The Evolution of Ship Building

From Ironclad to Icon -
A 175-Year Journey of Maritime Innovation

With
(Rear Admiral Retired)
Simon Hardern

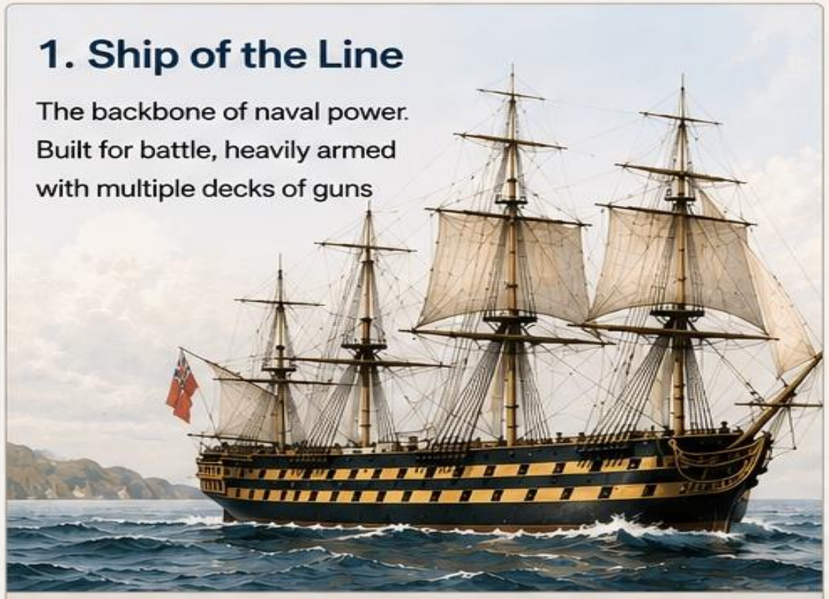
Contents

Shipbuilding Processes Through the Ages

Main Types of Ship in 1850

1. Ship of the Line

The backbone of naval power. Built for battle, heavily armed with multiple decks of guns



Displacement: 1,500 – 3,000+ tons | Crew: 600 – 800+

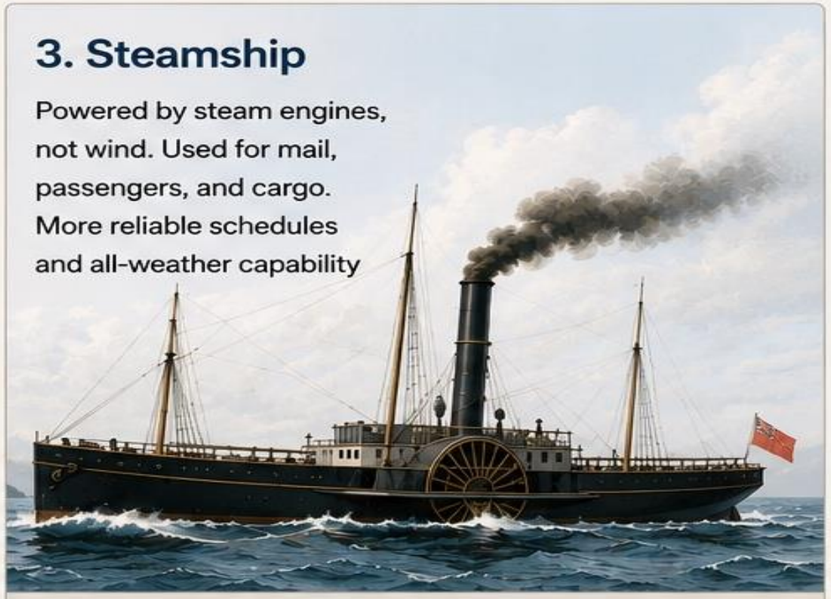
2. Frigate

Versatile warships used for scouting, escort, and patrol Faster and smaller than ships of the line, but strongly armed

Displacement: 800 – 1,500 tons | Crew: 200 – 300

3. Steamship

Powered by steam engines, not wind. Used for mail, passengers, and cargo. More reliable schedules and all-weather capability



Displacement: 500 – 2,000+ tons | Crew: 50 – 150

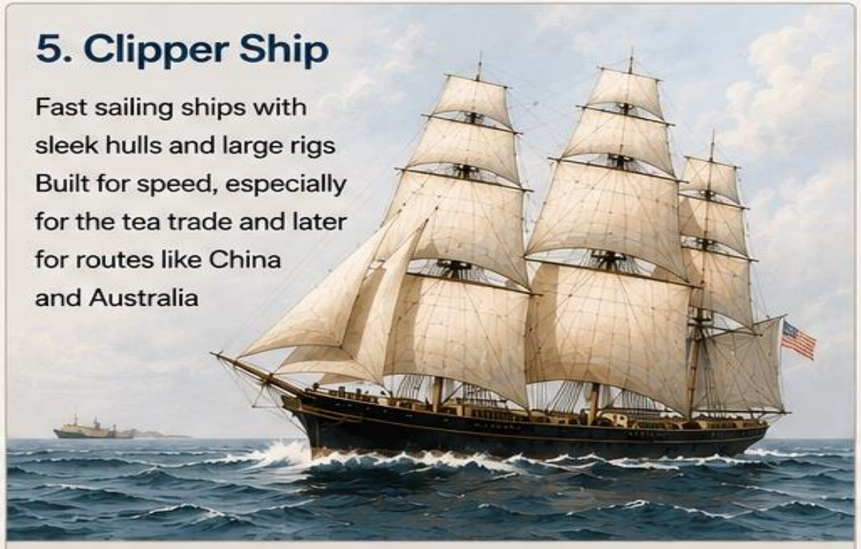
4. Merchant Sailing Ship

The workhorses of global trade. Carried general cargo, goods, and raw materials across the world

Displacement: 300 – 1,500 tons | Crew: 15 – 40

5. Clipper Ship

Fast sailing ships with sleek hulls and large rigs Built for speed, especially for the tea trade and later for routes like China and Australia



Displacement: 800 – 2,000 tons | Crew: 25 – 60

6. Coastal / Inland Vessel

Smaller ships used for coastal trade, harbour work, or river and canal transport. Included brigs, schooners, and steamboats.

Displacement: 50 – 300 tons | Crew: 5 – 20

1850s - The Age of Transition

Wooden Ships at Their Peak

By 1850, wooden shipbuilding had reached extraordinary sophistication. Clipper ships like the Flying Cloud (1851) could reach 22 knots, while naval vessels like HMS VICTORY represented the pinnacle of wooden warship design. However, wood's limitations - rot, fire risk and size constraints - were becoming increasingly apparent as global trade demanded larger, more durable vessels

Material Limitations

Wood could only support ships up to 5,000 tons maximum

Fire Hazard

Wooden ships highly susceptible to catastrophic fires at sea


FLYING CLOUD

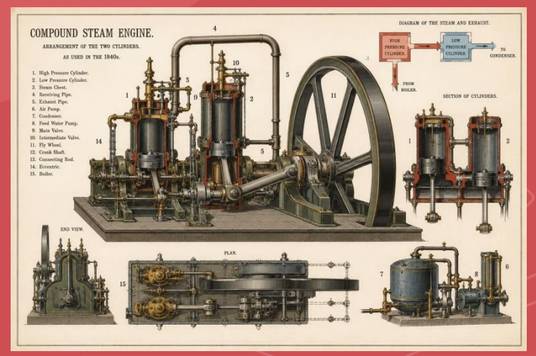
Steam Power Revolution - 1850 to 1860

Paddle Wheel Era (1840-1855)

Early steamships (like SS Great Western) used massive side paddle wheels, but these proved vulnerable in rough seas and took up valuable cargo space

Engine Efficiency Gains

Compound steam engines doubled fuel efficiency, making steam power economically viable for long-distance shipping



Screw Propeller Breakthrough (1846)

The SS Great Britain (1843) proved propellers were superior, leading to widespread adoption by navies and merchant fleets

Global Impact

Steam reduced Atlantic crossing time from 6 weeks to 10-14 days, revolutionising international trade and passenger travel

Iron vs Wood - The Great Debate

Iron Advantages

Fire-resistant, larger cargo capacity, longer lifespan and immune to rot and shipworm

Innovation Drivers

Crimean War (1853-56) accelerated ironclad development for military advantage

Iron Challenges

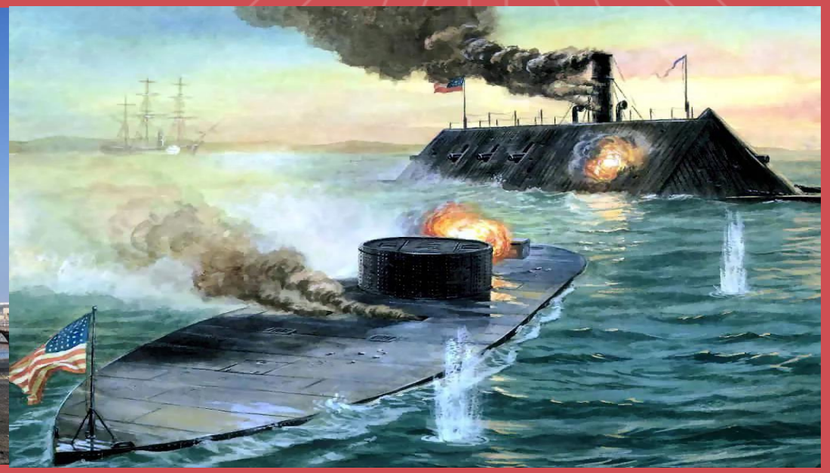
Higher initial cost, required new construction techniques and compass interference

Industry Resistance

Traditional shipwrights opposed change, fearing loss of centuries-old craftsmanship

For the French ironclad floating batteries used at Kinburn in 1855, most effective combat occurred at surprisingly close ranges by modern standards

Birth of the Ironclad - 1859-1862



La Gloire (France, 1859)

First seagoing ironclad warship, wooden hull with iron armour, sparked naval arms race

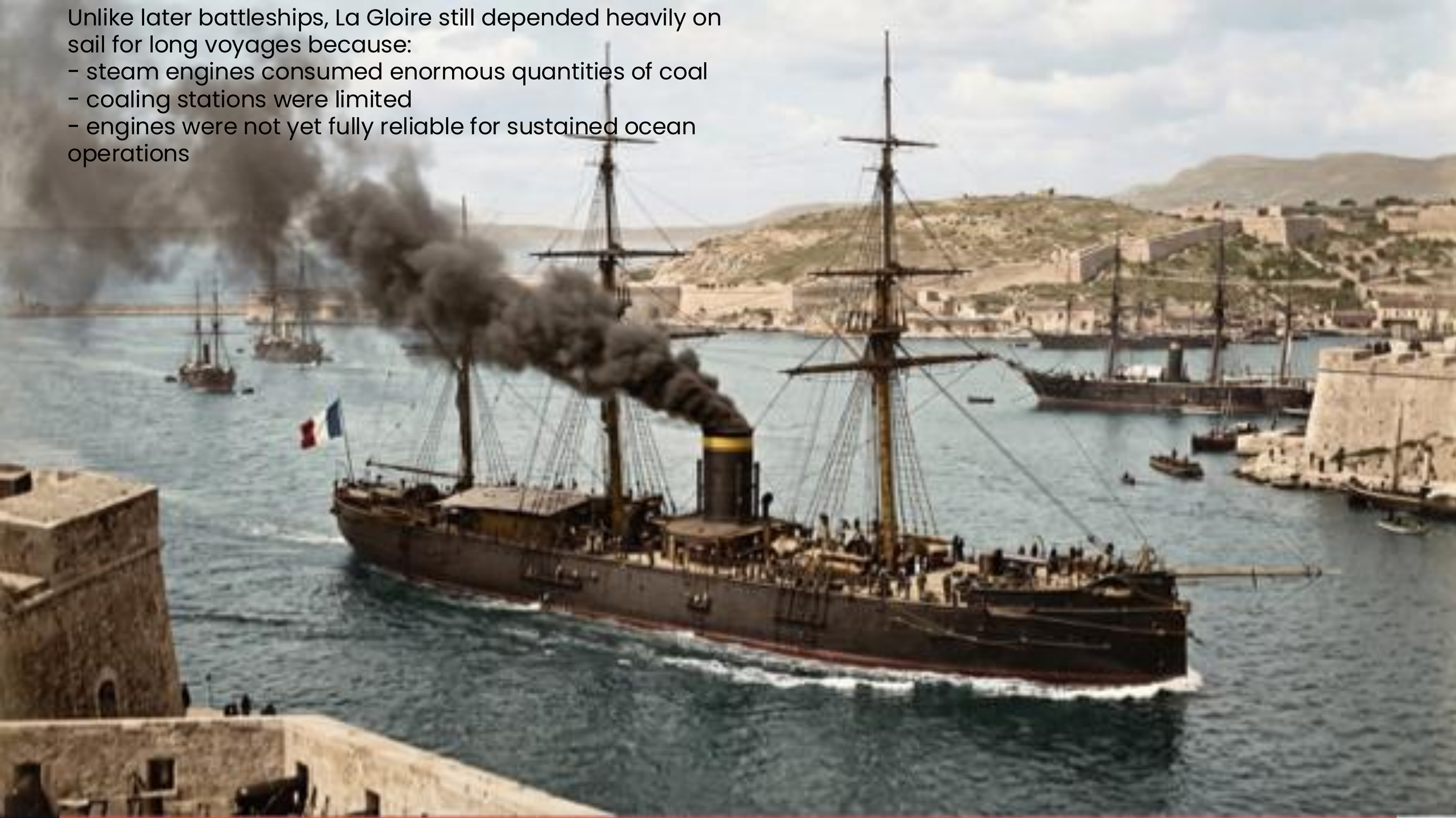
HMS Warrior (Britain, 1861)

