, the *Great Bark* that was rebuilt in 1543 was later referred to as the *Great Galleon*, which suggests the galleon influence predated the building of the *Philip & Mary*. However, no evidence has been found to support this theory, save the name. It might be safer to assume that the *Great Bark*, which was a rebuilt galleass (confusingly called the *Great Galley*), simply had a length to breadth ratio more akin to these new galleons than to the rest of the contemporary Tudor fleet. In other words, these three ships were markedly different from everything that had come before. In fact, the conversion of the *Great Bark* might well have inspired a similar refit to be ordered to six of the smaller galleasses in the Navy Royal, as in 1558 the 300-ton galleasses *Hart*, *Antelope* and *Swallow*,

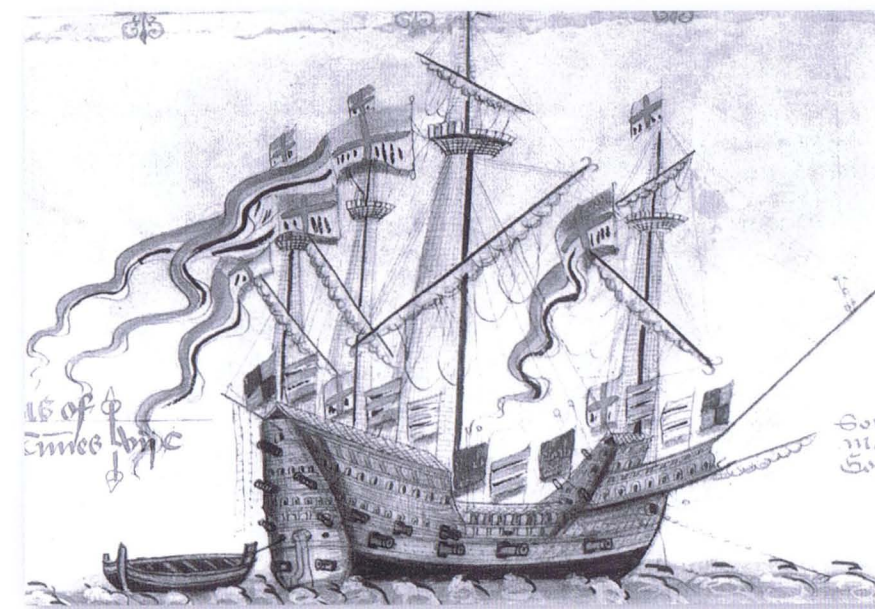
as well as the smaller vessels *New Bark*, *Jennet* and *Greyhound*, were all rebuilt as small galleons, following the Spanish model.

Much has also been made of the difference between the armament of English and Spanish ships during the Elizabethan period. In fact the groundwork for the English operational advantage in gunnery had already been laid during the reign of Henry VIII, as proved by several of the guns and carriages recovered from the *Mary Rose*. It has to be supposed that even as early as 1557, English commanders would have regarded their own gunnery system as superior to that of their new-found Spanish allies, and consequently would have armed their ships following the accepted English pattern. What these new ships did was to raise the possibility of using the ships and their armament in a different way. It is therefore ironic that it was the Spanish themselves who provided the means for English naval commanders to develop the 'stand off' gunnery tactics that would stand the Navy Royal in such good stead during the Spanish Armada campaign of 1588.

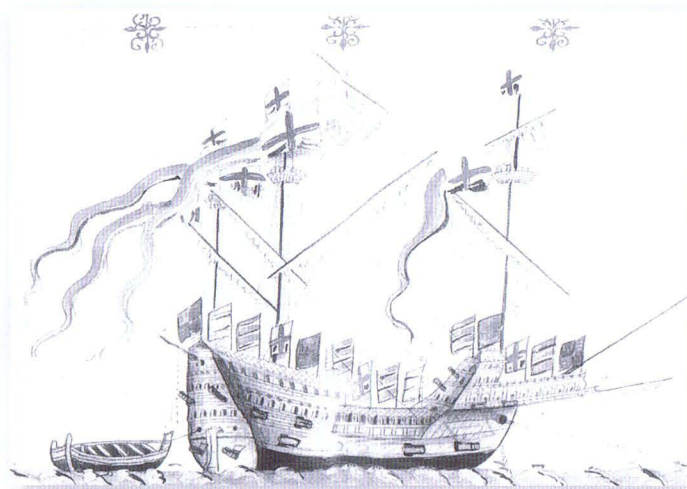
Just how successful the three large English galleons were is reflected by their longevity. The *Golden Lion* remained in service without undergoing any alteration to her original design until 1582, while the *Philip & Mary* (renamed the *Nonpareil* in 1584) survived without a major refit until 1584. The *Mary Rose* was only refitted in 1589, the year after the Spanish Armada episode. This refitting was part of the general programme in which the fleet was rebuilt along the lines of the race-built galleon conceived by Sir John Hawkins. Clearly until this refit, and for some three decades after they



A stern view of the same English galleon depicted opposite, from Wilhelm Dilich's *Kriegsbuch* (Frankfurt, 1610). When built, the *Philip & Mary*, the *Mary Rose* and the *Golden Lion* would have had their sterns painted and gilded, although Mary would have shied away from using overtly Catholic images. (Author's collection)



The great ship (carrack) *Jesus of Lubeck*, as depicted in the *Anthony Roll* of 1545. When Sir John Hawkins hired her as his flagship in the late 1560s, he cut down her superstructure in order to improve her sailing qualities. (By permission, the Master and Fellows, Magdalene College, Cambridge)



Apart from the *Jesus of Lubeck*, the *Great Bark* shown here was the only one of her father's major warships that was retained in the Navy Royal of Mary I when she succeeded her brother to the throne in 1553. Illustration from the *Anthony Roll*, 1545. (By permission, the Master and Fellows, Magdalene College, Cambridge)

were first built, all three galleons were considered the equals of more modern additions to the fleet. Even more surprisingly, all three ships remained in service until well into the 17th century. In fact, although she was renamed the *Lion* and was heavily rebuilt, the *Golden Lion* was only sold out of service in 1698, having fought in all three of the Dutch Wars.

At the accession of Elizabeth I in 1558, the Navy Royal therefore consisted of three large galleons, as well as the *Great Bark*, which can be grouped into the same category. In addition there was also the group of six

small galleons that were still in the process of being converted from galleasses when Mary I died. At that point the fleet also contained four great ships or carracks (*Matthew*, *Jesus of Lubeck*, *Pauncy* and *Mary Hamborough*), five ships that were essentially smaller carracks (*Trinity Henry*, *Sweepstake*, *Sacrett*, *Mary Willoughby*, *Jer-Falcon*), a 450-ton galleass (*Anne Gallant*), four small galleasses (*Salamander*, *George*, *Tiger* and *Bull*), all of which had been converted into ships, and two galleys (the *Galley Subtile* and *Mermaid*), as well as several smaller craft such as pinnaces and rowing barges. In theory this was a small but reasonably modern navy, capable of holding its own against a French fleet that had been slimmed down considerably following the death of Francis I in 1547.

As was often the case when a new regime took charge, the ships of the English Navy Royal were surveyed, and several were either condemned as unfit for use, or else were sold out of service. Another reason for this survey was that the change of monarch led to England withdrawing from her alliance with Spain and a joint war against France. In the six months following Elizabeth's accession, her fleet would be trimmed considerably,

A **JESUS OF LUBECK, 1558**

Despite her name, this 700-ton carrack was purchased in Hamburg in 1544. She was one of the few great ships of Henry VIII's navy to be retained by Elizabeth I, although by the late 1560s she was no longer considered seaworthy. However, in 1564 she was leased to Sir J. Hawkins, who spent a considerable sum refitting her and partially rebuilding her hull by cutting down her superstructure. She still remained an awkward vessel, and even before she sailed from Plymouth in September 1567 her officers complained that she was difficult to sail. The poor sailing performance would cost her dear in late 1568, when she was unable to escape when Hawkins' flotilla was attacked as it lay off San Juan de Uloa, in the Mexican port of Vera Cruz. The inset shows the appearance of the vessel after her conversion, looking much as she did when she served as Hawkins' flagship (1567–68).

Specifications – *Jesus of Lubeck*

Displacement: 700 tons

Keel length: 115ft (35m) approx.

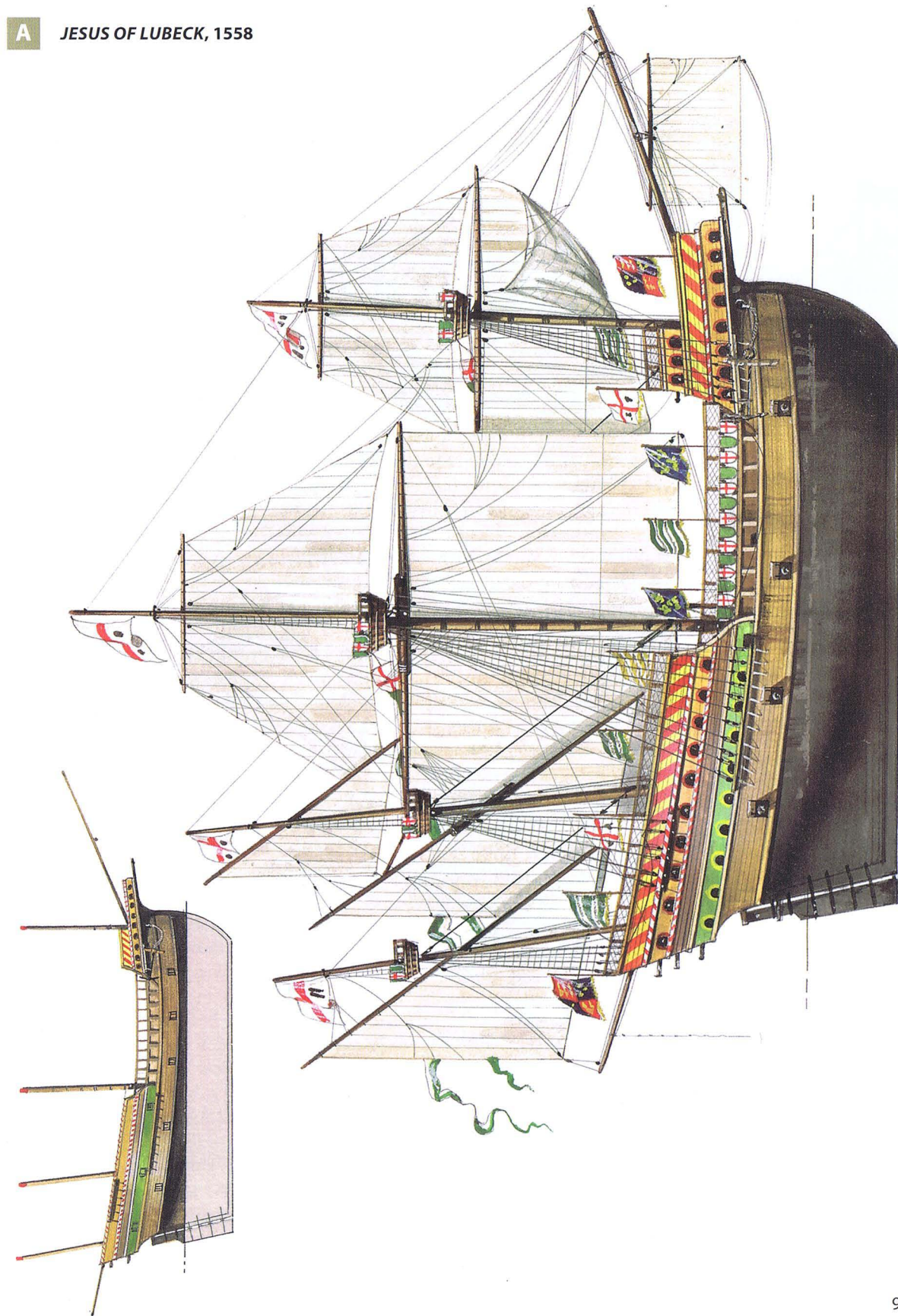
Beam: 30ft (9.1m)

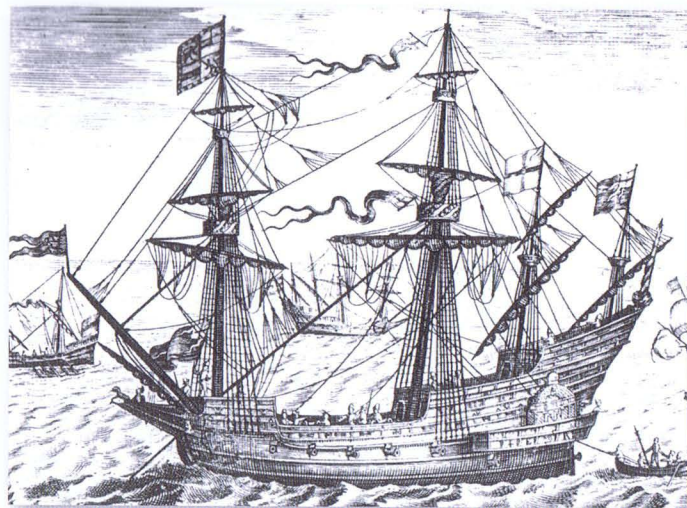
Armament: 26 guns

Crew: Approx. 240 men

Service notes: Built c.1540. Bought into service 1544. Rebuilt c.1566. Captured by Spanish, 1568.

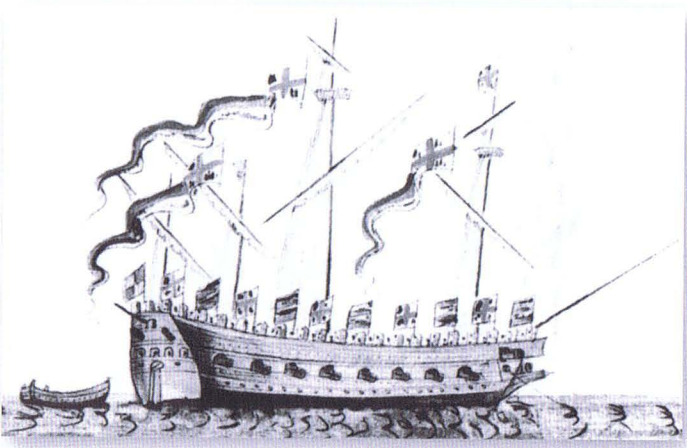
A **JESUS OF LUBECK, 1558**





The *Golden Lion*, a 600-ton galleon built in 1557, during the last year of Mary I's reign. She proved to be an excellent vessel, and her rebuilding by Hawkins helped extend her service life well past the end of Elizabeth I's reign. Engraving by Claes Visscher.

The galleass *Tiger*, as depicted in the *Anthony Roll*, 1545. Soon after her construction she was converted into a ship, and the vessel then underwent a second conversion to turn her into a small race-built galleon. (By permission, the Master and Fellows, Magdalene College, Cambridge)



as the 600-ton *Matthew*, the 400-ton *Mary Hamborough* and the 450-ton *Pauncy* were all decommissioned. This meant that by 1559 only the *Jesus of Lubeck* remained of Henry VIII's fleet of great carracks. Many of the smaller carracks suffered the same fate, leaving only the *Mary Willoughby*, the *Falcon*, the *Saker* and the *Phoenix* on the Elizabethan establishment. Of the smaller craft, the galleasses had already been reconfigured as ships by replacing their oar decks with gunports, and of the five, only the *Tiger* and the *Bull* survived the survey, as did the two galleys. In effect, the Elizabethan navy began its life pared down to a meagre

collection of five large warships, ten smaller ones, plus two galleys and a collection of tiny support vessels. It was therefore in no position to take on the maritime might of Spain.

The fleet soon became even smaller. In 1558 the 700-ton *Jesus of Lubeck* was chartered out for private use, and would soon be associated with the expeditions to the Spanish Main commanded by Sir John Hawkins. Oared warships were surveyed annually, compared to roughly five-year surveys for the rest of the fleet. Consequently, the 200-ton French-built *Galley Subtile* was condemned in 1560, just two years after her survey conducted at Elizabeth's accession. The galley *Mermaid* suffered the same fate three years later.

All these cuts meant that in the late 1550s, while Elizabethan England was embarking on a 'Cold War' with Spain that would last for almost three decades, the Navy Board was considering how best to build up the Navy Royal along modern lines. The two key figures on the board were its Treasurer Benjamin Godson and William Wynter, its Surveyor and Master of Ordnance. Together they embarked on a programme of rebuilding which would begin piecing together a fleet capable of confronting the Spanish.

During the 1560s, they ordered the construction of three new large galleons, all improved versions of those built at the order of Elizabeth's older sister. The first of these was the *Elizabeth Jonas* of 750 tons, built in 1559. As she was used as an example of shipbuilding in the 'old way' by the innovative ship designer Matthew Baker when he wrote a shipbuilding treatise in 1582, we know something about her dimensions. She had a 100ft (30.5m) keel, a 40ft (12.2m) beam, and a draft of 18ft (5.5m). These dimensions are largely comparable to those after her rebuild in 1598, although her original displacement was reduced by a little over 50 tons, suggesting her superstructure was lowered. It also suggests

that she began life as a fairly sleek vessel, and her length to beam ratio of about 2.5:1 is comparable with other later Elizabethan galleons.

Even after they were rebuilt, the three original large galleons built in the mid 1550s had narrower beams, giving an average ratio of about 3:1. The extra beam of the *Elizabeth Jonas* has been attributed to the desire to provide a more stable platform for ordnance, although this theory has never been proved. Another smaller vessel, the *Hope* (420 tons), was built in Deptford in 1559. Little is known about her apart from her armament and her dimensions. Her keel was 94ft (28.6m) long, she had a 33ft (10m) beam and the depth of her hold was given as 17ft (5.2m). As she remained in near-constant service, however, and survived without being rebuilt until after the death of Queen Elizabeth, then it can be assumed she was considered a sound and useful addition to the fleet.

