Shipping & Logistics

Figures current as of October 2026

How the world's goods move: the ships and their cargoes, the chokepoints, the container lines and their rates, bulk carriers and tankers, the shadow fleet, ports and shipyards, air, rail, and road, what freight costs, and the politics of a system that carries most of the world's trade, with the arithmetic worked at each step.

MODULE 1 — Foundations: How the World Moves

Goal: Establish the scale, the fleet, the cargo, and the container revolution.

About 12.7 billion tonnes a year by sea; the fleet by type; cargo by tonnage and by value; the shipping container, measured in twenty-foot equivalent units (TEU); and why a television crosses the Pacific for a few dollars.

MODULE 2 — The Chokepoints and Routes

Goal: Map the passages everything runs through, their keepers, and the shocks that closed them.

Malacca, Hormuz, the Red Sea and Suez, Panama, the Turkish and Danish straits, the Cape, the Arctic, and the rivers, with their status in October 2026; the Suez crisis of 1956, the Ever Given, the Red Sea closure, and Panama's droughts.

MODULE 3 — Container Shipping: The Lines and the Alliances

Goal: Explain the industry that carries manufactured goods.

The ten lines that carry 85% of containers, Hanjin's collapse and the consolidation it sealed, the alliances, the economics of a 24,000-TEU ship worked, and an orderbook near half the fleet.

MODULE 4 — Container Rates and the Cycle

Goal: Read the rate history and work the cost of a diversion.

The rate record from 2019 to October 2026, the pandemic's jam and its windfall, the Cape diversion's arithmetic worked, how carriers manage supply, and the reckoning the orderbook sets up.

MODULE 5 — Dry Bulk

Goal: Cover the ships that carry raw materials and food.

The ship classes, the Baltic Dry Index from 2008 to its 2026 high, the iron ore, coal, grain, and bauxite flows, and the Chinese demand that sets the market.

MODULE 6 — Tankers and Energy Shipping

Goal: Cover crude, oil products, and gas at sea, and the 2026 closure of Hormuz.

Very large crude carriers (VLCC) and their record rates, Hormuz from the first strikes to October with the bypass pipelines, product tankers, and the carriers of liquefied gas.

MODULE 7 — The Shadow Fleet and Sanctions at Sea

Goal: Give the parallel fleet its own module, and weigh boarding it.

About a thousand tankers outside the rules, the cut Baltic cables and the trials that followed, the European Union's sanctions, the legal gap, and the argument over stopping the ships at sea.

MODULE 8 — Ports and Terminals

Goal: Profile the nodes, and weigh automating them.

The largest ports and their operators, Panama's seizure of its canal ports, congestion, the Baltimore bridge and the 2024 port strike, and the argument over automated terminals.

MODULE 9 — Shipbuilding

Goal: Explain who builds the ships, why it became strategic, and the argument over rebuilding America's yards.

The shift from Britain to Japan to Korea to China, the port-fee fight and its truce, the naval shadow, and the cases for and against the Jones Act and the new American programs.

MODULE 10 — Flags, Crews, Insurance, and Law

Goal: Cover the rules the system runs on.

Flags against owners, the International Maritime Organization (IMO), two million seafarers and the record abandonments, the protection and indemnity (P&I) clubs and war risk, attacks at sea, and the law of the sea.

MODULE 11 — Air Cargo

Goal: Cover the mode that carries a third of trade's value.

The volumes, the hubs, the integrators and the bellies of passenger jets, the end of duty-free parcels in the United States and Europe, and the economics of a freighter.

MODULE 12 — Rail and Inland Waterways

Goal: Cover the land bridges and the rivers.

American freight rail and the first coast-to-coast merger, the China-Europe trains, the Middle Corridor, and the Rhine, the Mississippi, and the Yangtze in drought.

MODULE 13 — Trucking and the Last Mile

Goal: Cover the mode that delivers everything.

The industry and its cycle, the driver shortage, electric trucks in China and America, driverless trucks in Texas, and the economics of the last mile.

MODULE 14 — Logistics and Supply Chains

Goal: Explain the industry that manages the movement.

Forwarders and integrators, from just-in-time to just-in-case, the cyberattack that stopped Maersk, nearshoring and China-plus-one, the tariff wave, warehouses, and visibility.

MODULE 15 — What Freight Costs

Goal: Work the numbers a shipper actually pays.

A container of furniture from Vietnam to Chicago worked at October 2026 rates and tariffs, freight as a share of value by product, the Incoterms, and what disruption costs an economy.

MODULE 16 — Fuels and Decarbonization

Goal: Assess shipping's climate problem and weigh a global carbon price.

Three percent of the world's carbon dioxide, the rules from the sulfur cap to Europe's carbon market, the fuels compared, the timing problem, and the cases for and against the IMO's carbon price, put to a vote on December 4, 2026.

MODULE 17 — The Geopolitics of Shipping

Goal: Examine maritime power as state power.

China's maritime rise, the American response, Russia's Arctic, the keepers of the chokepoints, and the navies that guarantee, or fail to guarantee, the sea lanes.

MODULE 18 — Where Things Stand, and What to Watch

Goal: Close with the pattern, the questions, and a dated watch list.

What a decade of disruptions taught, overcapacity meeting disruption, the China question, decarbonization's timing, a watch list from October 2026 on, and a last word.

A note on the sources: the figures come from the industry's own counters. The UN Conference on Trade and Development (UNCTAD) counts world seaborne trade, Clarksons Research and BIMCO, the shipowners' association, count fleets and orders, and Alphaliner and Linerlytica track the container lines. The consultancy Drewry publishes container rates, the Baltic Exchange bulk and tanker rates, Lloyd's List Intelligence and the data firm Kpler ship movements, and the International Air Transport Association (IATA) air cargo. Where the field argues, over boarding shadow tankers, automating ports, the Jones Act and rebuilding American shipyards, and a global carbon price for ships, each side's case is put as its advocates make it, followed by the evidence and the course's reading. Each figure is dated, because in 2026 the numbers moved weekly.

Key Numbers, as of October 2026

The measurements the course relies on

Measure	Figure	Period	Source and release
Seaborne trade	12.72 billion tonnes, up 2.2%; ton-miles (tonnes multiplied by distance) up 5.9%, nearly three times as fast, as ships took longer routes	2024	UNCTAD, *Review of Maritime Transport 2025* (September 24, 2025)
Container ports	1.012 billion twenty-foot equivalent units (TEU) handled worldwide, up 8%; Shanghai 55.1 million, Singapore 44.7 million, Ningbo 43.9 million	2025	DynaLiners, as reported August 11, 2026
Container fleet and orders	About 34.7 million TEU in service; about 15.6 million TEU on order across 1,925 ships, about 45% of the fleet	September 2026	Linerlytica and BIMCO, as reported September 24, 2026
Container rates	Drewry's World Container Index (WCI) $4,351 per 40-foot container; Shanghai-Los Angeles $7,624, Shanghai-New York $10,220, Shanghai-Rotterdam $3,337; 2026 low $1,919 (February 19) and high $4,639 (July 9); record $10,377 (September 2021)	October 8, 2026	Drewry, weekly
Dry bulk	Baltic Dry Index 3,002, down from a September high of 3,488, the highest since October 2021; Capesize ships earned $52,315 a day on September 18	October 9, 2026	Baltic Exchange, daily
Tankers	Very large crude carriers averaged about $723,000 a day, against $79,700 a year earlier; the Gulf-to-China route briefly paid over $1.2 million a day	September 18, 2026	Baltic Exchange, as reported September 18 and 29, 2026
Strait of Hormuz	7 to just over 20 commodity ships a day crossed in early October, against about 125 before the war; about 4.5 million barrels a day of Gulf oil expected to stay shut in	October 6-8, 2026	Kpler, as reported October 8, 2026; US Energy Information Administration (EIA), *Short-Term Energy Outlook* (October 6, 2026)
Suez Canal	Revenue $4.67 billion in the year to June 2026, up 23% but half the record $9.4 billion of 2022-23; transits in late September 68% above a year earlier as container lines returned	July 2025-June 2026; September 2026	Suez Canal Authority (June 28, 2026); Drewry (October 1, 2026)
Panama Canal	33 daily transit slots from October 15 and a maximum draft of 49 feet (14.94 meters), after drought cuts to 32 slots in September	October 5, 2026	Panama Canal Authority
Shipbuilding	China won 76% of new orders by compensated gross tonnage and holds 68% of the orderbook; South Korea 15% and 17%	January to September 2026	Clarksons Research, as reported October 9, 2026
Shadow fleet	About 980 tankers, about 18.5% of the world's oil tankers; over 670 vessels listed by the European Union (EU), whose price cap on Russian crude stands at $44.10 a barrel	September 2025; July 2026	S&P Global (September 3, 2025); Council of the EU, 21st sanctions package (July 23, 2026)
Air cargo	Demand up 3.4% in 2025, a record, and 4.6% in January-August 2026; jet fuel $157 a barrel in August, up 79% in a year	2025-26	IATA (January and October 2026)
Supply-chain pressure	The Federal Reserve Bank of New York's index at 1.28 standard deviations above normal, after 1.81 in May; the record was 4.43 in December 2021	September 2026	Federal Reserve Bank of New York (October 6, 2026)
Carbon prices	EU allowances €82.40 (about $95) a tonne of carbon dioxide; the International Maritime Organization (IMO) votes on a global carbon price for ships on December 4, 2026	October 5, 2026	Intercontinental Exchange; IMO

Measure	Figure	Period	Source and release
American tariffs	After the Supreme Court struck down the emergency tariffs on February 20, 2026, tariffs of 10-12.5% under Section 301 of the Trade Act took effect on July 24: 12.5% on China and Vietnam, 10% on India, and 10% on Mexican and Canadian goods outside the North American trade agreement	July 24, 2026	Office of the US Trade Representative, as summarized by Kroll (September 9, 2026)
Oil	Brent crude $104.28 a barrel (futures settlement)	October 8, 2026	Intercontinental Exchange, London

A tonne is 1.10 US short tons. A nautical mile is 1.15 statute miles (1.852 km), and a knot is one nautical mile an hour. A TEU is one 20-foot container, so a 40-foot container is two TEU. Dollars are US dollars; the euro is converted at $1.15, the Federal Reserve's September 2026 average.

Terms the Course Uses

Term	Meaning	Why it matters
Twenty-foot equivalent unit (TEU)	The standard measure of container capacity: one 20-foot box; a 40-foot box is two	Ships, ports, and fleets are all counted in it
Deadweight tonnage (dwt)	The weight a ship can carry: cargo, fuel, water, and stores	How bulk carriers and tankers are sized
Gross tonnage (GT) and compensated gross tonnage (CGT)	A ship's enclosed volume, and that volume adjusted for how much work the ship takes to build	CGT is how shipbuilding shares are compared
Liner and tramp	Liners sail fixed schedules for many shippers; tramps go wherever a single cargo is	Container ships are liners; bulk carriers and most tankers are tramps
Time charter and voyage charter	Hiring a ship for a period, or for one voyage	Charter rates are the price of a ship's day
Very large crude carrier (VLCC)	A tanker of about 300,000 dwt that carries 2 million barrels; Suezmax (1 million) and Aframax (700,000) are smaller	The VLCC's Gulf-to-China rate is the tanker market's benchmark
Capesize, Panamax, Supramax, Handysize	Bulk carriers from about 180,000 dwt down to about 35,000	The Baltic Dry Index averages the first three
Liquefied natural gas (LNG) and liquefied petroleum gas (LPG)	Gas chilled to −162°C, or propane and butane carried under pressure or chilled to about −42°C, in specialized ships	Among the most expensive cargo ships afloat
Bunker fuel	Ship fuel: heavy fuel oil, very-low-sulfur fuel oil, marine gasoil, and now LNG and methanol	Fuel is about half a ship's operating cost
Blank sailing	A scheduled voyage cancelled to take capacity out of a market	The carriers' first tool when rates fall
Transshipment	Moving a container from one ship to another at a hub such as Singapore	Why a port can be huge without a large hinterland
Flag of convenience	Registration in a state whose registry is open to foreign owners, often for low tax and light rules	Most of the world's fleet flies one
Protection and indemnity (P&I) club	A mutual association of shipowners that insures liabilities: pollution, cargo, crew, collision	Its sanctions clauses enforce the price cap on Russian oil
War-risk insurance	A separate policy for war zones, priced per voyage as a share of the ship's value	Premiums, not navies, decide whether ships enter a war zone
Incoterms	The International Chamber of Commerce's standard terms for who pays for and bears the risk of each leg, such as free on board (FOB) and cost, insurance, and freight (CIF)	They decide who pays when rates spike

Term	Meaning	Why it matters
Freight forwarder	A company that buys transport and handles customs for shippers without owning ships or planes	The intermediaries that set prices in a crisis
Drayage	Short truck moves of containers between a port and a rail yard or warehouse	A cost that headline freight rates leave out
Jones Act	The 1920 US law requiring ships carrying cargo between American ports to be American-built, -owned, and -crewed	The center of the argument in Module 9

Module 1 — Foundations

How the World Moves

Recommended Reading / Reference

Book: Marc Levinson, *The Box: How the Shipping Container Made the World Smaller and the World Economy Bigger* (2006; second edition 2016)

Reference: UNCTAD, *Review of Maritime Transport 2025* (September 2025); Clarksons Research; Alphaliner's monthly fleet snapshots; the International Chamber of Shipping

1a. The Scale

Cargo	Seaborne trade (billion tonnes, 2024)	Share by tonnage	Share by value	Ships that carry it	Note
Dry bulk: iron ore, coal, grain, bauxite, fertilizer	About 5.6	About 45%	About 10%	Bulk carriers	Iron ore about 1.6, coal 1.3, grain and oilseeds 0.55
Crude oil	About 2.1	About 17%	About 15%	Crude tankers	About a fifth passed Hormuz before 2026
Oil products and chemicals	About 1.1	About 9%	About 8%	Product and chemical tankers	Gasoline, diesel, jet fuel, naphtha
Gas	About 0.6	About 5%	About 5%	Liquefied gas carriers	LNG about 0.42 billion tonnes, from Qatar, the United States, and Australia
Containers	About 2.0 (about 185 million TEU)	About 16%	About 55-60%	Container ships	Most of what people buy
Other: cars, general cargo, project cargo	About 1.0	About 8%	About 5%	Car carriers, roll-on/roll-off ships, general cargo and heavy-lift ships	About 20 million cars a year
Total	12.72	100%	100%		

UNCTAD's 2024 total; the split by cargo is approximate, from UNCTAD and Clarksons, and does not sum exactly to the total. Shares by value are estimates.

More than four-fifths of the world's trade by volume moves by sea: 12.72 billion tonnes in 2024, up 2.2% on the year, by UNCTAD's count. Distance grew faster than tonnage, since ton-miles rose 5.9% as ships sailed around Africa instead of through the Red Sea, and that gap is the story of shipping in the 2020s.

By tonnage, dry bulk is the largest cargo at nearly half, with oil and gas at about three-tenths and containers and everything else at about a quarter. By value the container dominates, since the roughly 185 million TEU moved a year hold most of what people buy. The world fleet counts about 110,000 merchant ships of 100 gross tons and more, of which about 60,000 are the large ocean-going vessels that carry the trade. The industry earns several hundred billion dollars a year in freight, is nearly invisible to the consumers it serves, and is the physical base of almost every other market.

1b. The Fleet

Ship type	Number (2026)	Largest class	New-build price	Typical owners and operators	Note
Container ships	About 6,700, holding 33.6 million TEU (March 2026)	24,000 TEU, 400 meters long	About $250 million for the largest; about $50 million for a small feeder	MSC (Mediterranean Shipping Company), Maersk, CMA CGM, COSCO (China COSCO Shipping), Hapag-Lloyd	Liners on fixed schedules
Bulk carriers	About 13,500	Valemax ore carriers of 400,000 dwt	About $75 million for a Capesize	Greek, Japanese, and Chinese owners	Tramps that go where the cargo is
Crude tankers	About 2,300, about 900 of them VLCCs	VLCC of 320,000 dwt, holding 2 million barrels	About $130 million for a VLCC	Greek, Chinese, and Gulf owners, and the shadow fleet	About a fifth of tankers now trade outside the rules (Module 7)
Product and chemical tankers	About 8,000	Long Range 2 (LR2) of 110,000 dwt	About $50 million for a Medium Range (MR) tanker of 50,000 dwt	Scorpio, Hafnia, Torm	The most numerous tankers
Liquefied gas carriers	About 800 LNG and 1,600 LPG carriers	Qatar's Q-Max, 266,000 cubic meters	About $250 million for an LNG carrier	Qatari, Japanese, Greek, and Korean owners	Among the most expensive cargo ships
Car carriers	About 800	9,000 cars	About $100 million	Japanese, Norwegian, and Chinese lines, including BYD's own fleet	China's car exports built a fleet
General cargo, ro-ro, heavy-lift, refrigerated	About 20,000	Varies	Varies	Many	Project cargo such as wind turbines
Cruise ships, ferries, offshore vessels	About 7,000	*Icon of the Seas*, 250,000 gross tons	About $2 billion for the largest cruise ship	Carnival, Royal Caribbean, MSC	Passengers, not trade
World merchant fleet	About 110,000 (about 60,000 ocean-going)			Greek owners hold about 20% of tonnage; Chinese, Japanese, and Singaporean owners follow	About 2.4 billion dwt in all

Clarksons Research, UNCTAD, and Alphaliner, approximate; prices are indicative 2025-26 levels.

1c. The Box

The container made modern globalization possible, because before 1956 cargo moved in sacks, crates, and barrels loaded by hand, a method called break bulk. A ship spent more time in port than at sea, loading was the largest part of the cost of freight, and theft was routine.