First iron-hulled warship, 9,200 tons, combined steam and sail power, rendered all wooden navies obsolete

Monitor vs Virginia (USA, 1862)

First battle between ironclads at Hampton Roads, proved iron's superiority over wood in combat

Unlike later battleships, La Gloire still depended heavily on sail for long voyages because:
- steam engines consumed enormous quantities of coal
- coaling stations were limited
- engines were not yet fully reliable for sustained ocean operations



On commission in 1861, HMS WARRIOR was:

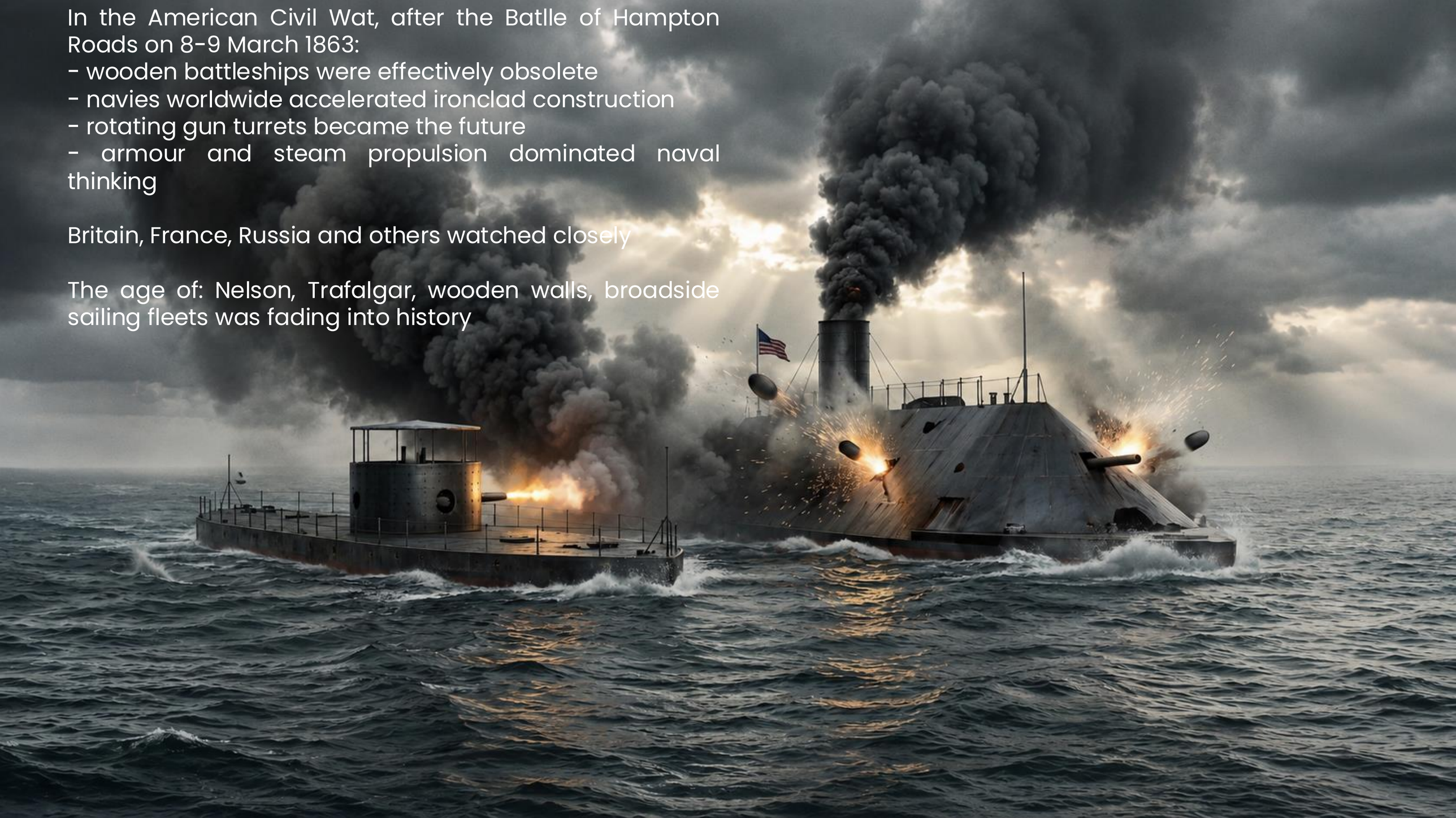
- the largest warship in the world (9,200 tonnes displacement)
- the fastest armoured warship afloat
- It became almost impossible for existing naval guns to destroy

Jun 89 off Hartlepool

In the American Civil Wat, after the Batlle of Hampton Roads on 8-9 March 1863:
- wooden battleships were effectively obsolete
- navies worldwide accelerated ironclad construction
- rotating gun turrets became the future
- armour and steam propulsion dominated naval thinking

Britain, France, Russia and others watched closely

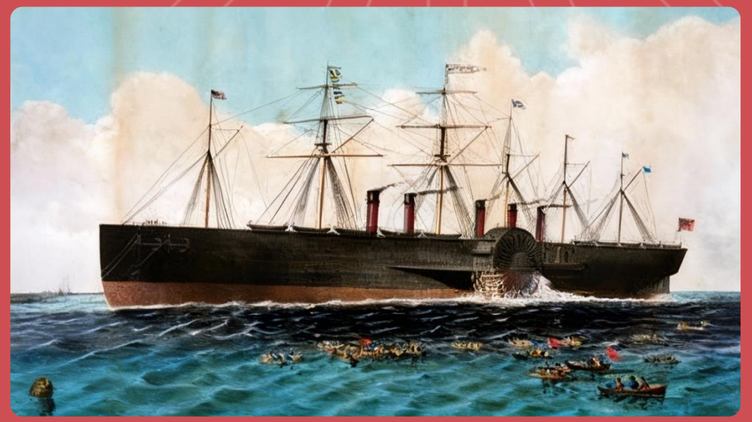
The age of: Nelson, Trafalgar, wooden walls, broadside sailing fleets was fading into history



1860s-1880s - Industrial Shipbuilding Emerges

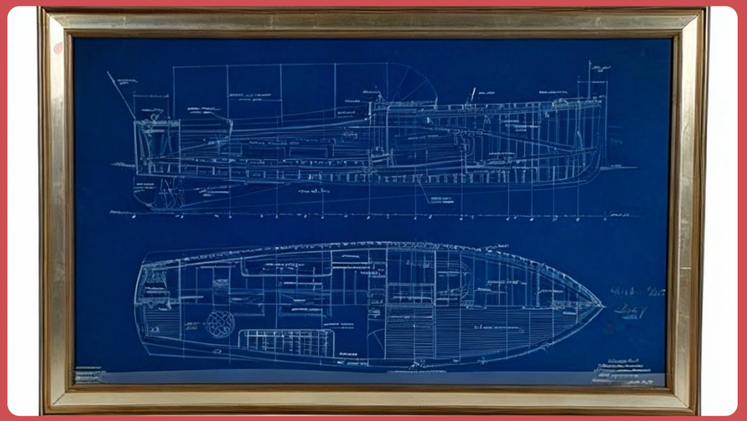
Scientific Design

Introduction of naval architecture as engineering discipline, using mathematical calculations for stability and strength



Mass Production Techniques

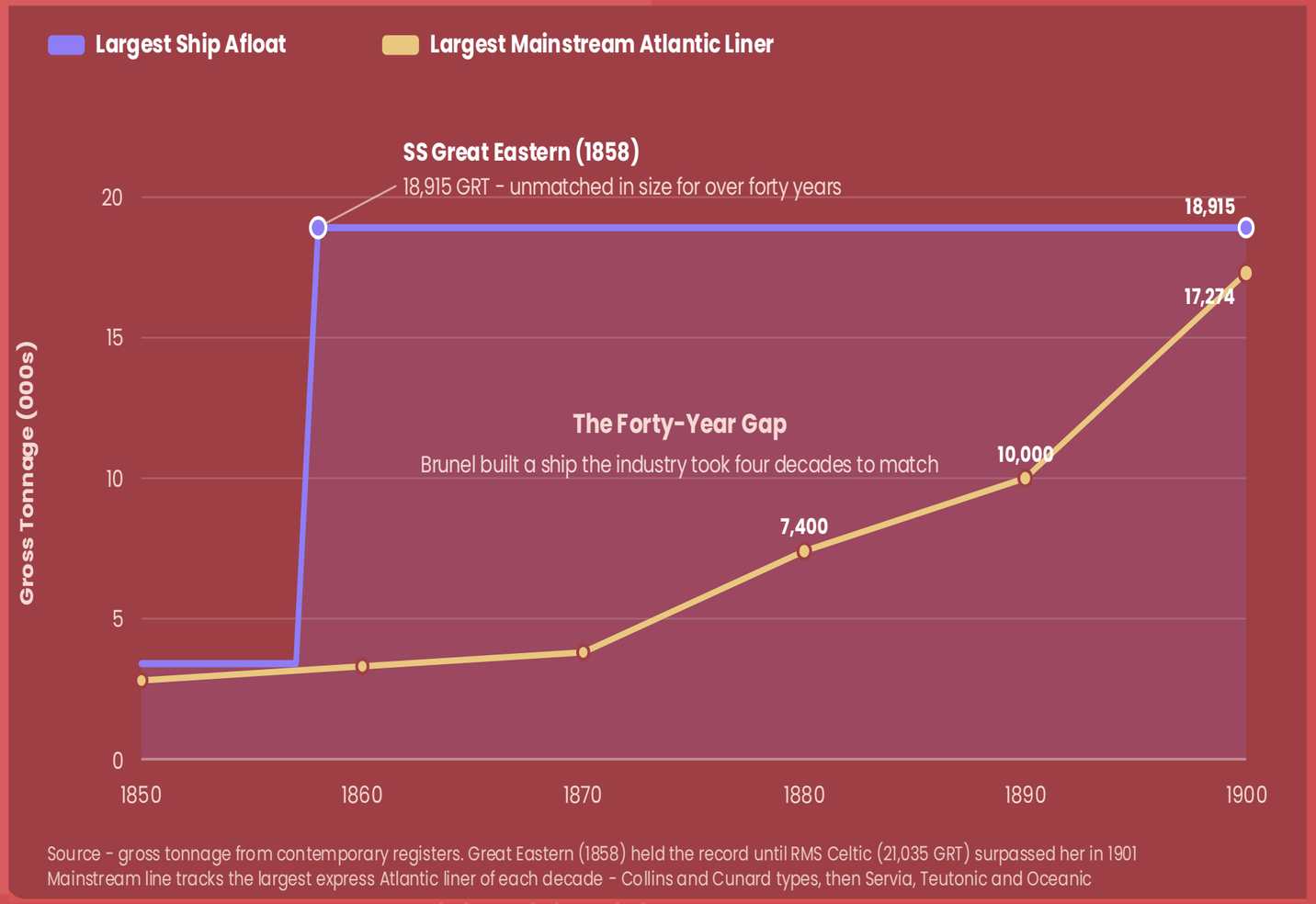
Riveted iron plate construction enabled standardised shipbuilding, reducing construction time from years to months



Scale Revolution

Ships grew from 2,000 to just about 20,000 tons, enabling transoceanic passenger and cargo service

Steel Revolution to 1900



Source - gross tonnage from contemporary registers. Great Eastern (1858) held the record until RMS Celtic (21,035 GRT) surpassed her in 1901
Mainstream line tracks the largest express Atlantic liner of each decade - Collins and Cunard types, then Servia, Teutonic and Oceanic