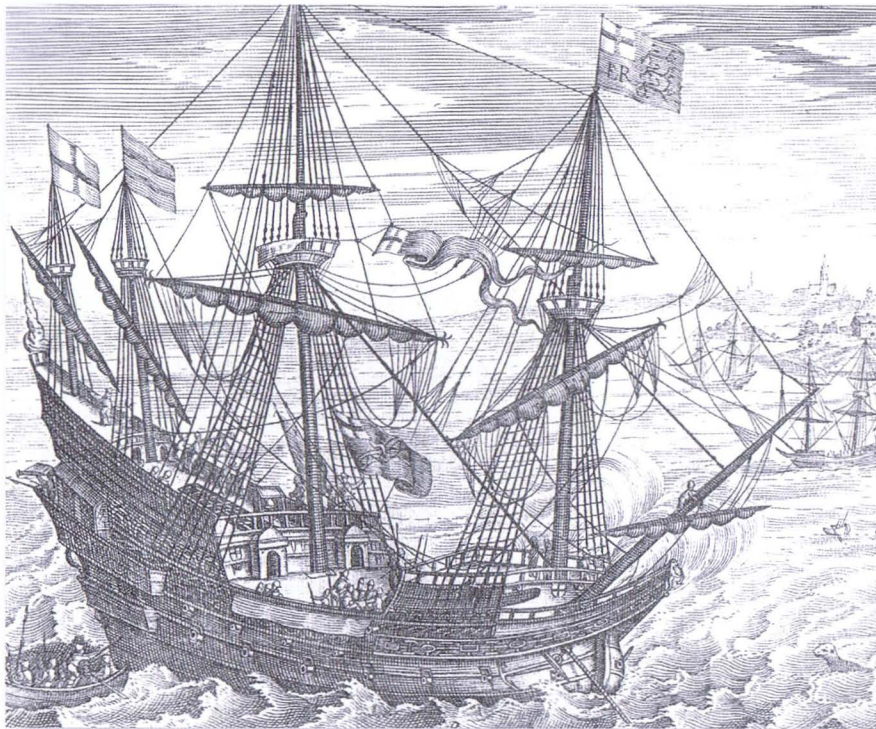
Two other larger galleons were added to the fleet during this period. The *Triumph* (740 tons) was built in 1561, and she was followed two years later by the *White Bear* of 730 tons. Although we know little of these ships before their rebuilding in the late 1590s, it is fairly safe to assume they were similar to the *Elizabeth Jonas*, as all three ships shared very similar specifications after the rebuild. Figures for the late 1590s suggest that while the *Triumph* was generally similar to the earlier galleon, the *White Bear* was beamier, with a length to beam ratio of 3:1. Contemporary or near-contemporary depictions of these ships show vessels that followed the general lines associated with Spanish galleons, merging this Iberian ship design with the English emphasis

The Navy Royal in 1560 ¹					
	Commissioned	Vessel type	Displacement	Guns carried	Decommissioned
<i>Jesus of Lubeck</i>	1544 (Pu)	Ship	700 tons	50	Lost in action, 1568
<i>Golden Lion</i>	1557	Galleon	600 tons	40	1698
<i>Mary Rose</i>	1556	Galleon	600 tons	40	1618
<i>Philip & Mary</i>	1554	Galleon	550 tons	44	1645
<i>Hart</i>	1546	Ship	300 tons	56	1568
<i>Antelope</i>	1546	Ship	300 tons	34	1649
<i>Minion</i>	1558 (Pu)	Ship	300 tons	?	1570
<i>Swallow</i>	1544	Ship	200 tons	30	1603
<i>Great Bark</i>	1515	Ship	500 tons	50	1562
<i>New Bark</i>	1543	Ship	200 tons	53	1565
<i>Greyhound</i>	1545	Ship	200 tons	45	Wrecked, 1562
<i>Jennet</i>	1539	Ship	200 tons	41	1589
<i>Mermaid</i>	1545 (Fr/Pr)	Galley	200 tons	?	1563
<i>Tiger</i>	1546	Ship	160 tons	43	1605
<i>Bull</i>	1546	Ship	160 tons	47	1589
<i>Mary Willoughby</i>	1535	Ship	140 tons	23	1573

Key: Pu = Purchased Pr = Prize Fr = French Sp = Spanish

¹ Note: Several warships listed as a 'Ship' were actually converted galleasses. Although the fleet also contained six pinnaces and a rowing barge, vessels displacing less than 140 tons have not been listed. In this and other tables throughout the book, if the armament is listed in italics, then the total includes light pieces such as bases and fowlers, which are not listed in later inventories. (See 'Armament and Gunnery' chapter for explanations of weapon types.) Also note that armament listings varied considerably, and gun numbers tended to increase throughout the service life of a ship. The listed tonnage of these vessels is also only a guide, as the means of calibrating displacement varied considerably during the period.

The *White Bear* of 730 tons, built in 1563, was the mainstay of the English fleet in home waters during the 'Cold War' of the 1560s and 1570s. By the time of the Spanish Armada, however, she was considered a little slow compared to more modern vessels. Engraving by Claes Visscher.



on viewing the ship as a floating gun platform. All three galleons saw service during the Spanish Armada campaign, the *Triumph* in particular distinguishing herself in her role as the flagship of Sir Martin Frobisher. Two more important additions to the fleet during this period were the *Hope* and the *Aid* (240 tons), both of which were built in Deptford in London between 1559 and 1562.

Although the five ships were all major additions to the fleet, new warships were costly, and took time to build. The Board therefore decided to augment the building programme by purchasing armed merchantmen that were suitable for conversion into warships. The first, and also the largest, of these was the *Victory*, which began life as the *Great Christopher* (800 tons) before being bought from London merchants in 1560. However, she was expensive to man and operate, and only went to sea three times during her service life – in 1563, 1588 and 1589. The Board also bought the *Primrose* (800 tons) in the same year, and then the *Elizabeth Bonaventure* (600 tons) from the London merchant Walter Jobson in 1567. Another smaller purchase was the 300-ton ship *Minion*, bought in 1558.

The loss of the *Jesus of Lubeck* in battle with the Spanish in 1568 highlighted the problems inherent in leasing out ships of the Navy Royal for private use. The venerable carrack had been hastily converted into something akin to a galleon by Sir John Hawkins as he prepared her for a trading voyage to the Spanish Main in 1566–67. She may have exuded prestige through her sheer size, but by all accounts she remained unwieldy and of limited value. The smaller *Minion* was also hired out to Hawkins, but along with Francis Drake's own ship the *Judith*, she managed to escape the disaster at San Juan de Uloa. Although this meant the Navy Royal had lost two valuable ships, it did mean that Hawkins returned to England, where his next business venture proved more beneficial.

Additions to the Elizabethan Fleet 1559–69

	Commissioned	Vessel type	Displacement	Guns carried	Decommissioned
<i>Elizabeth Jonas</i>	1559	Galleon	740 tons	56	1618
<i>Hope</i>	1559	Galleon	420 tons	33	1645
<i>Primrose</i>	1560 (Pu)	Ship	800 tons	43	1575
<i>Victory</i>	1560 (Pu)	Ship	800 tons	42	1608
<i>Triumph</i>	1561	Galleon	740 tons	58	1618
<i>Aid</i>	1562	Ship	240 tons	30	1599
<i>Ellynore</i> /1584: <i>Re. Bonavolia</i>	1562 (Fr/G)	Galley	180 tons	?	1600
<i>White Bear</i>	1563	Galleon	730 tons	40	1629
<i>Elizabeth Bonaventure</i>	1567	Galleon	600 tons	?	1611

Key: Pu = Purchased Fr = French G = Gift Re. = Renamed

The Race-Built Galleon

In 1570 Hawkins entered into partnership with Richard Chapman, at that time a private master shipwright, who would later enter the service of the Crown. Together they tendered to build or rebuild ships for the Navy Royal using the facilities at the Deptford shipyard. The tender was approved, largely because Hawkins' father-in-law Benjamin Godson was the Treasurer of the Navy at the time. The two business partners had their own ideas about ship design, and they put them to the test in their first design, the small 300-ton galleon *Foresight*. The new design involved a length to beam ratio of 3:1, creating a hull form below the waterline that resembled the fleet's earlier small galleasses, but with a deeper draught than before, and a stepped but continuous gundeck. The superstructure was kept low, sweeping upwards from waist to stern, while a long beakhead and rakish stem were designed to improve her handling in rough seas. Finally, the foremast was placed further forward than normal, and was raked forward slightly, which slightly improved the vessel's handling. She had a 78ft (23.8m) keel, with a 27ft (8.2m) stem rake, a 27ft (8.2m) beam, and a depth of hold of 14ft (4.3m). Even more importantly, she carried a powerful armament for her size of 28 guns.

Foresight proved to be a great success, prompting the former galleasses *Bull* and *Tiger* to be rebuilt along the same lines later that year. In effect, the *Foresight* was the start of a new breed of vessel, which correctly or not has been classified by historians as the Elizabethan 'race-built galleon'. Leaner, faster and more deadly than earlier galleons, these vessels would form the fighting core of the Elizabethan fleet in 1588. Two more galleons were soon commissioned following Hawkins' principles, the *Dreadnought* (360 tons) and the *Swiftsure* (350 tons), both of which were built at Deptford in 1573, followed that same year by the smaller 100-ton ships *Achates* and *Handmaid*, both of which were essentially smaller versions of the *Foresight*. The *Swiftsure* and *Achates* were built by Peter Pett, while Matthew Baker supervised the construction of the other two warships.

Hawkins would further refine his design based on the performance of these ships in the fleet. The practical experiences of serving officers tended to suggest that Hawkins had got it right. William Borough, Comptroller of the Navy, grouped his fleet into three categories. The first were vessels of: 'The shortest, broadest, and deepest sort – to have the length by the keel double the breadth amidships and the depth of the hold half its breadth ... this



order is used in some merchant ships for most profit.' In other words, they were slow, tubby armed merchantmen, unable to keep up with the most powerful warships of the fleet. However, they were considered suitable for patrolling, for the escort of fishing fleets or for the carrying of supplies.

Borough's second group were: 'The mean and best proportion for shipping for merchandise, likewise very serviceable for a purposes.' He described these ships as having a 'length of keel two or two and a quarter that of the beam. Depth of hold eleven-twenty-fourths that of the beam.' These were the armed merchantman that could be bought into service like the *Elizabeth Bonaventure* or the *Victory*, or else hired from merchants in time of crisis. The core of Borough's fleet were: 'The largest order for galleons or ships for the wars made for the most advantage of sailing.' These ships had a 'length of keel three times the beam ... a depth of hold two-fifths of beam.' On this basis, his perfect warships were the ones designed by Hawkins.

Other innovations introduced by Hawkins were less visible. First, his hulls were deeper than on previous vessels, and they acted much like a

centreboard on a sailing dinghy, functioning as a counterbalance to the force of the wind on the sails to reduce the effect of heeling. This design made his ships more stable gun platforms than previous vessels. Another innovation was the sheathing of the lower hull with a double layer of planks, with a hair and tar mixture laid between them, in an attempt to reduce hull corrosion caused by the teredo worm. This measure predated the introduction of copper-sheathed ship bottoms by almost a century, and was almost certainly the result of Hawkins' own experiences, operating in the worm-infested waters of the Caribbean Sea.

Hawkins' ships were also more streamlined than those that had come before, the result of Hawkins moving the largest frame of the ships further forward than normal, resulting in a more significant tapering off towards the stern of his vessels. The drawback of this design was that it reduced buoyancy towards the stern, which limited the weight of ordnance that could be carried. During the early Stuart period his designs were altered to increase

buoyancy and so permit a heavier armament to be carried. It was found, however, that this modification led to a far poorer sailing performance. In effect, Hawkins saw ship design as a balancing act between firepower and speed, and his fine-tuning of the fleet perfectly suited the requirements of the Navy Royal at the time.

Another innovation soon followed. Before 1570, every attempt had been made to form the gundeck into a continuous belt running for as far as possible along the length of the ship. Gundecks followed the curve of the hull, and therefore rose sharply towards the bow and

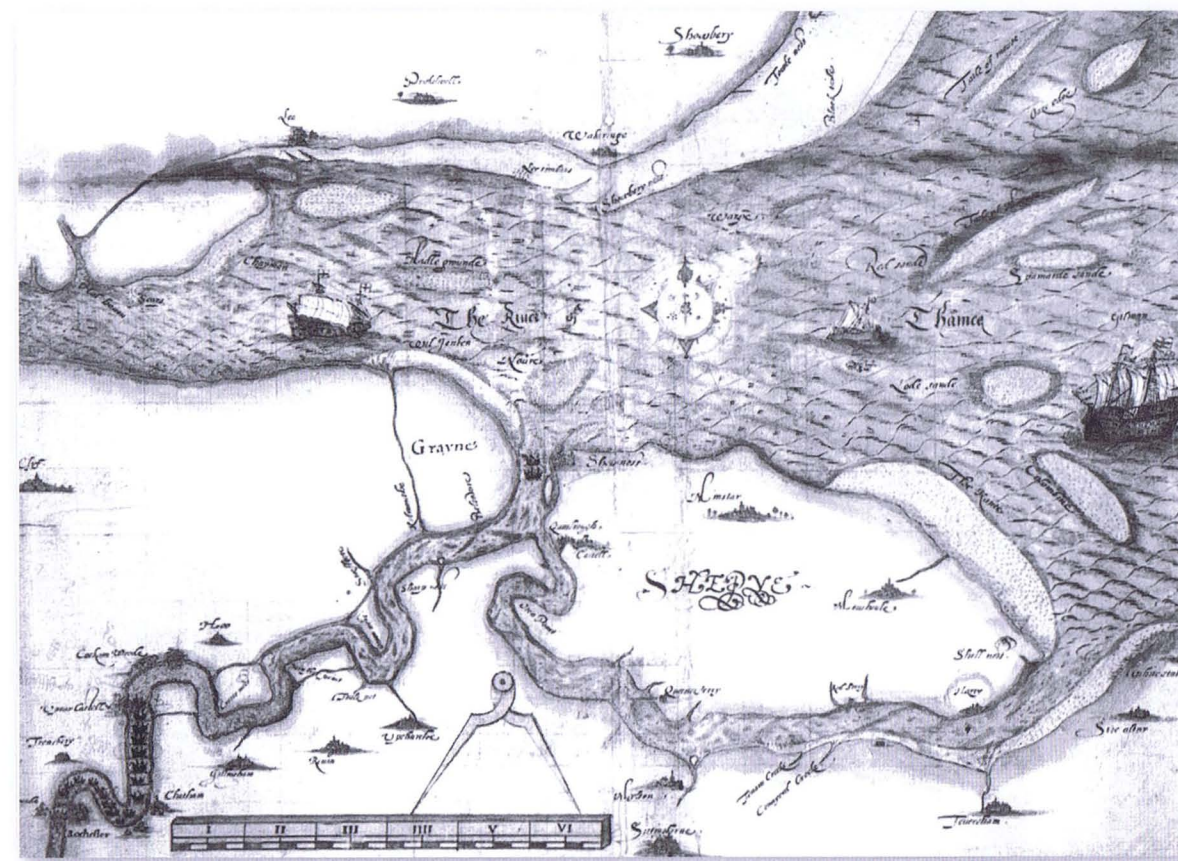
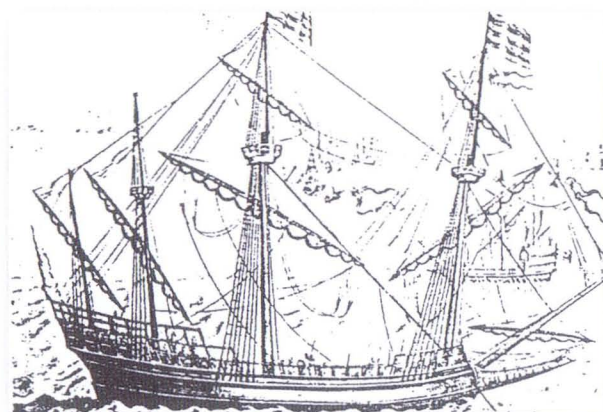
stern. Previously, this meant that few guns could be carried in the stern or beneath the forecastle, and the guns were therefore placed in the superstructure. Hawkins' solution was to break the run of the gundeck abaft of the mizzen mast, stepping it down by half a deck, and so creating a lower gunroom. This design allowed heavy guns to be carried lower down in the hull, thereby improving the stability of the ship. It also provided a platform for a pair of sternchase guns, the gunports for which were cut in the transom at its widest point rather than high up in the superstructure, where the guns would fill the available cabin space.