Malcolm McLean, a trucking owner, put 58 truck trailers on a converted tanker from Newark to Houston in April 1956. The standard steel box that followed, 20 or 40 feet long, stackable, lockable, and movable between ship, train, and truck without being opened, cut port time from days to hours and loading costs by

over 90%. Over three decades it pushed the cost of moving goods so low that it stopped mattering where things were made.

The container made the Asian export model possible, which is why manufacturing moved to wherever labor was cheapest. The world's box fleet holds about 50 million TEU, and China makes about 95% of new containers.

1d. Why It Is So Cheap, and Why That Matters

Sea freight is the cheapest form of transport ever devised, by orders of magnitude. A 40-foot container from Shanghai to Los Angeles, holding from about $25,000 of furniture to $135,000 of televisions, and far more for phones, cost between about $1,500 and over $12,000 in the 2020s, depending on the year, and a tonne of iron ore crosses the Pacific for less than a taxi ride. Ships have large economies of scale, since a vessel twice as large costs far less than twice as much to run, and that drove the race to the 24,000-TEU container ship and the 400,000-tonne ore carrier.

The world's production is therefore organized on the assumption that transport is nearly free and nearly instant. That holds until a canal blocks, a strait closes, or a pandemic shuts a port, and the 2020s have shown repeatedly that everything built on the assumption then stops.

Worked example — What It Costs to Move a Television

A 55-inch television leaves a factory in Shenzhen in a carton of 0.2 cubic meters, and a 40-foot container holds about 300 of them. **The sea leg:** at the Shanghai-Los Angeles benchmark of $7,624 on October 8, 2026, used here for Shenzhen too, the ocean freight is about $25 per television, about 6% of a $450 wholesale price. **The land legs:** add $300 for trucking to the port in China, $500 for terminal handling at both ends, $1,200 for drayage from Los Angeles to a warehouse in the Inland Empire, and $800 for the rail or truck leg to a store in Denver, about $9 a set. **The total:** about $35 from factory to shelf, or 8% of the wholesale price. At the $3,132 of January 8, 2026, before the Iran war, the sea leg was about $10 and the whole journey about $20. **Other goods:** ocean freight on a $30,000 car is $700-1,500, on a tonne of wheat from the Gulf of Mexico to Egypt $30-40 against a price near $250, and on a barrel of Gulf oil to China normally a dollar or two, before the tanker rates of September 2026 multiplied it about ninefold. **The lesson:** freight is a rounding error for high-value goods and a large share of the price of the cheapest bulk commodities. That is why a rate spike reaches the shelf as inflation in furniture and toys and barely at all in phones, and Module 15 works the numbers product by product.

Module 1 Key Points

Foundations

• More than four-fifths of trade by volume moves by sea: 12.72 billion tonnes in 2024, while ton-miles grew nearly three times as fast.

• Containers are about 16% of the tonnage but 55-60% of the value: the 185 million TEU that hold most of what people buy.

• About 110,000 merchant ships sail, about 60,000 of them ocean-going; Greek owners hold about a fifth of the tonnage.

• McLean's 1956 container cut loading costs over 90% and port time from days to hours, and made location stop mattering.

• Sea freight on a television is $10-25, a few percent of its price, which is why rate spikes hit furniture and toys, not phones.

Module 1 Quiz

Check Your Understanding

1. How do containers' shares of seaborne trade compare by tonnage and by value?

A) They are about half of both the tonnage and the value.
B) They are 55-60% of the tonnage but only 16% of the value.
C) They are about 16% of the tonnage and 55-60% of the value.
D) They are about 5% of the tonnage and about 90% of the value, because every manufactured good travels in them.

2. Which owners hold the largest share of the world fleet's tonnage?

A) Greek owners
B) US owners
C) Panama, under whose flag about a sixth of the world's tonnage sails
D) Norwegian owners

3. What did the shipping container cut by over 90% after 1956?

A) Ship speeds at sea
B) Loading costs
C) Crew sizes on board
D) The fuel burned per mile

4. In the worked example, what is the ocean freight on one television at the October 8, 2026 rate?

A) Under $1
B) About $100, a quarter of its price
C) About $200
D) About $25, roughly 6% of its wholesale price

5. Why does a freight-rate spike show up in furniture and toys but barely in phones?

A) Phone makers hedge freight
B) Phones avoid all tariffs
C) Furniture always moves on the costliest routes
D) Freight is tiny next to a phone's value

Module 2 — The Chokepoints and Routes

The Passages Everything Runs Through, Their Keepers, and the Shocks That Closed Them

Recommended Reading / Reference

Reference: US Energy Information Administration, *World Oil Transit Chokepoints*; the Suez Canal Authority's and the Panama Canal Authority's transit data; Lloyd's List Intelligence's Strait of Hormuz briefs (2026); Drewry's World Container Index commentary; the Lloyd's Joint War Committee's listed areas

2a. The Passages

Passage	Where	Normal traffic	What passes	Keeper	Status, October 2026
Strait of Malacca	Between Malaysia, Singapore, and Indonesia; 2.7 km wide at the narrowest	About 90,000 transits a year	Much of Asia's trade; most of the oil for China, Japan, and South Korea	Singapore, Malaysia, Indonesia	Open; China's 'Malacca dilemma'
Strait of Hormuz	The Persian Gulf's exit; shipping lanes 3 km wide	About 125-140 large ships a day	A fifth of the world's oil and LNG; about a third of seaborne fertilizer	Iran, with Oman on the far shore	Crippled since the war began on February 28: 7 to just over 20 commodity ships a day in early October, attacks at a seven-month high, and an American blockade of Iran's ports
Bab el-Mandeb and the Suez Canal	The Red Sea's southern gate and its Mediterranean exit	About 24,000-26,000 Suez transits a year before 2024	12-15% of world trade and about 30% of container traffic before 2024	Egypt (Suez); the Houthi militia (Bab el-Mandeb, in practice, since November 2023)	Container lines returning since August 2026; Suez revenue half its record; the Houthis declared a blockade of Saudi Arabia in July
Panama Canal	Atlantic to Pacific, 82 km, through the original locks and the larger ones opened in 2016	36-40 transits a day with full water	Asia-to-US East Coast containers; US grain and gas to Asia; about 5% of world trade	Panama, under the 1977 treaties	Drought cut it to 32 daily slots in September; 33 from October 15, with a 49-foot draft
Strait of Gibraltar	The Mediterranean's exit; 14 km wide	About 100,000 transits a year	Everything into and out of the Mediterranean	Spain and Morocco, with Britain at Gibraltar	Open
Turkish Straits	The Black Sea's exit through the Bosporus and the Dardanelles; 700 meters at the narrowest	About 40,000 transits a year	Black Sea grain and oil; Russian exports	Turkey, under the 1936 Montreux Convention	Open to trade; closed to warships of the warring states since 2022
Danish Straits	The Baltic's exit through the Øresund and the Great Belt	Tens of thousands of transits a year	Baltic trade; Russian oil in the shadow fleet	Denmark, bound to free passage by an 1857 treaty	Open; insurance checks and boardings of shadow tankers since 2025

Passage	Where	Normal traffic	What passes	Keeper	Status, October 2026
Cape of Good Hope	Africa's southern tip	Variable	Whatever cannot use Suez	None: open ocean	280 container ships carrying 4.0 million TEU still used it at the end of August, down from 380 carrying 5.5 million earlier in 2026
Northern Sea Route	Russia's Arctic coast, 5,600 km	103 transit voyages in 2025	Russian oil, gas, and ore; a few Chinese container ships	Russia: icebreaker escort, fees, permits	Marginal: 3.2 million tonnes of transit cargo in 2025
The rivers: Rhine, Mississippi, Yangtze	The inland arteries of Europe, America, and China	Hundreds of millions of tonnes each	Bulk and containers inland	National authorities	The Rhine at Kaub fell to 4 cm on September 24, 2026, its lowest since records began in 1880

Lloyd's List Intelligence and Kpler (October 8, 2026); Linerlytica (August 2026); Panama Canal Authority (October 5, 2026); Centre for High North Logistics (2025 season); German Federal Institute of Hydrology for the Rhine. Traffic figures are approximate.

2b. 2026: Four Passages at Once

The year 2026 was the most constrained for shipping routes in the modern era, because four passages were restricted at the same time. Hormuz has been closed or crippled since the Iran war began on February 28, and in early October attacks on tankers reached their highest in seven months. The Red Sea stayed closed to most container ships until August, and carriers are only now returning, with their arrivals bunching up at European hubs.

Panama rationed transits in September after a rainy season about a third drier than normal, and the Rhine fell to a few centimeters at its shallowest gauge. Typhoons and the returning ships added congestion at Asian ports and European hubs. The cost has been paid in freight rates (Module 4), in time, at one to two weeks more for each voyage around Africa, and in the capacity those longer voyages absorb.

2c. Who Controls Them

Each chokepoint has a keeper: Egypt owns the Suez Canal and depends on its tolls, which reached a record $9.4 billion in the year to June 2023 and were $4.67 billion in the year to June 2026. Panama owns its canal under the 1977 treaties, whose neutrality clause the United States invoked in 2025 when it pressed Panama over Chinese influence and its warships' passage. Turkey controls the Bosporus under the 1936 Montreux Convention, which lets it close the straits to the warships of countries at war, as it has since 2022.

Denmark controls the Baltic's exits under an 1857 treaty that guarantees free passage, which is the legal problem with stopping the shadow fleet (Module 7). Iran can close Hormuz, and did, while the Houthis, a militia with no navy, kept Western container lines out of the Red Sea for nearly three years. Singapore's position on Malacca made a city-state a power of trade, and China's dependence on the strait for most of its oil imports is what its strategists call the 'Malacca dilemma'. The 2020s showed that militias and mid-sized states can use a keeper's leverage as effectively as great powers.

2d. The Routes

World trade runs on a few trunk routes, and the largest long-haul container trades are Asia-Europe, through Suez or around the Cape, and the Transpacific between Asia and North America, the most lucrative for carriers. The Transatlantic is the oldest and now small, and the trades within Asia are the largest by number of voyages.

Bulk runs from Australia and Brazil to China for iron ore, from Indonesia and Australia to India and China for coal, and from the Americas and the Black Sea to Asia, Africa, and the Middle East for grain. Oil runs from the Gulf to Asia through Hormuz and Malacca, and since 2022 Russia's crude has run from the Baltic and the Black Sea to India, China, and Turkey. The routes are why the chokepoints matter: rerouting Asia-Europe around the Cape adds about 3,500 nautical miles, and closing Hormuz strands a fifth of the world's oil.

2e. The Shocks at the Chokepoints

Shock	When	What happened	Cost	Lesson
The Suez crisis	July 1956-April 1957	Egypt nationalized the canal; Britain, France, and Israel invaded; Egypt sank ships to block the channel, which stayed shut for about five months; Europe's oil ran short	The giant tanker was born of the closure, and Britain's imperial role ended	A blocked chokepoint invents its own bypass, and the bypass outlasts the crisis
The Ever Given	March 23-29, 2021	A 20,000-TEU ship wedged across the Suez Canal for six days, holding up about 12% of world trade; Egypt impounded it until the owners settled	Delays to several hundred ships and their cargo; 'general average' declared (Module 15)	One ship in one canal can stop a continent's supply
The Red Sea closure	November 2023-August 2026	Houthi missiles and drones sank ships and killed seafarers; nearly all Western container lines sailed around Africa; Suez revenue fell by more than half	Tens of billions of dollars in shippers' costs; a windfall for carriers (Module 4)	A militia with no navy can close a chokepoint for years when insuring the passage costs more than going around
Panama's droughts	2023-24 and 2026	Low water in Gatun Lake cut transits from about 36 a day to 22-24 in 2023-24, with auctioned slots selling for $2-4 million; in September 2026 slots were cut to 32	Weeks of delay and surcharges on the Asia-to-East-Coast trade; LNG and grain rerouted	Climate now constrains the canals themselves

Suez Canal Authority; Panama Canal Authority; Lloyd's List. The Hormuz closure of 2026 is in Module 6.

Module 2 Key Points

The Chokepoints and Routes

• Hormuz, the Red Sea, Panama, and the Rhine were all constrained in 2026, the most at once in the modern era.

• Early October 2026: 7 to just over 20 commodity ships a day crossed Hormuz, against about 125 before the war began on February 28.

• Container lines began returning to Suez in August 2026, after nearly three years around Africa; the canal's tolls halved meanwhile.

• Each chokepoint has a keeper, and the 2020s showed militias and mid-sized states can close one as well as great powers.

• From Suez in 1956 to the Ever Given, every closure taught that the system has no slack and invents its bypass afterward.

Module 2 Quiz

Check Your Understanding

1. Which four passages were constrained at the same time in 2026?

A) Hormuz, the Red Sea, Panama, and the Rhine
B) Malacca, Gibraltar, Dover, and the Cape
C) The Bosporus, Kiel, Malacca, and Dover
D) Gibraltar, the Bosporus, Kiel, and Dover

2. Who has kept most Western container lines out of the Red Sea since November 2023?

A) Egypt's canal authority
B) Somali pirate gangs
C) The Houthis
D) Iran's navy and coast guard

3. Under what treaty does Turkey control the Bosporus?

A) The 1977 treaties
B) The Montreux Convention of 1936
C) The Law of the Sea Convention of 1982, which lets it close the straits to all trade in wartime
D) The Treaty of Sèvres, signed in 1920

4. What cut the Panama Canal's daily transits in 2023-24 and again in 2026?

A) A pilots' strike
B) Drought lowering Gatun Lake
C) American warships taking priority
D) Lock repairs

5. What lesson does this module draw from the Suez crisis of 1956?

A) A blocked chokepoint invents its own bypass, and the bypass outlasts the crisis
B) Canals should be run by international bodies
C) Tolls rise after every war
D) Navies can always reopen a closed canal within weeks

Module 3 — Container Shipping

The Lines and the Alliances

Recommended Reading / Reference

Reference: Alphaliner's Top 100 and monthly fleet snapshots; Sea-Intelligence's schedule-reliability reports; Linerlytica's market reports; company reports for Maersk, Hapag-Lloyd, CMA CGM, and COSCO Shipping; the US Federal Maritime Commission (FMC) on alliances

3a. The Lines

Line	Home and ownership	Fleet (million TEU)	Share	Alliance	Note
MSC	Switzerland; the Aponte family, private	7.33	21.5%	None: alone since February 2025	The largest since 2022; buying ports, rail, and ferries
Maersk	Denmark; listed, controlled by the Møller family	4.72	13.8%	Gemini, with Hapag-Lloyd	Turned toward end-to-end logistics
CMA CGM	France; the Saadé family, private	4.37	12.8%	Ocean, with COSCO and Evergreen	Owns the logistics group CEVA
COSCO, including OOCL	China; state-owned	3.63	10.6%	Ocean	The state carrier, with port stakes worldwide
Hapag-Lloyd	Germany; listed, with Chile's CSAV, Kühne, Hamburg, Qatari, and Saudi holders	2.38	7.0%	Gemini	Agreed to buy ZIM in 2026
Ocean Network Express (ONE)	Japan; owned by NYK, MOL, and K Line	2.16	6.3%	Premier, with HMM and Yang Ming	Formed by merging the container businesses of Japan's three lines
Evergreen	Taiwan; listed	2.01	5.9%	Ocean	The operator of the *Ever Given*
HMM	South Korea; controlled by state lenders	1.03	3.0%	Premier	Rescued in 2016; the state wants to sell it
Yang Ming	Taiwan; state-linked	0.74	2.2%	Premier	
ZIM	Israel; listed	0.70	2.1%	Partnerships on individual trades	Hapag-Lloyd's $4.2 billion purchase awaits Israel's approval
Top ten		29.1	About 85%		

Alphaliner, end of June 2026. The whole fleet held about 34 million TEU.

Ten companies carry about 85% of the world's containers, and MSC, family-owned and private, became the largest in 2022 and now runs over a fifth of global capacity. Maersk, the former leader, turned toward integrated logistics, and CMA CGM, COSCO, Hapag-Lloyd, ONE, Evergreen, HMM, Yang Ming, and ZIM follow.

The industry consolidated from about twenty significant lines in 2015 to ten through a decade of losses and mergers. Hapag-Lloyd absorbed UASC, Maersk bought Hamburg Süd, COSCO bought OOCL, CMA CGM bought APL, and Japan's three lines merged their container businesses into ONE. The next step is

Hapag-Lloyd's agreed purchase of ZIM at $35 a share, about $4.2 billion, which ZIM's shareholders approved in April 2026. Israel's government holds a golden share in ZIM, and its review stalled on October 1 for want of a revised plan, under which a new Israeli company controlled by the private-equity firm FIMI would keep the state's rights.

The case that sealed the consolidation: on August 31, 2016, Hanjin Shipping of South Korea, then the seventh-largest line, filed for bankruptcy with about $5 billion of debt after the government declined to rescue it. Ports refused its ships for fear of unpaid fees, and about $14 billion of cargo was stranded at sea for weeks. The lesson the industry drew was that a line's failure strands the world's goods, which is why the survivors banked much of their pandemic windfall and why regulators watch the alliances.

3b. The Alliances

No line can serve every port as often as shippers want, so lines pool ships in alliances that share vessels and schedules but compete on price. The Ocean Alliance of CMA CGM, COSCO, and Evergreen is the largest and has been renewed to 2032, and the Premier Alliance of ONE, HMM, and Yang Ming is the smallest.

When the 2M alliance of Maersk and MSC ended in February 2025, Maersk and Hapag-Lloyd formed the Gemini Cooperation on a hub-and-spoke network with fewer direct port calls. Its promise of 90% schedule reliability is a bet that shippers will pay for punctuality, after reliability fell near 30% in the pandemic, while MSC, large enough to stand alone, runs its own network and sells space to others.