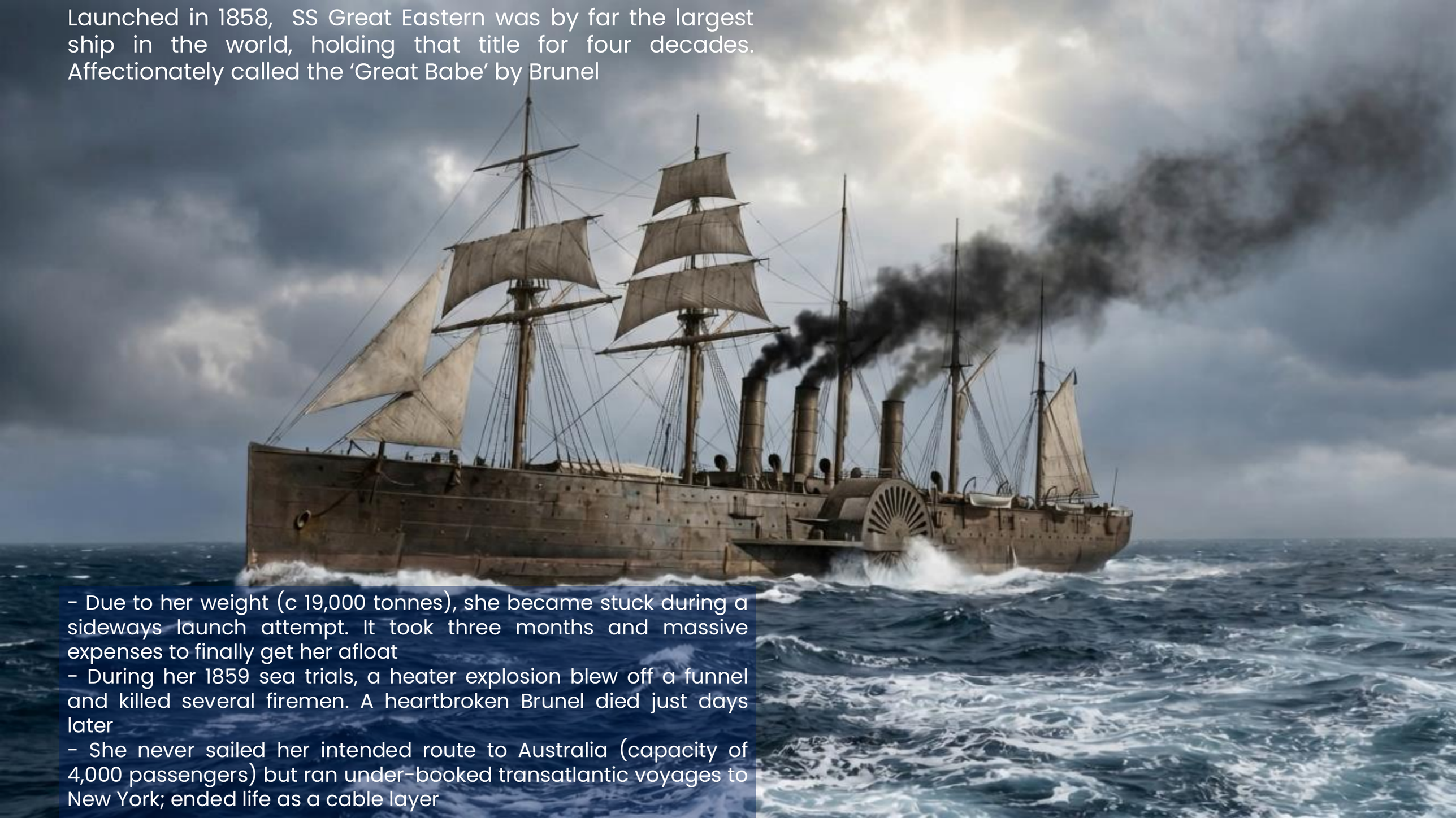
Steel Superiority

Steel provides 3x strength-to-weight ratio of iron, enabling larger ships with thinner hulls

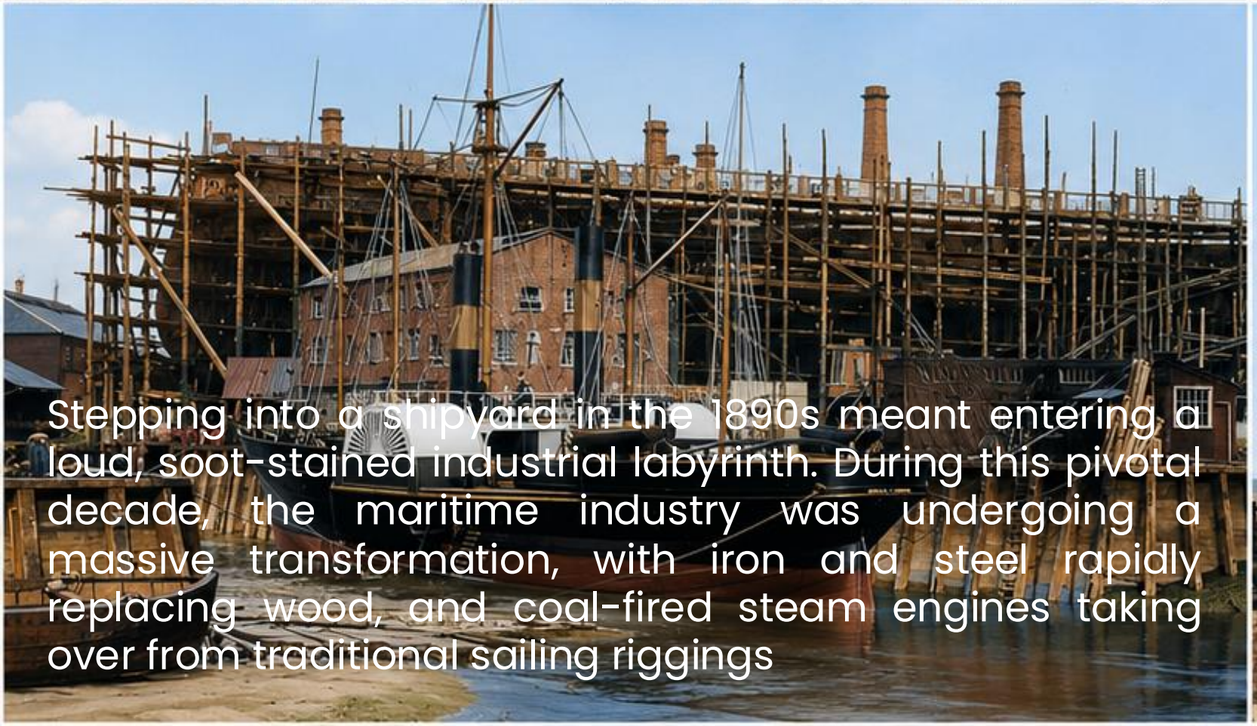
Bessemer Process

Mass-produced steel plates made large-scale shipbuilding economically viable for the first time

Launched in 1858, SS Great Eastern was by far the largest ship in the world, holding that title for four decades. Affectionately called the ‘Great Babe’ by Brunel



- Due to her weight (c 19,000 tonnes), she became stuck during a sideways launch attempt. It took three months and massive expenses to finally get her afloat
- During her 1859 sea trials, a heater explosion blew off a funnel and killed several firemen. A heartbroken Brunel died just days later
- She never sailed her intended route to Australia (capacity of 4,000 passengers) but ran under-booked transatlantic voyages to New York; ended life as a cable layer

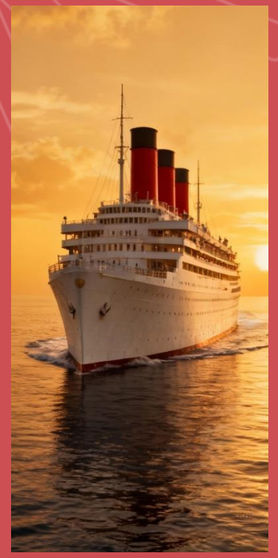


Stepping into a shipyard in the 1890s meant entering a loud, soot-stained industrial labyrinth. During this pivotal decade, the maritime industry was undergoing a massive transformation, with iron and steel rapidly replacing wood, and coal-fired steam engines taking over from traditional sailing riggings

SS Goldenfels - 1895

SS Chancellor - 1895

Triumph and Tragedy - 1900 to 1914



Olympic Class Giants

RMS Olympic, Titanic and Britannic represented the pinnacle of luxury shipbuilding, 46,000+ tons, 882 feet long

Advanced Construction

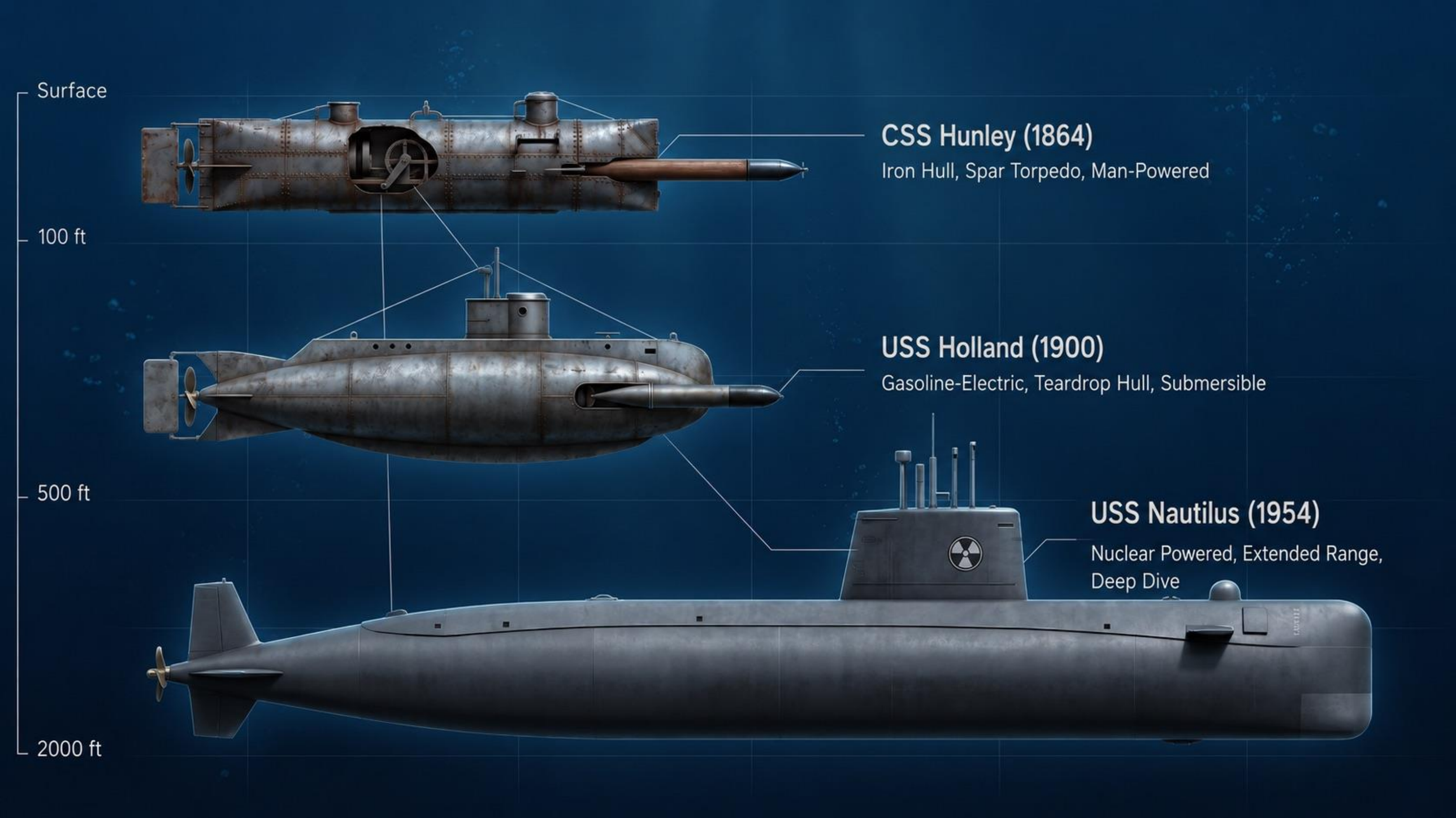
Riveted steel hulls with 16 watertight compartments, Marconi wireless and steam turbine engines

Titanic Disaster 1912

Sinking revealed critical flaws: insufficient lifeboats, bulkhead design, iceberg warnings ignored

SOLAS Convention 1914

International safety regulations mandated lifeboats for all, 24-hour radio watch, ice patrol service


Surface
100 ft
500 ft
2000 ft
CSS Hunley (1864)
Iron Hull, Spar Torpedo, Man-Powered
USS Holland (1900)
Gasoline-Electric, Teardrop Hull, Submersible
USS Nautilus (1954)
Nuclear Powered, Extended Range, Deep Dive

RMS Celtic

- In 1901, was the first of a quartet of massive White Star Line ships over 20,000 tons, followed later by the Cedric, Baltic and Adriatic
- White Star Line prioritised massive passenger capacity, steady 16-knot luxury, and maximum comfort
- The vessel stretched 214 metres (701 ft) long with a beam of 23 metres (75 ft). She was so physically large that New York Harbour had to be dredged deeper