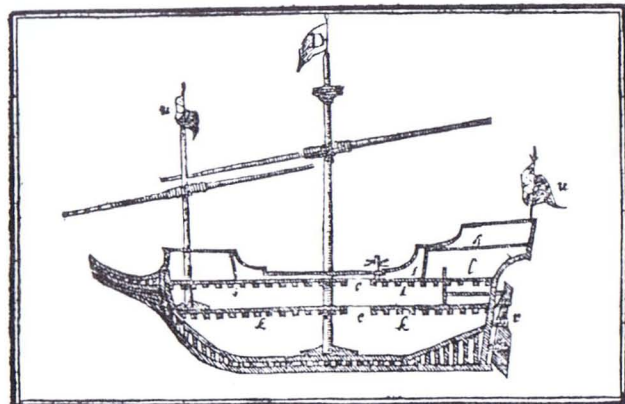
The upper deck was also stepped down abaft the mainmast, creating an additional space that became the upper gunroom. In the larger ships this gunroom was used to house another pair of sternchasers, and even a few extra broadside guns, which therefore would appear roughly in line with those sided in the waist, on the upper deck. The step down also allowed the lowering of the superstructure by providing enough headroom for any stern cabins, but at a lower level in the ship. This allowed Hawkins to reduce the height of the superstructure, and thereby improve the sailing performance of the ship. The result was the nearest thing to perfection that the Tudor world could produce. Compared to other warships, Hawkins' race-built galleons could sail faster and closer to the wind (up to 45° or 4 compass points from the wind direction), and they had less leeway – the sideways drift experienced by sailing ships when the wind was on the beam. In short, they were well-designed ships that could outsail the majority of other warships – particularly the carracks that made up the bulk of the Spanish fleet in 1588. When this

The Thames Estuary during the Elizabethan period was one of the busiest maritime waterways in Europe, and the entry point to the London shipyards of Deptford, Greenwich and Limehouse, and the anchorage at Chatham, seen in the bottom left of this map.

As the man responsible for developing the race-built galleon in the early 1570s, Sir John Hawkins (1532–95) is arguably the man behind the English victory over the Spanish Armada in 1588. (National Maritime Museum, Greenwich, London)

The former galleass *Tiger* underwent a second refit in 1570, being rebuilt according to the principles advocated by Hawkins. Her narrow hull made her a perfect candidate for this conversion, making her a useful member of the fleet.





In this cross-section of an English galleon of the 1550s, the traditional method of maintaining a straight run to the gundeck can be seen clearly. Hawkins' design replaced this with a stepped gundeck, designed to follow the line of the lower wale, and thereby provide a stronger hull structure. Reproduced in Wilhelm Dilichi's *Kriegsbuch* (Frankfurt, 1610).

superiority was combined with the gunnery innovations described later, the result was a winning combination.

When Benjamin Godson died in 1577, Hawkins was appointed as the new Treasurer of the Navy, charged with continuing his good work. For the next 12 years he was the man responsible for building up the Elizabethan fleet, for designing and overhauling its ships, and for preparing it for war. He never received the favours bestowed by the Queen on her court favourites and beaux, yet if any one man was responsible for her great victory over the Spanish in 1588 it was

Hawkins. During his career he was constantly suspected of corruption, of embezzlement and of profiteering. However, no formal charges were ever laid, and whether true or not the fact remains that during his tenure in office the fleet was always fully equipped and prepared for war. The 'Cold War' followed by the active conflict with Spain meant that during the period from 1577 to 1589 the Navy Royal went through a phase of considerable expansion, and just as in any historical period, the opportunities for profit were there, as too was the room for suspicion by those not involved in the process.

During those 12 years, Hawkins continued the process of building powerful new ships for the fleet, or supervising the conversion of existing older vessels to better conform to his new design. Three more galleons were built, all displacing less than 500 tons – a size Hawkins saw as ideal for a fleet that relied on speed, manoeuvrability and firepower rather than boarding to win its battles. The *Revenge* (460 tons) was built at Deptford in 1577, followed by the *Rainbow* (380 tons) in 1586, which was constructed under

B SWIFTSURE, 1573

This small 250-ton galleon was built during 1573 by Peter Pett, the Royal Master Shipwright at Deptford, and the father of several shipwrights, including Phineas Pett, who built the *Sovereign of the Seas* (1637).

The *Swiftsure* was one of the first of the English race-built galleons designed by Sir John Hawkins, and until the launch of the *Revenge* four years later, she and her sister the *Dreadnought* were considered the fastest warships in the fleet, despite criticisms in some quarters that they were too lightly built. This criticism might well have led to the rebuilding of both vessels in 1592, making them the only Hawkins galleons to be rebuilt during their designer's lifetime. The *Swiftsure* formed part of the usual Guard Fleets in home waters during the 'Cold War' with Spain, and participated in the Siege of Smerwick in 1580. During the Armada campaign of 1588, she formed part of Drake's squadron, under the command of Captain Edward Fenner.

The inset shows a bronze demi-saker, one of the principal gun types carried on board the *Swiftsure*, mounted on a reconstruction of an Elizabethan four-wheeled truck carriage. The barrel itself is based on an example in the collection of the Royal Armouries, Fort Nelson, Hampshire.

Specifications – *Swiftsure*

Displacement: 350 tons

Keel length: 74ft (22.6m) approx.

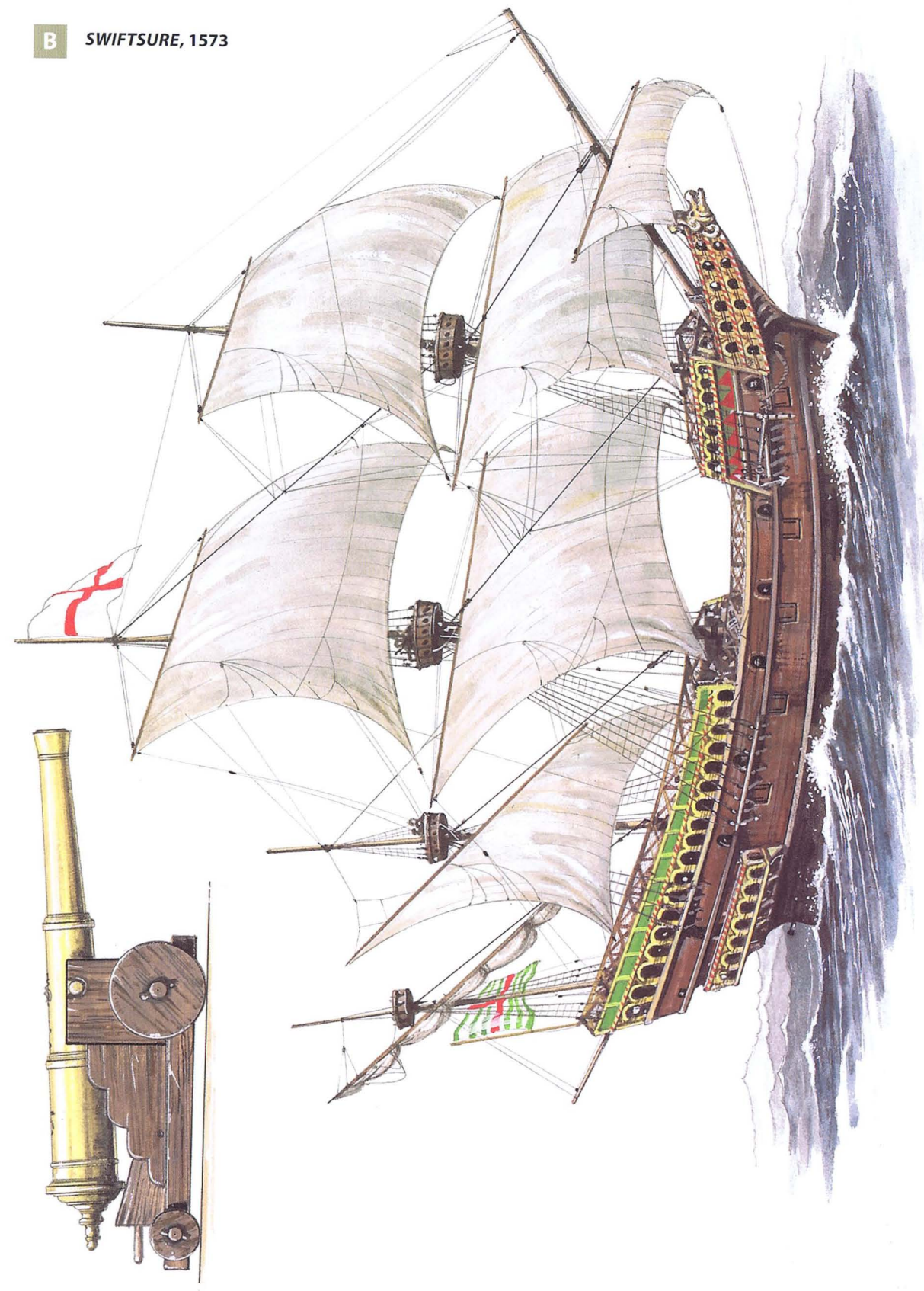
Beam: 30ft (9.1m)

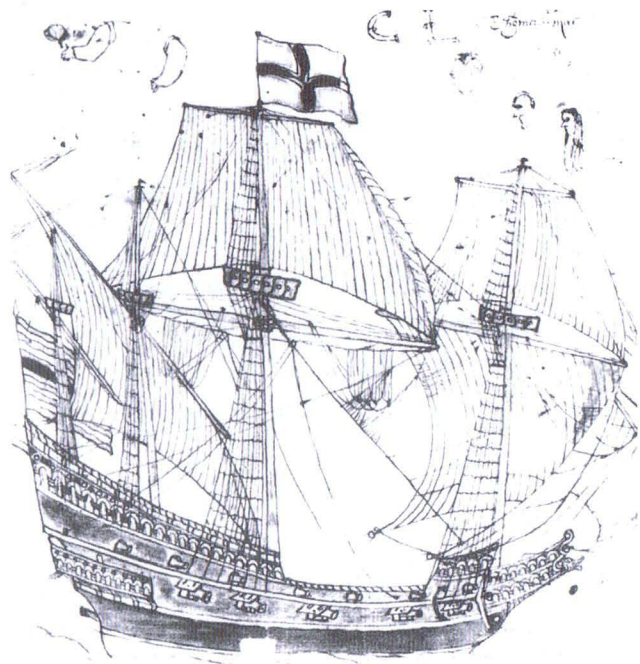
Armament: 34 guns

Crew: 130 sailors, 20 gunners, 30 soldiers

Service notes: Built 1573. Rebuilt 1592. Renamed *Speedwell*, 1607. Foundered off Dutch coast, 1624.

B SWIFTSURE, 1573



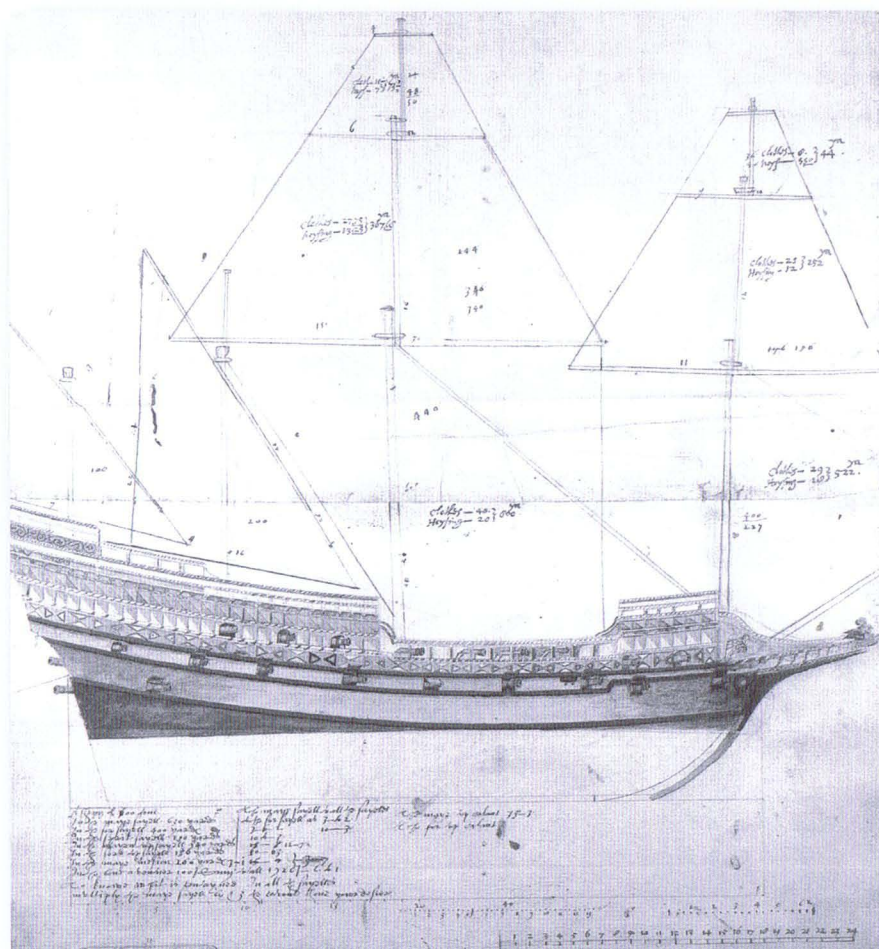


ABOVE

One of the best representations to be found of a small Hawkins-designed Elizabethan galleon of the 1570s, giving a good impression of the vessel's rigging. The figurehead may well represent a tiger, which means the vessel was probably the *Swiftsure*, although the vessel's size and armament suggest a smaller vessel, such as the *Foresight*. She lacks the extended beak of the *Tiger*, which would otherwise be an obvious candidate. (Bodleian Library, Oxford)

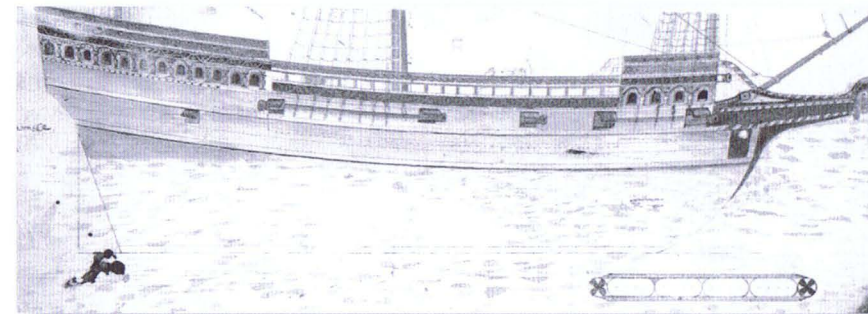
RIGHT

This profile of a galleon designed by Hawkins, from Matthew Baker's *Fragments*, was drawn around 1580, but the sail plan was probably added later. It has been suggested that the vessel shown here is the *Revenge*, as it was the last race-built galleon built before Baker's work was published. (Pepys Library, Magdalene College, Cambridge)



the supervision of Peter Pett. That same year, just down the River Thames at Woolwich, Matthew Baker built the *Vanguard* (450 tons). All three ships were powerful, well-armed race-built galleons, and all would play a leading part in the coming fight with Spain. They conformed to the lean, racy 3:1 ratio advocated by Hawkins and Burleigh. Exact details of the *Revenge* are unknown as she was lost before the survey that recorded ship specifications was drawn up. However, it is generally assumed that she had a keel length of around 110ft (33.5m), and a 34ft (10.4m) beam. The *Rainbow* had a keel of 100ft (30.5m) and a beam of 32ft (9.7m), while the *Vanguard* boasted dimensions of 108ft (32.9m) and 32ft (9.7m) respectively.

A major part of Hawkins' job was to supervise the rebuilding and refitting of the Navy Royal. During his tenure some 12



Another sketch from Matthew Baker's *Fragments* (1582). This ship profile is of a small galleon of around 200 tons. As such she could represent the *Foresight*, or one of the smaller vessels of the fleet that were rebuilt under Hawkins' direction. (Pepys Library, Magdalene College, Cambridge)

ships were rebuilt into race-built galleons. The first were the *Tiger* and the *Bull* (both rebuilt in 1570), undertaken as a means of proving that the process would indeed improve the sailing and fighting qualities of these two ships, now no longer recognizable as the small galleasses originally built for Henry VIII in 1546. When war with Spain appeared inevitable, then other larger units underwent the same process. The three galleons ordered by Mary – the *Golden Lion* (refitted in 1582), the *Nonpareil* (refitted in 1584) and the *Mary Rose* (refitted in 1589) – were only part of the overhaul. The *Aid* underwent the same process in 1580, the *Elizabeth Bonaventure* followed in 1581 and then the *Victory* was rebuilt in 1586. Other warships such as the *Elizabeth Jonas*, the *Triumph*, the *Hope* and the *White Bear* were all rebuilt after the Armada campaign, and after Hawkins' tenure ended in 1589.

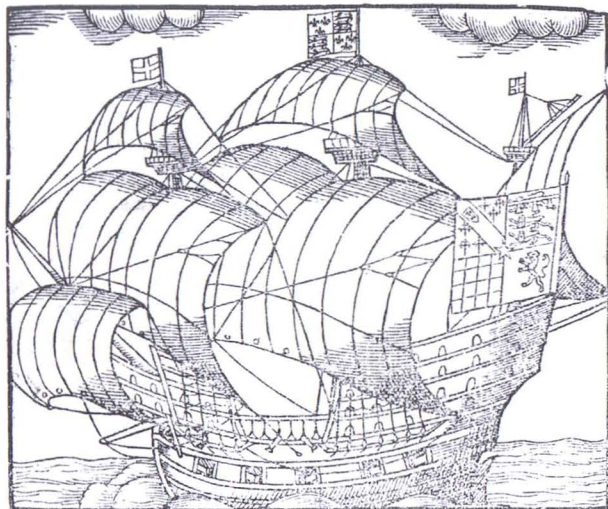
Then there was the *Ark Raleigh*, an impressive private warship of 550 tons and 55 guns, owned by Sir Walter Raleigh. She had been built in Deptford by Robert Chapman as a private venture, based on Hawkins' design. Although not noticeably larger than her predecessors (she had a 100ft/30.5m long keel, and a 33ft/10m wide beam), she carried a greater weight of ordnance (some 50 tons), which meant she had the firepower of a much larger warship such as the *Victory*. Renamed the *Ark Royal*, she was bought into service in time to participate in the Spanish Armada campaign, where served as Lord Howard's flagship.

