HISTORY OF BOATS AND SHIPS

Messing about in boats

Humans have tended to live near water, and it is natural to make use of things that float. Logs or bundles of reeds can be lashed together to form rafts; hollow trunks can be improved to become dugout canoes. Once the principle of a watertight hull is understood, animal hides or the bark of trees can be attached to a framework of bamboo or wicker to make a simple coracle.

Boats of all these kinds have been made by technologically primitive communities, and many continue to be made into the 20th century.

If planks are added to raise the edges of a dugout canoe, with wooden struts to hold them in place, the primitive boatbuilder is already on the way towards the only design of wooden boat capable of being built on a large scale. This consists of a keel to which a ribbed frame is attached - much as animal ribs curve outwards from a backbone.

Planks are attached to these ribs. They either overlap (clinker-built) or are fastened edge-to-edge (carvel-built). These remain the basic designs for large boats and ships until the gradual introduction of metal hulls in the 19th century.

Egypt and Mesopotamia: from 3000 BC

Both the earliest civilizations, the Egyptian and the Mesopotamian, make extensive use of boats for transport on the Nile, Euphrates and Tigris. The Nile in particular provides a superbly predictable thoroughfare, for the wind always blows from north to south and the current always flows from south to north. Egyptian boats sail upstream, hoisting a large rectangular sail, and then are rowed back down the river.

This distinction is even reflected in the Egyptian hieroglyphs for travelling south (a boat with a sail up) and travelling north (a boat being rowed).

The Egyptians, with access to the Mediterranean, also use larger seagoing vessels. These become known as 'Byblos' boats, revealing that their trade is with the eastern coast of the Mediterranean. Byblos is the main port for the export of the valuable cedar wood of Lebanon, essential for Egypt's architecture and for boat-building. One of the earliest known boats, buried beside a pyramid at Giza and dating from around 2500 BC, is made from planks of cedar; it is 143 feet (44m) long and 20 feet (6m) wide.

By around 1100 BC Byblos is a Phoenician port, and the Phoenicians have become the greatest seafarers of the ancient world.

Phoenician design: from 1100 BC

The Phoenician fleet contains two markedly different
designs of ship. A squat and tubby sailing vessel, rounded

at both ends, is used for carrying goods and passengers. A longer boat, also rounded at the stern but with a sharp battering ram for a bow, is for war; this warship is a galley, propelled by oars, making possible bursts of speed and rapid manoeuvres.

Ramming an enemy ship is the main tactic of naval warfare throughout the Phoenician, Greek and Roman periods. A thousand years after the first Phoenician example, Roman warships have a bronze beak beneath the prow, below water level. They are themselves protected from this form of attack by belts of metal around the vessel.
The only way of increasing the all-important speed of a Phoenician warship is by adding more oarsmen. To some extent this can be achieved in a longer ship, but there comes a point at which extra length brings structural weakness. The solution is to have banks of oarsmen. By 700 BC the Phoenicians are using two banks, one above the other, in the type of vessel known as the bireme. Within the next two centuries a third bank is added, probably by the Greeks, to provide the trireme.

The trireme is the vessel used in the first war to be decided largely by naval power - the conflict in the 5th century BC between the Greeks and the Persians. By the time of the Punic wars, galleys are even larger.

The first Roman navy: 260-255 BC

During the opening skirmishes of the first Punic War the Romans capture a Carthaginian warship which has run aground. It is of a kind only recently introduced in Mediterranean navies. As a quinquereme, with five banks of oars (rowed by 300 oarsmen), it is larger and heavier than the triremes which have been the standard ship of Greek warfare. Since victory at sea involves ramming other ships, the extra size is important.

Rome's new navy is to consist largely of quinqueremes, copied from the captured Carthaginian example. The senate orders 100, together with 20 triremes, and sets the astonishing delivery time of two months. Even more astonishing - the order is apparently met.

Rowing into battle: for 2000 years

The main ingredients of naval warfare remain essentially

the same throughout the classical and medieval centuries. Long, narrow ships, powered by banks of oarsmen, circle each other attempting either to ram the enemy or to grapple a ship so that marines can board it and slaughter the crew. Such encounters continue until 1571, when the battle of Lepanto is the last great engagement between warships propelled by oars.

The only refinement in these centuries is a famous Byzantine invention. It proves so devastating that it has retained, even today, the status of a terrifying mystery. It is Greek fire, first used in the 7th century.

Longships: 7th - 11th century

 A swift design of boat powered by oars is developed in northwest Europe, from the 5th century onwards, when the Germanic tribes begin raiding by sea. It is best known, in a later form, as the Viking longship.