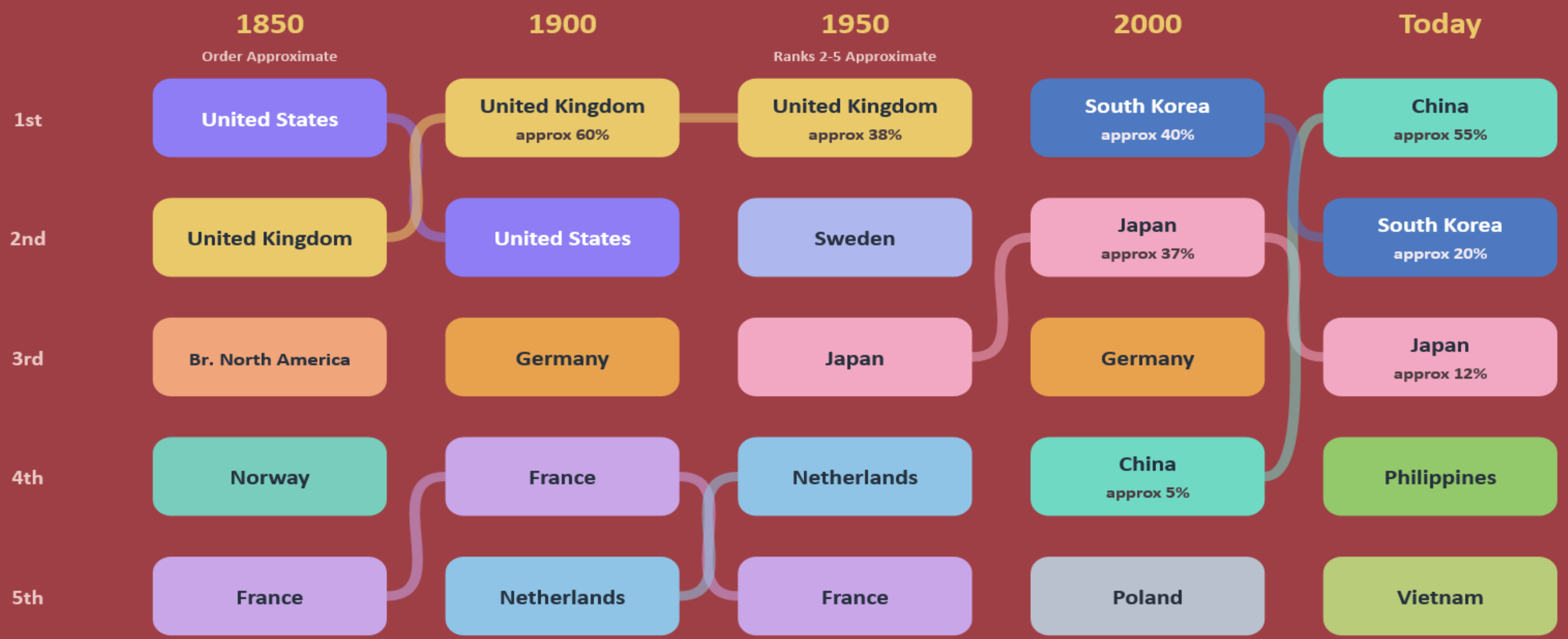
RMS Olympic arriving in New York Harbour on 21 June 1911

The Titanic disaster was not just a tragedy of human error, but a wake-up call that forced the maritime industry to fundamentally rethink safety at sea

The lessons learned from Titanic's sinking led to the first international maritime safety standards, establishing principles that still govern shipbuilding today. These regulations transformed ship design from an art to a science of safety engineering

The World’s Top Shipbuilding Nations – 1850 to Today

Leadership Passes From Sail, To British Steel, To East Asia



Share is of world merchant tonnage built. Below first place, the 1850 and 1950 orders are close and approximate, as sources differ on launches versus completions

1900 - Britain built close to 60 percent of world tonnage. 1950 - Britain still led, with Sweden, Japan and the Netherlands close behind and Japan already rising fast

2000 - South Korea led and China was under 6 percent. Today - China builds over half of world output, the top three about 95 percent

World War I - Military Innovation Spillover

Wartime Acceleration

WWI drove rapid advances in shipbuilding technology, mass production techniques, and standardised designs that would revolutionise civilian shipping

Oil vs Coal

- Steam turbines replaced reciprocating engines
- Oil fuel increased range and reduced crew
- Lighter power plants enabled faster ships

Welding Revolution

- First welded ships built 1917-1918
- Reduced construction time by 30%
- Stronger hulls with fewer weak points

Standardised Designs

Liberty ship concepts emerged for rapid wartime construction

Mass Production

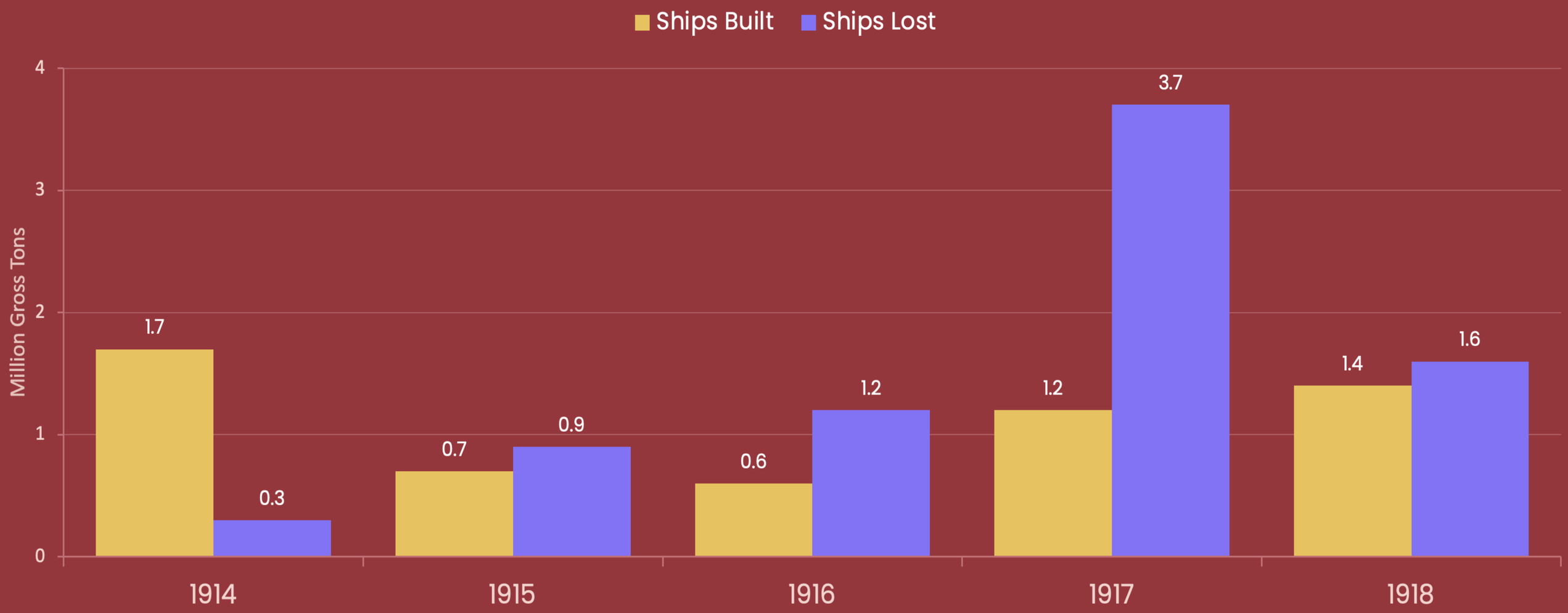
Shipyards adopted assembly line techniques from automotive industry

Legacy Impact

Post-war surplus ships became first cruise liners

World War I - Build Rates versus Losses

Annual Tonnage, 1914 to 1918 - How Convoys Turned The Tonnage War



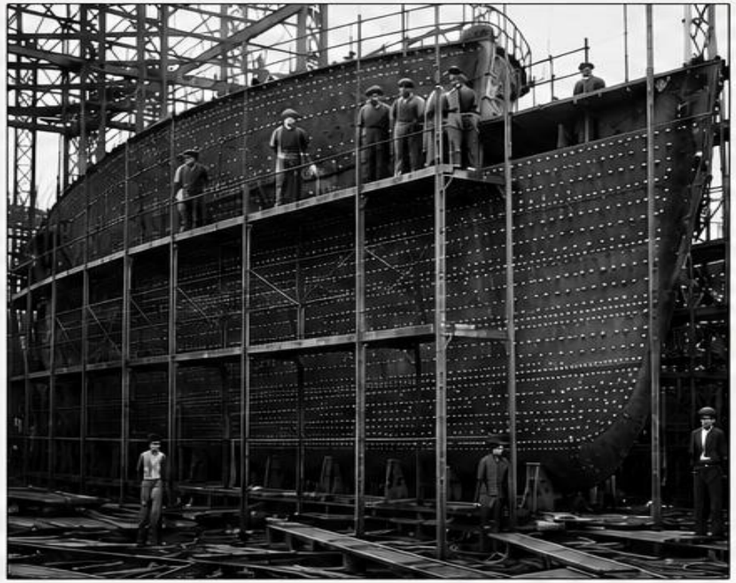
British merchant tonnage, gross registered tons. 1914 covers only the five months of war from August, when yards were still completing pre-war orders, so losses are light. Unrestricted U-boat warfare drove losses to a peak in 1917, with 860,000 tons sunk in April alone, and convoys from May 1917 then cut them sharply. Across the war Britain lost about 7.8 million tons, while Allied and neutral losses reached about 12.85 million tons in nearly 5,000 ships

Welding versus Rivets

1920s
Riveted Construction

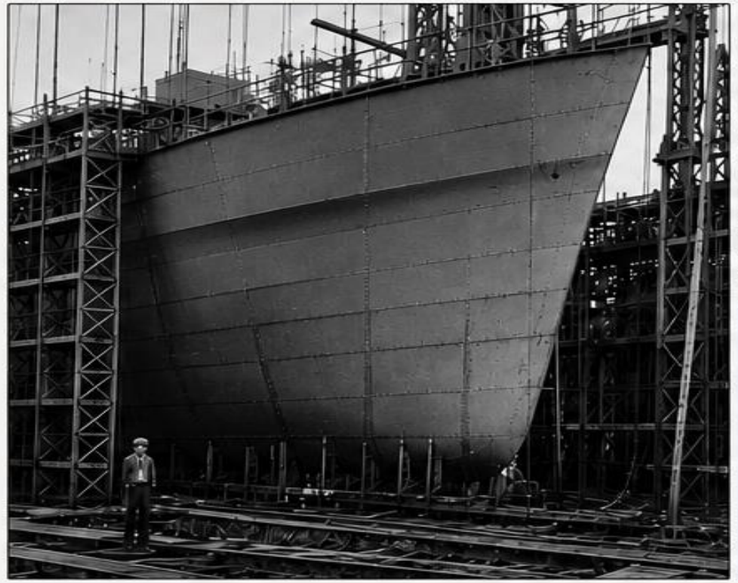
A decade of innovation
Stronger ships. Faster builds. A new era

1930s
Welded Construction



How it was built

- Plates fastened with thousands of rivets
- Rivets heated and hammered in place by skilled crews
- Strong, but heavy and time-consuming



How it was built

- Plates joined by electric arc welding
- Fewer joints, no rivet holes
- Stronger, lighter, and faster to build

Riveted Construction

- Heavier structure
- More materials
- Longer build time
- Thousands of skilled riveters required