Additions to the Elizabethan Fleet 1570–88²

	Commissioned	Vessel type	Displacement	Guns carried	Decommissioned
<i>Foresight</i>	1570	Galleon	295 tons	28	1604
<i>Dreadnought</i>	1573	Galleon	360 tons	34	1648
<i>Swiftsure</i>	1573	Galleon	350 tons	34	Wrecked, 1624
<i>Revenge</i>	1577	Galleon	464 tons	46	Foundered, 1591
<i>Rainbow</i>	1586	Galleon	384 tons	26	1680
<i>Vanguard</i>	1586	Galleon	449 tons	31	1667
<i>Seven Stars</i>	1586	Galley	140 tons	5	1603
<i>Ark Royal</i>	1587 (Pu)	Galleon	550 tons	55	1636
<i>Popinjay</i>	1587	Galleon	500 tons approx.	?	1601
<i>Rosario</i>	1588 (Sp/Pr)	Great Ship	1,150 tons approx.	?	Hulked, 1594

Key: Pu = Purchased Pr = Prize Sp = Spanish

² Note: The *Popinjay* never entered active service, while the *Rosario* (originally the *Nuestra Señora del Rosario*) was retained as a hulk until 1622, when she was broken up. All other vessels listed as 'Galleon' built from 1570 on were constructed according to Hawkins' design.



In this woodcut accompanying a contemporary book of printed poems, a warship purporting to be Drake's flagship the *Elizabeth Bonaventure* is shown cruising off Santiago in the Cape Verde Islands during the 1585 expedition to the Spanish Main.

Sir John Hawkins retired in the year following the Armada campaign, but the warships designed according to his specifications continued to be built. The most significant of these were the *Defiance* (440 tons) and the *Garland* (530 tons – also known as the *Guardland*), both of which were built in Deptford in 1590, the first by Robert Chapman and the second by Peter and Joseph Pett. In the same year an even larger galleon, the *Merhonour* (690 tons – also known as the *Mer Honour*), was built at Woolwich by Matthew Baker. Then in 1595 came the *Due Repulse*, a 620-ton replacement for the *Repulse* lost off the Azores four years earlier. She was followed in 1596 by the *Warspite*, a 520-ton galleon built by Edward Stevens at

Deptford. It can be argued that Hawkins' legacy lasted long after his death in 1595, as many of his ships remained in active service with the fleet long after the death of his monarch in 1603, and remained as mainstays of the Stuart Navy well into the 17th century.

Of course, Queen Elizabeth's Navy Royal contained more than just major warships. During her reign 99 warships of various types were commissioned into the fleet, a figure that includes some vessels that remained in service for a year or two at the most. Three of these were prizes captured from the Spanish, the most notable of which was the *Nuestra Señora del Rosario*, a 1,150-ton great ship captured by Sir Francis Drake in 1588. She was never used against her former owners, as she was far too lumbering a vessel for the English, who even classified her as a carrack rather than as a galleon. She became a floating storage hulk on the River Medway in 1594, and was broken up 28 years later.

C **TIGER, 1580**

The *Tiger* was first built as a 160-ton galleass, a reaction to Henry VIII's witnessing the French galley fleet in action off Portsmouth in 1545. She was launched in 1546, but within three years she was re-designated as a ship. The original probably involved little more than the removal of her sweeps. Her galley-like hull shape set her and her sister ship the *Bull* apart from the rest of the fleet, and made the two converted vessels ideal candidates for a second conversion. This time the hulls were modified considerably, in accordance with the design ideas proposed by Sir John Hawkins. The rebuilding was a success, and so from 1570 onwards the *Tiger* was re-designated as a 200-ton galleon.

The main illustration shows the *Tiger* as she looked during the siege of Smerwick in 1580, based on her depiction in a contemporary illustration of the action. The inset is an impression of her appearance before her conversion into a race-built galleon, as she would have looked from 1550–70.

Specifications – *Tiger*

Displacement: 464 tons

Keel length: 70ft (21.3m) approx.

Beam: 28ft (8.5m) approx.

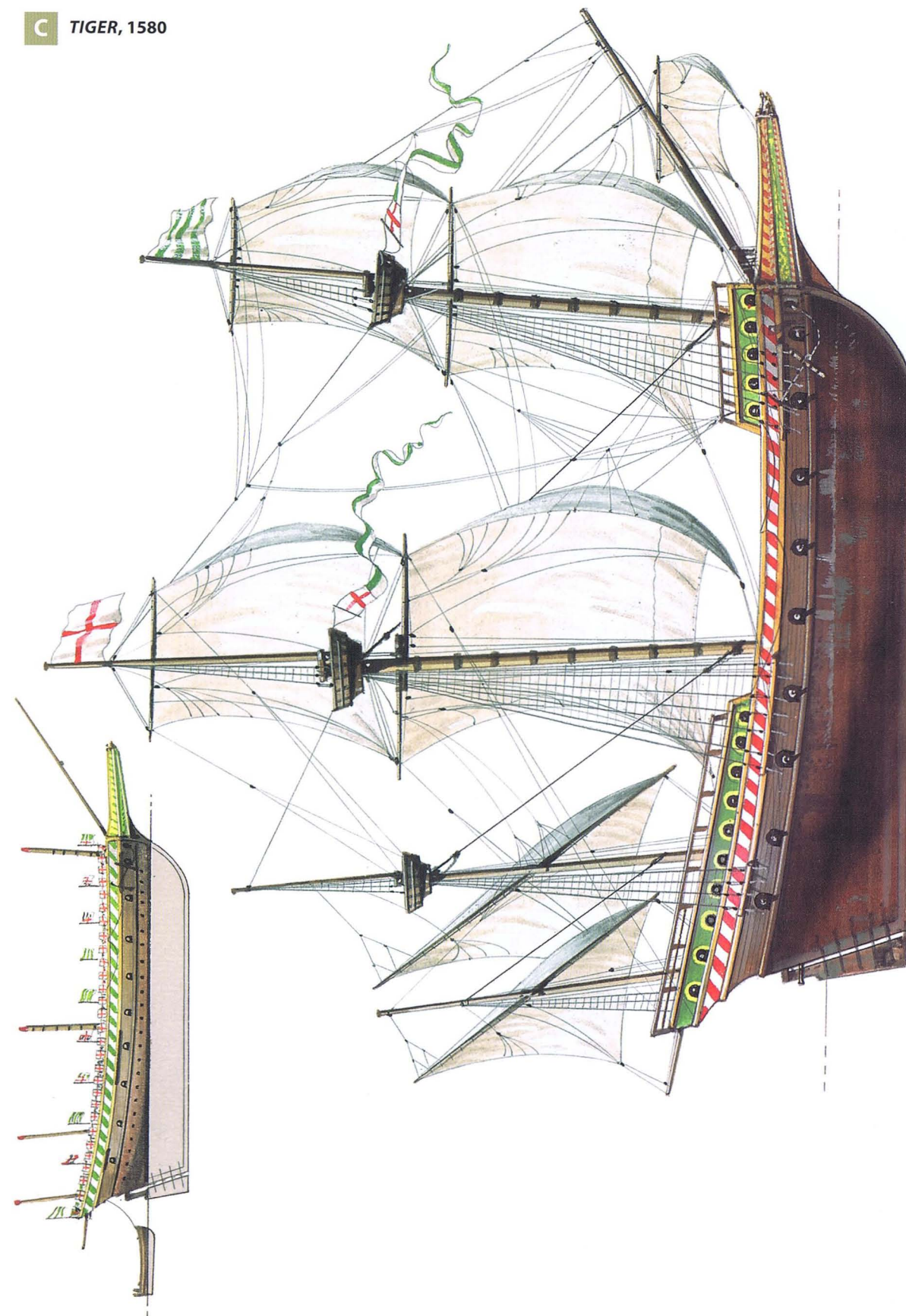
Armament: 43 guns

Crew: Approx. 100 men

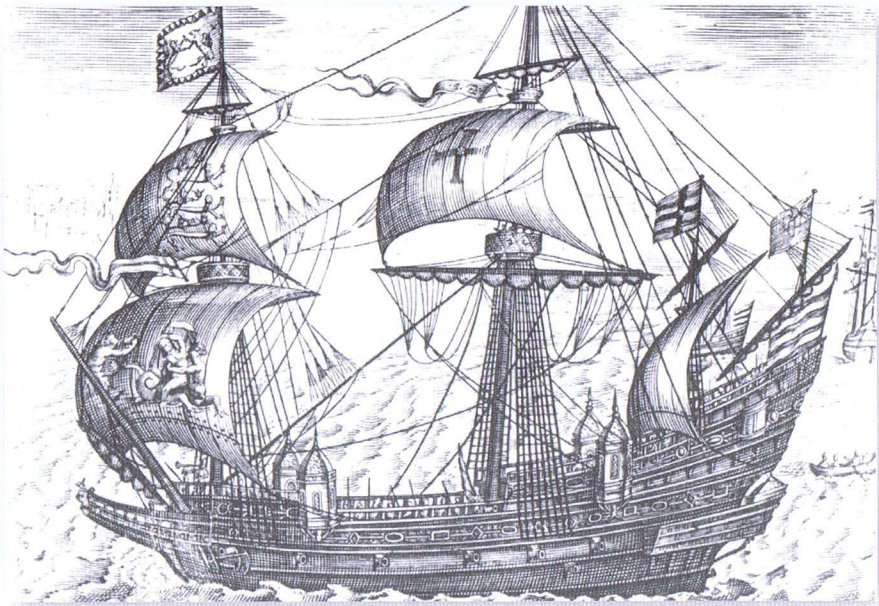
Service notes: Built 1546. Rebuilt 1570. Converted into floating battery at Chatham, 1600.

Condemned, 1605

C **TIGER, 1580**



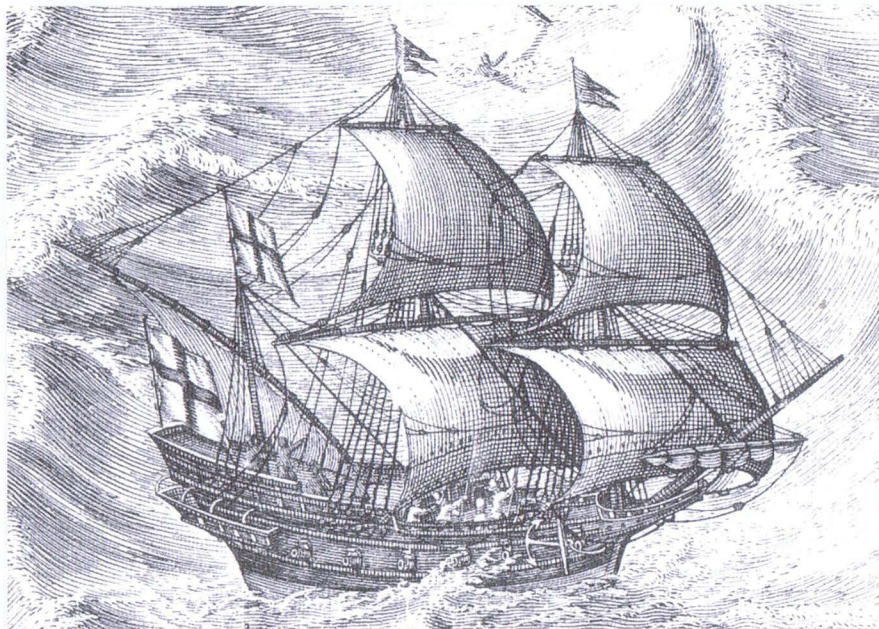
In this rather fanciful depiction of the *Ark Royal*, the early 17th century artist Claes Visscher has added curious (and erroneous) turret structures at either end of her waist, and the sailing rig and sail decoration should at best be considered imaginative. The general hull shape, however, appears to be reasonably accurate.



These 99 warships do not include the numerous armed merchantmen that were hired to augment the Navy Royal in wartime. Ninety-four such ships were hired or volunteered for service in 1588, a total that discounts the 15 or so vessels that displaced less than 90 tons. While the majority of these displaced less than 200 tons, 29 were larger, and included the *Galleon Leicester* and the *Merchant Royal*, both of 400 tons. With the addition of ordnance supplied from royal stores, these ships were almost as powerful as some of the major vessels in the Navy Royal, although they probably lacked the manoeuvrability of comparable warships such as the *Foresight* or the *Dreadnought*.

Other smaller additions to the Navy Royal during the Elizabethan period included nine galleys, four pinnaces, four small galleons, seven small ships,

In this detail of an engraving showing the last stages of the Spanish Armada campaign, a small English galleon struggles through heavy seas while her crew attempt to reduce sail. The vessel is a rare and accurate depiction of one of the smaller Hawkins-designed warships, such as the *Aid*, which he rebuilt in 1580.



Additions to the Elizabethan Fleet 1589–1603 ³					
	Commissioned	Vessel type	Displacement	Guns carried	Decommissioned
<i>Dainty</i>	1589 (Pu)	Discovery Vessel	200 tons	?	Captured by Spain, 1594
<i>Defiance</i>	1590	Galleon	441 tons	46	1650
<i>Garland</i>	1590	Galleon	532 tons	45	1618
<i>Answer</i>	1590	Galleon	219 tons	21	1629
<i>Advantage</i>	1590	Galleon	172 tons	18	Burnt, 1613
<i>Crane</i>	1590	Galleon	202 tons	24	1629
<i>Quittance</i>	1590	Galleon	216 tons	25	1618
<i>Merhonour</i>	1590	Galleon	691 tons	41	1650
<i>Adventure</i>	1594	Galleon	274 tons	24	1645
<i>Due Repulse</i>	1595	Galleon	622 tons	40	1645
<i>Warspite</i>	1596	Galleon	518 tons	38	1649
<i>St Andrew</i>	1596 (Sp/Pr)	Galleon	900 tons	50	1604
<i>St Matthew</i>	1596 (Sp/Pr)	Galleon	1,000 tons	50	1604

Key: Pu = Purchased Pr = Prize Sp = Spanish

as well as an assortment of small vessels labelled by their sailing rig – pinks, ketches, barks and hoys. The fleet even included seven discovery vessels at various times. A few of these were bought into service, but the majority were built specifically for the Navy, mainly at the yards at Deptford, Woolwich and Limehouse on the River Thames on the outskirts of London, or at Chatham on the River Medway. These all had their own distinct role in the Tudor fleet – as escorts, guard ships, supply vessels, dispatch boats, tenders, fleet launches and transports.⁴

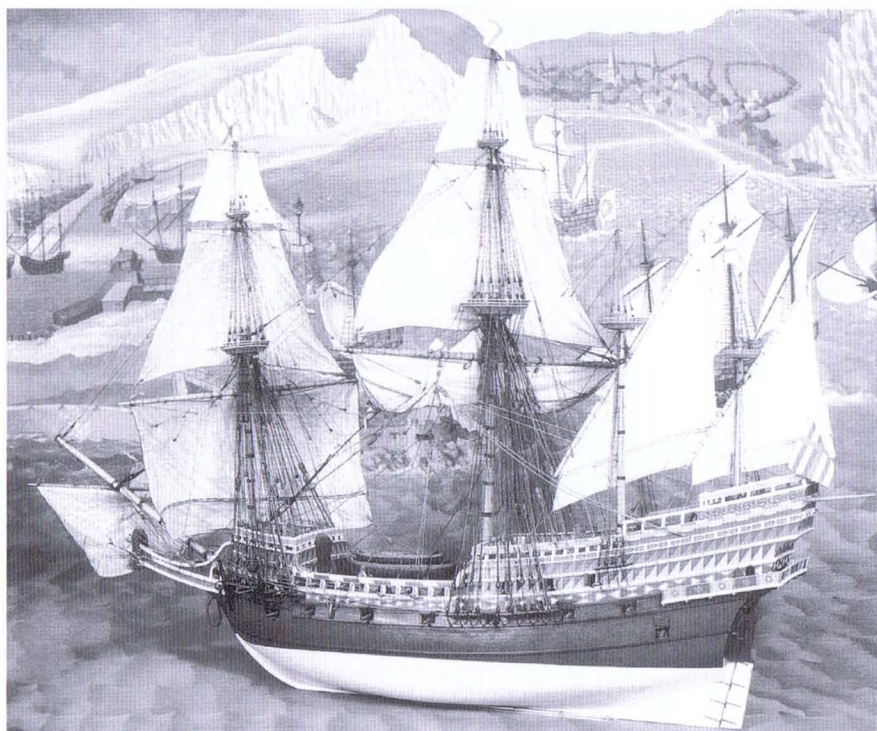
Shipbuilding

Regarding shipbuilding techniques, we are fortunate that not only in Matthew Baker’s *Fragments of Ancient English Shipwrightry* (1582) are we given an insight into Tudor ship construction, but we can also draw on evidence provided by maritime archaeology, most notably the remains of the earlier Tudor warship *Mary Rose* (1545) and the Elizabethan vessel known as the Alderney Wreck (1592). Unlike some earlier Tudor warships, Elizabethan royal ships were built using the carvel method, where a framework was created to form the shape of the hull, then the planking was fastened to it, with each plank laid side by side to form the outer hull. The earlier clinker-built method, where the planks overlapped each other had fallen into disuse by the early 16th century. The first step was the laying of the keel, using a series of three or more timbers, joined together using scarf joints. The keel on the *Ark Royal* was 100ft (30.5m) long, a fairly typical length for a vessel displacing around 400–600 tons. The keel was further strengthened by a keelson, which was also formed from several sections. The

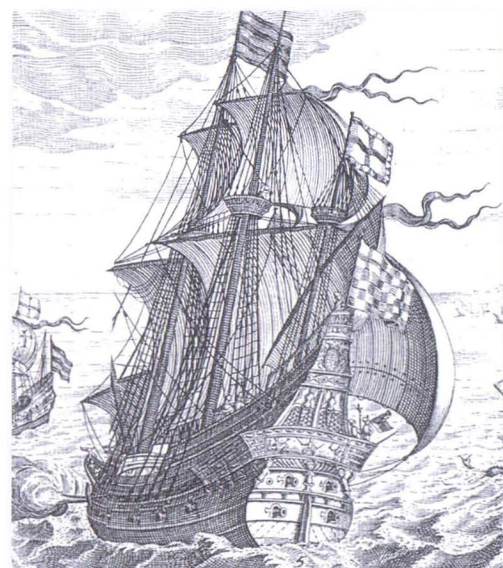
³ It has been suggested that the *Adventure* was a rebuild of the *Bull*, decommissioned in 1589. The *St Andrew* and the *St Matthew* were originally called the *San Andrea* and *San Mateo*, before being captured at Cadiz. One other large addition, the *Eagle* of 894 tons, was purchased as a careening hulk in 1592, and moored at Chatham until 1683.

