Steam

Introduction

The ancient Greeks and Romans studied the properties of steam, but did not apply its capacities, mainly for lack of resistant building materials.

In the late 17th century, a French engineer named Denys Papin produced the first known steam engine with a piston.

In 1735, an Englishman named Thomas Newcomen created a steam engine capable of pumping water out of a mineshaft.

In 1776 and 1783, another Frenchman, the Marquis Jouffroy d'Abbons, managed to propel a vessel with a steam engine. Vibrations, however, made it impossible to utilize Newcomen's engine.

Towards the end of the 18th century, a Scot named James Watt improved the steam engine and made it possible to propel vessels. Not a very gifted businessman, Watt was lucky enough to get an optimistic and dynamic partner in the company Boulton & Watt. His main developments were the creation of a low-pressure, double acting engine, and the insulation of the boiler and pipes, which resulted in a greatly improved fuel consumption.

John Fitch

In 1790, an American named John Fitch built a vessel named STEAM-BOAT and created the first commercial steamboat venture in the New World, running up and down the Delaware River at a speed of 6 to 8 knots.

After testing both stern and side mounted paddle wheels, paddle chains, and even a screw propeller, Fitch selected a peculiar system of vertical paddles.

It was very expensive, and could not compete with the stage lines running on the banks of the river. Besides, many were afraid of this noisy "floating sawmill."

However, Americans raced towards this new technology, and names like Thomas Jefferson, Benjamin Franklin, and George Washington are associated to steamboat commercial ventures in the last years of the 18th century.

A Board of Patent Commissioners was created, chaired by Thomas Jefferson, and patent wars delayed the adoption of practical steam navigation until 1807.
Robert Fulton

In 1802, an American named Robert Fulton made a society with Robert Livingston – the U.S. Minister to France largely responsible for the Louisiana Purchase – and in 1807 got a 16-year monopoly of steam navigation in the state of New York. His first vessel was called the *North River Steamboat of Clermont*, which made the 150-mile voyage between New York and Albany in 32 hours, averaging a speed of 5 miles per hour.

Steam in the north

This monopoly allowed Fulton and Livingston to develop steam transportation in the northern US (almost) unchallenged for many years.

In this section of the course we will look at two steam ships:

- The *Phoenix* (1814 - 1819)
- The *Lady Sherbrooke* (1817 - 1824)

Lake Champlain early steamers year by year

1807: Robert Fulton and Robert Livingston launched the *North River Steamboat of Clermont* (100 tons) and gained access to the monopoly of steam navigation in the State of New York.

1808: The Winan brothers launched the *Vermont* in Lake Champlain and cruised until 1815 without ever being bothered by the monopoly holders Fulton / Livingston.

1811: Elihu Bunker launched the *Hope* and the *Perseverance* on the Hudson River and lost a court case against Fulton / Livingston. Forced to sell his ships, he moved to Long Island Sound. However, three of Bunker’s investors gained the right to navigate in Lake Champlain, creating the *Lake Champlain Steamboat Company*.

1812: The war with England became inevitable, and the Navy bought their first steamship, still under construction: it became the sloop *Ticonderoga*.

1813: Elihu Bunker purchased the *Fulton* from Robert Fulton, a round bottom steamship, suited to the open waters of Long Island Sound. With one mast (rigged as a sloop), it would serve in the Hudson with its flat-bottomed cousins because the English blockade of the War of 1812 made it impossible to work in Long Island Sound.

1814: The war ended, and the *Lake Champlain Steamboat Company* launched the *Phoenix* four months later, although the terms of the 1811 court agreement stipulated eighteen.

1815: The *Vermont* sank.

1816: The *Lake Champlain Steamboat Company* launched the *Champlain*, which was not a big success. In that same year, the engine of the *Phoenix* was transferred to the *Champlain*, and a new engine was bought for the *Phoenix*. 
1817: The Champlain burned to the waterline.

1818: The Lake Champlain Steamboat Company launched the Congress, the fourth ship of the company.

1819: The Phoenix caught fire! Panic prevented all of the passengers to get to the second lifeboat and seven people drowned. The remains of the ship drifted to Colchester Point where the machinery was later salvaged. In the next spring, the hull slid from the bank and sunk.

1820: A smaller Phoenix II was launched with the old engine from the Phoenix.

1824: The Fulton / Livingston monopoly broke up and a new wave of companies brought the financial margins down. Nevertheless, the Lake Champlain Steamboat Company kept in business until 1833, when it merged into the Lake Champlain Transportation Company.

Epilogue: The Vermont was raised in the 1950s and left to rot. Art Cohn found its very deteriorated remains in the 1980s. The Phoenix was found in 1978, surveyed in 1980, and published in 1981: Davidson, R. The Phoenix Project, Champlain Maritime Society, Burlington, Vermont, 1981.