The impact

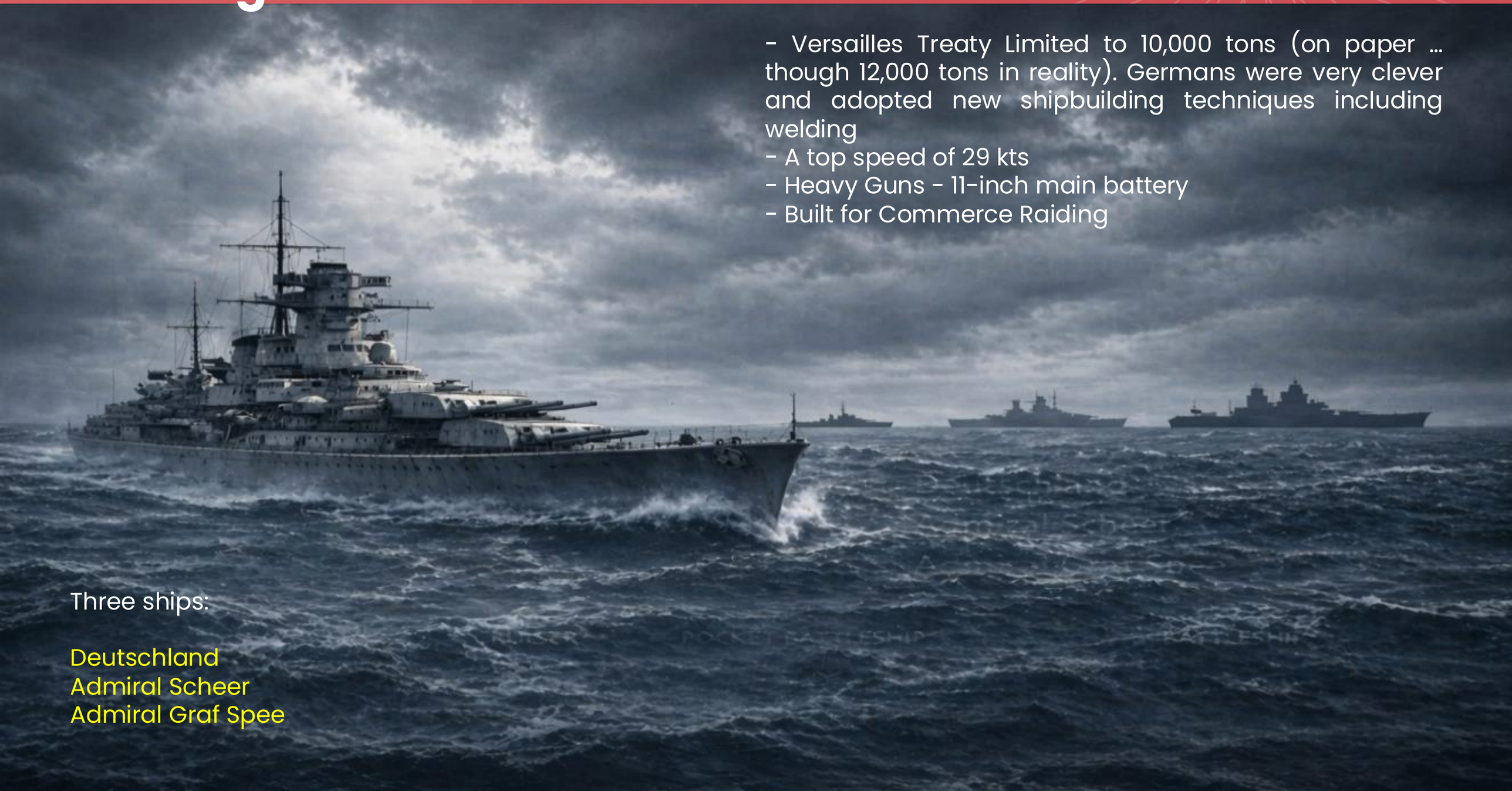
- Larger ships built faster
- Lower costs
- Stronger, more durable hulls
- A global shift in shipbuilding

Welded Construction

- Lighter structure
- Less material
- Shorter build time
- Smaller, more versatile workforce

Welding transformed shipbuilding – paving the way for modern steel fleets

Welding versus Rivets

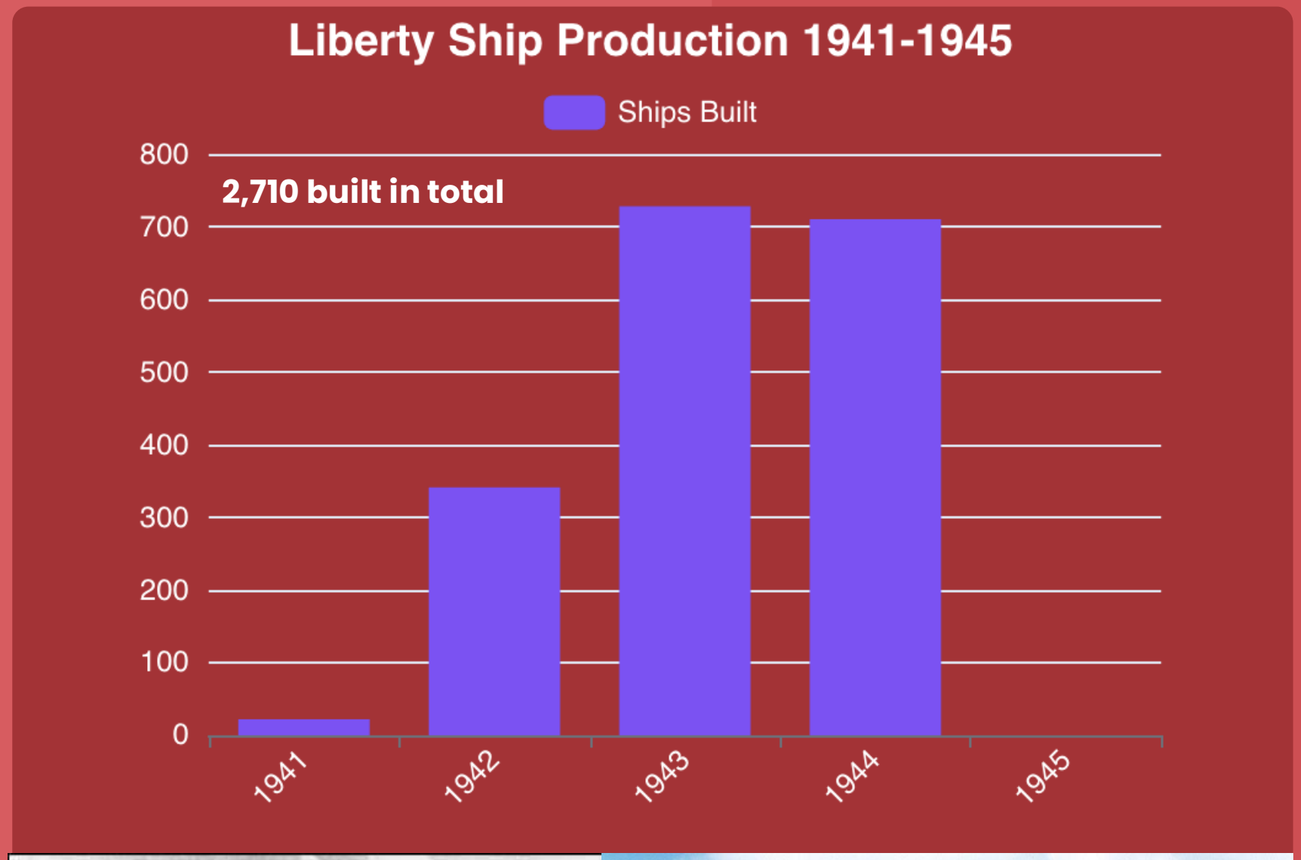


- Versailles Treaty Limited to 10,000 tons (on paper … though 12,000 tons in reality). Germans were very clever and adopted new shipbuilding techniques including welding
- A top speed of 29 kts
- Heavy Guns - 11-inch main battery
- Built for Commerce Raiding

Three ships:

Deutschland
Admiral Scheer
Admiral Graf Spee

World War II - Liberty Ships Mass Production

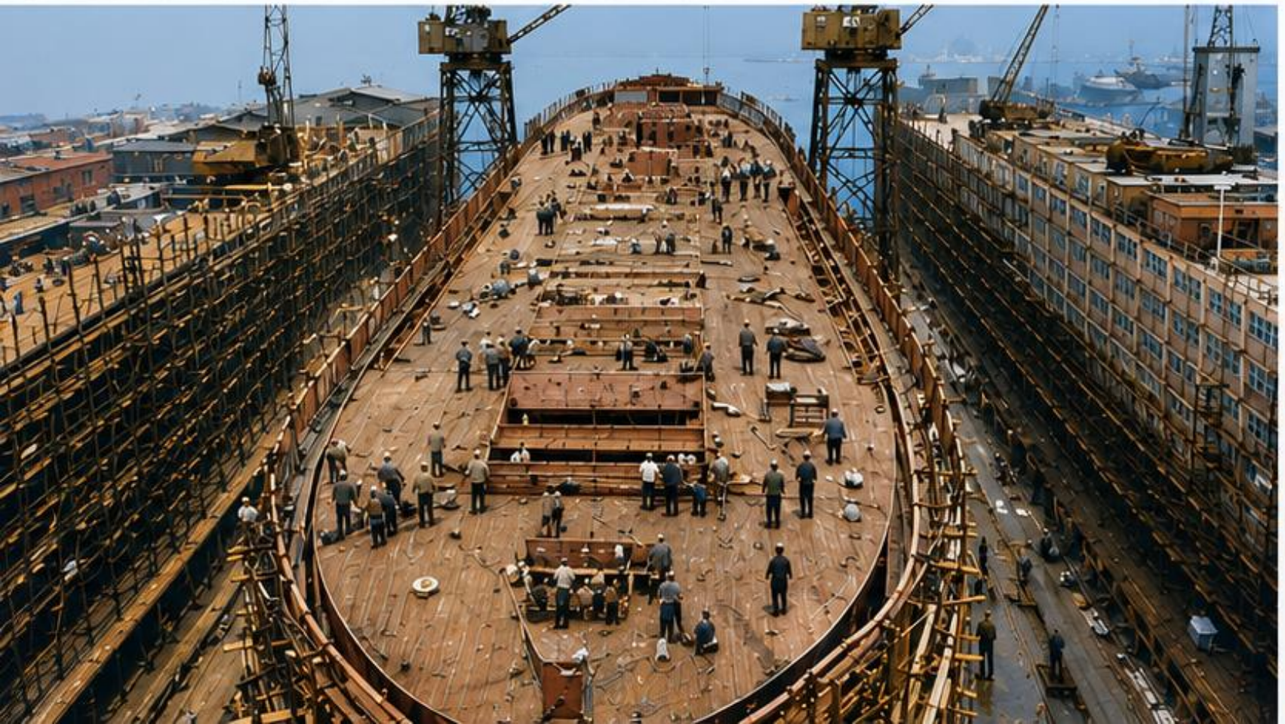


Production Miracle

Liberty ships revolutionised shipbuilding with standardised design and prefabricated sections. A ship that took 6 months to build in 1941 was completed in just about 40 days by 1943

The quickest Liberty ship ever built was the SS Robert E Peary, completed in an astonishing 4 days, 15 hours, and 29 minutes in November 1942 at the Oregon Shipbuilding Corporation in Portland, Oregon

- Welded hull construction
- Modular assembly techniques
- Female workforce integration




ROBERT E. PEARY
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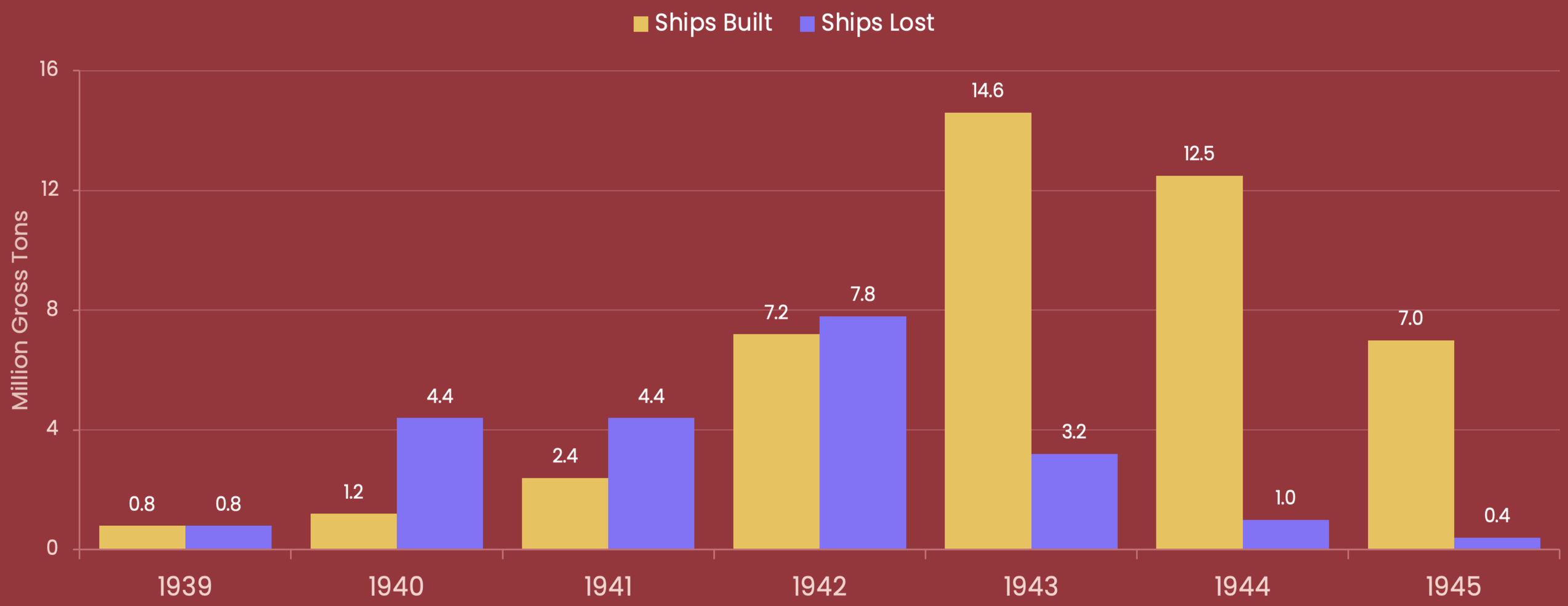
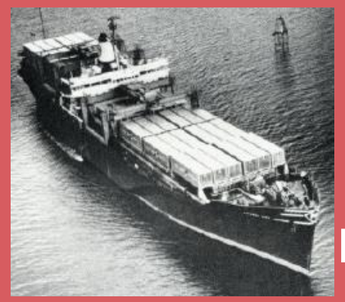
World War II – Build Rates versus Losses