Alliances are the industry's answer to scale and a standing concern for competition regulators. The EU let its block exemption for shipping consortia expire in April 2024, and in the United States the FMC has enforced the Shipping Act more firmly since the Ocean Shipping Reform Act of 2022.

3c. The Economics of a Ship

Worked example — A 24,000-TEU Ship on Asia-Europe

Take a 24,000-TEU ship that cost about $250 million and runs on the Shanghai-Rotterdam loop. **Running costs:** crew, insurance, and maintenance cost about $25,000 a day before fuel, and at 18 knots the ship burns about 200 tonnes of fuel a day, $140,000 at an assumed $700 a tonne. A round trip through Suez takes about 84 days with port time, and about 100 around the Cape. **One round trip through Suez:** $2.1 million of running costs, about $8 million of fuel for some 55 days at sea, about $2 million of Suez tolls, $2 million of port charges, and about $5 million of depreciation and financing, about $19 million in all. That is about $790 for each of the 24,000 slots over the round trip, or about $400 each way if the ship sailed full both ways. **It does not:** the eastbound backhaul from Europe sails 40-50% full at about a third of the westbound rate, so the economics rest on the westbound leg. **Revenue at three rates:** container rates are quoted per 40-foot box, so a TEU earns half. At October 2026's $3,337 a box, westbound slots 90% full earn about $36 million and the backhaul about $6 million, about $42 million against $19 million of cost. At the October 2023 trough of about $1,100 a box, the round trip earns about $14 million and loses money. Around the Cape at July 2024's $8,300 a box, it earns over $100 million against about $20 million of cost. **The lesson:** the largest ships have the lowest cost per slot and the most to lose when they sail empty, which is the industry's whole cycle in one vessel.

3d. The Orderbook, and What the Lines Are Becoming

Container shipping has enormous fixed costs and volatile revenue, which produces a boom-and-bust cycle. Lines order ships in good years, the ships arrive in bad ones, and rates collapse until scrapping and demand growth absorb the surplus.

The 2010s were a decade of overcapacity and near-zero margins that cut twenty lines to ten, and the pandemic reversed it overnight. Operating profits reached about $164 billion in 2021 and $208 billion in 2022 by Sea-Intelligence's count, about $370 billion in two years, far more than in any earlier boom.

The lines spent much of the windfall on ships: by September 2026 the orderbook held about 15.6 million TEU across 1,925 ships, about 45% of the fleet in service, by Linerlytica's count, with Maersk ordering 26 ships of 18,600 TEU and CMA CGM twelve of 24,000. BIMCO expects the fleet to grow 9% in 2027, while scrapping has been minimal and only about 0.6% of the fleet sat idle in late August.

The lines also spent on becoming something else: Maersk bought forwarders and warehouses and added cargo aircraft to become an end-to-end logistics provider, and CMA CGM bought CEVA Logistics. MSC bought terminal stakes, a rail operator, ferry lines, and an African logistics network, and its terminal arm is a partner in the bid for CK Hutchison's ports (Module 8). The lines are turning from ship operators into owners of infrastructure, which raises the stakes of their concentration.

Module 3 Key Points

Container Shipping

• Ten lines carry about 85% of containers; MSC, private and alone, holds 21.5%, and Hapag-Lloyd is buying ZIM.

• Hanjin's 2016 bankruptcy stranded $14 billion of cargo at sea and sealed the consolidation from twenty lines to ten.

• A 24,000-TEU ship costs about $19 million a round trip; it profits richly at October 2026 rates and loses at 2023's.

• The pandemic brought about $370 billion of operating profit in 2021-22, and the lines spent it on ships and logistics.

• The orderbook reached about 45% of the fleet in September 2026, with the fleet expected to grow 9% in 2027.

Module 3 Quiz

Check Your Understanding

1. Which line became the largest in 2022, and how does it operate today?

A) Maersk, which leads the Gemini Cooperation with Hapag-Lloyd.
B) COSCO, which is state-owned and leads the Ocean Alliance with subsidies.
C) MSC, which is private and sails outside any alliance.
D) CMA CGM, which is listed in Paris.

2. What did Hanjin Shipping's bankruptcy in 2016 show the industry?

A) Governments always rescue a line that is large enough to fail.
B) Alliances protect their members from bankruptcy by sharing debts.
C) Smaller lines are safer than large ones, because they own fewer ships.
D) A line's failure strands the world's goods.

3. In the worked example, why do the economics of an Asia-Europe ship rest on the westbound leg?

A) Fuel costs more going east, against the prevailing winds and currents.
B) Suez tolls are charged only on the westbound transit, not the return.
C) The ship must sail back empty, because European exports are banned from it.
D) The backhaul sails half full at a third of the rate.

4. How large was the container orderbook in September 2026, by Linerlytica's count?

A) Under 5% of the fleet
B) About 10% of the fleet
C) About 45% of the fleet in service
D) Twice the fleet

5. What is the bet behind the Gemini Cooperation of Maersk and Hapag-Lloyd?

A) Lower prices through scale
B) That shippers pay for punctuality
C) That larger ships on fewer, longer routes will cut costs enough to undercut MSC on every trade
D) A merger of the two companies by 2027

Module 4 — Container Rates and the Cycle

The Rate History, the Pandemic's Jam, and the Cost of a Diversion Worked

Recommended Reading / Reference

Book: Peter Goodman, *How the World Ran Out of Everything* (2024), on the pandemic's supply-chain crisis

Reference: Drewry's World Container Index (weekly); the Shanghai Containerized Freight Index; the Freightos Baltic Index; Sea-Intelligence and Linerlytica capacity analyses; BIMCO's container market outlooks

4a. The Record

Date	WCI composite ($ per 40-foot box)	Shanghai to Los Angeles	Shanghai to Rotterdam	Context
2019 average	About 1,450	About 1,500	About 1,600	The pre-pandemic norm; lines near break-even
May 2020	About 1,600	About 1,700	About 1,600	Lockdowns; voyages cancelled
September 2021	10,377, the record	About 12,400	About 14,800	Goods demand surging; about 100 ships waiting off Los Angeles
December 2022	About 2,100	About 2,000	About 1,900	Collapse as demand fell and congestion cleared
October 2023	About 1,400	About 2,000	About 1,100	Below break-even, weeks before the Red Sea closed
July 2024	About 5,900	About 8,100	About 8,300	The diversions around Africa absorb capacity
January 8, 2026	2,557	3,132	2,840	The diversion premium unwinding; new ships arriving
February 19, 2026	1,919	—	—	The low before the Iran war began on February 28
July 9, 2026	4,639	6,482	4,933	The 2026 high: war-risk surcharges, congestion, Hormuz
October 8, 2026	4,351	7,624	3,337	Transpacific firm, with Shanghai-New York at 10,220; Asia-Europe down 13 straight weeks as ships return to Suez

Drewry, weekly; earlier rows approximate. The composite averages eight major routes.

Drewry's World Container Index (WCI), the benchmark for spot rates, fell from its record of $10,377 in September 2021 to under $1,500 in 2023. It rose above $5,000 in mid-2024 on the Red Sea diversions and slid to $1,919 by February 19, 2026 as that premium unwound and new ships arrived.

The Iran war reversed the slide: the index more than doubled to $4,639 by July 9, its highest since September 2024, on war-risk surcharges, port congestion, and the scramble for ships, and it stood at $4,351 on October 8. The two great trades then split: Shanghai to New York rose above $10,000, while Asia-Europe rates fell for thirteen straight weeks as the return to Suez added capacity.

Spot rates are only part of the market, since much cargo moves on annual contracts negotiated each spring and priced off the spot level of the time. The 2026 contracts were largely signed before the war's surge, so the spike reached carriers' results gradually, as Maersk's raised forecast in August showed.

4b. The Pandemic's Jam

The 2020-22 crisis showed that demand can break the system as surely as a closed strait. Lockdowns first emptied ships, and then spending shifted from services to goods, with American demand for imported goods surging about 20%. Ports, trucks, and warehouses jammed, empty containers piled up in the wrong places, and about 100 ships queued off Los Angeles and Long Beach.

Rates rose about sevenfold, schedule reliability fell near 30%, and about 400,000 seafarers were stuck at sea past their contracts. The episode added an estimated one to two points to American goods inflation and handed the lines the windfall of Module 3. Its lesson was that a system with no slack amplifies a demand shock into a supply crisis.

4c. The Cape Diversion, Worked

Worked example — What the Red Sea Closure Cost and Earned

Routing an Asia-Europe ship around Africa instead of through Suez adds about 3,500 nautical miles, about eight days each way at 18 knots and 10-14 days at the slower speeds many ships sail. **The direct cost:** for the 24,000-TEU ship of Module 3, about 16 extra days of running costs ($400,000) and about 3,200 extra tonnes of fuel ($2.2 million at $700 a tonne), less about $2 million of Suez tolls saved. That is a net cost well under $1 million a round trip, or under $2 million counting the ship's extra time, and it is not the expensive part. **The capacity:** a loop that needs 12 ships for a weekly service through Suez needs about 14 around the Cape, so the diversions absorbed 5-7% of the world's container capacity, 1.7-2.4 million TEU by Linerlytica's estimate, in a market that had been heading into oversupply. **The rates:** demand did not change, effective supply fell, and the composite index rose from about $1,400 in October 2023 to about $5,900 in July 2024. **Who paid:** for the lines the diversion was a gift, a cut in capacity they could not have agreed among themselves without breaking competition law, imposed by a militia. Shippers paid thousands of dollars more per box on Asia-Europe for much of 2024, tens of billions of dollars in all, plus two more weeks of inventory at sea. **The reversal:** the same arithmetic runs backward as ships return. At the end of August 2026, 280 container ships carrying 4.0 million TEU still used the Cape route, down from 380 carrying 5.5 million earlier in the year, and each one that returns to Suez releases capacity into a market with a record orderbook.

4d. Managing Supply

Carriers manage capacity in four ways: blank sailings cancel scheduled voyages and are the first response to softening rates, while slow steaming cuts speed from 24 to 18 knots, saving about 40% of fuel and absorbing ships.

Lay-up parks ships in fjords and off Malaysia, as with about a tenth of the fleet in 2009, and scrapping, which almost stopped during the boom, resumes in downturns. Since 2023, though, the diversions that geopolitics imposed have absorbed more capacity than any of them. Alliances coordinate blank sailings among their members, the practice regulators watch most closely, and in 2026 the market was managed by disruption: every closure removed capacity and every reopening released it.

4e. The Reckoning the Orderbook Sets Up

Beneath the 2026 rates sits a large surplus of ships on order: the orderbook is about 45% of the fleet, demand grows 2-4% a year, and BIMCO expects ship supply to outgrow demand in 2027 whether Hormuz reopens or not.

The case for a downturn: disruption, through the Cape diversions, the Iran war's surcharges, and congestion, is all that has held rates up. As the Red Sea reopens and the 2026-28 deliveries arrive, rates fall toward break-even, as in 2009 and 2016, and the weaker lines suffer.

The case against: disruption has become chronic rather than episodic, with four routes constrained in one year, so the cycle may not turn on schedule. Ten lines now hold 85% of capacity and cancel sailings with a discipline the industry lacked in 2009 and 2016, an aging fleet is due for scrapping, and carbon rules reward the slow steaming that absorbs ships.

What the evidence says: the booms that ordered heavily in 2007-08 and 2014-15 ended in years of losses, and Asia-Europe rates have fallen for thirteen straight weeks as ships return to Suez, while the still-disrupted transpacific has held.

The course's reading, stated once: the orderbook wins in the end, as it always has, but disruption decides the timing, so rates fall trade by trade as each route reopens rather than all at once.

Module 4 Key Points

Container Rates and the Cycle

• The rate index went from $10,377 in 2021 to $1,919 in February 2026, then more than doubled to $4,639 by July.

• The pandemic showed demand can break the system: goods demand up about 20%, 100 ships off Los Angeles, rates up sevenfold.

• The Cape detour's fuel costs little once Suez tolls are saved; the expensive part is the 5-7% of capacity it absorbs.

• Every return to Suez releases capacity: Asia-Europe rates fell for thirteen straight weeks into October 2026.

• With an orderbook near 45% of the fleet, rates through 2028 turn on whether geopolitics or new ships win.

Module 4 Quiz

Check Your Understanding

1. Where did Drewry's World Container Index stand at its 2021 record, its February 2026 low, and on October 8, 2026?

A) $10,377, $1,919, $4,351
B) $5,900, $1,400, $2,557
C) $8,300, $900, $1,950
D) $20,000, $10,000, $5,000

2. Why did the war's 2026 surge reach carriers' results only gradually?

A) Carriers hedge their fuel a year ahead and booked the gains later.
B) Accounting rules spread freight revenue over the following three years.
C) Spot rates are set by regulators, who approved the rises in stages.
D) Much cargo moves on annual contracts.

3. In the worked example, what was the expensive part of the Cape diversion?

A) The capacity the longer voyages absorbed
B) The extra fuel
C) The crew's wages for sixteen more days at sea
D) Suez tolls charged anyway

4. Why did Asia-Europe rates fall for thirteen straight weeks into October 2026?

A) Europe banned Chinese goods
B) Ships returning to Suez added capacity
C) Fuel prices halved
D) Panama's canal reopened

5. What did the pandemic's jam of 2020-22 show?

A) Supply shocks alone can disrupt shipping.
B) Ports had too much capacity, so ships waited for cargo.
C) A demand surge can break a system with no slack.
D) Rates cannot rise far when carriers compete hard for every box.

Module 5 — Dry Bulk

The Ships That Carry Raw Materials and Food

Recommended Reading / Reference

Reference: The Baltic Exchange's daily indices; Clarksons' dry-bulk intelligence; BIMCO's bulk market reports; company reports for Star Bulk, Golden Ocean, and Pacific Basin

5a. The Ships and the Market

Class	Deadweight (tonnes)	Typical cargo	Routes	Note
Handysize	25,000-40,000	Grain, fertilizer, steel, minor bulks	Regional; small ports	The most versatile; about 4,000 ships
Supramax and Ultramax	50,000-65,000	Grain, coal, bauxite, cement; carry their own cranes	Everywhere, including ports without cranes	The workhorse; about 4,000 ships
Panamax and Kamsarmax	65,000-85,000	Coal, grain	Sized for the old Panama locks; US Gulf to Asia	About 3,000 ships
Capesize	150,000-210,000	Iron ore, coal	Australia and Brazil to China; too big for the old Panama locks	About 2,000 ships; the market's swing class
Valemax and very large ore carriers	325,000-400,000	Iron ore only	Brazil to China, mostly for Vale	About 70 ships on long-term contracts

Clarksons and the Baltic Exchange, approximate.

Bulk carriers move the raw materials of industry and food: iron ore from Australia and Brazil to China, coal from Indonesia and Australia, and grain from the Americas and the Black Sea. It is a market with no schedules, thousands of owners, and prices set voyage by voyage, the least glamorous and most purely economic corner of shipping.

A Capesize is chartered for a single voyage or a few months at a rate that swings with the day's demand. Its owner is likely Greek, Japanese, or Chinese, and its cargo is likely bound for China, which takes over 70% of seaborne iron ore and a large share of seaborne coal.

5b. The Baltic Dry Index

Date	Baltic Dry Index	Capesize earnings ($ a day)	Context
2003	About 2,500	About 30,000	China's boom begins
May 2008	11,793, the record	About 230,000	The commodity supercycle; freight from Brazil to China cost more than the ore
December 2008	663	About 2,000	The crash; ships laid up
February 2016	290, the lowest ever	About 1,500, below running costs	Overcapacity from the boom's orders
October 2021	About 5,650	About 80,000	Post-pandemic congestion and coal demand
2023-25	About 1,400-1,750	About 15,000-22,000	Normal times, with bauxite and diversions adding miles

Date	Baltic Dry Index	Capesize earnings ($ a day)	Context
September 2026	About 3,488, the highest since October 2021	52,315 on September 18	Longer routes, port congestion, and strong ore and coal cargoes
October 9, 2026	3,002	Capesize index 4,638 points	Easing from the September high

The Baltic Exchange; earlier rows approximate.

The Baltic Dry Index, an average of charter rates for Capesize, Panamax, and Supramax ships, is the market's barometer and a famous economic indicator. It soared to 11,793 in May 2008, when a Capesize earned about $230,000 a day and freight from Brazil to China cost more than the iron ore it carried, then collapsed to 663 six months later and to 290 in 2016, when the same ship earned less than it cost to run.

The index tracks China's demand for ore and coal more than anything else, and its swings come from a fixed fleet meeting lumpy demand. A few million tonnes of extra Chinese steel output, or a dam failure in Brazil like Vale's at Brumadinho in 2019, can move it by half. In September 2026 it rose to about 3,488, its highest since October 2021, as longer routes, congestion, and strong cargoes tightened the fleet, and it eased to 3,002 by October 9.

5c. The Flows

Commodity	Seaborne trade (million tonnes a year)	Main exporters	Main importers	2026 note
Iron ore	About 1,600	Australia (about 55%), Brazil (about 23%), South Africa, Canada, and now Guinea	China (about 72%), Japan, South Korea, the EU	Guinea's Simandou mine, shipping since late 2025, aims at 120 million tonnes a year
Coal	About 1,300	Indonesia (about 35%), Australia (about 27%), Russia, the United States, Colombia, South Africa	China, India, Japan, South Korea, Taiwan	Past its peak as China and Europe cut and India grows
Grain and oilseeds	About 550	The United States, Brazil, Argentina, Ukraine, Russia, Canada, Australia	China (soybeans), Egypt, Indonesia, Japan, Mexico, North Africa	War in the Black Sea; China's soybeans shifted to Brazil
Bauxite and alumina	About 200	Guinea (about 70% of seaborne bauxite), Australia	China	The fastest-growing bulk trade
Minor bulks: fertilizer, steel, cement, sugar, scrap, forest products	About 2,000	Various	Various	Gulf fertilizer cut off by the Hormuz closure
All dry bulk	About 5,600			About 45% of seaborne tonnage

Clarksons, UNCTAD, and the national statistics, approximate.