⁴ While the size of this book precludes a discussion into the appearance, construction and use of these craft, *Renaissance War Galley* (Osprey New Vanguard 62) and *The Pirate Ship* (Osprey New Vanguard 70) both provide further information on these smaller vessel types.

This model of an English galleon is a fairly accurate representation of one of the larger warships in the Elizabethan fleet, as she would have looked around 1600. She is modelled on accounts of the *Elizabeth Jonas*, which was built in 1559, and rebuilt in 1598. (Science Museum, London)



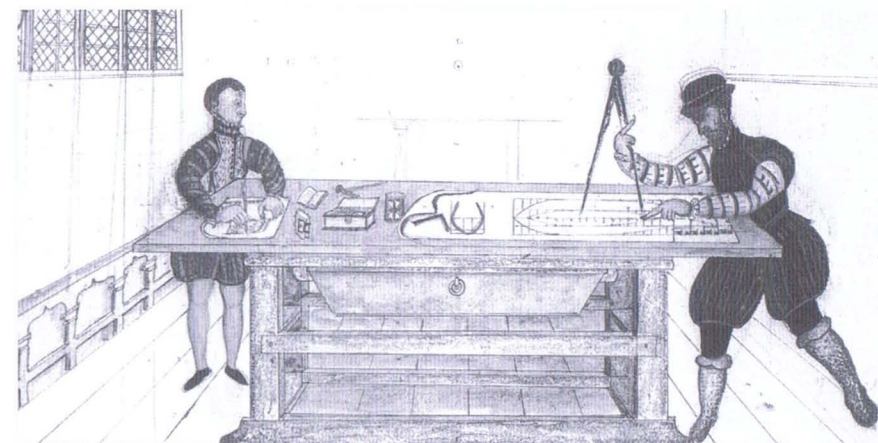
The *Griffin* was a 200-ton privateer or private warship from Plymouth, owned by Hawkins and designed according to his principles. Under the command of his brother William, Hawkins' privateer performed well during the Spanish Armada campaign of 1588. Engraving by Claes Visscher.



stem and sternposts rose to form the profile of the vessel – in the case of the *Ark Royal* the stern extending 6ft (1.8m) beyond the end of the keel, while the bow curved outwards for 33½ft (10.2m).

Next a series of 'C-shaped' frames were raised above the keel, a wooden ribcage that formed the shape of the hull. In Elizabethan ship construction, the key frame was called the main frame, usually located in the centre of the vessel, close to the site of the mainmast. The width and thickness of these frames tapered off towards the stem and stern, as too did the deck beams, which were then set in place to span the frames. The beams themselves were supported by a series of knees that were attached to the frames, rather like a line of modern shelf brackets. Matthew Baker referred to the framing system as 'whole moulding', where the dimensions of each frame, knee and deck beam followed a carefully proscribed mathematical formula. Further supports were provided by futtocks – a series of angled timbers that strengthened the base of the frames, and secured them to the keel and keelson.

The outer hull was formed by a series of wales, wooden beams attached to the outer sides of the frames; these followed the shape of the ship as she would finally lie in the water. The lower wale was sited just above the waterline at the waist, but rose gradually towards the stem and stern. Additional wales were spaced regularly between it and the upper deck of the ship. Between these wales came the planking of the hull, with both planks and wales secured to the frames by means of wooden treenails and iron fasteners. Additional cross bracing known as stringers were provided inside the ship, linking

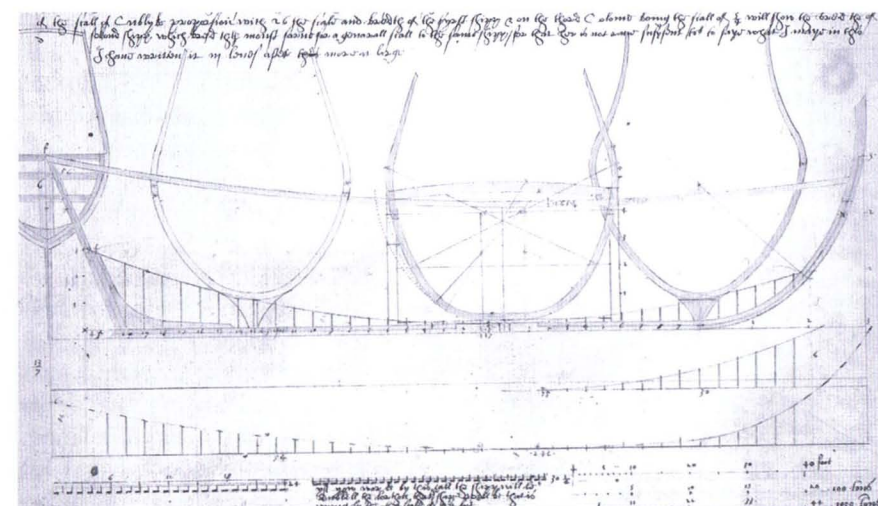


An English Master Shipwright and his assistant, as depicted in Matthew Baker's *Fragments of Ancient Shipwrightry*, 1582. During this period, warship construction was closely governed by mathematical principles. (Pepys Library, Magdalene College, Cambridge)

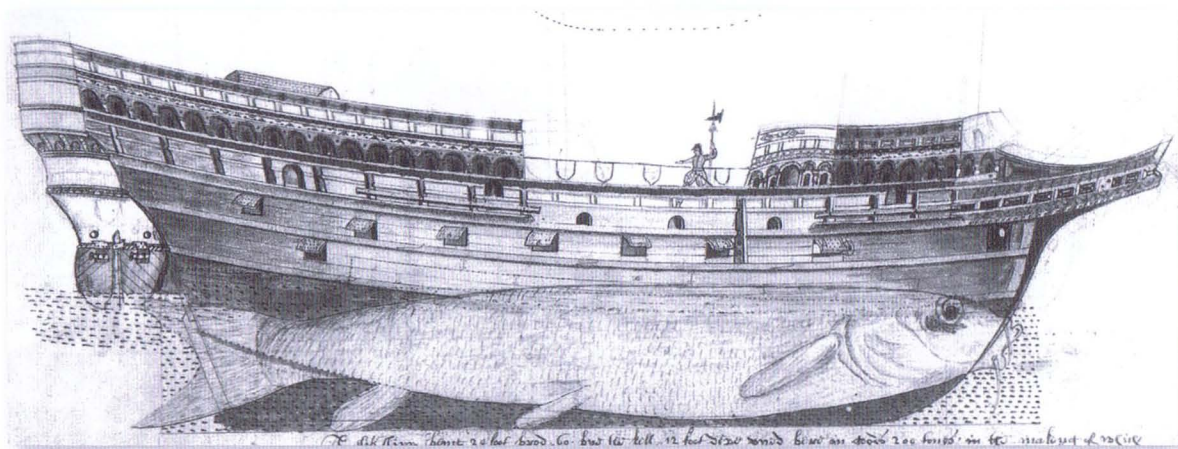
the frames together. The frames bulged outwards just above the lower wale, which meant the ship curved out slightly immediately above the waterline, then a tumblehome brought the sides of the hull inwards slightly as they rose towards the upper deck. The deck beams themselves also rose towards the centreline of the ship, a feature designed to allow water to drain easily into scuppers and so over the side of the ship.

As Royal Master Shipwright, Baker laid out the proportions he used in ship construction, and his formula reveals just how scientific the process was. While we have already stated that Sir John Howard introduced his design innovations based on his extensive practical experience, he also needed to team up with a first-class shipwright in order to see the project through – in his case Robert Chapman. Baker, along with his compatriot Peter Pett, was a disciple of Hawkins' approach to ship design. Therefore his *Fragments* should best be seen as a means by which the Hawkins' race-built galleon design was explained for all to see.

Unlike earlier galleons, those designed by Hawkins and built by men like Baker and Pett tapered rapidly towards the stern, while the lower wale and consequently the wide point of the hull immediately above it both rose towards the stern, creating a lean, streamlined hull that can be seen clearly in the illustrations supplied by Baker in his treatise. This tapering became more

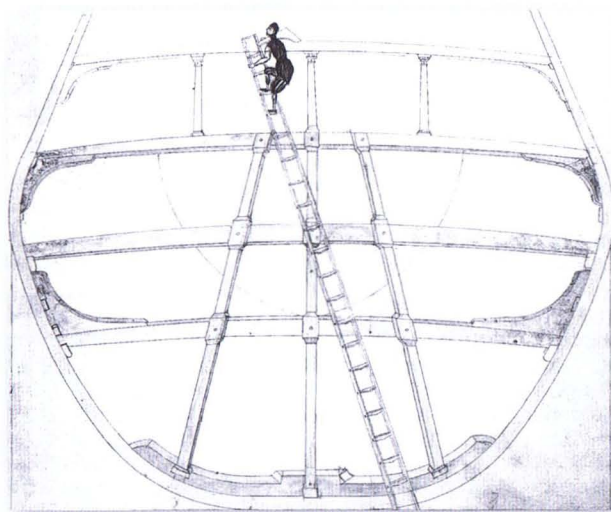


This important sketch from Matthew Baker's *Fragments of Ancient Shipwrightry* (1582) shows the shape of a galleon's keel, as well as the shape of her transom and several key frames. Judging by the keel length this sketch could well depict the ship profile of the *Revenge*. (Pepys Library, Magdalene College, Cambridge)



In this ship profile from Matthew Baker's *Fragments* (1582), the shipwright has likened the underwater shape of the galleon's hull to a fish. Hawkins followed the same basic lines in his design – the broadest part of the vessel being forward of its central point, the beam then tapering off gradually towards the stern. (Pepys Library, Magdalene College, Cambridge)

The cross-section of a Hawkins galleon, showing the main frame of the ship. The width of the beam has been exaggerated for the sake of clarity. From Matthew Baker's *Fragments*, of 1582. (Pepys Library, Magdalene College, Cambridge)



pronounced in the stern superstructure, where the quarterdeck rose gradually as it narrowed, until it reached the top of the narrow transom.

Decoration

The bare details of ship design and construction only tell part of the story. Elizabethan warships were also decorated with carvings and paintwork, giving the vessels a festive appearance. The naval accounts of the period provide us with some of the details. For example, in 1563 a financial account states that for 'painting and colouring red the great new ship called the *White Bear*' cost the Navy £20. A further 'three great personages in wood for the garnishing of the same vessel' cost £1 15s. each. Her upperworks were also described as being painted red, while those of the *Elizabeth Bonaventure* were painted in black and white – presumably in the diagonal panel pattern seen in some contemporary illustrations. Those of the *Revenge* were painted in green and white – no doubt a popular choice as they were the heraldic colours associated with the Tudor dynasty. There was no set pattern, and the colour scheme appears to have been decided either by the ships' captains themselves, or by dockyard supervisors.

Archaeological evidence from the Swedish warship *Vasa*, which sank in 1622, has shown that this penchant for decoration survived well into the next century, as the upperworks of the Swedish vessel were heavily decorated: her hull was extensively painted and gilded, and many otherwise ordinary features were further decorated with carvings. The Tudor accounts suggest that Elizabethan warships were decorated in a similar way, although probably not quite so lavishly. The exceptions are two of the largest and oldest vessels in the fleet. The records state that the *Elizabeth Bonaventure* had a dragon (a Tudor symbol) painted on her beakhead, the forward edge of her forecastle. The Elizabethan royal arms were painted on her stern transom, while two lions and two dragons were painted onto her stern gallery structure, and all four were gilded with gold leaf. She was also decorated by

'newe payntinge anf guildinge with fine gold her beake heade on both sides with Her Majesties whole armes and supporters.' Similar royal arms were added to the outside of the upper hull 'from stemme to sterne', on the stern galleries and in the cabins.

The *Foresight* also carried a painting of the Queen's coat of arms on her stern transom, surmounted by a Tudor rose and a *fleur de lys*. Carvings were also used, as an account dated 1579 claims that a sum was paid for a carving for the *Swallow* representing the Roman god Saturn as well as one of a salamander. The *White Bear* carried several carvings: 'an image of Jupiter sitting upon an eagle with the clouds, before the head of the shippe; twoe sidebordes for the heade with compartments and badges and fruitagers; the trayneboard (between the stem and the figurehead) with compartments and badges of both sides; brackets going round about the heade; 36 pieces of spoyle or artillarie round about the shippe; the great pece of Neptune and the Nymphes about him for the upright of the sterne.'

Figureheads were also mentioned in the Tudor accounts. The *Rainbow* carried a gilded carving of a lion, with planets, rainbows and clouds beneath it, while the royal coat of arms was painted onto the upper, middle and lower counters of her transom. Her cabins were also painted and upholstered in green, with 'Her Majesties badge' – the Tudor emblem – added in green and red. The lion was also used as a figurehead by the *Defiance*, *Repulse* and *Garland*, while *Nonpareil*, *Adventure*, *Dragon* and *Hope* favoured the carving of a dragon. The *Swiftsure* had a tiger as a figurehead, and the *Mary Rose* a unicorn. While it appears that not every royal vessel was decorated or painted, most appear to have some form of decoration added, and most carried a figurehead. The fleet would certainly have made a colourful display as it sailed out to fight the Spanish Armada.

OPERATION Fleet Operations

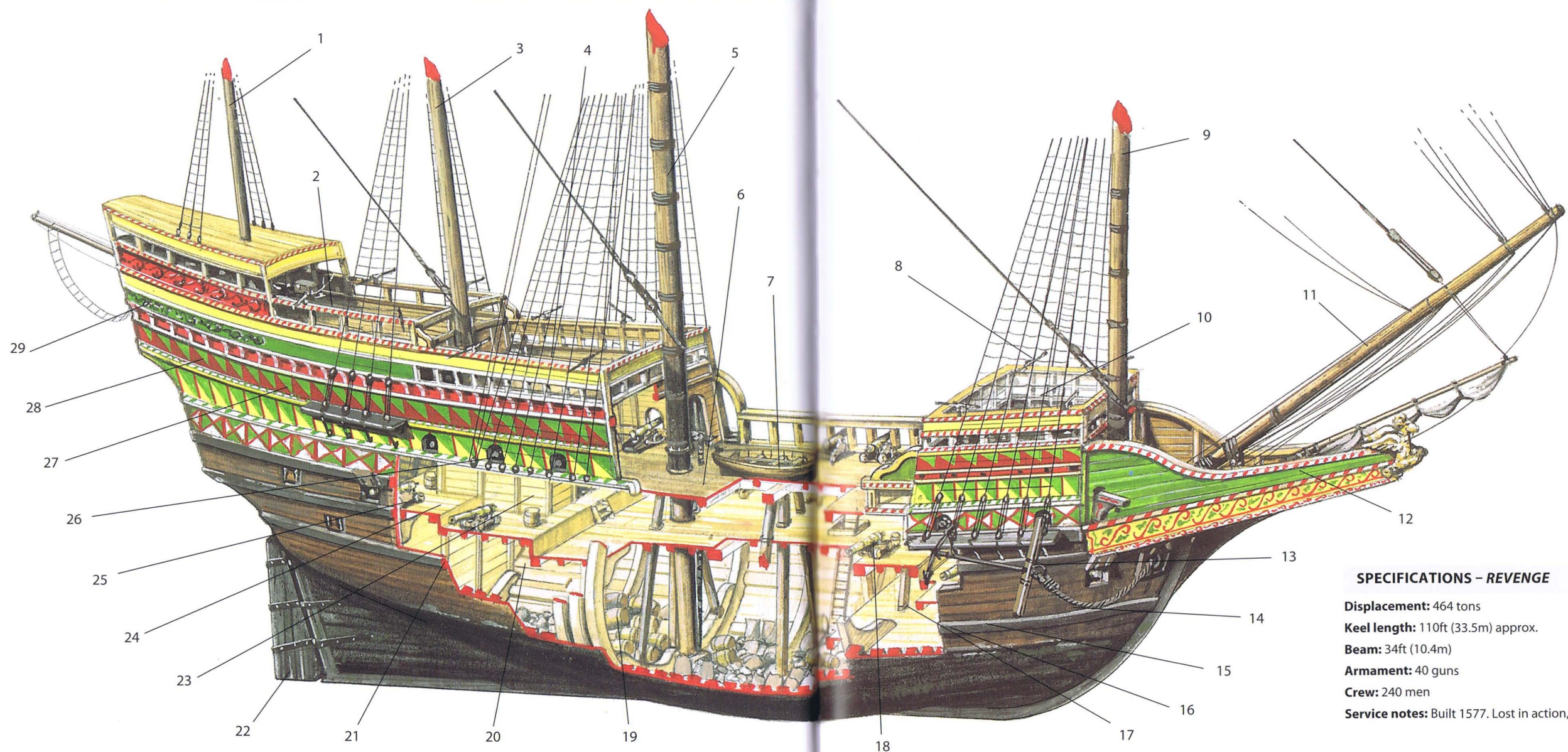
When Mary I came to the throne in 1553, the Navy Royal consisted of 39 ships of various sizes. At least on paper, all but two were operational. The real situation was a little different, and an average of ten ships were actually manned and sent to sea on patrol, including an average of three large warships. During the Tudor and early Stuart periods, the peacetime routine was to send out a Summer Guard and a Winter Guard, charged with protecting English fishing fleets or merchantman from pirates, and patrolling the waters of the English Channel and the Irish Sea. This was also a period when England was allied to Spain, so another function of the fleet was to prevent continental arms and money reaching England, where they were used by Protestant rebels against the crown.