Annual Tonnage, 1939 to 1945 – How American Shipyards Won The Tonnage War



Allied merchant tonnage, gross registered tons. Built figures are approximate and Allied-wide, with the United States providing about 93 percent of wartime construction. Losses peaked in 1942, then American shipyards led by the Liberty ship programme out-built losses more than fourfold from 1943, after the U-boats were broken in Black May. Losses to enemy action totalled about 21.6 million tons in 4,774 ships

Container Revolution - 1956 to 1970



First Container Ship (1956)

SS Ideal X carried 58 containers, revolutionising cargo handling and ship design

Standardised Dimensions

ISO container standards (8x8x20ft) created global intermodal transportation system

Purpose-Built Vessels

Cellular container ships with specialised cargo handling systems emerged

Cruise Ship Divergence

Cargo ships became specialised, while passenger ships focused entirely on tourism

SS Potrero Hills - Jan 45

MV Clifford J Rogers - 1955

SS Ideal X - 26 Apr 56

- The **SS Ideal X** was the world's **first commercially successful container ship**. Launched on its historic voyage in April 1956, it fundamentally revolutionised global trade
- **The Visionary** - Trucking magnate Malcom McLean bought the vessel through the Pan-Atlantic Steamship Company. He wanted to bypass highly inefficient slow, and expensive highway transit and dockside cargo handling
- **Modification** - The ship was retrofitted with a custom reinforcing framework, known as **mechano decking**, above its standard oil piping. This allowed it to carry a dual cargo of liquid petroleum inside the hull and modular freight containers on top

TEUs in the World

The Global Container Shipping Capacity

~33.6 Million TEU
Total Global Container Ship Carrying Capacity

~6,700
Fully Cellular Container Ships in Service Worldwide

What is a TEU?

TEU stands for Twenty-foot Equivalent Unit
It is the standard measurement used to quantify container capacity.

20-Foot Container
= 1 TEU

40-Foot Container
= 2 TEU

The World's Largest Container Ships Can Carry
24,000+ TEU
on a Single Voyage

How Many Containers Exist in the World?

~45 – 50 Million
Individual Shipping Containers

~65 – 70 Million TEU
Total Capacity (All Containers)

These figures include dry cargo containers, refrigerated containers, specialized containers, and **tank containers**

TEU Capacity Around the World

TEUs are the standard of the global container shipping industry, driving international trade and connecting the world.

The Little Things

Propellor Designs

Different propeller designs are used to match a vessel's purpose, operating conditions, and performance requirements

Fixed Pitch Propeller

Ideal for vessels with consistent operating conditions and steady speeds such as bulk carriers and tankers where simplicity and reliability are key

Controllable Pitch Propeller

Perfect for vessels that experience frequent changes in load or speed such as tugs and offshore support vessels offering better control and maneuverability

Variable Pitch Propeller

Best for vessels requiring a wide range of speeds such as ferries and naval ships providing optimal efficiency across different operating conditions

Ducted Propeller

Well-suited for vessels operating in shallow or confined waters such as tugs and offshore support vessels where increased thrust and blade protection are important

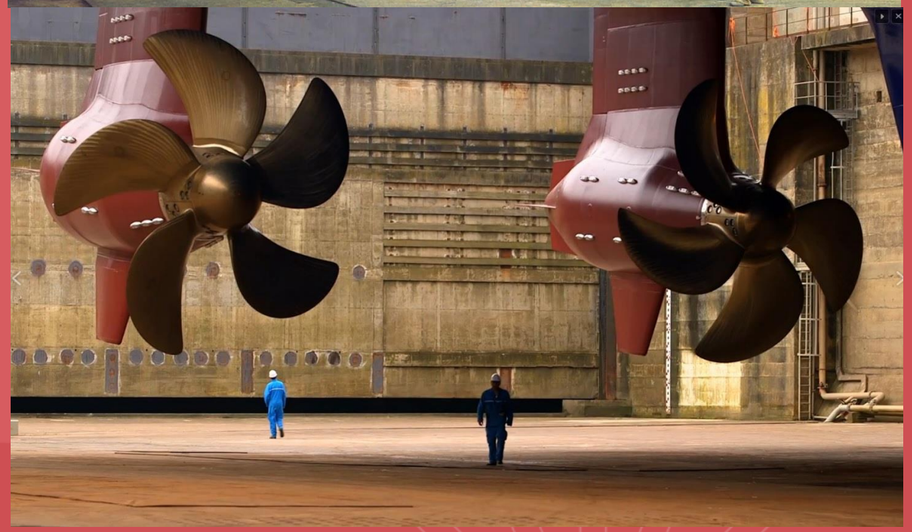
Contra-Rotating Propeller

Designed for large high-power vessels like cruise ships and tankers improving fuel efficiency and reducing vibration and hull rotation

Pump Jet Propeller

Ideal for high-speed vessels and those operating in shallow waters such as ferries and dredgers delivering high thrust and excellent maneuverability

Azipod Propulsion



Timelines for Building a Ship Today

Construction time versus order-to-delivery wait, by ship type

Ship Type	Construction Time	Order To Delivery
Container Ship	12 to 24 Months	About 3.2 Years
Oil Tanker (VLCC)	12 to 18 Months	About 3 Years
LNG Carrier	24 to 36 Months	3.5 to 4.8 Years
Bulk Carrier	10 to 14 Months	About 3 Years
RoRo / Car Carrier	16 to 24 Months	About 3 Years
Cruise Ship	20 to 30 Months	**5 to 10+ Years**

Construction time runs from keel-laying to delivery. Order-to-delivery includes the wait for a yard slot, which now dominates the lead time. With the world orderbook at supercycle levels of around 340 million dwt across roughly 348 active yards, about half the 2007 peak, queues have lengthened across every segment. Cruise ships are the outlier, with four European yards holding almost all global capacity and orders now extending to 2035 and beyond

The World’s Three Largest Ship Builders

CSSC, HD Hyundai And Samsung Heavy Industries - Key Figures At A Glance

	CSSC (China)	HD Hyundai (Ulsan)	Samsung Heavy Industries (Geoje)
Established	1999, current form 2019	1972	1974
Flagship Site	20+ yards led by Jiangnan, Shanghai	7.2 km² over 4 km of Mipo Bay coast	About 4 km² on Geoje Island
Drydocks	30+ across the group	10, largest 672 m by 92 m at 1 million dwt	9, largest 640 m by 97.5 m by 13 m
Workforce	About 310,000 group-wide	About 20,000 at Ulsan	About 13,000 at Geoje
Share Of World Orderbook	About 20%	About 15% (group)	About 10%
Current Orderbook	30+ M CGT; 38.9 M dwt of new orders in 2025	453 vessels / 41 M dwt; $17.4 bn booked in 2025	132 vessels, $28.2 bn, slots filled to late 2029
Famous Builds	Aircraft carriers Shandong and Fujian; Adora Magic City, China's first large cruise ship	Over 2,300 vessels to 344 owners in 51 countries; only yard building both LNG types	Prelude FLNG (488 m, largest floating object ever); Q-Max LNG carriers; MSC Gülsün, 23,756 TEU
Stand-Out Fact	About one in five merchant ships on order globally, plus the entire PLA Navy fleet	Yard and first 260,000 ton VLCC built and delivered together in 1974	Best dock turnover in the world - ten complete ships per dock per year

All three are corporate groups, not single sites. CSSC is a Chinese state holding company with 20+ yards; HD Hyundai and Samsung Heavy Industries are private Korean groups, each centred on one mega-yard. Hanwha Ocean, the former Daewoo, sits in close fourth

China State Shipbuilding Corporation (CSSC)
- Shanghai

Hyundai
HD
- Ulsan

Samsung Heavy Industries - Geoje

Shipbuilding … for American Passengers

From The Liberty Ship Miracle To A Single Vessel Built In 2024

2,710

Liberty Ships Built By American Yards between 1941 and 1945, in the largest industrial mobilisation in history

5

Large commercial ships built in the United States In 2023 (against 1,800 in China)

0.05%

United States share of world commercial shipbuilding today

- America's first golden age was the wooden-ship era of the 1840s and 1850s, when US yards built more tonnage than any nation on earth. The second was the wartime miracle - between 1941 and 1945, American yards launched 2,710 Liberty ships in the largest industrial mobilisation in human history, peaking at one delivered every five days. Henry Kaiser's Richmond yard once launched the SS Robert E. Peary just four days and fifteen hours after her keel was laid

- Today, the picture is more sober. In 2024 US shipyards built one large commercial vessel against China's 717, and only about 80 US-flagged commercial ocean vessels work in international trade against China's 5,500. The April 2025 'Restoring America's Maritime Dominance' Executive Order and the October 2025 port fees on Chinese-built ships mark the first serious revival attempt in decades

- A cruise-relevant aside - NCL's Pride of America is the only large US-flagged cruise ship in service, and only because Congress passed a special law allowing her to count as American-built despite being launched in Germany

Pride of America

Shipbuilding ... for Canadian Passengers

From The Maritimes' Wooden-Ship Heyday To The Western World's Largest Icebreaker Order Book

3rd

British North America's rank among world shipbuilders in the 1850s, behind only Britain and the United States

$6.4 bn

Polar Icebreaker Contracts awarded to Davie and Seaspan in March 2025

1825

Year Chantier Davie was founded, making it Canada's oldest working shipyard

- In the 1840s and 1850s British North America - chiefly the Maritimes and Quebec - was the world's third-largest shipbuilder, behind only Britain and the United States. In some years colonial output actually exceeded Britain's own. The yards of Saint John, Quebec City and Yarmouth built enormous tonnage, much of it sold to British owners. The shift from wood to iron ended that era because the yards converted very slowly

- Modern Canada has chosen a niche rather than chase commercial shipbuilding. Through the National Shipbuilding Strategy three yards now anchor the industry - Chantier Davie in Lévis, Quebec, Irving in Halifax, and Seaspan in Vancouver. Davie now holds the largest icebreaker order book in the Western world, and in 2023 it bought the Helsinki Shipyard outright to import Finnish Arctic expertise

- In March 2025, the government awarded the two new polar icebreaker contracts - Polar Max to Davie at $3.25 billion, and a parallel vessel to Seaspan at $3.15 billion - both for delivery by the early 2030s. Irving is building the new River-class destroyers for the Royal Canadian Navy

Icebreaking Giant

Shipbuilding ... for British Passengers

From sixty per cent of world tonnage to Spanish-owned Harland & Wolff

60%

Britain's share of world shipbuilding output in 1900, a position held for more than half a century

1956

Year Britain lost the world number-one spot to Japan, after UK output grew just 18 per cent against 300 per cent for the world

1967

Year QE2 launched at Clydebank, the last large British-built ocean liner

- Britain built close to 60 per cent of the world's tonnage in 1900 and was still the world's largest shipbuilder until 1956, briefly building more than the rest of the world combined just after the war. The yard names tell the story - Harland and Wolff at Belfast, John Brown on the Clyde, Swan Hunter, Cammell Laird, Vickers at Barrow - and the products were the great ocean liners, from Titanic to QE2

- The decline is best captured in a single comparison. Between 1947 and 1957 UK shipbuilding output rose by 18 per cent, while world output rose by over 300 per cent. Britain did not shrink, it was overtaken at warp speed. QE2, launched at Clydebank in 1967, was the last large British-built ocean liner. Cunard and P&O remain British-flagged, but every modern ship in both fleets has been built by Fincantieri in Italy

- The fresh news is that Titanic's yard is back at work. In January 2025, the Spanish state shipbuilder Navantia acquired Harland and Wolff after a second bankruptcy, and £115 million is being invested to modernise Belfast to build three Fleet Solid Support ships for the Royal Navy - the first ships built there since 2003

New RN Fleet Solid Support Ships

Shipbuilding … for Australian Passengers

7th

Nuclear Powered Submarine Builder

1%

of Australia's exports are carried by Australian-flagged vessels, and even on its own coastal routes

5th

biggest shipping task and one of its smallest flag-state registers (number 37, though ahead of Germany, France and Spain!)