Of the three cargoes that dominate, iron ore runs from Australia's Pilbara and Brazil's Carajás to China's steel mills, the longest-haul, largest-ship trade, on which the Capesize market lives. Its geography is shifting as Guinea's Simandou, the largest new iron-ore project in a generation and Chinese-financed, ramps up from its first cargoes in late 2025.

Coal has passed its peak as China and Europe cut and India grows, and grain is the trade most exposed to war and weather. The Black Sea corridor, the Panama Canal's route from the US Gulf to Asia, and the Mississippi's low water each moved it in the 2020s. Bauxite from Guinea to China is the fastest-growing bulk trade, and the dry-bulk orderbook, at about a tenth of the fleet, is modest, its owners disciplined by the memory of 2016.

Module 5 Key Points

Dry Bulk

• Bulk carriers, from Handysize to the 400,000-tonne Valemax, carry ore, coal, grain, and bauxite on a voyage-by-voyage market.

• China takes about 72% of seaborne iron ore, so the Baltic Dry Index tracks Chinese steel more than anything else.

• The index peaked at 11,793 in 2008, hit 290 in 2016, and rose to about 3,488 in September 2026, a five-year high.

• Guinea's Simandou, shipping since late 2025, is shifting the ore trade's geography toward West Africa.

• Grain is the trade most exposed to war and weather; bauxite from Guinea to China is the fastest growing.

Module 5 Quiz

Check Your Understanding

1. Which country takes about 72% of seaborne iron ore?

A) Germany
B) South Korea
C) India, whose steel output passed China's in 2025 after a decade of mill building
D) China

2. What does the Baltic Dry Index measure, and what moves it most?

A) It tracks Baltic Sea ferry fares, which follow European tourism.
B) It averages bulk charter rates and tracks China's demand for ore and coal.
C) It averages container rates, which follow American consumer spending.
D) It measures tanker rates, which follow oil prices and the oil producers' cartel, so it moves with Brent.

3. What happened to the Baltic Dry Index in 2008?

A) It hit a record 11,793 in May and fell to 663 by December
B) It was suspended
C) It held near 2,500 all year
D) It fell to 290, its lowest ever

4. Where did the Baltic Dry Index stand in September 2026?

A) Near 290
B) Above 11,000, near its 2008 record
C) About 3,488, a five-year high
D) Unchanged from its 2023-25 range

5. Which bulk trade does the module call the fastest growing?

A) Coal to Europe
B) Bauxite from Guinea
C) Grain from the Black Sea
D) Iron ore from Brazil to China

Module 6 — Tankers and Energy Shipping

Crude, Products, and Gas at Sea, and the Closing of Hormuz

Recommended Reading / Reference

Reference: Clarksons' tanker intelligence; the Baltic Exchange's tanker routes, among them TD3C from the Gulf to China; Kpler and Vortexa flow data; Lloyd's List Intelligence's Strait of Hormuz briefs (2026); the EIA on Hormuz and the bypass pipelines; UNCTAD's March 2026 note on the Hormuz crisis

6a. Crude Tankers

Class	Deadweight (tonnes)	Barrels	Routes	Note
Very large crude carrier (VLCC)	300,000-320,000	2 million	The Gulf to China, Japan, South Korea, and India; the US Gulf and Brazil to Asia	About 900 ships; earnings averaged about $723,000 a day on September 18, 2026, against $79,700 a year earlier
Suezmax	150,000-165,000	1 million	West Africa, the Black Sea, and Brazil to Europe and Asia	About 700 ships; fits the Suez Canal laden
Aframax	100,000-120,000	700,000	Regional: the North Sea, the Caribbean, the Mediterranean, Russia's Baltic exports	About 1,000 ships; the shadow fleet's favorite
Panamax and smaller	55,000-80,000	400,000	Short-haul	

Clarksons and the Baltic Exchange; ship counts approximate, and the Aframax count includes the long-range product tankers of the same size.

Tankers carry about 30% of seaborne trade by tonnage: crude oil in VLCCs of two million barrels from the Gulf, West Africa, and the Americas to Asian refineries, and refined products in smaller ships. The market's benchmark is the VLCC rate from the Gulf to China, a route the Baltic Exchange calls TD3C, which in normal years swings between below running costs and about $100,000 a day.

The fleet is old, with the average VLCC over twelve years, and its orderbook was thin until 2024. About a fifth of the world's oil tankers now trade outside the mainstream market in the shadow fleet (Module 7), which has tightened the compliant market, and in 2026 a war did the rest.

6b. The Closing of Hormuz

Exporter	Exports through Hormuz before the war	Bypass	What happened in 2026
Saudi Arabia	Most of about 7 million barrels a day	The East-West pipeline to Yanbu on the Red Sea, 5 million barrels a day, expandable to about 7	Diverted to Yanbu, where loadings surged, though the Houthis declared a blockade of Saudi Arabia in July
United Arab Emirates	About 3 million barrels a day	The Habshan-Fujairah line to the Gulf of Oman, 1.5-1.8 million barrels a day	Fujairah loadings maximized; the rest shut in
Iraq	About 3.5 million barrels a day	The Kirkuk-Ceyhan line to Turkey, 0.5-1 million barrels a day when operating	Mostly shut in; the largest loser

Exporter	Exports through Hormuz before the war	Bypass	What happened in 2026
Kuwait	About 2 million barrels a day	None	Shut in
Qatar (LNG)	About a fifth of the world's LNG	None	Production halted on March 2; no laden LNG tanker crossed between March 1 and April 24; exports stopped again in July; force majeure extended through November
Iran	About 1.5 million barrels a day	The little-used Goreh-Jask line to the Gulf of Oman	Its exports became the war's target, and the United States blockades its ports
Total	About 20 million barrels a day of crude and products, a fifth of world use, and a fifth of the world's LNG	Roughly 7-9 million barrels a day at most	About 4.5 million barrels a day expected to stay shut in as of October (EIA)

EIA; Kpler; Lloyd's List Intelligence; company statements; approximate.

A fifth of the world's oil and LNG passed Hormuz before 2026, which is why the closing that began with the war on February 28 was the tanker market's largest event since the 1980s. Daily transits fell 97% within days, from about 141 ships a day in February to single digits, by UNCTAD's count, and war-risk premiums for a $100 million ship rose from about $250,000 a voyage to as much as $1 million. Saudi Arabia and the United Arab Emirates used their pipelines around the strait, Iraq's northern line carried a fraction of its exports, and Kuwait and Qatar, with no way around, largely stopped.

The war's course set the traffic: a ceasefire on April 8 let some ships out, a memorandum signed in Islamabad on June 17 brought a brief surge of departures, and it collapsed in July, followed by renewed strikes from August 30 to September 3. Since then the strait has been open only to ships Iran authorizes, and an American blockade of Iran's ports has turned back about 130 vessels.

By September transits recovered to at least 477 for the month, the most since the war began, with tankers running a shuttle service for a handful of willing owners. In the first week of October attacks on tankers reached a seven-month high, nine ships were struck between October 1 and 6, and daily crossings swung between 7 and just over 20 commodity ships, against about 125 before the war. Even so, crude crossing the strait ran at about 10 million barrels a day in the week to October 8, and loadings outside it, on the Gulf of Oman and the Red Sea, more than doubled to 6.7 million. That brought the region's crude exports that week back to their pre-war level, by Kpler's count. Brent crude still settled at $104.28 a barrel on October 8.

The closing rewrote the tanker market: VLCC earnings, about $80,000 a day a year earlier, averaged about $723,000 on September 18, and the Gulf-to-China route briefly paid over $1.2 million a day, because fewer ships would go and the voyages that replaced Gulf oil were longer. Five-year-old VLCCs rose about 19% in value between July and September, and the owners of compliant tankers, many of them Greek, are having an exceptional year. The LNG that could not sail is one reason fertilizer plants in South Asia shut and European gas prices rose.

6c. Product Tankers and Gas Carriers

Product tankers, from Medium Range ships of 50,000 dwt to Long Range ones of 75,000-110,000, carry gasoline, diesel, jet fuel, and naphtha from the refining hubs to consumers. Those hubs include the US Gulf, the Middle East's new refineries, India's Jamnagar, Singapore, and South Korea, and the trade boomed after 2022 as Europe replaced Russian diesel with cargoes from India and the Middle East on longer routes.

LNG carriers, about 800 ships of 125,000-266,000 cubic meters insulated to hold gas at −162°C, are built almost entirely in South Korea and increasingly in China, at about $250 million each. Before the war they carried over 400 million tonnes of LNG a year from Qatar, Australia, and the United States, their charter rates swing with the gas market, and a wave of new ships ordered for Qatar's and America's expansions arrives in 2026-28. Very large gas carriers take propane and butane from the US Gulf and the Middle East to Asian petrochemical plants, and energy shipping's geography has been rewritten twice since 2022, by Russia's turn to Asia and by Hormuz.

Module 6 Key Points

Tankers and Energy Shipping

• Tankers carry about 30% of seaborne tonnage; the VLCC's Gulf-to-China rate is the market's benchmark.

• Hormuz carried a fifth of the world's oil and LNG; the bypass pipelines can carry roughly 7-9 million barrels a day at most.

• After February 28 transits fell 97% within days; in early October attacks hit a seven-month high, with 7 to 20-odd ships crossing daily.

• VLCC earnings averaged about $723,000 a day on September 18, 2026, nine times the level a year earlier.

• Qatar halted LNG output on March 2, shipped again from about May 10, and stopped in July; fertilizer plants as far as Bangladesh shut.

Module 6 Quiz

Check Your Understanding

1. How did the Gulf's exporters respond when Hormuz closed?

A) All rerouted through Suez
B) All switched to rail
C) They exported normally under naval escort through the strait, as in the 1980s Tanker War
D) Those with bypass pipelines used them; the rest largely stopped

2. What is the tanker market's benchmark?

A) The Baltic Dry Index
B) The LNG spot price
C) The VLCC rate from the Gulf to China
D) Brent crude's price

3. Roughly how did VLCC earnings on September 18, 2026 compare with a year earlier?

A) Nine times higher
B) About the same as before
C) Twice as high, on longer routes
D) Half, as Gulf cargoes stopped

4. Why did Qatar's halted LNG matter beyond the gas market?

A) It mattered only for Japan's power plants.
B) It lowered fertilizer prices by freeing up gas.
C) It cut European electricity demand by a fifth.
D) Its missing gas helped shut fertilizer plants in South Asia, which run on it.

5. Why did product tankers boom after 2022?

A) European refineries closed for good
B) Longer diesel routes to Europe
C) Demand for jet fuel collapsed worldwide
D) EU price controls on tanker freight rates

Module 7 — The Shadow Fleet and Sanctions at Sea

The Parallel Fleet Outside the Rules, and Whether to Stop It

Recommended Reading / Reference

Reference: The Kyiv School of Economics' monthly shadow-fleet tracker; S&P Global's shadow-fleet factbox (September 2025); the Council of the EU's sanctions packages (2024-26); Lloyd's List Intelligence and Windward tracking; the Helsinki courts' rulings in the *Eagle S* case

7a. What It Is

Feature	The shadow fleet	Note
Size	About 980 tankers, about 18.5% of the world's oil tankers and about 127 million dwt (September 2025)	A few hundred ships in 2021
Russia's share	176 shadow tankers carried Russian oil in June 2026, 54% of the tankers used, moving about 3.2 of Russia's 6.0 million barrels a day of seaborne oil	Russia's seaborne exports rose 8.7% in a year
Age	94% of the shadow tankers carrying Russian oil were over 15 years old (June 2026)	Bought second-hand at premiums by obscure owners
Flags	Gabon, Cameroon, the Comoros, the Cook Islands, Sierra Leone, and false or fraudulent registries	Flag-hopping after each sanction
Owners	Single-ship shell companies in the United Arab Emirates, Hong Kong, India, Turkey, and the Marshall Islands	Ownership changes after each listing
Insurance	Russian insurers, unknown insurers, or none, outside the P&I clubs	The pollution and rescue risk
Cargo	Most of Russia's seaborne crude and nearly all of Iran's	Plus sanctioned oil products
Methods	Transponders switched off, spoofed positions, ship-to-ship transfers off Malaysia, Greece, and Oman, forged documents	Satellite tracking follows them regardless
Listed by name	Over 670 vessels by the EU (July 2026), with hundreds more by Britain and the United States	73% of the shadow tankers carrying Russian oil in June 2026 were under EU sanctions

S&P Global (September 3, 2025); Kyiv School of Economics, shadow-fleet tracker (June 2026 data); Council of the EU (July 23, 2026).

Sanctions on Russian and Iranian oil created a parallel tanker fleet outside the rules. The 'shadow' or 'dark' fleet, about a thousand tankers, is made of aging ships bought by obscure owners, registered under flags of convenience or false flags, insured by unknown underwriters or none, and often sailing with their transponders off.

It carries most of Russia's seaborne crude and nearly all of Iran's, passes the Baltic and Danish straits daily, and transfers cargo from ship to ship off Malaysia and Greece. It grew from a few hundred ships in 2021 to about a thousand after the Group of Seven's price cap of December 2022, which let Western tankers and insurers carry Russian crude only below a set price and pushed Russia to build a fleet that needed neither. The EU lowered its cap to $44.10 a barrel and in July 2026 froze it there until July 2027, so that the Hormuz price spike would not lift it.

7b. The Incidents

Uninsured, poorly maintained ships with exhausted crews produce accidents, and on December 25, 2024 the *Eagle S*, a Cook Islands-flagged tanker carrying Russian oil, dragged its anchor for hours across the Estlink 2 power cable and several data cables between Finland and Estonia, and Finland seized it.

A Helsinki court dismissed the case against its three senior officers in October 2025 for want of jurisdiction, but the Court of Appeal ruled in August 2026 that Finland does have jurisdiction and sent the case back for trial. On December 31, 2025 another ship, the *Fitburg*, sailing from Russia, cut two more cables between the two countries, and its captain and a senior crew member were charged in June 2026.

Shadow tankers have run aground off Denmark and in the Turkish Straits, spilled oil off Malaysia, and collided off Singapore, and a laden tanker losing power in the Danish straits is the scenario Nordic authorities plan for. The fleet has also become a military matter, since Russia sends warships to escort some of the tankers through the Baltic, and Ukraine's sea drones have struck Russia-linked tankers in the Black Sea.

7c. The Response and the Legal Gap

The EU had listed over 670 vessels by July 2026, barring them from its ports and from European insurance and services, and its July package let member states confiscate and sell the cargo of shadow ships they detain. Britain and the United States have listed hundreds more, and the United States has sanctioned Chinese refineries and terminals that buy Iranian crude. The Baltic and Nordic states check the insurance of tankers in their waters, and Estonia, Finland, France, and Germany have boarded or detained ships.

The law of the sea limits how far this can go, since the 1982 UN Convention on the Law of the Sea (UNCLOS) guarantees innocent passage through territorial seas and transit through straits, and Denmark's straits are open by the treaty of 1857. A coastal state may act against a ship that pollutes its waters, and the Baltic states assert a right to check tankers' insurance, which Russia disputes. A ship with no genuine flag is stateless and may be boarded on the high seas, but a ship flying a real flag cannot be stopped there for carrying sanctioned cargo.

The result is a fleet slowed by listings, inspections, and the occasional seizure but not stopped, because the oil pays. Russia's seaborne oil exports were 6.0 million barrels a day in June 2026, 8.7% higher than a year earlier.

7d. Should States Stop the Ships at Sea? The Cases as Their Advocates Make Them

The case for boarding: the shadow fleet is an uninsured environmental hazard sailing through narrow, crowded waters, and it pays for a war. Many of its ships fly false flags, which makes them stateless and lawfully boardable, and some have cut the cables Europe's power and data run on. Sanctions without enforcement teach owners that a listing costs a few weeks, while detaining ships and confiscating cargo, as the EU now allows, changes the arithmetic, and deterrence requires that some tankers be stopped.

The case for restraint: freedom of navigation is the West's own interest, since the same rules protect its ships in the South China Sea, the Red Sea, and Hormuz. Stopping ships with genuine flags for their cargo would hand Russia, China, and Iran a precedent for doing the same. Boardings invite escalation, as when a

Russian fighter entered Estonian airspace after Estonia tried to stop a tanker in May 2025, and Russia now escorts some ships with warships. The oil finds other routes and buyers anyway, so the risk buys little.

What the evidence says: listings and boardings have not cut Russia's volumes, which rose in 2026, but they have pushed most of the trade onto older, sanctioned, Russian-insured ships at higher cost and risk. The *Eagle S* appeal ruling, if it stands, shows that coastal states can prosecute damage done in their economic zones, and stateless ships can be boarded under the law as written. Ships with valid flags on the high seas cannot, without a new legal basis.

The course's reading, stated once: enforce hard where the law is clear, against stateless ships and anyone who cuts a cable, press the insurance checks the Baltic states assert, and keep pressure on the buyers, refiners, and service providers who make the trade pay. Stopping validly flagged ships on the high seas for their cargo would trade a lasting principle for a marginal gain.

Module 7 Key Points

The Shadow Fleet and Sanctions at Sea

• About 980 tankers, nearly a fifth of the world's, form the shadow fleet; those carrying Russian oil are nearly all over 15 years old.

• In June 2026 shadow tankers moved about 3.2 of Russia's 6.0 million barrels a day of seaborne oil.

• The EU has listed over 670 ships and froze its price cap at $44.10 a barrel until July 2027.