This type of boat features already in the 7th century in the Sutton Hoo ship burial. The shape of the Sutton Hoo ship is known only from the traces left by its timbers in the earth, but a smaller boat of similar kind was found at Nydam in Schleswig in 1863. More elaborate longships of the 9th century survive in excellent preservation from two Norwegian ship burials, excavated at Gokstad in 1880 and at Oseberg in 1903.
The Oseberg ship is famous because of its superb carved decoration. But the Gokstad example is probably the more typical longship, swift and of shallow draught, of the kind used to carry Vikings on their raids across the North Sea and up the rivers of Britain and Ireland.

The Gokstad ship is 78 feet long, clinker-built from oak planks, with two high pointed ends, holes for sixteen oars along each side, and fittings for a broad oar to be worked as a rudder by the helmsman on the right-hand side of the stern (this 'steer-board' provides the word starboard). A mast near the centre carries a large rectangular sail. Scenes in the Bayeux tapestry reveal that the Norman ships are still of precisely this kind in the 11th century,

with the addition of a small fortified platform for archers at each end. But the warship is only one of the Scandinavian sea-going vessels. Five boats discovered in the Roskilde Fjord, north of Copenhagen (apparently sunk there in the 10th century), are all of slightly differing shapes within the same double-ended convention.

One, more stoutly built than the others, has higher sides and a central hold. It may be in ships of this kind that the Vikings, together with their families and livestock, make their bold expeditions to Iceland, Greenland and even north America.

The Chinese junk: 12th century - 15th century

The design of the Chinese junk (a western word from the Malayan *djong*, meaning 'boat') is perfected during the later part of the Song dynasty, when the loss of the northern empire increases the importance of overseas trade. A merchant fleet, and a navy to defend it, become essential. The resulting junk is an ideal craft for the South China seas.

The region suffers violent typhoons, so a strong hull is essential. The Chinese achieve this by means of the bulkhead - a partition across the interior of the hull, and sometimes along its length as well. Bulkheads make the hull rigid and also provide watertight compartments - invaluable when a leak at sea needs repair.
The Chinese junk has other pioneering features later copied elsewhere. Traditionally built without a keel (allowing access to shallow waters), the junk is ill-equipped to sail a straight course until an important innovation of the Song period - the addition of the sternpost rudder. This is a large heavy board which can be lowered on a sternpost when the junk moves into deep water. Coming below the bottom of the boat, and capable of hinging on its post, it fulfils the function both of keel and rudder.

Until this time, throughout the world, the conventional method of steering a boat has been by means of a long oar projecting from the stern.
Another important innovation on the Chinese junk is multiple masts. Marco Polo describes sea-going junks as having four masts, with a further two which can be raised when required. Each mast has square-rigged sails. They concertina on themselves, when reefed, in the manner of a

Venetian blind.

These ships are huge. Marco Polo claims that sixty private cabins for merchants can be built on the deck, and archaeological evidence suggests that by the 15th century a large merchant junk is about 450 feet from the bow to the high poop in the stern - six times the length of the contemporary Portuguese caravel. In 1973 the discovery of a junk of the 13th-century confirms much of what Marco Polo reports from the time of Kublai Khan.

Multiple masts and sails: 15th century

The humble European cargo ship - slow, tubby and propelled by a single sail, as opposed to the sleek lines of a galley with its crew of oarsmen - has changed little in design since the ships of the Phoenicians. In1400 such a vessel still has a single mast in the centre of the ship. And it still carries a single sail, in most cases a rectangle of canvas set square against the mast.

This type of ship would have been familiar to Greeks, Romans, Byzantines and crusaders as the standard vessel of Mediterranean trade. But in the 15th century, with attention turning increasingly to the Atlantic, there are rapid developments.
A second mast is added, and then a third. By the middle of the 15th century three masts are standard on the larger sailing ships, some of which are now of considerable size. In 1418 the *Grace Dieu* is built at Southampton for Henry V. Her remains, found in the mud of the nearby Hamble river in 1933, reveal that she was 125 feet long and 50 feet wide.

At the same period it is discovered that the main mast can take a second smaller sail at the top. By the end of the 15th century there are ships with four masts, carrying between them sometimes as many as eight sails. The development is under way which will lead to the massive weight of sail on the 18th-century East Indiaman and man-of-war.
The most effective sailing ship of the 15th century is the caravel, developed in the Mediterranean but subsequently adapted by the Spanish and Portuguese for service in the Atlantic. Caravels are considerably smaller than the *Grace Dieu* built early in the century for Henry V (they are usually about 75 feet in length), but they are sturdy and relatively fast.

When Dias, Columbus and Magellan set off on their great expeditions, their ships are caravels.

Carracks, galleons and galleys: 16th century

The largest European sailing ship of the 15th century is the Spanish carrack, easily outdoing the caravel in tonnage (more than 1000 tons compared to an average of 250 for the caravel). The carrack becomes the standard vessel of Atlantic trade and adventure in the mid-16th century, until an important modification is made to its design.