The Phoenix (1814 - 1819)

The Phoenix had an overall length of 147 ft. (44.9 m), a beam of 27 ft. (8.25 m) and a displacement of 336 tons. Its length to beam ratio was 5.44.

It was equipped with a single mast, stepped fairly well forward on a hole in the keelson. It had a 45 Hp engine capable of generating a speed of 8 mph. The engine was a cross head (or steeple) engine which was in line with the paddlewheels, at one third of the length from the bow, over the midship frame. During the archaeological survey, it was seen how it had been reinforced with a series of heavy longitudinal timbers measuring 10 x 10 in. (30 x 30 cm) laid beneath the engine. The boiler was located abaft the engine, as indicated by a pile of bricks. Another pile of bricks, located before the engine, showed the possible location of the ship's cooking stove. There is evidence for the existence of a steering wheel above or before the paddlewheels, the only position in which the helmsman could actually see anything, considering the dimensions of the engine above deck. Its total cost was $45,000.

The Phoenix was a steamer with a round hull. Certainly because its construction was supervised by Elihu Bunker's captain Jahaziel Sherman, it is no longer a flat-bottomed, wall-sided hull. It follows the trend of the Fulton, as every steamer designed or built by Robert Fulton would from 1813 on.

Early Canadian steamers year by year

1809: John Molson, John Jackson, and John Bruce launched the Accommodation in the St. Lawrence River, the first Canadian steamship. It was 85 ft. long (25.5 m) and 16 ft. (4.9 m) in beam, with a Canadian engine of 6 Hp.
1811: The Accommodation was taken out of service, judged too weak in view of its small engine.

1812: Molson launched the Swiftsure, 139 ft. 4 in. (42 m) long and 24 ft. 6 in. (7.2 m) in beam, this time with an English Boulton and Watt engine.

1814: Molson launched the Malsham, 155 ft. 6 in. (45 m) long and 30 ft. 6 in. (9 m) in beam, with another Boulton and Watt engine capable of generating 45 Hp.

1815: Thomas Torrence formed a steam company and launched the Car of Commerce, 162 ft. 6 in. (50 m) long and 30 ft. (9 m) in beam, with a Boulton and Watt of 50 Hp!

1816: Robert Fulton launched his twenty-first ship on the Hudson: The Chancellor Livingston, 156 ft. (47.55 m) long and 35 ft. (10.61 m) in beam, a beautiful ship that lasted until 1834.

1817: Molson launched the Lady Sherbrooke, 60 Hp. It was said to be the most perfect steamship ever built in America, except for the Chancellor Livingston.

1818: Molson launched the New Swiftsure.

1824: The escalation continued, and there were 63 steamships on the St. Lawrence River by 1841.

The Lady Sherbrooke (1817 - 1824)

Molson's correspondence with his father and with Fulton show that the Lady Sherbrooke plans were reviewed after the launching of the Chancellor Livingston. The Lady is said to have been a twin sister of the Chancellor.

Only the Lady was fitted for the transport cargo, a market waiting to be exploited in the St. Lawrence, and a few passengers (10-12). Still, it was considered one of the best steamboats in North America for comfort and safety.

Its first voyages were by no means very successful. On the second trip she sank a small vessel. Harbored for refitting, a sudden rise of the waters took her downstream and placed her over a shallow where she stayed almost a year, waiting for another rise of waters to come out.

After these incidents, she carried on and enjoyed a profitable and proficient life. Designed to carry 10 to 12 people, she once took aboard 548 immigrants. The first elephant ever to set a foot in Canada refused to board the Lady, boarding a different steamer the next day without any problem. Anyway, she held a speed record for the trip between Sorel and Montréal.

The Lady was found and excavated in the 1980s. Her hull was fairly flat, double framed and heavily reinforced. An extremely strong keel, keelson and three sets of footwales were found, with the second level of footwales being reinforced at the machinery room. The hull planking was 5 cm thick and the ceiling 3.5 cm. On deck, the planking was 7 cm thick and, over the deck extension before and abaft the wheel case, it was 9 cm thick. This ship was mostly built of white oak. However, certainly because of the scarcity of
good white oak – widely mentioned at the time – the second layer of wood of the double frames was made of spruce, and the ceiling was of pine above the third footwale. The section excavated revealed a very important part of its deck structure at the level of the paddlewheels. Here, two beams extend outside the hull, supporting the wheel case. The deck structure in this zone was formed by a series of deck beams supported by a clamp – where they were inserted in dovetail mortises – on the outer side and by a strong coaming strake on the inner side, leaving free space for a hatch. The engine extends up from this hatch and the axis of the paddlewheels runs over the gunwale.