• Finland's appeals court ruled in August 2026 that it can try the officers of the Eagle S, which cut the Estlink 2 cable.

• The law allows boarding stateless ships but not stopping flagged ones on the high seas for their cargo.

Module 7 Quiz

Check Your Understanding

1. What created the shadow fleet?

A) Piracy off Somalia
B) A Chinese shipbuilding boom
C) Sanctions and the price cap on Russian oil
D) A tanker shortage after the pandemic in Asia and Africa

2. What did Finland's Court of Appeal rule in the Eagle S case in August 2026?

A) That Finland can try the officers
B) That the officers were acquitted
C) That only the Cook Islands, as the flag state, could try the officers, so the case was closed for good
D) That the damage was an accident caused by a storm

3. Which ships may a state lawfully board on the high seas under the Law of the Sea?

A) Stateless ships with no genuine flag
B) Any ship over 15 years old
C) Any tanker carrying Russian oil, once the EU has listed it by name in a sanctions package
D) Any ship whose transponder is switched off

4. In June 2026, how much of Russia's seaborne oil did shadow tankers carry?

A) About 1 million barrels a day, a sixth
B) Nearly all 6.0 million barrels a day
C) About 0.6 million barrels a day
D) About 3.2 of 6.0 million barrels a day, over half

5. What is the course's reading on stopping shadow tankers at sea?

A) Board every listed tanker on the high seas
B) Leave enforcement entirely to the flag states
C) Enforce where the law is clear
D) Close the Danish straits to Russian ships

Module 8 — Ports and Terminals

The Nodes, Who Runs Them, and Whether to Automate Them

Recommended Reading / Reference

Reference: Lloyd's List's Top 100 Ports; the World Bank and S&P Global's Container Port Performance Index; company reports for PSA, DP World, APM Terminals, and COSCO Shipping Ports; the US National Transportation Safety Board on the *Dali*; reporting on the Panama ports ruling (2026)

8a. The Largest Ports

Port	Country	Throughput (million TEU)	Operator	Note
Shanghai	China	55.1 (2025)	Shanghai International Port Group, state-owned	Nearly three times Los Angeles and Long Beach combined; the automated Yangshan terminals
Singapore	Singapore	44.7 (2025)	PSA, state-owned	The largest transshipment hub; the Tuas mega-port building to 65 million TEU
Ningbo-Zhoushan	China	43.9 (2025)	State-owned	The largest by total tonnage, with ore and oil
Shenzhen	China	35.4 (2025)	Yantian (Hutchison) and Shekou (China Merchants)	The Pearl River Delta's gateway
Qingdao	China	32.9 (2025)	State-owned	Among the most efficient large ports
Guangzhou, Busan, Tianjin	China, South Korea, China	About 23-26 each (2024)	Mostly state-owned	Busan is Northeast Asia's transshipment hub
Jebel Ali (Dubai), Port Klang, Rotterdam	United Arab Emirates, Malaysia, Netherlands	About 14-15.5 each (2024)	DP World; Westports and Northport; Rotterdam's Port Authority, with terminals run by APM, Hutchison's Europe Container Terminals, and others	Rotterdam is Europe's largest; Jebel Ali the Gulf's hub, disrupted by the Iran war
Hong Kong, Antwerp-Bruges	China, Belgium	About 13.5-14 each (2024)	Hutchison and others; the Port Authority	Hong Kong losing share to Shenzhen
Los Angeles and Long Beach	United States	About 10 each (2024)	City-owned, with terminals leased to lines	America's largest gateway; the 2021 queue

DynaLiners (August 2026) for 2025; Lloyd's List and port authorities for 2024; rounded.

The world's largest ports are Chinese: Shanghai handled 55.1 million TEU in 2025, nearly three times Los Angeles and Long Beach combined, and Chinese ports fill six of the top ten. Container ports worldwide handled about 1.01 billion TEU in 2025, up 8%, a count that includes each transshipment move.

A modern container terminal is a machine of automated cranes, driverless carriers, and software that can turn a 24,000-TEU ship in two days. Chinese and Gulf ports lead the World Bank's efficiency rankings, while American ports, with older equipment and labor contracts that limit automation, rank low.

8b. The Operators

Operator	Owner	Footprint	Note
PSA International	Singapore's state fund Temasek	Terminals in over 40 countries	The largest by throughput: Singapore, Antwerp, Mumbai
COSCO Shipping Ports and China Merchants Port	The Chinese state	Stakes in over 90 ports abroad	Piraeus (67%), Hambantota on a 99-year lease, Chancay in Peru (opened 2024), Abu Dhabi, Rotterdam
APM Terminals	Maersk	About 60 terminals	Rotterdam, Tangier, and, since February 2026, Panama's Balboa as interim operator
DP World	The Dubai government	Over 80 terminals	Jebel Ali, London Gateway, Africa, India
Hutchison Ports	CK Hutchison of Hong Kong	Ports in over 20 countries	Felixstowe, Rotterdam; lost its Panama terminals in 2026
Terminal Investment Limited (TiL)	MSC	Over 70 terminals	Panama's Cristóbal as interim operator; partner in the bid for Hutchison's ports
Adani Ports	India's Adani Group	Mundra and over a dozen Indian ports; Haifa; Colombo	India's gateway
Eurogate, HHLA, Yilport, ICTSI, SSA Marine	German, Turkish, Philippine, American	Regional	ICTSI in emerging markets; SSA on the US West Coast

Company reports, approximate.

Ports are owned by states and cities and increasingly operated by a handful of global companies. The operators decide which lines get berths and which ports get investment, and their ownership has become a security question.

China's state operators hold stakes in over 90 ports abroad, including Piraeus, Greece's largest, Hambantota in Sri Lanka, leased for 99 years in 2017 by a government struggling with its debts, and Chancay in Peru, opened in 2024 as a Pacific gateway for South American exports to China. Chinese firms, above all ZPMC, also make about 70% of the world's port cranes, which the United States has tariffed and legislated against.

8c. The Panama Fight

The 2025 dispute over the Panama Canal turned on ports, since CK Hutchison of Hong Kong ran the terminals at both ends of the canal, Balboa and Cristóbal, through its subsidiary Panama Ports Company, and the Trump administration cited its presence as Chinese control of the waterway. In March 2025 CK Hutchison agreed to sell most of its ports outside China, 80% of 43 ports in 23 countries plus 90% of the Panama terminals, to a group led by BlackRock and MSC's terminal arm for about $22.8 billion, and Beijing answered with an antitrust review and a demand that COSCO join the buyers.

Panama settled its own part when, on January 29, 2026, its Supreme Court ruled the Panama Ports concession unconstitutional, and on February 23 the government took over both terminals, installing Maersk's APM Terminals at Balboa and MSC's TiL at Cristóbal as interim operators for 18 months, before a tender for two separate long-term concessions.

COSCO suspended its operations at Balboa in March, and CK Hutchison's side has filed arbitration claims against Panama: over $2 billion in March and over $1.5 billion under an investment treaty in August 2026.

The wider sale had not closed by August 2026, which shows that port ownership is now contested at the level of great-power politics.

8d. Congestion, Accidents, and Labor

Ports are where the system's disruptions become visible: the 2021 queue of about 100 ships off Los Angeles, and in 2026 the congestion at Asian ports and at European hubs as ships returning through Suez arrived together.

The Baltimore bridge: on March 26, 2024 the container ship *Dali* lost power leaving Baltimore and struck the Francis Scott Key Bridge, which collapsed, killing six road workers and closing the port's main channel for about eleven weeks. The insured losses run to billions of dollars, among the largest marine claims on record. The lesson is that ships have outgrown the ports and bridges built for smaller ones.

The port strike: from October 1 to 3, 2024 the International Longshoremen's Association shut every port on the US East and Gulf Coasts over wages and automation. A tentative deal ended it on October 3, and the six-year contract ratified in February 2025 raised wages 62% over its term and bars fully automated terminals until 2030. Labor holds a chokepoint too, and ports are also where tariffs and fees are collected.

8e. Should Ports Automate? The Cases as Their Advocates Make Them

The case for automation: automated terminals at Rotterdam, Qingdao, Shanghai's Yangshan, and Long Beach run around the clock, keep people away from heavy machinery, and cut emissions and running costs. The ports that lead the efficiency rankings are automated, while America's slow ports raise every importer's costs. Their competitors in China and the Gulf are automating fast, and ports that refuse will lose cargo and investment.

The case against: automation costs billions up front, and its productivity gains are often smaller than promised. A 2018 McKinsey survey found that automated terminals cut operating costs but were frequently less productive than conventional ones. Software can stop a whole terminal, as a ransomware attack stopped Nagoya's container terminals for about two days in July 2023. The jobs lost are skilled, well-paid, and concentrated in port towns, and a contract freely bargained has settled the question until 2030.

What the evidence says: automation reliably lowers operating cost and improves safety, while gains in ship turnaround depend on how well the terminal's whole system is run. Some conventional ports remain among the world's most productive, and the most productive automated ones are new terminals designed for it from the start. Cyber risk rises with automation, and the American ports' low rankings owe as much to old layouts, short operating hours, and land constraints as to cranes.

The course's reading, stated once: automation lowers costs and improves safety, while its productivity gains depend on design, and in American ports it will be negotiated rather than imposed. The near-term gains lie in semi-automated yards, longer operating hours, and shared data on arrivals, which the 2025 contract allows, with cyber resilience as a condition of any driverless terminal.

Module 8 Key Points

Ports and Terminals

• Shanghai handled 55.1 million TEU in 2025, nearly three times Los Angeles and Long Beach; China holds six of the top ten.

• China's state operators hold stakes in over 90 ports abroad, and Chinese firms make about 70% of port cranes.

• Panama's Supreme Court voided Hutchison's concession in January 2026, and Maersk and MSC now run the canal ports.

• The Dali's strike on Baltimore's bridge in 2024 killed six and showed that ships have outgrown older infrastructure.

• The 2025 dockworkers' contract bars full automation until 2030; the gains will come from yards and data first.

Module 8 Quiz

Check Your Understanding

1. How did Shanghai's container throughput in 2025 compare with America's largest gateway, Los Angeles and Long Beach?

A) About half
B) At 55.1 million TEU, nearly three times their total
C) About equal, at 20 million TEU each
D) Far smaller, because the two ports together handle over 60 million TEU a year

2. Why has port ownership become a security question?

A) Chinese state firms hold stakes in over 90 ports abroad.
B) Most ports lose money and must be rescued by the governments that own them.
C) The operators have begun refusing ships from countries under sanctions.
D) Navies are now required to own a share of every container terminal they use.

3. Who has run Panama's canal ports since February 2026?

A) COSCO
B) Maersk's and MSC's terminal arms
C) CK Hutchison, as before the ruling
D) BlackRock, after the sale closed in April

4. What does the 2025 contract for East and Gulf Coast dockworkers say about automation?

A) It requires full automation by 2027
B) It is silent on it
C) It bars fully automated terminals until 2030
D) It bans all new cranes and requires the ports to keep manual lashing until 2040

5. What did the Dali's collision with Baltimore's Key Bridge in 2024 expose?

A) Poor bridge design alone
B) Weather risk
C) A crew strike at the port
D) That ships have outgrown infrastructure built for smaller ones

Module 9 — Shipbuilding

Who Builds the Ships, Why It Became Strategic, and the Argument Over America's Yards

Recommended Reading / Reference

Reference: Clarksons Research's newbuilding data; BIMCO's shipbuilding analysis; the Office of the US Trade Representative's (USTR) Section 301 determination on Chinese shipbuilding (2025) and its notices; the White House's *America's Maritime Action Plan* (February 2026); the Center for Strategic and International Studies, *Ship Wars* (2025)

9a. The Shift East

Era	Leader	Share of world output	Why it led	Why it lost the lead
1850-1955	Britain	About 60-80% around 1900	The industrial revolution, steel, empire, the yards of the Clyde and the Tyne	Labor costs, underinvestment, and subsidized rivals
1956-1999	Japan	About half in the 1970s and 1980s	Block construction, quality, state coordination, a captive fleet	A stronger yen, Korean costs, an aging workforce
2000-2010	South Korea	About 40%	Hyundai, Samsung, Daewoo; LNG carriers and the largest container ships	Chinese scale and state finance
2010-	China	76% of new orders in January-September 2026; 68% of the orderbook	State finance, scale, an integrated chain from steel to ship, and domestic naval and merchant demand	—
2026 shares	China 68%, South Korea 17% of the orderbook; Japan, Europe, the United States, and the rest the remainder		Korea leads in LNG carriers, with about two-thirds of their orderbook; Europe in cruise ships and warships	The United States builds under 1% of the world's commercial tonnage

Clarksons Research (October 2026); Wood Mackenzie on LNG carriers; historical shares approximate. Shares measured in compensated gross tonnage.

Shipbuilding has moved east three times since the 1950s: Britain led until the mid-1950s, Japan until the 1990s, South Korea overtook Japan around 2000, and China overtook Korea in 2010.

China's lead is widening: in the first nine months of 2026 its yards won 76% of new orders measured in compensated gross tonnage, against South Korea's 15%, and they hold 68% of the world's orderbook, by Clarksons' count. China's advantages are state finance, sheer scale, a supply chain that runs from its own steel to the finished ship, and a navy and merchant fleet that anchor demand. Korea's are technology, above all in LNG carriers, where it still holds about two-thirds of the orderbook, while both Korea and Japan face shortages of workers as their populations age.

9b. The Port-Fee Fight

Date	Measure	Effect
April 2024	USTR opens an investigation into Chinese shipbuilding under Section 301 of the Trade Act, on a petition by five American unions	Signals intent
January 2025	USTR finds China's practices 'unreasonable': subsidies, state finance, and market share	Sets up remedies
February-April 2025	Proposed fees of up to $1.5 million a port call for Chinese-built or -operated ships; final rules on April 17	Owners hedge: Korean yards win most orders in March 2025
October 14, 2025	Fees take effect: $50 a net ton for Chinese operators and owners, and the higher of $18 a net ton or $120 a container for Chinese-built ships, both scheduled to rise; China imposes mirror fees on American-linked ships the same day	Exemptions for smaller ships, short voyages, and others send orders back to China
November 10, 2025	Both sides suspend their fees for a year under the trade truce agreed in Busan on October 30	The suspension ends at 11:59 pm on November 9, 2026
September 24, 2026	The truce is extended to January 10, 2027, but the extension does not cover the ship fees, a separate USTR action	Unless USTR acts, the fees return on November 10, 2026

USTR notices; Federal Register; FreightWaves (September 28, 2026).

The United States, which builds under 1% of the world's commercial ships and whose navy depends on a withered shipbuilding base, decided in 2025 to fight. The threat alone reshaped ordering for a season, as owners hedged by ordering in Korea, before the final rules' exemptions sent them back to China.

Both countries' fees were suspended for a year under the October 2025 truce, the same deal that paused China's export controls on battery materials. The suspension runs out on November 9, 2026, and the September extension of the wider truce did not mention it, so the fees resume on November 10 unless the Trade Representative extends the pause. The episode showed that shipbuilding is now industrial policy on the level of chips.

9c. The Naval Shadow and the American Response

The strategic concern is the yards more than the merchant ships, since China's shipbuilding capacity is estimated at over 200 times America's, and the same yards that launch container ships launch destroyers. China's navy has passed America's in number of ships, at over 370 against 295 at the end of 2024, and the US Navy's plan to reach 381 ships by 2054 would require about a dozen new ships a year, which its yards are not delivering.

America's response has three strands, and the first is *America's Maritime Action Plan*, released in February 2026, which proposes a fee on every foreign-built ship entering American ports to fund a Maritime Security Trust Fund, a strategic commercial fleet, and tax breaks for shipyards. It counts 66 American shipyards, only eight of them actively building ships. The second is the Shipbuilding and Harbor Infrastructure for Prosperity and Security (SHIPS) for America Act, reintroduced in Congress in 2025, which has not passed.

The third is allied capital: South Korea's pledge of $150 billion for American shipbuilding, the centerpiece of its 2025 trade deal, has Hanwha planning $5 billion to raise its Philadelphia yard, bought in 2024, from about 1.5 ships a year to 20. HD Hyundai and Samsung Heavy have teamed with American naval builders, and the Navy sent the Korean yards requests for information on building destroyers in 2026, although a 1960s law, the Byrnes-Tollefson Amendment, bars building American warships abroad.

9d. The Jones Act and America's Yards: The Cases as Their Advocates Make Them

The Jones Act of 1920 requires ships carrying cargo between American ports to be American-built, -owned, and -crewed. It has preserved a small, expensive fleet of about 90 large ships, and it sits at the center of the argument over how to rebuild.

The case for the Jones Act and protection: a country that cannot build or crew ships cannot sustain a war at sea, and a rival with 200 times the capacity will not sell it ships in a crisis. The Act guarantees demand for American yards and mariners, its defenders credit it with hundreds of thousands of jobs, and repeal would hand the coastal trade to foreign-built ships while the last commercial yards close. Port fees, a strategic fleet, and allied investment build on that base rather than replacing it.

The case for reform: a century of protection has not produced a competitive industry; it has produced ships that cost several times the world price and a domestic fleet that shrank anyway. The Act raises the cost of moving fuel, food, and goods to Puerto Rico, Hawaii, and Alaska, and it can make it cheaper for New England to import fuel from abroad than to ship it from the Gulf Coast. Port fees tax American exporters and consumers, and the money would do more as direct support for yards and workers, with foreign-built ships allowed in domestic trade.