In 1580, the English fleet helped lay siege to a stronghold held by Irish rebels, supported by a contingent of Spanish troops. This detail of an illustration of the action provides us with a rare contemporary view of the Tudor fleet in combat. From top to bottom the largest ships are *Swiftsure*, *Aid*, *Revenge* and *Tiger*, supported by the pinnace *Marline* (left) and the small ship *Achates* (right).



D REVENGE, 1588

The most famous of all Elizabethan galleons, the *Revenge* was built at Deptford in 1577, and cost the royal exchequer around £4,000. She proved a sound investment, as the new galleon built according to Hawkins' principles proved to be one of the best-designed galleons in the fleet. Although her builder was never named, it is usually accepted that the man responsible for her construction was Master Shipwright Matthew Baker, the author of *Fragments of Ancient Shipwrightry*. However, Peter Pett was also almost certainly involved in the project. The *Revenge* was noted for being a stoutly built ship, and while her sailing qualities were not as impressive as those of her lighter contemporaries, she was considered probably the best all-round warship in the fleet. During the Spanish Armada campaign of 1588, the *Revenge* served as the flagship of Sir Francis Drake, and consequently she was involved in the fighting from the first engagement off Plymouth on 31 July, until the close-range engagement fought off Gravelines on 8 August. Under Drake's command she forced the surrender of the Spanish galleon *Nuestra Señora del Rosario*, and her crew were first to loot the Spanish prize. Her most famous battle, however, came in 1591, when she was overtaken by a Spanish fleet off the Azores. Her commander Sir Richard Grenville put up a spirited fight, but after 16 hours of battle he was forced to surrender the battered hulk of his ship. The *Revenge* was caught in a storm a few days later, and was wrecked off the island of Terceira.



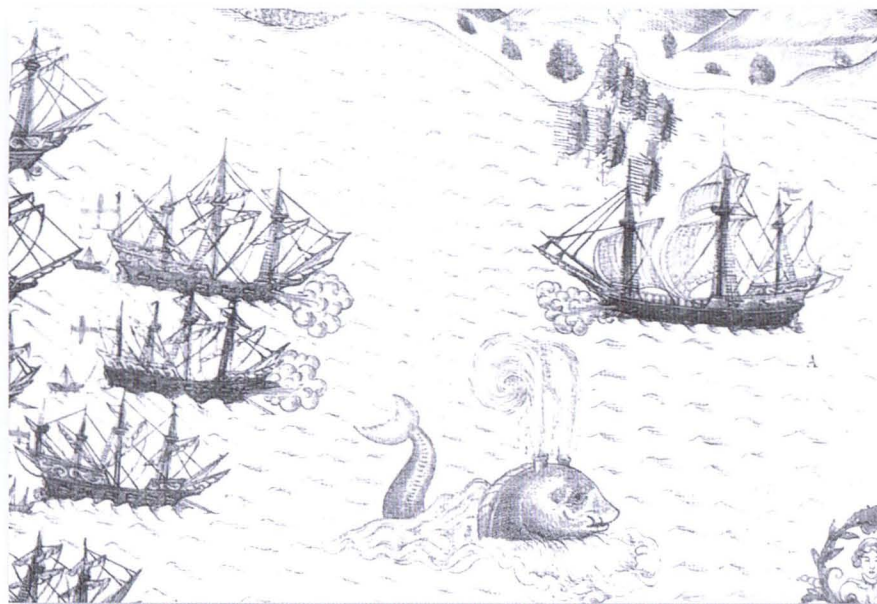
KEY

- | | | |
|-----------------------|--|------------------------------------|
| 1 Bonaventure mast | 11 Bowsprit Foremast | 20 Orlop deck |
| 2 Poop deck | 12 Beak | 21 Lower wale |
| 3 Mizzen mast | 13 Main anchor | 22 Rudder |
| 4 Quarterdeck | 14 Cable store | 23 Surgeon's cabin |
| 5 Mainmast | 15 Boatswain's store | 24 Lower gunroom |
| 6 Waist | 16 Carpenter's cabin | 25 Upper gunroom armament (sakers) |
| 7 Ship's boat | 17 Galley | 26 Port pieces |
| 8 Fowler (swivel gun) | 18 Main deck armament (demi-culverins) | 27 Officers' cabins |
| 9 Foremast | 19 Powder store | 28 Captain's cabin |
| 10 Forecastle | | 29 Admiral's cabin |

SPECIFICATIONS - REVENGE

Displacement: 464 tons
Keel length: 110ft (33.5m) approx.
Beam: 34ft (10.4m)
Armament: 40 guns
Crew: 240 men
Service notes: Built 1577. Lost in action, 1591.

In this detail of Drake's attack on Santiago in the Cape Verde Islands (1585), the fleet (strangely shown firing from the bow) provides naval gunfire support to cover the disembarkation of Drake's raiding party, which captured and sacked the town. The vessels on the left are shown at anchor, and the restriction of the gunnery to bow guns suggests the landing was conducted on an ebb tide. From a chart by Baptista Boazio, 1588. (National Maritime Museum, Greenwich, London)

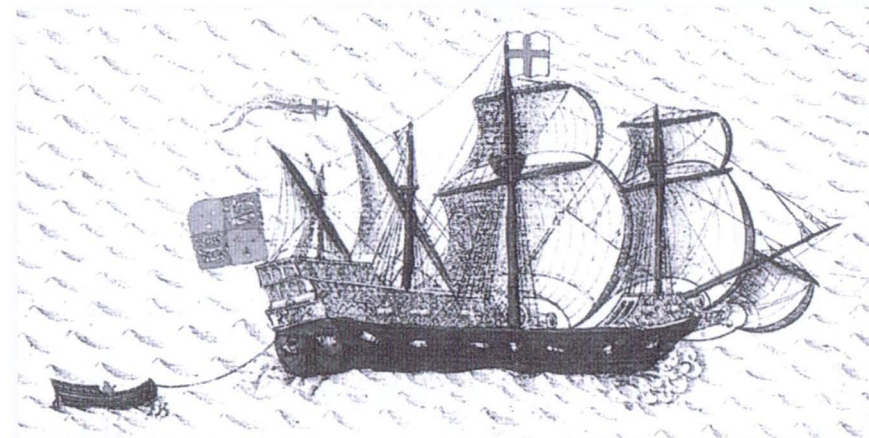


Royal warships laid up 'in ordinary' ('mothballed' in modern naval parlance) were also available for private hire. For example, in 1554 the new galleon *Philip & Mary* and the older carrack *Edward Bonaventure* were leased out to Richard Chancellor's Muscovy Company. Although the galleon returned from Russia in 1556, the carrack was wrecked on the Scottish coast. This policy continued during Elizabeth I's reign, although the terms had changed, and the Crown was usually an active stockholder in these trading ventures. Typically the terms were extremely advantageous for Elizabeth, who ensured that her otherwise inactive ships were overhauled, refitted and manned at someone else's expense, and guaranteed a return whether the venture was successful or not. As the vessels were hired privately, the government could also deny any involvement in these ventures – an important legal point that helped maintain the fragile peace with Spain during the 'Cold War' of 1558–85. The best-known example of this practice is the hiring out of the *Jesus of Lubeck* and the *Minion* to Sir John Hawkins in 1568.

A very thin line existed between privateering and piracy during this period, and while 'Sea Dogs' such as Hawkins and Sir Francis Drake were issued with 'letters of marque' in order to exact 'reprisals' against the Spanish, Elizabeth stopped short of anything that could be seen as direct involvement in the 'Cold War'. This situation all changed in 1585, when the *Elizabeth Bonaventure* and the *Aid* took part in Drake's latest raid on the Spanish Main, and Elizabeth even appointed the expedition's commanders as admirals in the Navy Royal. At least three of the private warships that made up the fleet of 14 ships and eight pinnaces were built according to the principles laid down by Hawkins, which made them virtually identical to warships of the Tudor fleet. It is hardly surprising that the Spanish viewed the highly successful enterprise as a declaration of war.⁵

The first official operation of the Spanish War came in 1587, when Drake led an attack on Cadiz. Four royal warships, the *Elizabeth Bonaventure*, *Golden Lion*, *Dreadnought* and *Rainbow* were involved in 'singeing the

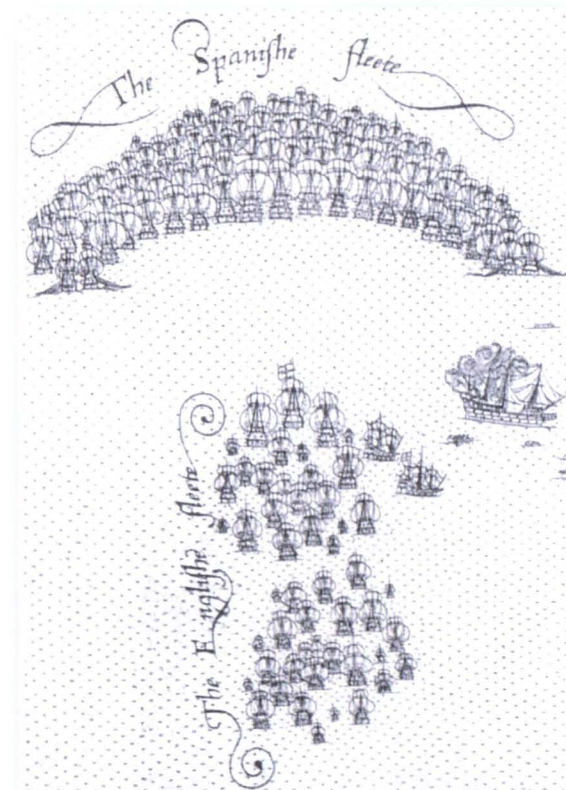
⁵ *Elizabethan Sea Dogs* (Osprey Elite Series 20) contains more information about Drake's 'privateering' activities during this period.



In this detail from the chart by Baptista Boazio, produced in 1588, of Drake's attack on Cartagena on the Spanish Main (1586), a vessel that is probably meant to portray Drake's flagship *Elizabeth Bonaventure* is shown approaching the Spanish-held port. (National Maritime Museum, Greenwich, London)

King of Spain's beard', although the bulk of the 14-ship main battle fleet was made up of armed merchantmen. This proportion was also reflected in the composition of the English fleet during the Spanish Armada campaign of the following year. The English fleet that sailed out of Plymouth in late July 1588 consisted of just 19 warships of the Navy Royal, accompanied by no less than 54 armed merchant vessels. A further 21 armed merchantmen temporarily joined the fleet during the fighting off the Devon coast. A secondary force stationed off the Downs in Kent was more equally balanced, with seven royal warships and seven armed merchantmen in the squadron. However, this force was reinforced by 17 additional armed merchantmen mid-way through the campaign, making the proportion of royal ships to hired ships in the squadron similar to that in the main fleet.

If we discount the 15 volunteer merchantmen that displaced less than 90 tons, we find that the main fleet consisted of 19 royal ships and 79 merchantmen, the royal ships being approximately 24 per cent of the total. Similarly, if we include the additions to the Downs Squadron, we reach a tally of 7 royal ships to 31 merchantmen, or 23 per cent of the total. This means that for every royal ship that sailed out to fight the Spanish that year, three armed merchantmen sailed alongside her. While Hawkins' race-built galleons might have formed the fighting core of the fleet, the majority of the force – some 44 ships, or 40 per cent of the English fleet, consisted of privately owned vessels displacing between 150 and 250 tons. Although the records of the time described the vessels as armed merchantmen, this was something of a misnomer. Many of these were the ships used by men such as Drake and Hawkins during their expeditions, or else were fitted out and operated as 'privateers', or private warships. Some were even race-built galleons, and so were the equals in manoeuvrability and firepower to equivalent-sized warships in the Navy Royal.



In this detail from the *Expeditionis Hispanorum in Angliam* series of Armada charts by Richard Adam, a loose gaggle of English ships is shown harrying the rear of the Spanish formation off the Devon coast on 1 August 1588. On the right the artist has depicted the crippled Spanish galleon *Nuestra Señora del Rosario*, which was captured then added to strength of the Navy Royal. (National Maritime Museum, Greenwich, London)



Another depiction of the Armada campaign by Claes Visscher, this time showing the fighting off Gravelines on 8 August 1588. The loose melee of ships is somewhat fanciful, as the Spanish managed to maintain some semblance of a battle formation during the engagement.

Contrary to popular belief, the English fleet failed to break up the Spanish battle formation as it progressed up the English Channel, although the lessons learned during the early fights led to an important revision of fleet tactics and operations.⁶ Rather than operating as a large body, Lord Thomas Howard divided his fleet into four more manageable squadrons, commanded by himself, Hawkins, Drake and Frobisher. During these early battles the fleet relied on long-range gunnery to disrupt the Spanish formation, and this tactic had proved largely ineffective. Therefore, during the climactic fighting off Calais in early August, the fleet fought at close range, where the English advantage in gunnery would be most apparent.

Fireships were used to drive the Spaniards from their secure anchorage, and although the English failed to destroy the now-disrupted Armada through gunnery alone, they succeeded in preventing the Spanish from landing on

⁶ A detailed examination of the operation of the fleet during the campaign is found in *The Armada Campaign, 1588* (Osprey Campaign Series 86).

E

THE ENGLISH FLEET OFF CALAIS, 1588

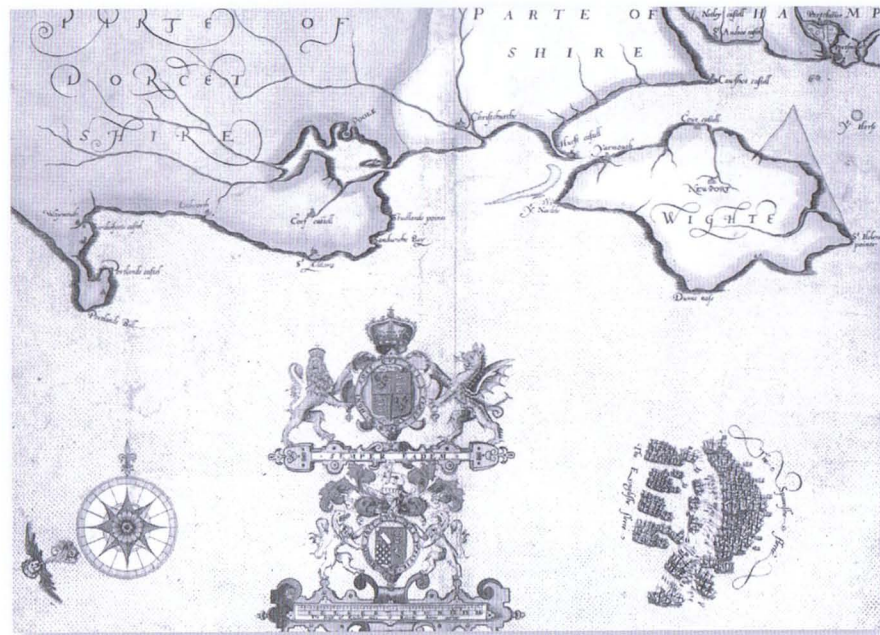
In early August 1588, as the Spanish Armada worked its way up the English Channel, a reserve fleet based off Dover prepared itself for battle. This force – the Narrow Seas Squadron – was commanded by Lord Henry Seymour, a veteran naval leader, and the cousin of Lord Howard, the English fleet commander.

On 6 August Sir Henry led his vessels out from the Downs, the anchorage between Sandwich and Dover that had long been a mustering point for the fleet. Two days previously, reinforcements consisting of 17 armed merchantmen had sailed from London to join his squadron, and once they arrived, Seymour sailed across the narrows of the Channel to join the rest of the English fleet off Calais.

Seymour's fleet of 31 ships was spearheaded by seven vessels of the Navy Royal: the 500-ton galleons *Rainbow* and *Vanguard*, the 400-ton *Antelope*, the two 200-ton converted galleasses *Tiger* and *Bull*, and two smaller vessels, the *Tramontana* and the *Scout*. The plate shows Seymour flying his flag in the *Rainbow*, the flagship followed by the other ships of the Navy Royal in his squadron. They are pictured sailing in the order given above.



One of the *Expeditionis Hispanorum in Angliam* series of Armada charts by Richard Adam, this shows the fighting off the Isle of Wight on 4 August 1588. After the first days of the fighting, Lord Howard divided his fleet into four squadrons – his own, and those of Hawkins, Drake and Frobisher.