Western Steamboats

By 1810, most of the Mississippi was uninhabited by Europeans. Only the area around New Orleans and part of the upper Ohio River were actually occupied by European settlements.

Spanish and French authorities controlled most of the Mississippi River territory until 1803-- when Louisiana was purchased by the US-- and did not encourage the northern movement of settlers out of New Orleans.

Anyway, in 1810, Robert Fulton and Robert Livingston got a navigation monopoly for the Territory of Louisiana.

In 1811, the NEW ORLEANS, of 371 tons, was the first steamship to sail the Mississippi waters. The 2,000-mile voyage between Pittsburgh and New Orleans took more than 100 days. Unable to steam upstream for long periods, it was assigned a small route between Natchez and New Orleans. Designed with too deep a draft, it was lost on a snag near Baton Rouge in 1814. It has not yet been found.

The first western, flat-bottomed, shallow draft steamboat is believed to have been the WASHINGTON, built in 1816 after Henry Shreve's design. It was certainly not as flat as the future western steamboats of the 1850s, but in 1817 it made the 1,440-mile voyage from New Orleans to Louisville in 25 days. The WASHINGTON was probably abandoned in 1823.

The first high-pressure engines exploded frequently. Between 1828 and 1830, passengers were typically transported in barges towed behind the steamships. By 1830, after two years virtually explosion-free, these barges were abandoned. Between 1838 and 1850, boilers still exploded at an impressive rate, but no barges were utilized. Snags were much less deadly, but sunk 20 times more vessels than boiler explosions.

Mark Twain wrote in his 1883 novel Life on the Mississippi that, in 1840, the distance between St Louis and Cairo, Illinois (200 miles) had an average of one wreck per mile.

In 1819, the Fulton/Livingston monopoly was defeated in court, opening a golden era for steamships that only ended with the Civil War.

Steamboats evolved to fill different niches:

Packet boats
Mountain boats
Packet boats

These were the most numerous. They carried freight and passengers. They could be side-wheelers or stern-wheelers. Their structures were highly reinforced with cross-chains or hogging chains, both due to the vibrations induced by the engine and hogging, this problem being more important on stern-wheelers. They typically had two decks, a main deck and boiler deck, overhanging the hull.

Mountain boats

These were in use on the upper sections of the rivers Missouri, Niobrara, Yellowstone, Colorado, and other. All had very shallow drafts. All of them were sternwheelers. Mostly, they were used as supply boats for military installations and gold mining operations. They had shortened cabin structures and a minimum number of decks.

Towboats

Towboats were used to push freight barges. They were almost exclusively stern-wheelers.

Ferryboats

Ferryboats could be side-wheelers, stern-wheelers, and center wheelers. Vehicles entered from one side and exited from the other. Railroad ferries had tracks to carry trains.

Showboats

Had no engine. They were simply theaters installed on barges that were pulled by steamers.

Maintenance vessels.

These could be snag boats, dredges, or light tenders.
The **BLACK CLOUD** (1865-1873)

A side-wheel cotton packet built in Orange, Texas, 1864. Abandoned in the Trinity River at Old Green's Ferry Crossing, in Liberty County, Texas, 1873. The normal life-span of a steamer was 5 years. Its bell was offered to a church in Liberty. It was found in 1965 by a contractor laying a pipeline, and was later excavated by a Texas A&M team. Only a portion of the hull survived, together with the bed of firebricks laid under the furnace, which was located forward.

The **BERTRAND** (1864-1865)

Built in Wheeling, West Virginia, in 1864, it was lost on the Missouri River in 1865 after hitting a snag at Portage La Force, 25 miles north of Omaha, Nebraska. In 1968, it was found under 8 m of sediments in an old ox bow of the river by two treasure hunters who thought that there was gold, mercury, and whisky aboard. Archaeologists from the National Park Service excavated the *Bertrand*, and the artifacts were divided between the salvers (60%) and the US government (40%). Extensive hull remains were found preserved together with around 2,000,000 artifacts. These consisted of foodstuffs, liquor, clothing, agricultural and mining supplies, some mercury, and varied objects of leather, wood, glass, porcelain and other ceramics. After excavation, the hull was filled again with silt and protected with polyethylene and steel aircraft landing-strips. Part of the collection of artifacts was treated and is now on exhibit in the DeSoto National Wildlife Refuge.

**Decline**

Trains caused steamers to decline quickly in the depression years that followed the Civil War. There are only 6 steamboats surviving today, 2 paddle-wheelers and 4 screw boats.

**Readings for this class**