What the evidence says: after a century of the Act, the United States builds under 1% of commercial tonnage, and Philadelphia's commercial yard was delivering about one and a half ships a year before Hanwha's plan. On the defenders' side, the Maritime Administration has estimated that the country lacks about 1,800 of the mariners a sustained sealift would need, a gap defenders say the protected fleet keeps from widening, and in 2013 the Government Accountability Office could not measure the Act's effect on prices in Puerto Rico. The threat of port fees moved orders for a season, but China's share of new orders rose to 76% in 2026 with the fees suspended. The most concrete gains so far came from allied capital: Korean investment, technology, and managers.

The course's reading, stated once: the security case for shipyards is real, but the Jones Act's century shows that protection without competition preserved a costly fleet rather than a strong industry. The path with the best evidence behind it is allied yards and capital building in America, direct support for naval and commercial shipbuilding, and loosening the build requirement where it only raises domestic freight costs.

Module 9 Key Points

Shipbuilding

• Shipbuilding moved from Britain to Japan to Korea to China, which won 76% of new orders in January-September 2026.

• The United States builds under 1% of commercial ships; China's capacity is estimated at over 200 times America's.

• Port fees on Chinese ships, suspended since November 2025, resume on November 10, 2026 unless USTR extends the pause.

• Korea's $150 billion pledge and Hanwha's Philadelphia yard are the most concrete parts of America's response.

• The Jones Act kept about 90 costly ships, not a strong industry; allied yards and direct support are the better bet.

Module 9 Quiz

Check Your Understanding

1. What share of new ship orders did Chinese yards win in January-September 2026?

A) About 76%, measured in compensated gross tonnage
B) About 15%
C) About a third
D) About half

2. What happens to the American port fees on Chinese ships on November 10, 2026?

A) They double automatically
B) They resume unless USTR extends the pause
C) They are abolished by the September extension of the trade truce, which covers all the fees on both sides
D) They are replaced by a tariff on Chinese steel

3. Why is shipbuilding a naval concern?

A) Shipyards are owned by the navies that use them
B) The IMO sets naval building quotas each year
C) Warships need merchant crews under the Jones Act
D) The same yards build warships

4. What does the Jones Act require?

A) American crews on all imports
B) That all imports arrive on American-flagged ships, with half the crew drawn from the US Navy reserve
C) American-built, -owned, and -crewed ships between US ports
D) That foreign yards build half of America's warships

5. What is the course's reading on rebuilding American shipbuilding?

A) Back allied yards and direct support, and loosen the build rule.
B) Repeal every protection at once and buy all ships abroad, as most allies do.
C) Keep the Jones Act unchanged and raise the port fees until China's share falls.
D) Leave shipbuilding to China and spend the savings on buying foreign warships.

Module 10 — Flags, Crews, Insurance, and Law

The Rules the System Runs On

Recommended Reading / Reference

Reference: The IMO's conventions on safety at sea (SOLAS), pollution from ships (MARPOL), and seafarers' training (STCW); the International Labour Organization's Maritime Labour Convention (MLC); the International Chamber of Shipping (ICS) and BIMCO's *Seafarer Workforce Report*; the International Transport Workers' Federation (ITF) on abandonment; the International Group of P&I Clubs; the Lloyd's Joint War Committee's listed areas; the UN Convention on the Law of the Sea (1982)

10a. Flags and Owners

Flag state	Share of world tonnage	Registry run by	Why owners choose it
Liberia	About 16-17%	A private company in Virginia	A reputation for quality among open registries
Panama	About 16%	The government, with private agents	Low tax and easy registration; it struck over a hundred sanctioned ships from its register in 2024-25
Marshall Islands	About 13%	A private company in Virginia	Popular with Greek owners; fast-growing
Hong Kong, Singapore, Malta, China	About 5-7% each	Governments	Asian owners; an EU flag of convenience (Malta); domestic trade (China)
Bahamas, Greece, Japan, Cyprus, Norway, Denmark	About 2-4% each	Mixed	National and second registries
Gabon, Cameroon, the Comoros, the Cook Islands, Sierra Leone	Under 1% each, but rising	Private agents	The shadow fleet's flags (Module 7)

UNCTAD and Clarksons, approximate shares of deadweight tonnage.

A ship's flag decides whose law it sails under, and most of the world's fleet flies the flag of a country its owner has never visited. Liberia, Panama, and the Marshall Islands, three small states whose registries are run partly or wholly by private companies, Liberia's and the Marshalls' from Virginia, register about 45% of world tonnage. Owners choose them for low taxes, light regulation, flexible crewing rules, and anonymity.

The real ownership is different: Greek owners hold the largest share, about a sixth to a fifth of the fleet's deadweight, followed by Chinese and Japanese owners, then Singapore, Hong Kong, South Korea, Germany, and Norway. The gap between flag and owner makes the shadow fleet possible, complicates sanctions, and leaves crews with no one to turn to when a ship is abandoned. In 2025 a record 6,223 seafarers were abandoned on 410 ships, 32% more ships than in 2024, and 82% of the cases were on flags of convenience, by the ITF's count.

10b. The IMO and the Crews

The IMO, a UN agency in London whose climate rules are the subject of Module 16, writes the conventions on safety, pollution, and crew training, while the International Labour Organization's Maritime Labour Convention (MLC) of 2006 sets working conditions. Flag states enforce them with varying zeal, and port

states inspect ships under regional agreements, the Paris and Tokyo memoranda, that detain substandard ones.

About 1.9 million seafarers crew the fleet, drawn above all from the Philippines, the largest source of ratings, and from China, India, Indonesia, Russia, and Ukraine. They serve contracts of six to nine months, for wages that make the profession attractive in poor countries and hard to fill in rich ones. ICS and BIMCO projected a shortfall of about 90,000 officers by 2026, and the pandemic's crew-change crisis, which left about 400,000 seafarers stuck at sea past their contracts, showed how invisible they are.

10c. Insurance and War Risk

Ships are insured in two layers: hull and machinery cover comes from commercial underwriters at Lloyd's and elsewhere, while liability for pollution, cargo, crew, and collision comes from the twelve mutual P&I clubs of the International Group, which cover about 90% of ocean-going tonnage and pool their largest claims.

War risk is a separate policy, priced per voyage for the high-risk areas the Lloyd's Joint War Committee lists, and its premium is the fastest-moving price in shipping. Red Sea premiums rose from about 0.05% of a ship's value to around 1% after the Houthi attacks began, about $2 million for one transit of a $200 million ship. In Hormuz in March 2026 they rose from about $250,000 to as much as $1 million a voyage for a $100 million ship.

When insuring a passage costs more than avoiding it, ships go around: war cover for two Red Sea transits of a large container ship cost $4-5 million, against a net cost of well under $1 million for the detour around Africa once the Suez tolls saved are counted (Module 4). Insurance and the risk to crews, more than law or navies, are what closed the Red Sea to Western lines. Sanctioned tankers, which cannot buy Western cover, sail with Russian insurance or none, and the clubs' sanctions clauses are how the price cap on Russian oil is enforced.

10d. Attacks at Sea and the Law of the Sea

UNCLOS sets the rules: a territorial sea of 12 nautical miles, an exclusive economic zone of 200, freedom of navigation beyond, and transit passage through straits. The United States enforces the framework with warships despite never ratifying the treaty, and China, a party to it, rejects the 2016 arbitration ruling it lost to the Philippines over the South China Sea.

Piracy peaked off Somalia in 2011, with over 200 attacks, and was suppressed by naval patrols and armed guards. It persists in the Gulf of Guinea and returned off Somalia in 2023-25. The larger threat is attack by states and militias: the Houthis have sunk ships and killed seafarers since 2023, Iran has seized and struck ships throughout 2026, and the Maltese-flagged container ship *Safeen Prestige* was hit near Hormuz in early March 2026, its crew abandoning ship. The law of the sea assumed that states would not fire on merchant ships, an assumption the Tanker War of the 1980s broke and the 2020s have broken again.

Module 10 Key Points

Flags, Crews, Insurance, and Law

• Liberia, Panama, and the Marshall Islands register about 45% of world tonnage; Greek owners hold the largest share.

• A record 6,223 seafarers were abandoned on 410 ships in 2025, most of them on flags of convenience.

• About 1.9 million seafarers crew the fleet, led by the Philippines; the pandemic stranded 400,000 at sea.

• War-risk premiums, not navies, decide whether ships sail: Hormuz cover rose to about 1% of a ship's value a voyage in 2026.

• The 1980s Tanker War and the 2020s showed that states and militias will fire on merchant ships despite the law of the sea.

Module 10 Quiz

Check Your Understanding

1. Which three flags register about 45% of world tonnage?

A) Greece, Japan, and China.
B) Singapore, Malta, and Cyprus, all members of the IMO's council.
C) Liberia, Panama, and the Marshall Islands.
D) The United States, Britain, and Norway, the old maritime powers.

2. How many seafarers were abandoned in 2025, by the ITF's count?

A) About 600
B) A record 6,223, on 410 ships
C) About 60,000
D) Fewer than 100

3. What actually closed the Red Sea to Western container lines?

A) A UN Security Council resolution
B) Egypt's rules on the canal
C) An order from the IMO, which closed the strait to all ships after the first Houthi attacks in 2023
D) Insurance that cost more than the detour

4. How is the price cap on Russian oil enforced at sea?

A) By IMO inspectors
B) Through the insurers' sanctions clauses
C) By a naval blockade
D) By the flag states

5. What assumption of the law of the sea have the 2020s challenged?

A) That ships need flags
B) That straits stay open in peacetime under the 1982 convention, even to warships
C) That piracy ended in 2011
D) That states would not fire on merchant ships

Module 11 — Air Cargo

The Mode That Carries a Third of Trade's Value

Recommended Reading / Reference

Reference: IATA's monthly air cargo market analyses (2025-26); Airports Council International's cargo rankings; Boeing's *World Air Cargo Forecast*; company reports for FedEx, UPS, DHL, Cathay, and Qatar Airways Cargo; US Customs and Border Protection and the European Commission on low-value parcels

11a. The Numbers

Measure	Air cargo	Note
Volume	About 70 million tonnes a year	Under 1% of world trade by weight
Value	About a third of world trade by value	Electronics, medicines, perishables, fashion, spare parts
Revenue	About $145-150 billion a year	A larger share of airline revenue in the pandemic, when passenger flights stopped
Cost	About $2-6 a kilogram on long-haul routes, many times sea freight	Reserved for what is worth it
Belly and freighter	About half in the holds of passenger jets, half in about 2,000 dedicated freighters	The pandemic grounded the bellies and halved capacity
Fuel	30-40% of costs in normal years; jet fuel reached $157 a barrel in August 2026, up 79% in a year	The most fuel-exposed mode
Growth	Up 11% in 2024 on e-commerce, 3.4% in 2025, a record volume, and 4.6% in January-August 2026	Middle Eastern carriers' cargo down 6.5% in 2026 as the war disrupted the Gulf

IATA (January and October 2026); Boeing; approximate.

Air freight carries under 1% of world trade by weight and about a third by value: the electronics, medicines, perishables, fashion, spare parts, and documents for which speed is worth many times the cost of sea freight. About half flies in the holds of passenger aircraft and half in dedicated freighters.

The 2020s reshaped it twice: the pandemic grounded passenger flights, removed half the capacity overnight, and sent rates to records and freighter conversions to a boom. Then Chinese e-commerce, with Shein and Temu shipping individual parcels to Western consumers, became the largest driver of transpacific air cargo.

The parcels' advantage was 'de minimis', the duty-free treatment of low-value shipments. The United States ended it for Chinese parcels in May 2025 and for all countries in August 2025, and the EU replaced its €150 (about $170) exemption with a €3 (about $3.45) duty per item on July 1, 2026. Volumes shifted toward Europe-Asia and intra-Asian routes in 2025, which grew about 10%, while Asia-North America fell slightly. In 2026 the Iran war added the costliest jet fuel since 2022 and disrupted the Gulf hubs of Doha and Dubai.

11b. The Hubs and the Carriers

Airport	Cargo (million tonnes, 2024)	Why	Operator or anchor
Hong Kong	About 4.9	Asia's export gateway	Cathay Pacific Cargo
Memphis	About 3.9	FedEx's global hub, a sorting city that works at night	FedEx
Shanghai Pudong	About 3.8	China's manufacturing and e-commerce	China Eastern and China Cargo Airlines
Anchorage	About 3.7	The refueling stop between Asia and North America	Freighters in transit
Louisville	About 3.1	UPS's Worldport	UPS
Incheon (Seoul)	About 2.9	Korea's electronics; transshipment	Korean Air Cargo
Doha, Dubai	About 2-2.6 each	The Gulf carriers' global freighter networks, disrupted in 2026	Qatar Airways Cargo, Emirates SkyCargo
Taipei, Miami, Los Angeles, Frankfurt, Paris, Leipzig, Chicago	About 1.5-2.5 each	Chips (Taipei), Latin perishables (Miami), DHL's hub (Leipzig), Europe's gateways	

Airports Council International, approximate.

The integrators, FedEx, UPS, and DHL, own everything from aircraft to vans and sell delivery by a guaranteed time. They run the largest freighter fleets and the hubs at Memphis, Louisville, and Leipzig that sort millions of parcels a night.

The combination carriers, among them Qatar, Emirates, Cathay, Korean, Lufthansa, Air France-KLM, Turkish, and the Chinese state airlines, sell space in passenger holds and fly freighters on the main trade lanes. Amazon built its own air network to escape the integrators, and Anchorage is on the list because a freighter from Shanghai to Chicago cannot carry a full payload and the fuel to cross the Pacific nonstop, so it lands in Alaska to refuel.

11c. What Flies, and the Economics

What flies is decided by value density and time: semiconductors, smartphones, and medicines, worth thousands of dollars a kilogram, always fly, while fresh salmon, flowers, and berries fly because they spoil. Fashion flies at the start of a season and sails in bulk, and aircraft engines, oil-rig parts, and factory spares fly when a stoppage costs more than the freight, while everything else sails.

A Boeing 777 freighter carries about 100 tonnes and earns $4-6 a kilogram on the transpacific, $400,000-600,000 a flight, with the return to Asia often half empty at a third of the rate, the mirror of the container backhaul. E-commerce changed the cargo, since a parcel is light, valuable, and urgent, which is why Shein and Temu could fill freighters and why ending their duty-free status cut transpacific volumes.

Module 11 Key Points

Air Cargo

• Air cargo carries under 1% of trade by weight but about a third by value, at many times the cost of sea freight.

• Demand rose 3.4% in 2025 to a record and 4.6% in January-August 2026, with Gulf carriers down 6.5%.

• The United States ended duty-free parcels in 2025 and the EU in July 2026, slowing Chinese e-commerce by air.

• The integrators own the chain from plane to van; Anchorage ranks high because transpacific freighters stop to refuel.

• Value density and time decide what flies: chips and medicines always, salmon because it spoils, spares in a crisis.

Module 11 Quiz

Check Your Understanding

1. What share of world trade moves by air, by weight and by value?

A) Under 1% by weight, a third by value
B) About 10% of both
C) About 30% by weight and nearly all of it by value
D) Half by weight and a fifth by value, since bulk flies too

2. Why does Anchorage rank among the world's largest cargo airports?

A) Alaska's seafood exports to Asia
B) It is FedEx's main global hub
C) Freighters stop to refuel
D) Oil equipment for the North Slope

3. What did the EU do on July 1, 2026?

A) Replaced its €150 exemption with a €3 duty
B) Banned Chinese parcels
C) Cut air cargo taxes
D) Closed its airports to all freighters from China for a year after the parcel fraud cases of 2025

4. What decides whether a product flies or sails?

A) Its weight alone, whatever its value.
B) The distance it must travel.
C) Which port is nearer the factory.
D) Its value per kilogram and how urgently it is needed.

5. What distinguishes the integrators from the combination carriers?

A) Integrators fly only within one country
B) Integrators own the chain from plane to van
C) Combination carriers own no aircraft and rent space on the integrators' freighters
D) Combination carriers carry only passengers' luggage

Module 12 — Rail and Inland Waterways

The Land Bridges and the Rivers

Recommended Reading / Reference

Reference: The Association of American Railroads; the Surface Transportation Board (STB) docket on the Union Pacific-Norfolk Southern merger; the Eurasian Rail Alliance Index on China-Europe trains; the Central Commission for the Navigation of the Rhine; the German Federal Institute of Hydrology; the US Army Corps of Engineers on the Mississippi

12a. Freight Rail

System	Scale	Structure	What it carries	2026 note
United States	A network of about 225,000 km; about 40% of long-distance freight ton-miles; about $85 billion of revenue	Six large private 'Class I' railroads: Union Pacific, BNSF (owned by Berkshire Hathaway), CSX, Norfolk Southern, CPKC, CN	Intermodal containers, coal (falling), grain, chemicals, cars	Union Pacific's bid for Norfolk Southern, which would create the first coast-to-coast railroad, before the STB, with a decision expected in the second half of 2027
China	About 160,000 km, including about 48,000 km of high-speed line; the largest freight volume	State-owned China Railway	Coal, ore, containers	Trains to Central Asia growing fast; lines built in Laos and Indonesia
Russia	About 85,000 km, including the Trans-Siberian	State-owned Russian Railways (RZD)	Coal, oil, ore	Turned east since 2022
India	About 68,000 km; the largest passenger system	State-owned Indian Railways	Coal, ore, grain	Dedicated freight corridors cutting Delhi-Mumbai transit times
European Union	About 200,000 km, fragmented	National incumbents and open-access operators	About 17-18% of freight; trucks dominate	Gauge, signaling, and language barriers; Rail Baltica under construction
Canada, Australia, Brazil, South Africa	National networks	CN and CPKC; Aurizon; Vale's and Rumo's lines; Transnet	Ore, grain, coal to port	Transnet's troubles strand South African exports

National railways and regulators, approximate.

Rail moves bulk over land, carrying coal, grain, ore, chemicals, and containers from ports inland. America's freight railroads are among the world's most efficient and profitable, moving about 40% of long-distance freight ton-miles on private track, with operating margins near 40%.