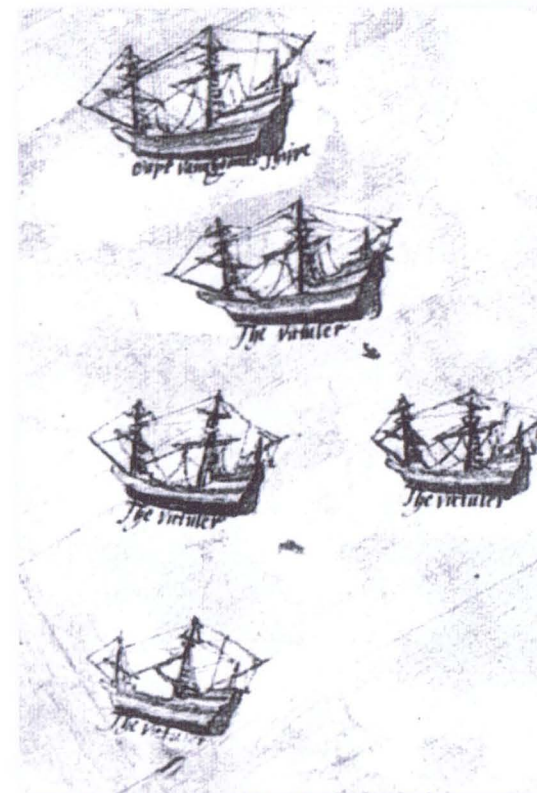


English soil. A chronic shortage of ammunition also prevented the English from taking full advantage of their victory. Fortunately for them, an unseasonable storm front wrecked the Spanish fleet as it sailed home by circumnavigating the British Isles. One clear outcome of the campaign was the vindication of Hawkins' design. The principal warships of the Navy Royal had proved their worth in the fighting, and could be relied upon to more than hold their own against the Spanish in the future.

Despite their losses, the Spanish still posed a serious threat, and so the war continued as the English attempted to prevent the gathering of a second armada by raiding Spanish ports and disrupting the flow of specie from the New World. During the Portuguese expedition of 1589, Sir Francis Drake's force of 85 ships included eight vessels from the Navy Royal, including his own flagship *Revenge*, as well as *Nonpareil* and three of Hawkins' galleons. The English fleet was also joined by some 60 Dutch vessels, thereby creating what was effectively an Armada in reverse. The expedition achieved little, and cost the royal treasury dear.

In 1591 a second expedition was launched against the Spanish, except this time Elizabeth returned to the old policy of leasing out her warships, as part of a joint stock venture. Lord Howard's fleet of 28 vessels included eight warships of the Navy Royal, including *Revenge*, *Defiance*, *Elizabeth Bonaventure* and *Nonpareil*. In theory it was a powerful force, but disease and dissent greatly reduced its effectiveness, and the Spanish managed to intercept Howard as he lay off the Azores. This encounter led to the loss of the *Revenge*, commanded by Sir Richard Grenville, whose vessel was cut off from the rest of the fleet and pounded into submission by the bulk of the Spanish fleet. The one-sided engagement, however, did demonstrate the clear superiority of Hawkins' ships over those of the Spanish, and played a part in discouraging the Spanish from attempting another full-scale assault on England.

During the final years of Elizabeth's reign, the bulk of the Navy Royal was held in reserve against an attack that never came, while Drake, Hawkins and Raleigh resumed their policy of conducting raids against the Spanish



Main, where their enemy was considered vulnerable. In 1592 the *Foresight* and the *Garland* were leased out for an attack on the Spanish treasure fleet off the Azores, a venture that yielded great profits for the participants but little for the Queen, as the bulk of the plunder was divided before the Queen's officers could intervene. For the 1595 expedition to the Spanish Main led by Drake and Hawkins, the Queen provided the *Garland*, *Elizabeth Bonaventure*, *Defiance*, *Hope*, *Foresight* and *Adventure* as her stake in the venture, although the tight conditions she imposed on her ships' use did much to limit Drake's independence. Despite delivering attacks on Las Palmas in the Canary Islands and San Juan on Puerto Rico, the expedition proved to be another failure, and resulted in the deaths of both Drake and Hawkins.

Following the deaths of her two greatest 'sea dogs', Elizabeth abandoned her policy of contracting out major elements of her fleet, although she still relied on hiring merchant vessels to augment the Navy Royal for specific operations, and of regarding such expeditions as sources for profit. In 1596 Lord Howard led the bulk of the Navy Royal – some 17 warships – in another attack on Cadiz, supported by 47 armed merchantmen and a small Dutch contingent. In effect, this was the first real national effort undertaken by the fleet since 1588. Raleigh spearheaded the attack in the *Warspite*, and the operation proved an unqualified success, yielding two prize ships (the galleons *San Andreas* and *San Mateo*), the loss of at least eight further major Spanish warships, and the seizure of a sizeable haul in plunder.

By way of retaliation, Philip II of Spain launched two further armadas against England, both of which were dispersed by gales. Their threat meant that the bulk of the Navy Royal was held in readiness at Plymouth, supported by the usual merchant auxiliaries. An unsuccessful pre-emptive raid was also



ABOVE LEFT

A group of small English supply ships (or 'victualers') at anchor off Smerwick in Ireland, in this detail of the coloured chart showing the siege of the Irish fort there in 1580. The importance of ensuring an adequate supply of stores and ammunition to the fleet was demonstrated in 1588, when the English fleet was forced to disengage from the Spanish when their ammunition ran out.

ABOVE RIGHT

The late Tudor fleet at anchor in the River Medway, close to the dockyard at Chatham. Elizabeth established Chatham as a royal dockyard in 1567, and the riverine anchorage was where warships of the Navy Royal were kept 'in ordinary' (i.e. mothballed) when not in active use.

Sir Francis Drake (c.1540–96) was probably the most famous 'Sea Dog' of his day, leading expeditions against the Spanish Main, commanding a division of warships against the Spanish Armada (1588) and leading raids against the Spanish coast. He remained a plunderer at heart, and consequently performed best as a privateer rather than as a naval commander.



launched by the Earl of Essex against the Azores, his force including 17 royal warships, which incorporated the two galleons captured at Cadiz. This operation proved to be the last major naval action of the war. The threat of invasion evaporated following the death of Philip II in 1598. Elizabeth took the opportunity to place the bulk of her fleet in ordinary, although small forces were retained on active service to provide Summer and Winter Guards, and to cruise off the Spanish coast in search of prey. True to form, Elizabeth turned these cruises into commercial ventures, effectively turning the royal warships that participated in them into privateers.

F

TRIUMPH AND ARK ROYAL, 1592

The aim of this plate is to highlight the differences between two of the most powerful ships in the Elizabethan Navy Royal. The *Triumph* was a galleon of 740 tons, built in 1561 according to the requirements of the time. In many respects she resembled her Spanish counterparts, which is hardly surprising as her lines were probably based on the trio of galleons commissioned by Mary I, based upon the warships used by her husband, Prince Philip of Spain. However, the *Triumph* boasted a powerful armament of 46 heavy guns, mounted on modern carriages. This meant she could outshoot any vessel in the Spanish Armada. During the 1588 campaign, she served as the flagship of Sir John Hawkins. By contrast, the 550-ton *Ark Royal* was built in 1587 according to the race-built galleon design advocated by Hawkins, and represented the latest word in Elizabethan ship design at the time of the Spanish Armada. Although her armament of 38 heavy guns made her less powerful than the *Triumph*, her speed and manoeuvrability more than compensated for any lack of hitting power. During the Armada campaign she served as the fleet flagship.

Specifications – *Triumph*

Displacement: 741 tons

Keel length: 100ft (30.5m)

Beam: 40ft (12.2m)

Armament: 46 guns

Crew: 340 sailors, 40 gunners, 120 soldiers

Service notes: Built 1561. Rebuilt 1596. Condemned, 1618

Specifications – *Ark Royal*

Displacement: 550 tons

Keel length: 100ft (30.5m)

Beam: 37ft (11.3m)

Armament: 38 guns

Crew: 268 sailors, 32 gunners, 100 soldiers

Service notes: Built 1587. Rebuilt 1608. Wrecked off Tilbury, 1636

F



TRIUMPH



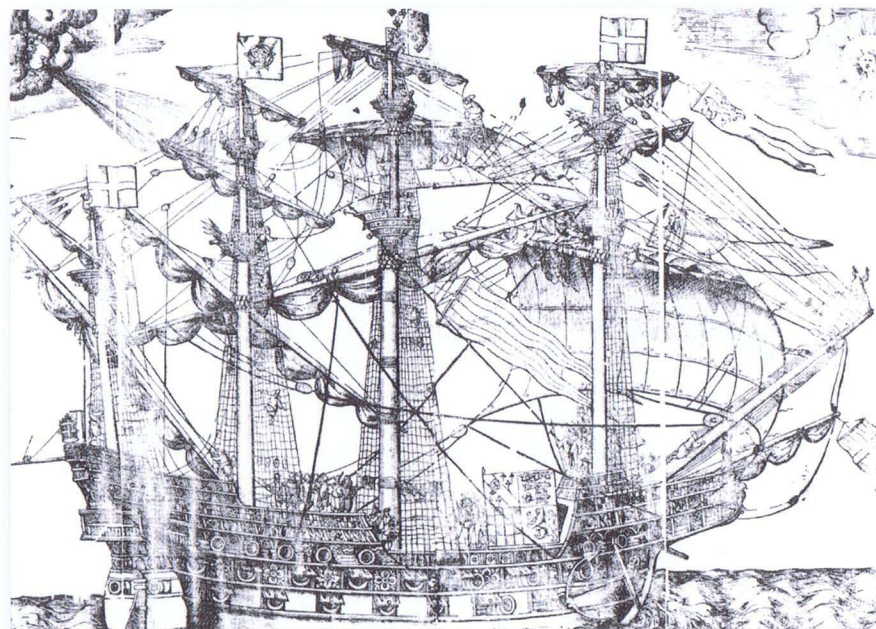
ARK ROYAL

During her reign Elizabeth may well have built up a powerful navy, but what the above summary shows is that it lacked the resources needed to do more than avert the strategic threat posed by Philip II's Spain. Throughout her reign, the Navy Royal was too small to engage the Spanish without augmenting the fleet with hired merchantmen, and although it proved highly successful, it was unable to challenge Spain's control of the seas as defined by Alfred Mahan in *The Influence of Sea Power Upon History* (1890). Instead, she used the limited resources at limiting the ability of the Spanish to launch more than one effective Armada.

While the process of hiring out warships for commercial gain had been practised by her father Henry VIII, Elizabeth turned this procedure into a form of strategic policy, one that greatly reduced the cost of maintaining her fleet and which offered the chance of substantial profit. Above all, it turned the business of England's naval defence into a commercial venture, where men such as Drake, Hawkins, Frobisher and Raleigh all stood to gain from their achievements. This unusual policy worked, creating a breed of commanders willing to take extraordinary risks in the service of their Queen – and for their own profit.

ARMAMENT AND GUNNERY

We are lucky to have fairly detailed ordnance records for the later Tudor period. A comprehensive survey of the Tudor fleet, forts and arsenals was conducted in 1545–46, detailing the guns, ammunition and ordnance stores owned by the crown. Supporting this wealth of information is the archaeological evidence from the *Mary Rose*, which sank in 1545. A similar survey was conducted in 1602, during the last year of Queen Elizabeth I's reign. During the intervening years a handful of ordnance manuals and lists were published, identifying the gun types mentioned in these inventories. A comparison of all this information helps to highlight the gunnery revolution that helped transform the Tudor fleet during the Elizabethan age.



If it does nothing else, this contemporary although extremely fanciful German woodcut of an English galleon does demonstrate the reputation for firepower enjoyed by Elizabeth's Navy Royal among other European states. The artist has depicted the warship with two gun decks – a development not introduced to English ship design until the following century.

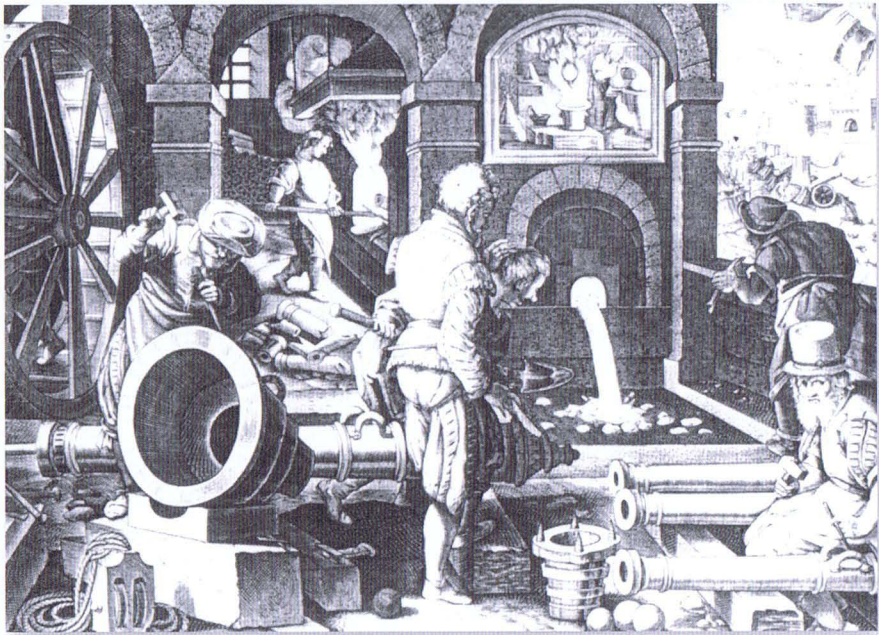


What is immediately apparent is the increase in the size and calibre of ordnance carried in the fleet. Equally important is the reduction in the number of wrought-iron guns carried. While these accounted for almost half of the ordnance supplied on warships in Henry VIII's navy, guns of this kind were extremely rare by the close of Elizabeth's reign. However, as late as the Spanish Armada campaign of 1588, a small number of these obsolete breech-loading weapons – by then classified as port pieces – were carried throughout the fleet as close-range anti-personnel weapons. Smaller wrought-iron breech-loading bases (or swivel guns) continued to be carried, mounted on the ships' gunwales in a manner reminiscent of more modern machine guns. Their role was also much the same – delivering a hail of anti-personnel rounds at an enemy that was attempting to board. A larger version of the base, known as the fowler, was used in much the same way.

If we compare a list of the guns issued to the *Elizabeth Bonaventure* in 1585, and those she actually carried during the expedition to the Caribbean that year, we see that Drake altered her suite of ordnance, dropping all her anti-personnel weapons (port pieces, fowlers and bases), and instead carried a handful of extra cannon periers, culverins and demi-culverins (see table below for definitions). In other words, he had no intention of fighting a boarding action, and preferred to equip his most powerful ship with a formidable broadside. The layout of Hawkins' race-built galleons gave commanders the ability to carry larger, heavier guns than before, and so men like Drake made full use of this opportunity. The cannon-perier was an unusual, short, large-calibre weapon that fired a stone rather than a cast-iron roundshot. Although stone shot was expensive and time-consuming to produce, 16th century navies retained a few such weapons, which had a limited range but were lethal at close quarters, the shot most probably shattering on impact into a shower of high-velocity stone flakes.

This contemporary woodcut depicting a mid 16th-century sea battle shows vessels trading artillery fire, while their crews fire at the enemy using muskets, arquebuses and bows. The advantage of the Elizabethan gunnery revolution meant that for the first time, warships had the option to keep their distance, and pound the enemy into submission beyond range of enemy small-arms fire.

Gunfounders at work during the mid 16th century. The development of an efficient English gunfounding industry and the technical excellence of the pieces these founders produced did much to ensure England's tactical naval advantage over its Spanish adversaries during the Elizabethan period.



Excluding the handful of light swivel guns and other anti-personnel weapons, the vast majority of ordnance carried on ships of the Navy Royal was cast from bronze. An inventory detailing the ordnance carried by the ships of the fleet in 1603 lists very few iron pieces – less than 8 per cent of the total carried in the fleet, if swivel guns are excluded from the total. Despite improvements in the techniques of cast-iron gunfounding, and the development of a large and reliable iron gunfounding industry in the Wealden area of south-east England, the Navy Board remained unconvinced, and continued to purchase bronze guns for the fleet, the majority supplied by royal foundries. Cast-iron ordnance, however, proved popular with private ship owners, largely because the metal was a third of the cost. Merchant vessels usually carried a significantly smaller armament than warships of a comparable size, and so the greater weight of iron guns compared to bronze ones was of less importance. Equally importantly, the Navy Board could exert more control over exactly what kind of weapons the royal gunfounders produced.

