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Isambard Kingdom Brunel

Brunel 200th Anniversary

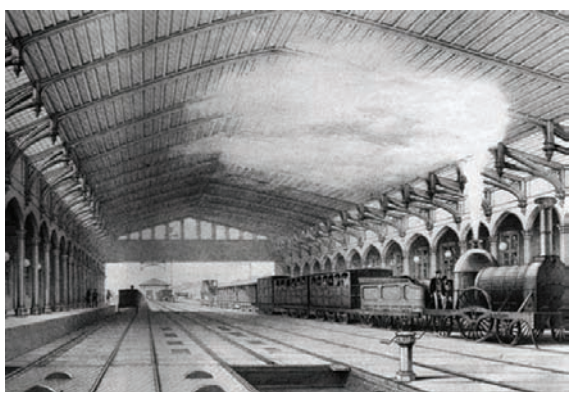
He was the first man to embody all the elements of the modern ship in one hull: metal construction, steam driven screw propeller and large size deliberately aimed at goods economics.

In the early 1850s three brilliant engineers gathered together to air their views about the future of the merchant ship. One of them was Isambard Kingdom Brunel who, with the successful Great Western and Great Britain already to his credit, was the most influential ship designer in England. He realised that, although there was a limit to the size to which a wooden ship could be built because of the strength, or lack of it, in the building material, this limitation did not apply when a much stronger building material was used. Iron was this stronger material, and with it ships much bigger than the biggest wooden ship ever built could be constructed._In Brunel's estimation there was, too, a definite need for a very big ship. Emigration was on the increase, the main destinations at this time being the United States and Canada. On the other side of the world, in Australia and New Zealand, there were immense areas of uninhabited land which, it seemed to Brunel, were ready and waiting to receive Europe's dispossessed multitudes. They would need ships to take them there and ships to bring their produce back to Europe after the land had been cultivated. And as the numbers grew, so also would grow the volume of trad with Europe, all of which would have to be carried across the oceans in ships. The second engineer concerned was John Scott Russell. He had become interested in the maritime side of engineering in 1834 when he was consulted on the possibilities of introducing steam navigation on the Edinburgh and Glasgow Canal. He owned a shiphuilding yard at Millwall, on the River Thames, but his greatest interest lay in the study of wave-formation. From many experiments, carried out both with models in a tank and with full-sized vessels on a canal, he established that there was a connection between a vessel's wave-making properties and her resistance to forward motion, and that a ship could be driven faster and more economically by designing her underwater hull shape to create the least possible wave disturbance.

The third engineer associated with the new ship, albeit to a lesser extent than the other two, was William Froude, who had been an assistant of Brunel in 1837 when he was principally a railway engineer. After nine years, Froude left the railway to devote himself to the study of ship behaviour and hydrodynamics, working on very similar lines to Scott Russell. The new ship was therefore designed with an underwater shape that conformed to the principles of Scott Russell and Froude, and an overall size that met Brunel's requirement for accommodation for 4,000 passengers, and space for 6,000 tons of cargo and enough coal for a voyage to Australia or India. The result was an overall length of 692 ft (210,9 m), a beam of 83 ft (25 m) and a loaded draught of 29,3 ft (8,9 m), at which the displacement was around 25,000 tons. Because of her great size she was to be named Leviathan, and an idea of just how revolutionary was the increase in size which Brunel had proposed can be gained from the fact that the biggest ship in the world hitherto had an overall length of 375 ft (114,3 m) and a designed tonnage of 3,300. In tonnage terms, Leviathan was to be more than five times as large as any ship yet built.Brunel persuaded the Eastern Steamship Navigation Company that her construction was a feasible commercial venture, and her keel was laid in Scott Russell's shipyard at Millwall. Because of her great length, it would be impossible to launch her in the normal way, stern first, as the Thames at Millwall was not wide enough, and so she was built broadside on to the river, and would eventually have to be launched sideways. During building, her name was changed from Leviathan to Great Eastern. So many difficulties arose during construction that her cost rose enormously. More than one company associated with it was forced into bankruptcy, including Scott Russell's shipyard, and Brunel's own health broke down as a result of the constant worries associated with her building. She was finally ready for launching in 1858, but even this went wrong. After moving a few inches down the slipway, she stuck.

Large hydraulic presses had to be built, to push her, and wire cables on winches mounted on the opposite bank of the Thames, to pull her. Finally, weeks later, she floated off on a very high tide. Her new owners, the Great Ship Company, (the original company having gone bankrupt) decided to use her on the Atlantic run, and her cabins and saloons were fitted out at considerable expense, and with great luxury, for the period. By the time she was ready for her maiden crossing, Brunel himself had died from a heart attack. He was, perhaps, fortunate in not living to see the unhappy fate of his great ship. On her first voyage to America, she attracted no more than thirty-six passengers, instead of the 4,000 for which she had been built, and once at sea she rolled so heavily that prospective passengers refused to travel in her. She was taken out of service after a short period, and found no employment until 1865, when Sir Daniel Gooch chartered her to lay the first electric telegraph cable across the Atlantic. In all, she laid four cables across the Atlantic, and another from Aden to Bombay. At the end of her cable-laying career, she lay at Milford Haven for twelve years, until she was bought by a firm in Liverpool as a summer attraction for visitors. She was refitted more or less in her original state, her grand saloon was used as a music hall, and there were side-shows in her cabins and a merry-go-round with a steam organ installed on her upper deck. It was a sad end for a once proud ship, but even in her new guise she did not pay. At the end of the summer she was laid up, and two years later sold for breaking-up. Yet, commercial failure that she was, the Great Eastern marks a very important milestone in the history of ships. She proved Brunel's theory that with iron as a shipbuilding material there was no limit to the size of ship that could be built.

Her construction introduced the principle of the cellular double bottom, and she was the first ship to fit a steering engine, at that time a novel means of overcoming the pressure of water on the rudder, but now a universal feature in all ships of any size. And, perhaps most important of all, she was the first large ship whose underwater shape was designed according to the principles of hydrodynamics. It was, at this time, admittedly an inexact science, but after the Great Eastern both Scott Russell and William Froude continued their work on the wave-line theory, and it is on this theory that all modern ship design is based.



Bristol Station. Design: Isambard Kingdom Brunel © Public Record Office

Top: Brunel stands in front of the giant iron chains of the 'Great Eastern' during her construction at Millwall. Brunel was one of the greatest, most innovative and self-publicising engineers of the 19th century. He was responsible for many large engineering projects including the Clifton Suspension Bridge, Paddington Station and the Great Western Railway, with its many bridges, tunnels and viaducts. He also constructed three very important ships: the "Great Britain", the "Great Western", and the vast "Great Eastern". Brunel smoked over 40 cigars a day, kept in a purpose-built bag, which he carried with him at all times. Photograph: Robert Howlett © Birmingham City Council