Union Pacific's bid for Norfolk Southern, announced in July 2025, would create the first railroad from coast to coast and is the largest rail merger question since the 1990s. Shippers warn of a duopoly, and the railroads promise single-line service across the country. In August 2026 the STB lengthened its review, citing the merger's 'unprecedented' nature, and set a schedule with comments due on November 18, 2026, final briefs on May 28, 2027, and a decision in the second half of 2027.

The railroads' vulnerabilities were shown in 2022, when Congress averted a national strike only by imposing a contract, and in 2023, when Norfolk Southern's derailment at East Palestine, Ohio, released toxic chemicals and reopened the safety debate.

12b. The Land Bridges

China built the world's largest freight and high-speed networks and, through the Belt and Road, the China-Europe rail bridge. Container trains run from Chongqing, Xi'an, and Yiwu to Duisburg, Hamburg, and Madrid in 12-16 days, faster than ships and cheaper than planes.

Russia's invasion of Ukraine in 2022 did not end the trains, but it turned Western shippers away from the route through Russia. Trains to Russia and Central Asia kept growing, and China's trains to Central Asia carried 1.13 million TEU in 2025, up 28%. The trade through Russia to the EU, by contrast, fell to 310,579 TEU in 2025, down 14%, by the Eurasian Rail Alliance Index's count, hurt by a Polish border closure, cheaper sea freight, and weak European demand.

Part of the flow shifted to the 'Middle Corridor' through Kazakhstan, the Caspian Sea, Azerbaijan, Georgia, and Turkey, which carries a fraction of the volume at higher cost and is being upgraded with European and Chinese money. Rail also depends more than any other mode on a single path, since one blocked line, from a derailment, a strike, or a bridge, stops everything behind it.

12c. The Rivers

Waterway	Traffic	What moves	The 2020s' stress
The Rhine, Rotterdam to Basel	Europe's busiest river; about 80% of Germany's inland-waterway freight	Coal, oil products, chemicals, grain, containers, ore for the Ruhr	Very low water in 2018 and 2022, and 4 cm at the Kaub gauge on September 24, 2026, the lowest since records began in 1880; barges loaded to a fraction of capacity; surcharges
The Mississippi system	About 500 million tonnes; about 60% of US grain exports move down it	Grain and soybeans south, fertilizer and fuel north	Low water at harvest in 2022 and in later autumns stranded barges and raised rates; aging locks
The Yangtze	Over 3 billion tonnes, the world's busiest river	Everything for central China, from Shanghai to Chongqing	The 2022 drought cut its depth and Sichuan's hydropower
The Danube	About 40 million tonnes	Grain from Ukraine, Romania, and Serbia	Low water in 2022 and 2026; Ukrainian grain through Constanța
The Great Lakes and St. Lawrence	About 200 million tonnes	Ore, grain, coal, steel	Seasonal; the Soo Locks a single point of failure
The Amazon and the Paraná-Paraguay	Growing	Brazilian soy and ore; Paraguayan and Argentine grain	Record lows on the Amazon in 2023-24 and on the Paraná in 2021-23

River commissions and national agencies, approximate. The Kaub reading is a gauge level, not the channel's depth.

Rivers are the oldest bulk transport and, per tonne, the cheapest after the sea. The Rhine carries the Ruhr's coal, chemicals, and grain, the Mississippi takes about 60% of America's grain exports toward New Orleans, and the Yangtze is the busiest river on earth.

All three are exposed to the climate: the Rhine's 4 cm at Kaub in September 2026 left barges carrying a fraction of their loads, the Mississippi's droughts stranded barges at harvest, and the Yangtze's 2022 drought cut both navigation and Sichuan's hydropower. The response, from dredging to shallow-draft barges and more rail, is slower than the droughts.

Module 12 Key Points

Rail and Inland Waterways

• America's six large railroads move about 40% of long-distance freight ton-miles at margins near 40%.

• The STB rules in the second half of 2027 on Union Pacific's bid to make the first coast-to-coast railroad with Norfolk Southern.

• China-Europe trains via Russia fell 14% in 2025 to 310,579 TEU, while trains to Central Asia grew 28%.

• Rail depends on a single path: one derailment, strike, or bridge stops everything behind it.

• The Rhine fell to 4 cm at Kaub on September 24, 2026, the lowest since records began in 1880; rivers feel climate first.

Module 12 Quiz

Check Your Understanding

1. Which railroad merger is before the Surface Transportation Board?

A) BNSF and CSX, a coast-to-coast merger decided in 2025
B) CPKC and CN, joining Canada's two railroads
C) Union Pacific and Norfolk Southern
D) Amtrak and the freight lines of the Northeast

2. What happened to China-Europe rail freight through Russia in 2025?

A) It doubled as sea freight rose.
B) It ended entirely after the Polish border closed.
C) It fell 14%, while trains to Central Asia grew 28%.
D) It moved wholly to the Middle Corridor through Kazakhstan, the Caspian, and Turkey.

3. Why is rail uniquely vulnerable among the modes?

A) Its rates swing with diesel prices
B) One blocked line stops everything behind it
C) It needs more crew per tonne
D) It is unregulated

4. Where did the Rhine's Kaub gauge stand on September 24, 2026?

A) At 4 cm, a record low
B) At a flood high
C) At its long-run average for September
D) Closed for repairs to the gauge after a barge strike

5. Which is the world's busiest river by freight, and what did 2022 do to it?

A) The Mississippi; a strike by barge crews halted it.
B) The Rhine; a flood closed it for most of the year.
C) The Danube; the war in Ukraine closed its delta to grain.
D) The Yangtze; drought cut its depth.

Module 13 — Trucking and the Last Mile

The Mode That Delivers Everything

Recommended Reading / Reference

Reference: The American Trucking Associations; the Bureau of Transportation Statistics; C.H. Robinson's monthly market reports; FTR and ACT Research on the trucking cycle; China's State Post Bureau; Aurora's and Tesla's company reports

13a. The Industry

	United States	Europe	China	India
Trucking's share of freight	About 72% by weight	About three-quarters of inland tonne-kilometers	About three-quarters by weight	About two-thirds
Revenue	About $900 billion	About €400 billion ($460 billion)	About $700 billion	About $150 billion
Heavy trucks	About 4 million	About 6 million	About 10 million	About 5 million
Carriers	About 750,000, over 90% with fewer than ten trucks; J.B. Hunt, Knight-Swift, Schneider, Werner, XPO, and Old Dominion the largest	Fragmented; DHL, DSV, Geodis, Dachser	Highly fragmented, with freight-matching platforms such as Full Truck Alliance	Fragmented; owner-drivers
Drivers	About 3.5 million, with a disputed shortage of 60,000-80,000	A shortage of several hundred thousand	About 17 million	About 7 million
Cycle	A boom in 2020-22, a freight recession of nearly four years, and capacity shrinking in 2026	Similar, with driver costs	Overcapacity	Growing with the highways
Electrification	Under 1% of heavy trucks; Tesla began volume deliveries of its Semi in September 2026	Daimler, Volvo, and Traton electric trucks; EU carbon rules	New-energy trucks 29% of heavy-truck sales in 2025 and over half in December	Early

American Trucking Associations; national statistics; CV World for China's 2025 sales; approximate.

Everything arrives on a truck in the end, and trucking moves about 72% of American freight by weight and is the largest employer in the logistics chain. It is fragmented into hundreds of thousands of carriers, short of drivers in rich countries, and the first mode to feel a recession and the last to recover.

The 2020-22 boom drew tens of thousands of new small carriers into the American market. The downturn that followed bankrupted Yellow, the third-largest less-than-truckload carrier, in 2023, along with thousands of the newcomers, in what became a rate recession of nearly four years. In 2026 capacity kept shrinking under higher insurance costs, stricter driver requirements, and federal enforcement, and the largest American truck broker expects spot rates to rise about 10% in 2027 if it continues.

China's trucking fleet is the world's largest and has become the most electrified. New-energy trucks, mostly battery-electric, were 29% of its heavy-truck sales in 2025 and outsold diesel in December, running on cheap batteries and fast chargers. The American fleet is under 1% electric, and Tesla, after delivering a small fleet of its Semi from 2022, began volume deliveries from a Nevada plant designed for 50,000 trucks a year only in September 2026, into a country with few chargers for them.

13b. The Last Mile

The last mile, the delivery from warehouse to door, is the most expensive part of a parcel's journey, often about half of the total cost, because it is the least dense: one van, one driver, one address at a time, and e-commerce industrialized it.

Amazon built the largest delivery network in the United States in a decade, through its own vans, contracted delivery partners, and its air network, and it has delivered more parcels than UPS or FedEx since 2023. UPS, which set out in 2025 to halve the Amazon volume it carries, and FedEx, which spun off its freight arm as a separate company on June 1, 2026, have restructured around it.

China's express carriers handled 199 billion parcels in 2025, up 13.7%, at a few cents each on the world's densest network. The economics push toward density, through lockers, consolidated deliveries, and urban micro-hubs, and toward automation, with delivery robots in Chinese and American cities, drones in niches such as Zipline's medical deliveries in Rwanda and Ghana, and the driverless van as the endpoint.

13c. Driverless Trucks

The long-haul truck is the most plausible early home of driving automation. Highways are simpler than cities, drivers are scarce, and a truck that runs 22 hours a day pays for its sensors.

Aurora began carrying freight with no driver between Dallas and Houston in spring 2025, soon with an observer back in the cab at its truck maker's request, and had logged over 250,000 driverless miles by January 2026, on routes reaching Fort Worth, El Paso, and Phoenix. In the second quarter of 2026 it added a second fleet with no one behind the wheel, and it aims to have 200 driverless trucks working by the end of the year, while Kodiak runs driverless trucks in the Permian oilfields.

The model is hub-to-hub: a human drives to a transfer point beside the interstate, the automated system drives the highway, and a human takes the city leg, which fits the interstate network and sidesteps the last mile. Rules are set state by state, with Texas, Arizona, and New Mexico permissive and California slow, and the Teamsters oppose it. The honest timeline is hundreds of trucks in 2026 and a meaningful share of long-haul freight in the 2030s.

Module 13 Key Points

Trucking and the Last Mile

• Trucks move about 72% of American freight by weight, across about 750,000 carriers, most with fewer than ten trucks.

• A rate recession of nearly four years is easing as capacity shrinks; C.H. Robinson sees spot rates up about 10% in 2027.

• New-energy trucks were 29% of China's heavy-truck sales in 2025; Tesla's Semi began volume deliveries only in September 2026.

• The last mile is often half a parcel's cost; China delivered 199 billion parcels in 2025 at a few cents each.

• Driverless trucks run hub-to-hub in Texas; Aurora aims for 200 by the end of 2026, a meaningful share only in the 2030s.

Module 13 Quiz

Check Your Understanding

1. What share of American freight by weight moves by truck?

A) About 72%
B) Half
C) About 95%, nearly all of it, since rail now carries little but coal
D) About 40% by weight

2. Why is the last mile the most expensive part of a parcel's journey?

A) Insurance on parcels costs more than the goods inside them.
B) Tariffs are collected at the customer's door, not at the port.
C) It is the least dense leg.
D) It is the longest leg, often thousands of miles by van.

3. What is the hub-to-hub model of driverless trucking?

A) Fully driverless from factory to store
B) Humans drive the city legs, and the automated truck the highway
C) Remote driving
D) Platooning: three trucks follow one human-driven leader across the country, coast to coast

4. Which country leads in electric heavy trucks?

A) Germany, on hydrogen
B) Japan, on hybrid trucks
C) The United States, on the Tesla Semi since 2024
D) China, where new-energy trucks were 29% of 2025 heavy-truck sales

5. How has the American trucking market moved since the 2020-22 boom?

A) A steady boom
B) Rates doubled in 2025
C) A rate recession of nearly four years, now easing
D) A collapse of the largest carriers, with every truckload carrier bankrupt by 2024

Module 14 — Logistics and Supply Chains

The Industry That Manages the Movement

Recommended Reading / Reference

Book: Peter Goodman, *How the World Ran Out of Everything* (2024); Andy Greenberg, *Sandworm* (2019), on the NotPetya attack

Reference: Armstrong & Associates' forwarder rankings; company reports for DSV, Kuehne+Nagel, DHL, Prologis, and Amazon; the US Bureau of Economic Analysis's trade data (February 2026); Stanford's Center on China's Economy and Institutions on China's share of US imports (October 2026)

14a. Forwarders and Integrators

Company	Home	What it does	Note
DHL Group	Germany	Express with its own aircraft, forwarding, contract logistics, parcels	The largest logistics company, with revenue of about €84 billion (about $97 billion) in 2024
DSV	Denmark	Air, sea, and road forwarding; contract logistics	Bought DB Schenker for about €14 billion (about $16 billion) in 2025 to become the largest forwarder
Kuehne+Nagel	Switzerland	Sea and air forwarding, contract logistics	The largest sea forwarder, owning no ships or planes
UPS	United States	Parcels, air, supply chains, healthcare logistics	Halving the Amazon volume it carries
FedEx	United States	Express and ground parcels	Spun off FedEx Freight as a separate listed company on June 1, 2026
The lines' logistics arms: Maersk; CMA CGM's CEVA	Denmark; France	Forwarding, warehousing, air cargo	The carrier as integrator
Expeditors, C.H. Robinson, Nippon Express, Sinotrans, Kerry, Geodis	United States, Japan, China, France	Forwarding and brokerage	C.H. Robinson is the largest American truck broker
Amazon	United States	Fulfillment, delivery, air, and now services for other sellers	The largest private logistics network
Prologis, GLP, Goodman, Blackstone	United States, Singapore, Australia	Warehouse owners	Logistics property, the asset class e-commerce built

Company reports, approximate.

Between the shipper and the ship sits the logistics industry, whose freight forwarders, among them DSV, Kuehne+Nagel, DHL Global Forwarding, Expeditors, and thousands of smaller ones, own no ships or planes. They buy capacity in bulk, consolidate cargo, handle customs, and sell movement from door to door, and in a crisis they set the prices.

Integrators such as FedEx, UPS, and DHL Express own everything from aircraft to vans and sell delivery by a guaranteed time, while contract-logistics firms run warehouses for retailers and manufacturers. The shipping lines have bought into all of it, and the industry's revenue exceeds a trillion dollars, its margins are thin, with forwarders netting a few percent, and its value lies in information, knowing where every container is and when it will arrive.

14b. From Just-in-Time to Just-in-Case

Toyota's just-in-time system, with parts arriving as needed and inventory near zero, became the world's manufacturing doctrine from the 1980s, and cheap, reliable shipping was its precondition. The pandemic broke it (Module 4): a single shortage of chips disrupted car production worldwide for two years, and the *Ever Given* became the image of a system with no slack.

The response was 'just-in-case': higher inventories, with American retail stocks up about $100 billion, second suppliers, mapping suppliers down to the third tier, and moving production nearer home. By 2024 inventories had normalized and the doctrine had partly reverted, because resilience costs money and money cost 5% a year. That left a system somewhat more buffered than in 2019 and, as 2026 showed, not buffered enough.

The case of NotPetya: on June 27, 2017 malware spread from a hacked Ukrainian accounting program and wiped Maersk's network in hours, about 45,000 computers and 4,000 servers, stopping the world's largest container line for days at a cost of about $300 million. The company rebuilt its systems from a single copy of its network directory that had survived on a server in Ghana, offline during a power cut. Ports have been hit since, among them Nagoya in 2023 and DP World's Australian terminals the same year, and the lesson is that the system runs on software that can be switched off.

14c. Nearshoring, China-Plus-One, and the Tariff Wave

Country	Role	US goods deficit, 2025	Trend	Note
Mexico	The nearshoring winner; America's largest trading partner since 2023	$196.9 billion	Rising; Chinese firms building plants in Nuevo León	The largest share crosses by truck and rail at Laredo, Texas; goods meeting the North American trade agreement's rules are exempt from the 2026 tariffs
China	Still the largest manufacturer; about 8% of US imports by late 2025, down from about 21% in 2017	$202.1 billion, down $93.4 billion	Exports redirected to Southeast Asia, Europe, Latin America, the Gulf	Older tariffs plus 12.5% from July 2026; a truce to January 10, 2027
Vietnam	The largest China-plus-one beneficiary: electronics, furniture, apparel	$178.2 billion, up 44%	Rising; Chinese components inside	12.5% tariff since July 24, 2026
Taiwan	Chips and the servers for the AI build	$146.8 billion, roughly doubled	Rising fast	Tariff capped at 10%
India	Phones, medicines, textiles	$58.2 billion	Rising	10% tariff since July 24, 2026
Ireland and Germany	Medicines, cars, machinery	$114.2 billion and $73.0 billion	Mixed	EU tariff capped at 10%

US Bureau of Economic Analysis (February 2026), Census basis; Stanford's Center on China's Economy and Institutions (October 2026); tariff rates from the Office of the US Trade Representative as summarized by Kroll (September 2026).

The 2020s rearranged where things are made, as tariffs, the pandemic, and China's rising costs pushed manufacturers to a 'China plus one' strategy, adding Vietnam, India, Mexico, Malaysia, Thailand, or Indonesia, and Mexico overtook China as America's largest trading partner in 2023. China's share of American imports fell from about 21% in 2017 to about 8% by late 2025.

The map of factories moved more than the map of ownership. Chinese firms built plants in Mexico, Vietnam, Hungary, and Morocco to serve markets that tax Chinese goods, and China's share of the value added in American imports barely moved between 2017 and 2022, from 15.7% to 15.3%, while its direct share fell by a quarter. The components inside a Vietnamese laptop are still largely Chinese.