The carrack has unusually high castles in bow and stern, but the English trader of slaves John Hawkins discovers in the 1560s that the forecastle seriously hampers sailing. The great bulk of it, catching the wind ahead of the mast, has the effect of pushing the bow to leeward - making it very difficult to sail close to the wind.

 From 1570 Hawkins experiments with a design in which the high forecastle is eliminated. He proves that a ship with high stern and relatively low bow is faster and more manoeuvrable. With an official post on the Navy Board, he is able to improve the English fleet dramatically before the encounter with the Spanish Armada in 1588 - when the agility of the English vessels wins the day.

Hawkins' 'low-charged' design, which acquires the general name of galleon, becomes the standard form for all large ships, whether merchant vessels or men-of-war, and remains so until the late 18th century.
The development of the galleon, the warship of the future, overlaps with the final chapter in the story of the galley - a vessel with some 2500 years of service in naval engagements.

In 1571, while Hawkins is improving the design of the carrack, a fleet of Christian galleys engages with the Turks at Lepanto in the coastal waters of Greece. Using the ancient tactics of ramming and boarding, the Christians rout the Turks - sinking some 50 galleys and capturing another 117. It is the last and the largest encounter in which ships

are rowed into battle. Some 15,000 enslaved Christians, rowing the Turkish galleys, win their freedom as a result of the victory.

East Indiamen: 17th - 18th century

The great value of trade from India and the East Indies prompts the various East India companies - and particularly those of England and Holland - to invest in magnificent ocean-going merchant ships. They need to be capacious to store the cargo; they need to be strong and well-armed to fight off pirates or even the ships of rival companies; and they need to be comfortable for their captains and for important passengers, busy making fortunes in the east.

Beautifully carved and gilded, these are the most splendid ships of the time. The largest class, outdoing even the biggest warships, are 1200 tons.
These vast ships are not fast, as their statistics reveal. The largest are 165 feet long and as much as 42 feet wide, a ratio of less than 4:1 between length and width. These are the portly aldermen of the high seas. While the East India companies enjoy a monopoly of trade, speed is not of great importance. Each ship completes just one journey out to the east and one back each year, using the trade winds to help it in each direction.

But in the 19th century the monopolies end, bringing competition, urgency and speed - in the age of the clippers.

Wilkinson's iron boat: 1787

In 1787 an unusual barge is launched on the Severn in Shropshire. John Wilkinson's successful manufacture of cannon, mortars and shells has been presenting him with transport problems. There are as yet no railways; the roads are almost impassable for such heavy items in bulk; wooden barges can be fragile.

The new craft has been designed and made at Wilkinson's own foundry at Coalbrookdale. It is the world's first iron boat. It seems to the onlookers inconceivable that such a heavy metal object should float even if empty. And loaded with cannon and shells? Ridiculous.
But Wilkinson is able to write soon after the event about his daring invention: 'It answers all my expectations, and it has convinced the unbelievers who were 999 in a thousand.'

His firm subsequently makes several other metal barges for transport on the Severn, but they are a long way ahead of their time. When iron first makes a widespread contribution to boat-building - in the 19th century, in the form of the ironclad - it is as an outer protection for wooden warships against enemy cannon and the danger of fire.
Sections are as yet missing at this point.

The Laird brothers: 1832-1839

The most extensive contribution to the development of iron steamships takes place in a Liverpool shipyard in the 1830s. It is owned by the Laird family.

In the early 1830s John Laird designs two paddle steamers which are sent from Liverpool in pieces to be assembled on site - in 1833 the *Lady Lansdowne* travels to Dublin, in 1834 the *John Randolph* goes to Savannah in the USA. But in 1832 John's younger brother Macgregor has designed an iron paddle steamer, the *Alburkah*, which is capable of making its own way to its destination - in this case to the Niger river in west Africa, where the Lairds hope to trade. Macgregor Laird takes personal charge of the expedition. The *Alburkah* steams south from Milford Haven in July 1832 with forty-eight on board. She reaches the mouth of the Niger three months later, entering history as the first ocean-going iron ship.

After making her way up one of the many streams of the Niger delta, the *Alburkah* progresses upstream on the main river as far as Lokoja, the junction with the Benue. The expedition demonstrates that the Niger offers a highway into the continent for ocean vessels. And the performance of the iron steamer is a triumph. But medicine is not yet as far advanced as technology. When the *Alburkah* returns to Liverpool, in 1834, only nine of the original crew of forty-eight are alive. They include a much weakened Macgregor Laird.
In the second half of the 1830s John Laird designs and delivers an iron paddle steamer for the exploration of the

Euphrates, another commissioned by Mohammed Ali for use on the Nile, and for the East India Company in 1839 the *Nemesis,* the first iron steamship to carry guns.

Meanwhile, in 1837, Macgregor Laird becomes one of the promoters of the British and American Steam Navigation Company, established for the purpose of running steamships across the Atlantic. He is therefore much involved in the dramatic adventure of the *Sirius* in 1838. *This History is as yet incomplete.*