The following list of ordnance types is culled from a contemporary artillery manual, *The Arte of Shooting in Great Ordnance*, by William

Table of types of ordnance as listed by William Bourne, c.1578

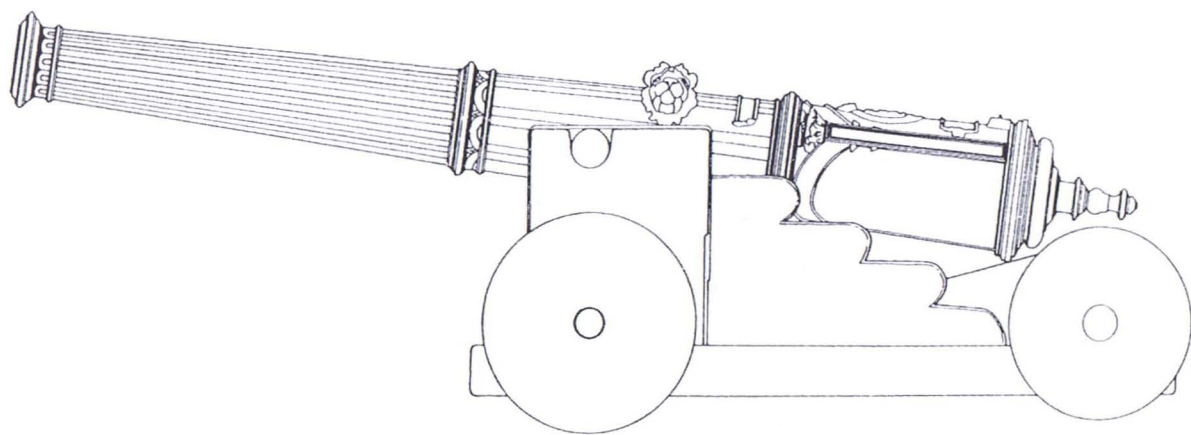
	Calibre	Length	Weight	Shot Size
Cannon	8"	12 feet	7,500 lbs.	64-pdr.
Demi-Cannon	6½"	10–11 feet	5,500 lbs.	33-pdr.
Culverin	5½"	12 feet	4,500 lbs.	17-pdr.
Demi-Culverin	4½"	10 feet	2,700 lbs.	10¼-pdr.
Saker	3¾"	8–9 feet	1,500 lbs.	6-pdr.
Minion	3¼"	8 feet	900 lbs.	3-pdr.
Falcon	2¾"	7 feet	700–750 lbs.	2½-pdr.
Falconet	2¼"	5–6 feet	360–400 lbs.	1¼-pdr

Bourne, published in London in 1578. As a land-based master gunner in the Queen's service, Bourne was careful to include a list of the most common contemporary types of gun, and listed their basic specifications.

We can compare Bourne's list with a list of ordnance carried in the Navy Royal in 1585, which gave the number of guns carried on all the major units of the fleet that were then on active service, dividing them by gun type. Cannons were considered too large for shipboard use, as there was insufficient room to mount these weapons in pairs, one on each broadside, even if the gundeck beams could support the weight. This meant that the demi-cannon was the largest practical gun carried onboard warships of the Elizabethan fleet, a weapon equivalent to the late 18th century 32-pdr. The list also shows that as late as the 1580s, most ships in the fleet still carried between one and three paired wrought-iron breech-loading guns, similar to the pieces found on the *Mary Rose*. This practice reaffirms the idea, already noted, that although these weapons were considered obsolete compared to modern bronze pieces, their ability to fire rapidly at close range made them a valuable weapon to include in a ship's arsenal. For a similar reason most large warships carried one or two pairs of cannon-periers, which were essentially the modern replacement for the port-piece as a large-calibre anti-personnel weapon.

Ordnance carried by active ships of the Navy Royal, 1585

	Demi-cannon	Cannon-perier	Culverin	Demi-culverin	Saker	Minion	Falcon	Falconet	Port Pieces	Fowlers	Bases
Elizabeth Bonaventure	9	4	14	7	6	2	8		4	10	12
Triumph	9	4	14	7	6	2			4	10	12
White Bear	1	6	17	10	10	4	4		4	10	12
Victory	6	4	14	8	2		4		6	10	12
Hope	4	2	6	10	4	2	1		4	6	12
Mary Rose	4	2	8	6	8				2	6	4
Nonpareil	4	2	4	6	12	1	1		4	6	12
Golden Lion	4	4	6	8	6		2		4	6	2
Revenge	2	4	10	6	10		2		2	4	6
Bonaventure	4	2	6	8	6	2	2		4	6	12
Dreadnought		2	4	10	6		2		2	8	8
Swiftsure		2	4	8	8		4		2	6	8
Antelope		2	2	6	6	2	2		4	4	10
Swallow		2		4	8	2	6		4	4	10
Foresight			4	8	8	4			2	2	8
Aid				2	8	2	6	1	4	8	8
Bull				6	8	2	1			4	4
Tiger				6	10	2	2			4	4
Scout					8	2	6	2		2	6
Achates					2	4	10			2	4
Merlin							6	2		2	2



A drawing by archaeological illustrator Debbie Fulford of a bronze 'bastard' demi-culverin cast by the London gunfounders John and Robert Owen in 1537, recovered from the wreck of the *Mary Rose*, which sank in 1545. The remains of its four-wheeled carriage were also recovered, and would have been a forerunner to the carriages employed by Elizabeth's navy. (Mary Rose Trust, Portsmouth)

Taking the *Revenge* as an example, we see that in just three years before the start of the Spanish Armada campaign, she carried 36 large guns, all but two of which were almost certainly bronze pieces. In addition she was fitted out with ten swivel guns (fowlers and bases). Using the terminology of the 18th century, the heavy armament was divided into 32-pdrs, 18-pdrs, 12-pdrs and 6-pdrs – not counting the cannon-periers. The heaviest guns would be carried as low as possible in the ship, leaving the sakers and demi-culverins to be housed on the upper deck, and in the upper gunroom. Given that the *Revenge* had a beam of about 32ft (9.7m) at the position of her main frame (immediately forward of her mainmast), then according to Bourne's table there was barely sufficient room to deploy two guns in broadside, one on either side of the gundeck. However, the Navy Board had already addressed this problem. During the 1570s, William Wynter, the Master of Ordnance for the Navy, developed a new and shorter range of bronze guns designed for sea service, and these were in general use by the time the Spanish Armada sailed up the English Channel.

After a period of refitting in the aftermath of the Portuguese campaign of 1589, the *Revenge* was prepared for sea again, and a new batch of guns were assigned to her from the ordnance stores at the Tower of London. Some 40 pieces were listed: 4 cannon-periers, 2 demi-cannons, 10 culverins, 6 demi-culverins, 10 sakers, 2 falcons, 2 port-pieces and 4 fowlers. This is remarkably similar to her 1585 armament, which suggests that apart from the lighter swivel pieces, the same suite of guns may well have been re-issued. The guns were also listed by weight and length, and all were shorter and lighter than those listed by Bourne. This suggests they were pieces designed by Wynter. While the demi-cannons were still 10ft (3m) long, culverins ranged from 7 to 8½ft (2.1 to 2.6m) long, demi-culverins were 8ft (2.4m), while sakers and falcons were listed as being 7ft (2.1m) long. Once these guns were mounted on compact four-wheeled carriages with small truck wheels, they would take up considerably less deck space than earlier, longer guns, and would consequently be easier to reload and to fire.

While the Spanish still mounted their guns on two-wheeled carriages – essentially solid-wheeled and slightly shortened versions of those employed on land – the English had developed their own form of gun carriage. The carriages recovered from the *Mary Rose* which sank in 1545 show that this process was already underway during Henry VIII's reign, and a combination of accounts and a few scant pictorial records suggest that by 1580 the Navy

Royal had fully adopted the four-wheeled carriage. The combination of shorter guns and more manoeuvrable carriages was as important to the success of the Elizabethan warship as the design of her hull. In fact, in 1588, while one English gunner complained about the lack of skilled gunners in the fleet, Spanish observers claimed that the English fired their guns as frequently as the Spanish could fire a musket. The gun and carriage were perfectly designed for the business of naval gunnery, and consequently they easily outdid the Spanish in terms of rate of fire if not in accuracy.

The effect this gunnery advantage had on English naval tactics has already been examined in some detail in *Elizabethan Sea Dogs* (Osprey Elite Series 70). However, it is worth repeating that while the Spanish based their tactics on boarding the enemy, the English preferred to keep their distance and rely on their ordnance. This is exactly why Drake altered the ordnance carried on board the *Elizabeth Bonaventure* in 1585. Royal warships were issued with boarding weapons, muskets and other close-range weapons, but it was much safer to keep the better-trained Spanish sea soldiers at a safe distance. If the English fleet closed to within point-blank range of the enemy – just as they did during the final stages of the Armada campaign – then the effect could be devastating.

This depiction of the Battle off Gravelines (1588) by a Flemish artist, compresses various stages of the battle into one engraving, including the attack by English fireships – shown in the background – and the close-range gunnery duel that dominates the centre of the work.



THE TUDOR WARSHIP IN ACTION

On 30 August 1591, the *Revenge* was lying off the island of Flores in the Azores, as part of Lord Thomas Howard's English fleet. The 500-ton galleon was commanded by the veteran sea captain Sir Richard Grenville, and carried a crew of about 250 men. Dawn revealed the approach of a Spanish fleet of over 30 warships, the majority of which were large galleons. All but one of Howard's fleet escaped to the north, but Grenville's galleon was delayed as many of his crew were ashore on the island. Unable or unwilling to escape, Grenville ordered the *Revenge* to turn towards the enemy. Grenville forced his way into the middle of the powerful Castilian Squadron, repeatedly firing both broadsides as he went. His ship broke through the Spanish formation and headed north, with the Spanish galleons in pursuit.

The galleon *San Felipe* overhauled the *Revenge* on her starboard side, stealing her wind. As the Spaniard tried to board, Grenville fired a broadside that all but crippled the enemy galleon, which fell away astern. However, the Spanish vessel had slowed the *Revenge* down sufficiently for the *San Barnabe* to come alongside her port side. The two ships locked together. The English were unable to fire their heavy guns for fear of sinking the Spaniard, which would probably have taken the *Revenge* down with her. The Spanish upper deck guns concentrated on the masts and sails of the *Revenge*, denying her the opportunity to escape even if she could free herself. Meanwhile, Spanish sea soldiers took advantage of their vessel's height and whittled down the English defenders using firearms and grenades.

Howard made several attempts to break through the ring of Spanish ships that now surrounded the *Revenge*, but to no avail. Grenville and his men were on their own. Just as darkness fell, the galleon *San Cristobal* crashed into the stern of the *Revenge*, and a wave of Spaniards scrambled onto her quarterdeck. Although the attackers cut their way forward as far as the mainmast, the crew of the *Revenge* rallied and drove them back to the *San Cristobal*. Grenville himself was mortally wounded in the melee. Meanwhile, English gunners fired their sternchasers into the Spanish galleon, holing her below the waterline. The *San Cristobal* pulled away, her commander signalling for assistance.

G

THE LAST FIGHT OF THE REVENGE, 1591

In the summer of 1591, the *Revenge*, commanded by Sir Richard Grenville, took part in an English expedition to the Azores. Lord Howard's fleet was surprised by a much larger Spanish force, and while most of the English ships managed to escape, the *Revenge* was unable to follow them to safety. Grenville's ship was overhauled, and soon the *Revenge* was surrounded by Spanish galleons, pouring shot into her at close range. The fight lasted for around 16 hours, the English crew repulsing numerous boarding attempts, while their ship lay battered and helpless. With the *Revenge* unable to fight back, and with most of his men killed or wounded, the dying Grenville finally surrendered his ship. The action was immortalized in verse by Lord Alfred Tennyson in *The Revenge: A Ballad of the Fleet*:

And the night went down, and the sun smiled out far over the summer sea,
And the Spanish fleet with broken sides lay round us all in a ring;
But they dared not touch us again, for they feared that we still could sting,
So they watched what the end would be.

The plate shows the action soon after dawn, when the *Revenge* was surrounded by three Spanish galleons: the *San Barnabe* on her port side and *La Asuncion* and *La Serena* pinning her bow. Having just driven off a fourth galleon pinned to her stern, the *Revenge* is exchanging fire with the rest of the Spanish fleet, massed in the darkness off her starboard beam.



An English seaman of the Elizabethan period, from a contemporary illustration. Although he appears unusually well dressed, apart from the ruff, the shoes and the stockings, his dress was typical of that worn by sailors of the time. Fur hats were worn extensively by seamen of the 16th to 18th centuries during winter weather.



The next ship to attack was the *La Asuncion*, whose crew boarded the *Revenge* over her port bow. The attack was driven back, as were several more attempts to storm the *Revenge*'s forecastle. The *La Serena* was next, but the English defenders hung on grimly, and repulsed all assaults. Three Spanish galleons were now grappling with the *Revenge*, and Spanish reinforcements were ferried over to these three ships, thereby adding a fresh impetus to the fight. Only the starboard side of the *Revenge* remained clear of enemy ships, which were kept at bay by repeated broadsides from the English guns. The Spanish fired back during lulls in the boarding action. At some point the battered *San Barnabe* gave up the attack, having been badly damaged.

However, English losses continued to mount, and the deck of the *Revenge* was beginning to resemble a charnel house.

As dawn rose the true extent of her damage was revealed. Most of her upper works had been shot away, but her lower deck guns were still firing intermittently. Daylight also offered the Spanish soldiers fresh targets, and before long few of the English defenders remained standing. The dying Grenville ordered his ship to be blown up, but was convinced by his surviving officers that his ship was already sinking, and that he needed to surrender in order to save his crew. He did so reluctantly, despite being offered full honours by the Spanish commander General Alonso de Bazan. Grenville died three days later. As for the *Revenge*, she sank in a storm a few days later, as did the five Spanish ships that had been badly damaged during the engagement.

While a stirring piece of English naval history, the last fight of the *Revenge* also demonstrates the ability of Howard's race-built galleons to fight and to absorb damage. The engagement demonstrated both the heavy volume of firepower available to Elizabethan naval commanders, as well as the way in which the Spanish preferred to fight a naval action by boarding rather than by gunnery. A key element in the fight was the sheer determination of Grenville's crew. According to Sir Walter Raleigh, we may assume that as many as 90 of the English crew were already too sick to participate in the action. That left Grenville with a crew of just 160 men. At least half of these were killed during the 16-hour battle, and most of the remainder were badly wounded. While books such as this may talk about the technical aspects of ships and their armament, we must remember that warships are only as effective as the men who served aboard them. In this respect, it appears that Grenville, Drake, Hawkins, Frobisher and their like were extremely fortunate to have both the ships and the men they deserved.

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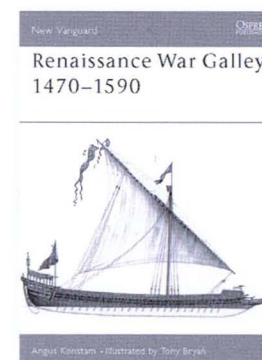
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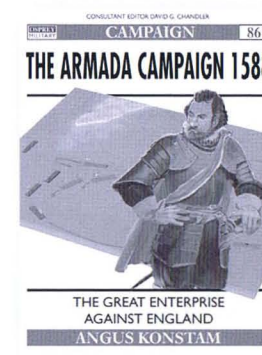
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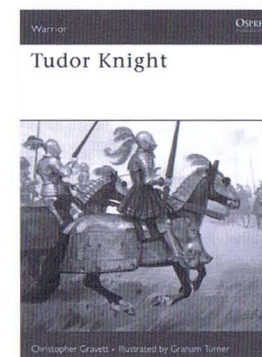
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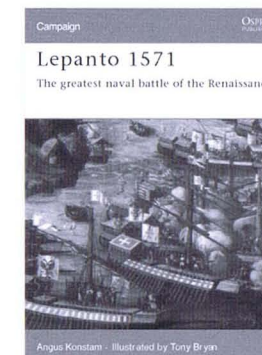
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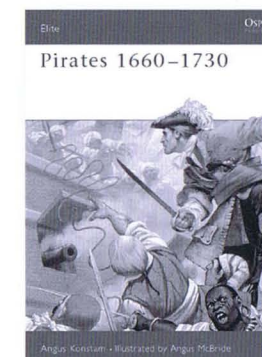
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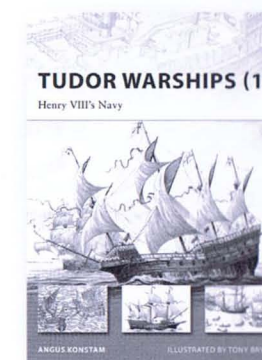
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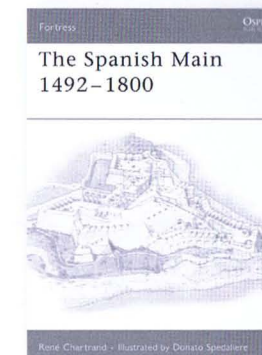
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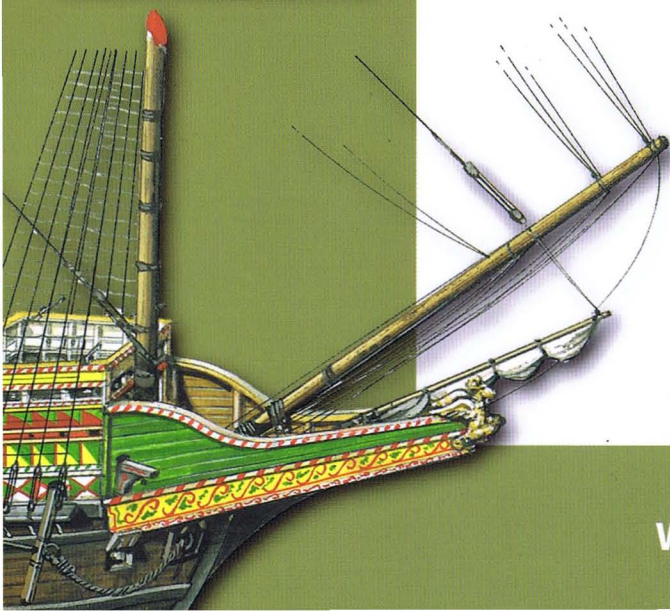
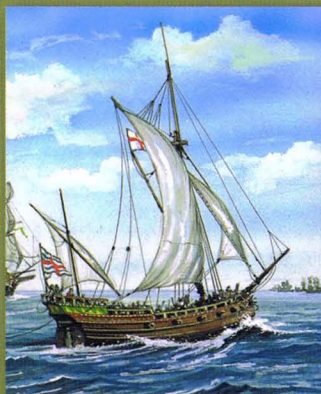
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Elizabeth I's Navy

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