- So, if and when Australia delivers its first SSN-AUKUS, it will be the seventh nation able to build nuclear submarines - one of the most exclusive industrial clubs on earth - only six nations today can build a nuclear-powered submarine, and Australia is on its way to becoming the seventh

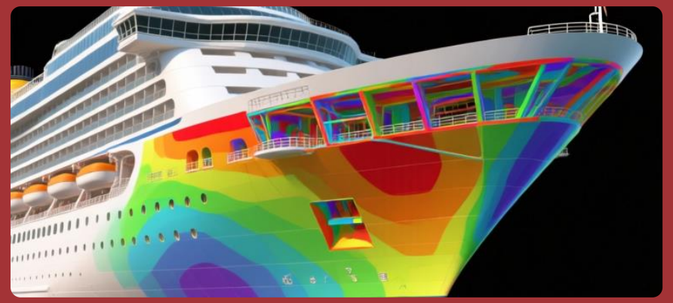
- Henderson, near Perth, in Western Australia is where Austal lives - Australia's biggest home-grown shipbuilder, founded in Perth in 1988 – current revenue of around A$1.8 billion and 4,500 employees. Most cruise passengers won't realise that Austal's American subsidiary in Mobile, Alabama builds Littoral Combat Ships for the United States Navy - an Australian company building US warships. At Henderson, Austal is currently building eighteen Landing Craft Medium and eight Landing Craft Heavy for the Australian Army, contracts worth A$5 billion in total, signed in late 2025 and early 2026

AUSTEL – A 26 Year Success Story

Advanced Materials and Engineering

High-Tech Materials

- High-strength steel reduces hull weight by 15% while maintaining strength
- Aluminum superstructures reduce top weight, improving stability
- Composite materials for lifeboats and interior components
- Advanced coatings prevent corrosion, extending hull life to 30+ years



Computer-Aided Design

- Finite element analysis optimises hull strength and weight
- Computational fluid dynamics improves fuel efficiency by 8-12%
- 3D modeling enables clash detection before construction
- Digital twins monitor ship performance throughout lifetime

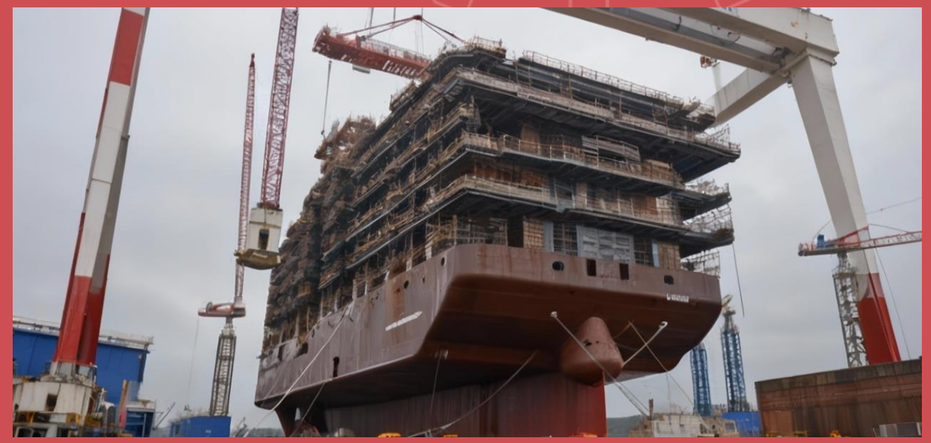
Automation Integration

- Robotic welding ensures consistent quality and speed
- Laser scanning verifies dimensional accuracy
- Automated painting systems reduce environmental impact
- AI-powered quality control detects defects early

Modular Construction Revolution

Building Blocks of Giants

Modern ships are constructed like massive LEGO sets. Instead of building from the keel up, ships are assembled from 100+ pre-fabricated blocks, each weighing 200-800 tons. These blocks contain complete cabins, restaurants, and technical systems, allowing parallel construction. The technique, pioneered by Chantiers de Atlantique for Queen Mary 2, reduced construction time by 40% while improving quality control

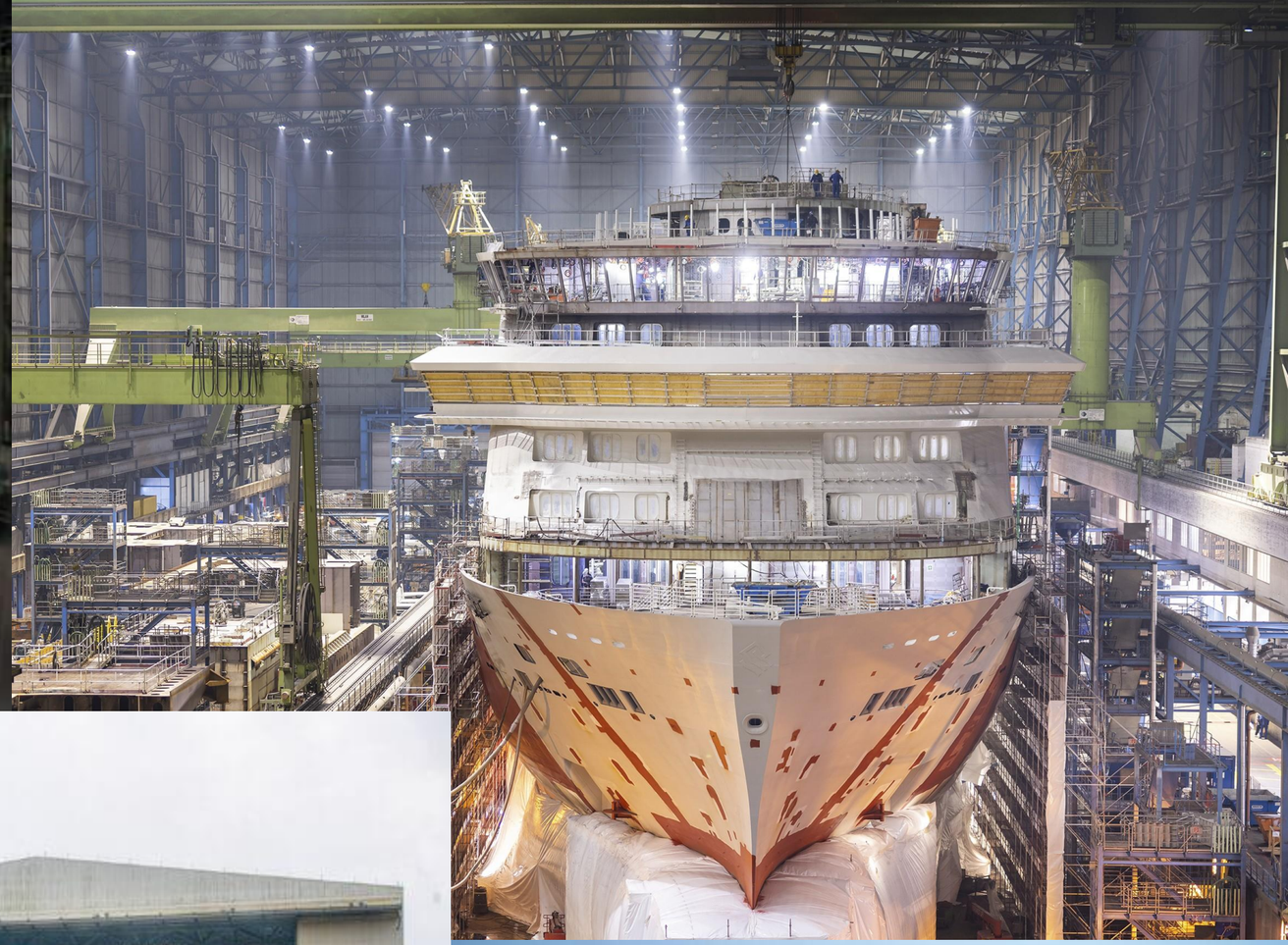


Block Assembly

Complete sections built in covered halls, weather-independent

Quality Control

Systems tested before installation, reducing sea trial failures

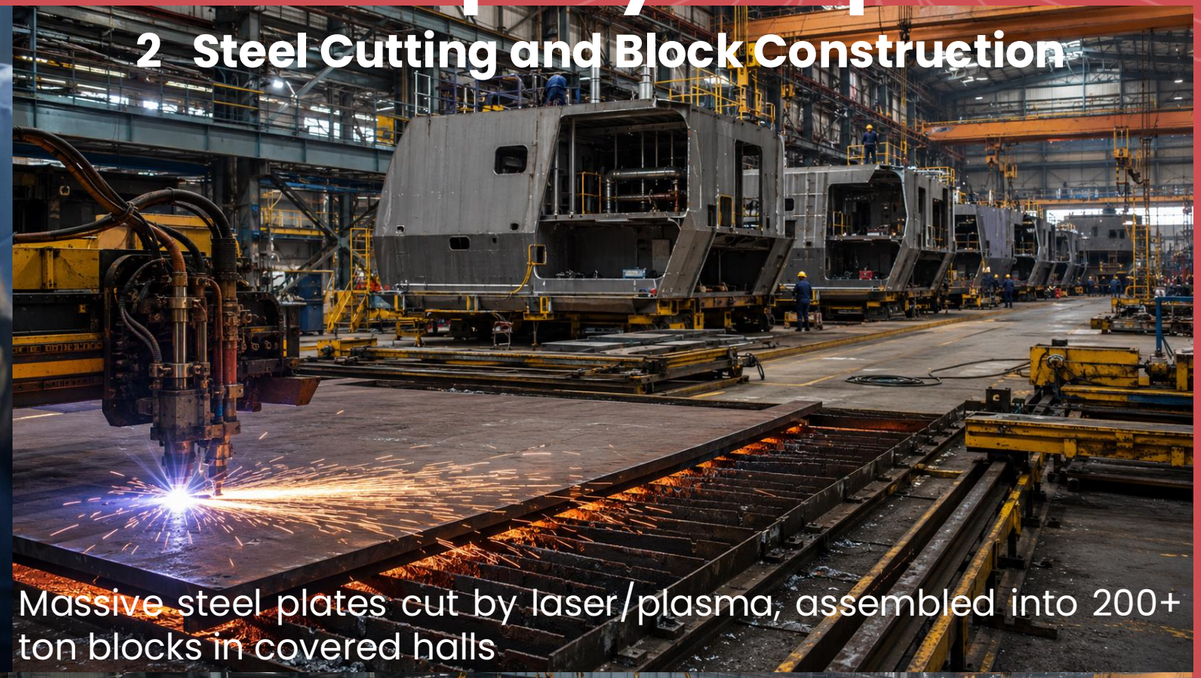


Modern Ship Construction Process - Step-by-Step

1 Design and Engineering

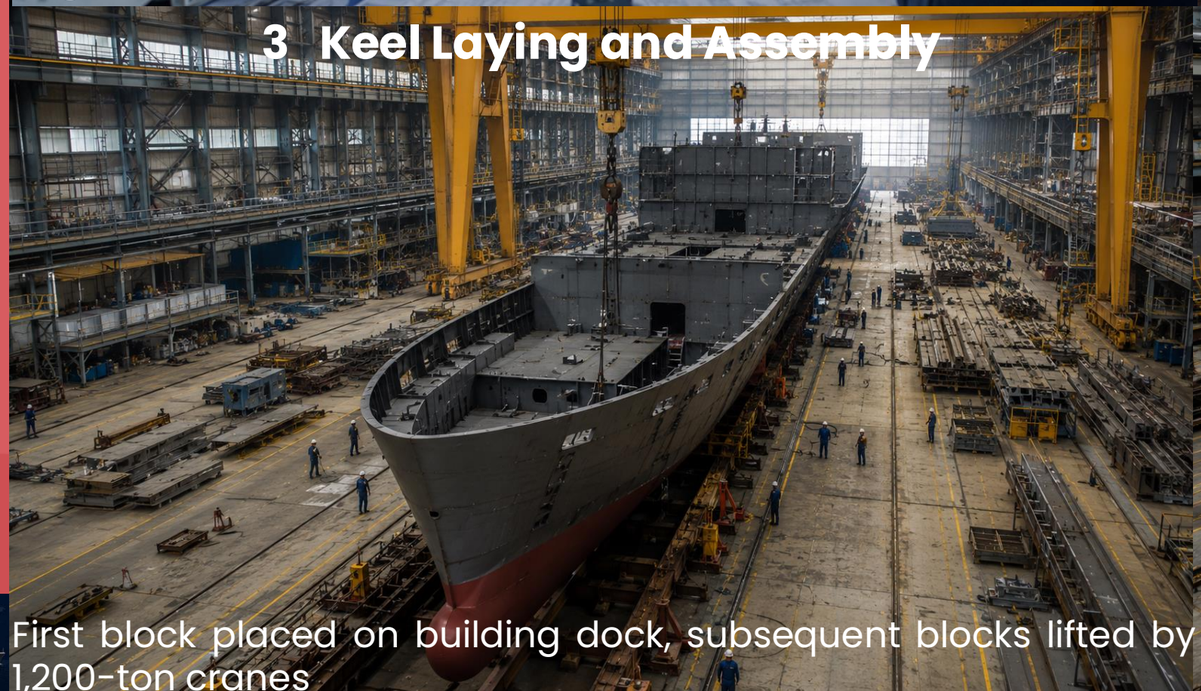
Naval architects create 3D models, stability calculations, and regulatory compliance plans

2 Steel Cutting and Block Construction



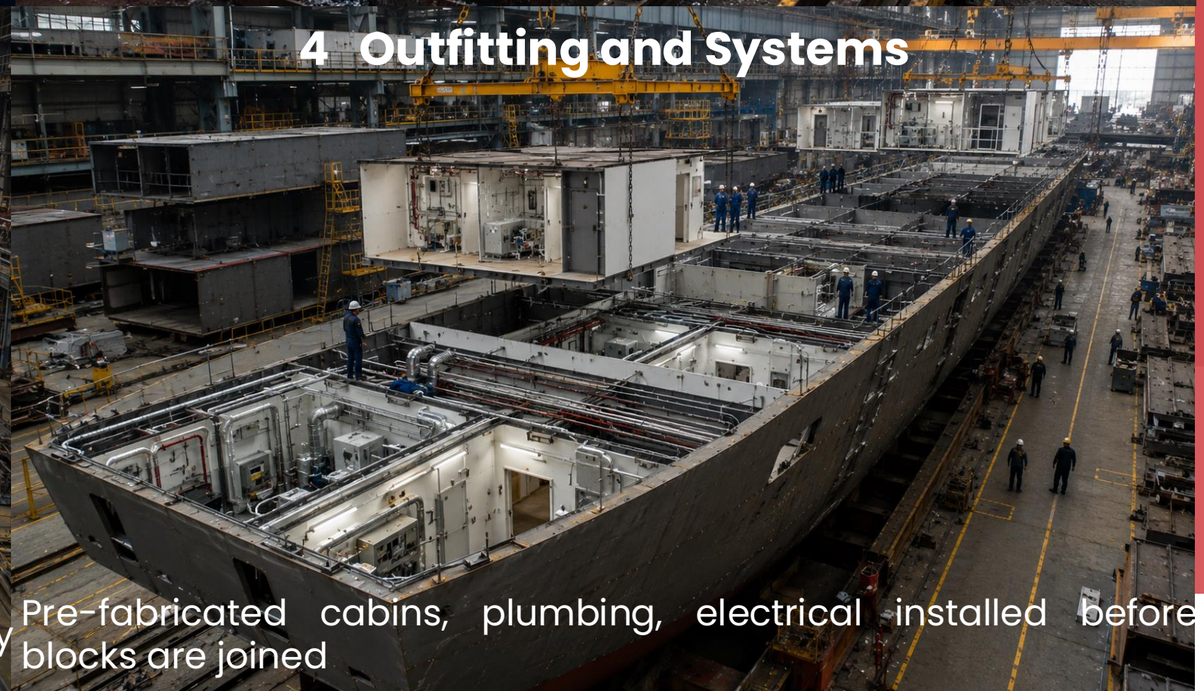
Massive steel plates cut by laser/plasma, assembled into 200+ ton blocks in covered halls

3 Keel Laying and Assembly



First block placed on building dock, subsequent blocks lifted by 1,200-ton cranes

4 Outfitting and Systems



Pre-fabricated cabins, plumbing, electrical installed before blocks are joined

Modern Ship Construction Process - Step-by-Step

5 Float Out and Dock Transfer

Ship launched and moved to outfitting dock for final construction phases

6 Interior Completion

Casinos, restaurants, theaters, pools installed - like building a city in 30 days

7 Sea Trials and Testing

Comprehensive testing of all systems, safety drills, speed and maneuvering tests

8 Delivery and Christening

Final inspections, crew training, champagne ceremony, first passenger voyage

Future Shipbuilding Technologies

Alternative Fuels

The next generation of ships will be powered by revolutionary clean energy systems

- Hydrogen fuel cells for zero-emission operations
- Battery hybrid systems for port navigation
- Synthetic e-fuels from renewable energy
- Ammonia and methanol as marine fuels

Autonomous Systems

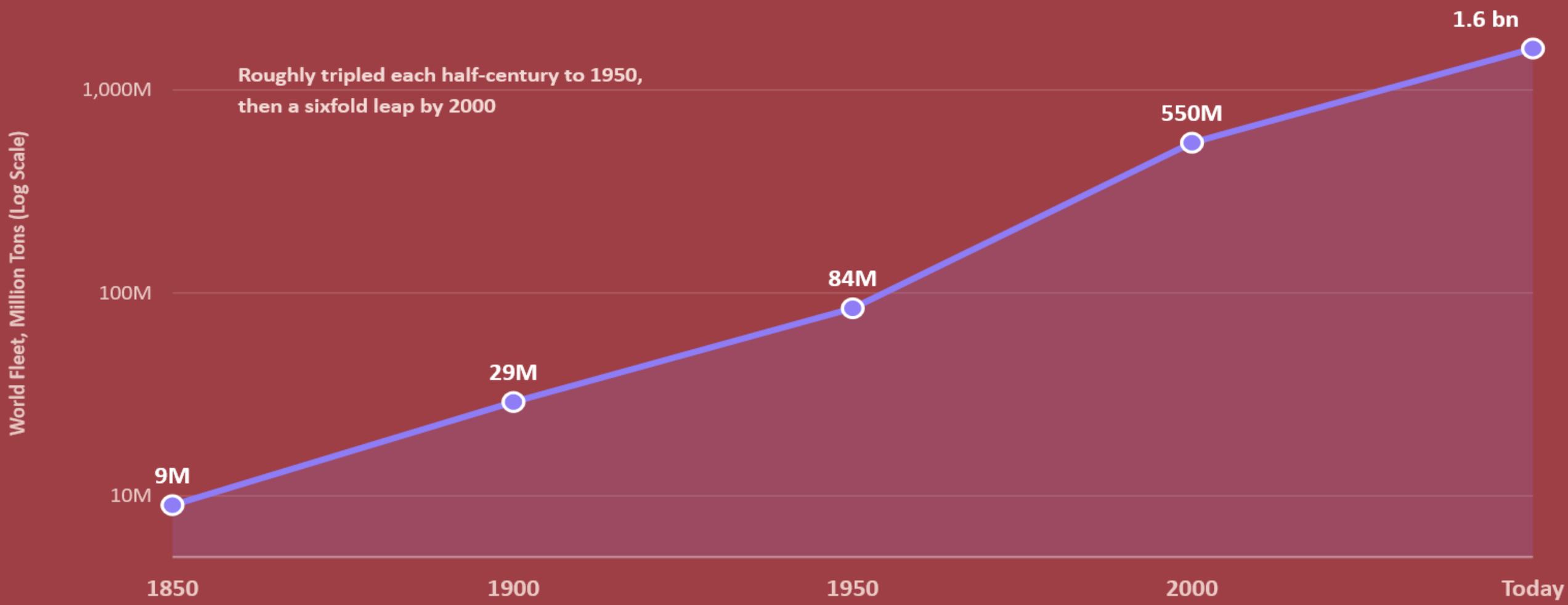
AI and automation will transform ship operations and passenger experience

- Autonomous navigation systems reduce human error
- AI-powered energy management optimizes efficiency
- Robotic maintenance and cleaning systems
- Predictive maintenance prevents breakdowns

Yara Birkeland – First autonomous and all all electric cargo ship under long-term trials in Norway

The World’s Merchant Fleet Size – 1850 to Today

Total Registered Tonnage - A 180-Fold Rise From Sail To Steam To Containers



Total world merchant fleet. Figures to 1950 are gross or net registered tons, later figures gross tonnage. Today also about 2.44 billion deadweight tons

Plotted on a logarithmic scale so the sail and early-steam centuries stay visible beside the modern container, bulk and tanker explosion

Size Matters

The world's largest container ship is the MSC Irina, with a maximum carrying capacity of 24,346 TEUs (twenty-foot equivalent units). Delivered in March 2023, it has a tonnage of 236,000 tons and a length of 400 m

The largest tankers in operation as active trading vessels are the four sister ships of the TI-class (TI Europe, TI Oceania, FSO Africa, and FSO Asia), with a tonnage of 442,000 and a length of 380 m

New Designs

Sea Shadow (IX-529) was an experimental stealth ship built by Lockheed Martin

Sea Zero project to construct its first ship with a zero-emission propulsion system began in spring 2022. The plan is now in a research and development phase, which lasts through late 2025/early 2026

The project will then advance to the new-build stage as we gear up to have the ship ready for launch by 2030

The Unusual/Novel

Cable Layer

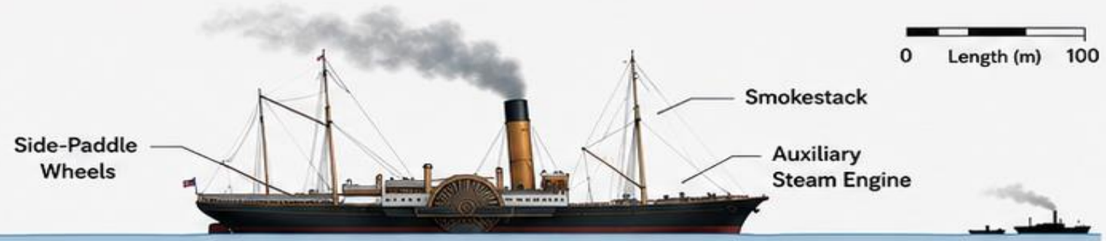
Semi-submersible ship (a heavy-lift cargo vessel that partially submerges to load cargo (BOKA Vanguard, which has a deadweight capacity of up to 117,000 tonnes)

Drill Ship

How Ships Have Changed

1850s
The Age of Sail & Steam

Merchant Clipper Ship



Early Steamer / Packet Ship

1900s
Steamships and Ocean Liners

Passenger Liner

Cargo Freighter

1950s
Mid-Century Maritime Commerce

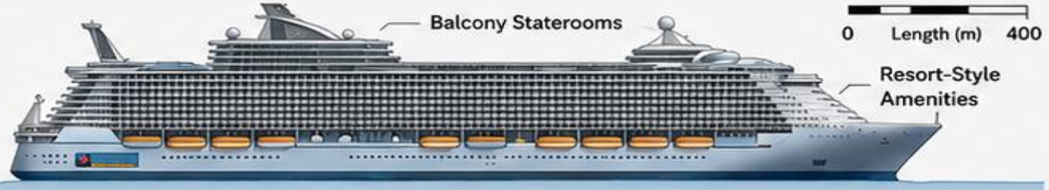
Streamlined Liner

Bulk Carrier

Oil / Product Tanker

2000s
Containerisation and Modernisation

Panamax Container Ship



Cruise Ship

2025s
Next-Generation Efficiency

ULCV Container Ship

Hybrid Bulk Carrier

Main Types of Ship in 2025

1. Container Ship

- Carries standardized containers
- Global trade backbone
- Large capacity, high efficiency

2. Bulk Carrier

- Carries dry bulk cargo (coal, iron ore, grains, bauxite, etc.)
- High volume, low cost per ton
- Essential for raw material transport

3. Tanker (Oil & Chemical)

- Transports liquid cargo (crude oil, petroleum products, chemicals)
- Includes crude, product & chemical tankers
- Critical to energy and chemical supply chains

4. LNG Tanker

- Carries liquefied natural gas (LNG) at -162°C
- Specialized cryogenic containment systems
- Key to the global clean energy transition

5. Ro-Ro / Car Carrier

- Transports wheeled cargo (cars, trucks, trailers, construction equipment)
- Roll-on/roll-off for easy loading
- Supports automotive and machinery trade

6. Offshore Support Vessel (OSV)

- Supports offshore energy operations
- Types include AHTS, PSV, CSV, SOV
- Essential for oil & gas and offshore renewables (wind)

7. Cruise Ship

- Carries passengers for leisure and tourism
- Floating resorts with amenities
- Strong focus on sustainability in 2025

8. Autonomous Vessel

- Operates with little or no human on board
- Uses AI, sensors, and remote control
- Increasingly used for cargo, surveys, and offshore operations

The shipping industry in 2025 is driven by innovation, efficiency, and sustainability—powering global trade and a cleaner future.

Key Takeaways - Evolution Lessons

Innovation Drivers

Each major advancement was driven by crisis, competition, or changing passenger expectations

Safety Evolution

- Every major disaster led to revolutionary safety improvements
- International cooperation essential for global standards
- Technology alone insufficient without proper procedures

Global Impact

- Shipbuilding advances transformed global trade and tourism
- Standardisation enabled worldwide cruise industry growth
- Environmental leadership drives future innovation

Future Vision

Autonomous systems, zero-emission fuels, and AI optimisation will define next 50 years

Human Element

Despite technology, skilled crews and proper training remain irreplaceable

Continuous Innovation

The evolution continues - tomorrow's ships will be unrecognisable from today's

Thank You