The case of the tariff wave: in 2025 the United States imposed tariffs on nearly all its trading partners, and importers rushed goods in ahead of each deadline, then stopped. Transpacific bookings collapsed and rebounded within weeks, carriers cancelled sailings, and rates whipsawed. On February 20, 2026 the Supreme Court struck down the tariffs imposed under emergency powers, and a temporary 10% surcharge followed until July 24, when tariffs of 10-12.5% under Section 301 of the Trade Act took its place. Policy is now the largest single demand shock, and the container trades reprice on announcements.

14d. Warehouses, Data, and Visibility

Warehouses are the system's buffers, and they became an asset class: Prologis, the largest owner, built a portfolio worth over $200 billion on e-commerce demand. Inside them, automation is advancing fastest at Amazon, which runs over a million robots.

Visibility is the industry's other frontier: satellite tracking of ships, sensors in containers, port data, and forecasting software promise to tell a shipper where every box is and when it will arrive, and to let carriers price and route in real time. The gap between what is possible and what most shippers see remains wide, and the 2021 crisis showed that even the largest companies did not know where their cargo was.

Module 14 Key Points

Logistics and Supply Chains

• Forwarders own no ships but buy capacity, handle customs, and set prices in a crisis; DSV became the largest in 2025.

• Just-in-case followed the pandemic and partly reverted by 2024, because resilience costs money.

• NotPetya wiped Maersk's network in hours in 2017; it rebuilt from one server that survived in Ghana.

• China's share of US imports fell from about 21% in 2017 to about 8% in late 2025; its value-added share barely moved.

• After the Supreme Court's ruling in February 2026, tariffs of 10-12.5% took effect on July 24, and policy now drives freight demand.

Module 14 Quiz

Check Your Understanding

1. What do freight forwarders do?

A) Operate the ships they book space on
B) Buy capacity in bulk, consolidate cargo, and handle customs for shippers
C) Set the freight rates by law
D) Insure cargo and nothing else

2. How did Maersk recover from the NotPetya attack in 2017?

A) It paid the ransom the attackers asked
B) It moved its bookings to paper for good
C) It rebuilt from backups held at its Copenhagen headquarters
D) It rebuilt from a server in Ghana

3. What happened to China's share of American imports between 2017 and late 2025?

A) It fell from about 21% to about 8%.
B) It rose to about a third of all imports.
C) It held near a fifth.
D) It fell to zero after the tariffs, and Vietnam took all of it.

4. Why did just-in-case partly revert to just-in-time by 2024?

A) Regulators ordered it
B) Resilience costs money
C) The disruptions had ended for good, as the Red Sea and Hormuz reopened in 2023 and stayed open
D) Warehouses were full everywhere

5. What replaced the emergency tariffs after the Supreme Court struck them down in February 2026?

A) A free-trade deal with China
B) A 50% tariff on everything
C) A tariff on Chinese goods only, set by Congress at 25% in a law passed in March 2026
D) A 10% surcharge, then 10-12.5% under Section 301

Module 15 — What Freight Costs

The Numbers a Shipper Actually Pays

Recommended Reading / Reference

Reference: The International Chamber of Commerce's *Incoterms 2020*; Drewry's World Container Index (weekly); the Federal Reserve Bank of New York's Global Supply Chain Pressure Index (monthly); the International Monetary Fund's analysis of shipping costs and inflation (March 2022); the US International Trade Commission's tariff schedule

15a. Landed Cost, Worked

Worked example — A Container of Furniture From Vietnam to Chicago

A US importer buys 400 flat-pack bookcases from a factory near Ho Chi Minh City at $60 each, $24,000 for one 40-foot container. **Getting it to the ship:** trucking to Cat Lai port costs $250, and export customs and terminal handling in Vietnam $350. **The sea:** the ocean freight to Los Angeles is about $7,600, taking Drewry's Shanghai-Los Angeles benchmark of $7,624 on October 8, 2026 as the rate, and cargo insurance at 0.3% of value adds $72. **Getting it to Chicago:** customs brokerage and filings cost $200, terminal handling and port fees at Los Angeles $600, drayage to a rail ramp $500, rail to Chicago $1,400, drayage to the warehouse $450, and unloading $300. **The total:** about $11,700 of logistics, or $29 a bookcase, 49% on top of the factory price. **The duty:** the ordinary duty on wooden bookcases is zero, but the 12.5% tariff on Vietnamese goods since July 24, 2026 adds $3,000, or $7.50 a bookcase, for a landed cost of about $97 against a $60 factory price. **In January:** at the $3,132 of January 8, 2026, the ocean freight was about $7.80 a bookcase instead of $19. The 20% emergency tariff then in force made the duty $12, so the landed cost was about $90. **Against the shelf price:** the retailer sells the bookcase at $199. At October's rate, ocean freight is about 10% of that price, the duty about 4%, and the trucks, rail, terminals, and handling that no one reports about 5%. **Cheaper goods:** a container holds about 20,000 cotton T-shirts, so the ocean freight is about 38 cents a shirt. The duty, 16.5% plus the 12.5% tariff on a shirt imported at $3, is about 87 cents. **The lesson:** the headline rate is the most volatile cost, and for cheap goods it is often not the largest.

15b. Freight as a Share of Value

Product	Typical mode	Freight's share of delivered value in normal years	Sensitivity to rate spikes
Smartphones, semiconductors	Air	Under 1%	None: the value is too dense for freight to matter
Medicines	Air, refrigerated	1-2%	Low
Cars	Roll-on/roll-off car carrier	3-5%	Low
Apparel	Container ship	3-6%, more for the cheapest items	Moderate; seasonal
Televisions and appliances	Container ship	4-7%	Moderate
Furniture, toys, bicycles	Container ship	8-15%	High: the goods whose prices rose with the 2021-22 freight spike
Grain, soybeans	Bulk carrier	10-20%	High; the water levels at Panama and on the Mississippi matter

Product	Typical mode	Freight's share of delivered value in normal years	Sensitivity to rate spikes
Iron ore, coal	Capesize bulk carrier	10-25%	Very high: freight is a large part of the delivered price
Crude oil	VLCC	1-3%	Low until 2026, when the Hormuz war multiplied tanker rates about ninefold
Cement, sand, gravel	Coastal bulk carrier	30-50%	Rarely shipped far

Indicative ranges for this course, not an official series; each share rises in a rate spike.

Freight is a rounding error for high-value goods and a large share of the price of the cheapest bulk commodities. That is why a rate spike reaches the shelf as inflation in furniture and toys and barely at all in phones.

The International Monetary Fund estimated in 2022 that a doubling of freight rates raises inflation by about 0.7 percentage points, with the effect peaking after about a year. The effect is larger in countries that import more of what they consume. Small island and landlocked developing countries, which pay far more for transport relative to the value of their imports than the world average, are the most exposed to any disruption.

15c. Incoterms and Who Pays

Term	Seller delivers when	Who pays the freight	Who bears the risk in transit	Used for
EXW (Ex Works)	Goods are ready at the factory door	The buyer, for everything	The buyer	Buyers with their own forwarders
FCA (Free Carrier)	Goods are handed to the buyer's carrier	The buyer, from handover	The buyer, from handover	The term the International Chamber of Commerce recommends for containers
FOB (Free on Board)	Goods are loaded on the ship at the origin port	The seller to the ship, the buyer from there	The buyer, once the goods are aboard	The traditional sea term, still common for container exports from Asia
CFR (Cost and Freight) and CIF (Cost, Insurance, and Freight)	Goods are aboard, with freight, and insurance under CIF, paid to the destination port	The seller, to the destination port	The buyer, once the goods are aboard, though the seller paid the freight	Commodities; sellers who control the shipping
DAP (Delivered at Place) and DDP (Delivered Duty Paid)	Goods arrive at the buyer's premises, with duty paid under DDP	The seller, for everything	The seller, until delivery	E-commerce; sellers offering a landed price

International Chamber of Commerce, *Incoterms 2020*; seven of the eleven terms.

The Incoterms, eleven standard terms published by the International Chamber of Commerce, define who pays for each leg and who bears the risk. They decide who suffers when rates spike: an importer buying FOB Shanghai pays the ocean freight and bore the whole of the 2021 spike, while a buyer on DDP terms had a fixed landed price and its Chinese supplier bore it. They also decide who pays for a closed chokepoint: a seller who agreed CIF Rotterdam before the Red Sea closed paid the Cape surcharge out of its margin.

Cargo insurance, at 0.1-0.5% of value in normal times, is the last line. Behind it stands 'general average', the ancient rule under which all the cargo owners on a ship share the cost of saving it. The owners declared it

after the *Ever Given* grounding in 2021 and after the *Dali* struck Baltimore's bridge in 2024, and cargo owners had to post security before their containers were released.

15d. What Disruption Costs an Economy

The Federal Reserve Bank of New York's Global Supply Chain Pressure Index combines freight rates, delivery times, and backlogs, measured in standard deviations from normal. It went from about zero in 2019 to a record 4.43 in December 2021 and was back to normal by 2023. In 2026 it rose to 1.81 in May, its high for the year, as the Iran war closed Hormuz, and it stood at 1.28 in September.

The 2026 disruptions are smaller in aggregate than 2021's, because the container fleet is about two-fifths larger and the goods most affected, oil, gas, fertilizer, and the Gulf's trade, are more specific. They fall hardest on the countries that depend on the closed passages. The rule from the two episodes is that freight disruption is a modest tax on rich consumers, a large one on poor importers, and a windfall for whoever owns the ships.

Module 15 Key Points

What Freight Costs

• A $60 Vietnamese bookcase carries about $29 of logistics and $7.50 of duty to Chicago at October 2026 rates: a $97 landed cost.

• Ocean freight is about 10% of the bookcase's $199 shelf price; the unreported trucks, rail, and terminals add about 5%.

• Freight is under 1% of a phone's value and up to a quarter of ore's; spikes show up in furniture and toys.

• Incoterms decide who pays when rates spike: buyers on FOB terms, or sellers who promised a delivered, duty-paid price.

• The New York Fed's supply-chain index hit a record 4.43 in December 2021, 1.81 in May 2026, and 1.28 in September.

• Disruption is a modest tax on rich consumers, a large one on poor importers, and a windfall for shipowners.

Module 15 Quiz

Check Your Understanding

1. In the worked example, what share of the bookcase's $199 shelf price is ocean freight at October 2026 rates?

A) Under 1%, like a phone's
B) About 40%, more than the factory price
C) About 10%
D) About 25%, because the Shanghai-Los Angeles rate tripled in the war's first month

2. Why did the bookcase's landed cost rise only about $7 between January and October 2026, when ocean freight more than doubled?

A) A 12.5% tariff replaced the 20% emergency tariff, offsetting much of the freight rise
B) Rail costs fell
C) The factory cut its price to $50
D) Insurance was waived on Vietnamese cargo

3. For which goods is freight the largest share of delivered value?

A) Smartphones flown from Shenzhen
B) Medicines flown from Ireland
C) Sand and gravel
D) Cars on roll-on/roll-off ships

4. Under FOB terms, who paid the 2021 spike in ocean freight?

A) The carrier
B) The buyer, once goods were aboard
C) The insurers
D) The seller, who always pays the freight to the destination port under the Incoterms

5. What is 'general average'?

A) The rule that all cargo owners share the cost of saving a ship
B) An average freight rate for a lane
C) A port fee on every call
D) A customs valuation

Module 16 — Fuels and Decarbonization

Shipping's Climate Problem and the Vote on a Carbon Price

Recommended Reading / Reference

Reference: The IMO's *2023 IMO Strategy on Reduction of GHG Emissions from Ships* and its Net-Zero Framework (approved April 2025); the EU's rules for shipping in its Emissions Trading System and the FuelEU Maritime regulation; DNV, the Norwegian classification society, on alternative-fuel orders (July 2026); UNCTAD's *Review of Maritime Transport 2025*; the Global Maritime Forum and the Mærsk Mc-Kinney Møller Center on the cost of green fuels

16a. The Problem

Ships burn about 300 million tonnes of fuel a year, mostly heavy fuel oil, the residue of refining, and since 2020 the low-sulfur blends the IMO's sulfur cap required. They emit about a billion tonnes of carbon dioxide, roughly 3% of the world's total and more than Germany, and UNCTAD counted a 5% rise in 2024, the year of the long way around Africa.

International shipping was left out of the national targets set under the Kyoto and Paris agreements and handed to the IMO, which moved slowly, with efficiency standards for new ships from 2013 and a first climate strategy in 2018. Its 2020 sulfur cap, which cut the sulfur allowed in fuel from 3.5% to 0.5%, was its largest intervention in the fuel itself. Studies since 2023 have found that the cleaner exhaust thinned the reflective haze over the shipping lanes enough to add measurably to warming, though they disagree about how much.

16b. The Rules

Rule	Who	What	Status, October 2026
Sulfur cap	IMO, global	Fuel sulfur cut from 3.5% to 0.5% from January 2020, by scrubbers or low-sulfur fuel	In force
2023 greenhouse-gas strategy	IMO, global	Net zero 'by or around' 2050, with cuts of at least 20% by 2030 and 70% by 2040 against 2008	Adopted; the targets are not binding
Net-Zero Framework	IMO, global	A falling limit on the greenhouse-gas intensity of fuel; ships above it pay $100 or $380 a tonne of carbon dioxide-equivalent for the shortfall from 2028	Approved in April 2025; adoption put off for a year in October 2025; vote set for December 4, 2026
Emissions Trading System (ETS) for shipping	EU	Ships pay for 40% of 2024 emissions, 70% of 2025's, and all of 2026's, on voyages within the EU and for half of each voyage to or from it	In force; allowances at €82.40 (about $95) a tonne on October 5, 2026
FuelEU Maritime	EU	The greenhouse-gas intensity of the energy used on board must fall 2% from 2025 and 80% by 2050; shore power at berth from 2030	In force
Carbon Intensity Indicator (CII) and Energy Efficiency Existing Ship Index (EEXI)	IMO, global	Efficiency ratings from A to E for ships in service	In force since 2023; weakly enforced; slower steaming the main response

Rule	Who	What	Status, October 2026
United States	National	No carbon rule for shipping; opposes the IMO's price	Threatened sanctions and visa restrictions on supporters in October 2025

IMO; European Commission; Intercontinental Exchange for the allowance price.

The IMO's 2023 strategy targets net-zero emissions 'by or around' 2050, and the instrument meant to deliver it is the Net-Zero Framework. It would set a falling limit on the greenhouse-gas intensity of ships' fuel and charge ships above the limit for the shortfall, the first global carbon price on any industry, and after its approval in April 2025 it was due for adoption that October.

The United States threatened sanctions on the countries that supported it, Saudi Arabia moved to adjourn, and the vote was put off for a year. It returns for a vote on December 4, 2026, after Japan proposed in August to soften the targets after 2030.

The European Union acted alone: shipping entered its Emissions Trading System in 2024, and ships pay for all their 2026 emissions on voyages within the EU and for half of each voyage to or from it. To stop lines dodging the charge with a call just outside Europe, the EU does not count stops at Tanger Med in Morocco or East Port Said in Egypt as the end of a voyage. The result is a patchwork: a European carbon price, a pending global one, and nothing elsewhere.

16c. The Fuels

Fuel	Cut in carbon dioxide, well to wake	Cost (fuel oil = 1.0)	Uptake	Verdict
Very-low-sulfur fuel oil	None	1.0	Over 90% of the fleet's tonnage runs on conventional fuel	The default
LNG	15-25%, less if methane escapes unburned	1.0-1.3	The largest alternative: 73 ships ordered and 61 delivered in the first half of 2026	The transition fuel; locks in fossil gas
Biofuel blends	50-90%	1.5-2.5	Used in blends by Maersk, CMA CGM, and others	The easiest immediate cut; limited by feedstock
Methanol: from gas, from biomass, or made with renewable power	None, about 60%, or about 90%	1.5, 2-3, or 3-4	38 ships delivered and 2 ordered in the first half of 2026	Maersk's bet; green supply barely exists
Ammonia made with renewable power	90% or more	3-4	4 ships ordered in the first half of 2026; the first ocean-going ships due in 2026-27	The long-term deep-sea candidate; toxic and unproven
Hydrogen	90% or more	4-5	Ferries and harbor craft; 1 ship ordered in the first half of 2026	Short-sea only; too bulky to store for long voyages
Batteries	Up to 100% on clean power	Depends on the route	Ferries, tugs, and short-sea ships in Norway and China	Short-sea only
Wind assistance: rotor sails, wings, kites	5-20%	A retrofit of $1-3 million	About 100 large ships	Real and small
Slower steaming	About 20% less fuel per voyage at 10% lower speed	Saves money	Any ship	The cheapest measure; adopted in every downturn and abandoned in every boom

DNV (July 2026) for orders and deliveries; UNCTAD, *Review of Maritime Transport 2025*, for the fleet; cuts and costs are indicative ranges from the Global Maritime Forum and industry studies.

No fuel is both clean and cheap: LNG is the largest alternative and burns with less carbon dioxide, but methane that escapes unburned can erase much of the gain. Biofuel blends cut the most today and are limited by the supply of waste oils and crops, while methanol and ammonia made with renewable power would cut nearly everything and are barely produced. DNV counted 137 alternative-fuel ships ordered in the first half of 2026: 73 for LNG, 55 for liquefied petroleum gas or ethane, four for ammonia, two each for methanol and ethanol, and one for hydrogen.

16d. The Timing Problem

A ship lasts 25-30 years, so the ships ordered in 2026 will still be sailing in 2050, and the orderbook's fuel choices are the industry's real climate policy. UNCTAD counts ships able to use alternative fuels at over half of the tonnage on order but under a tenth of the fleet in service, and most of the orders are for LNG engines that can also burn oil.

The green fuels cost two to four times as much as fuel oil and are not produced at scale. Owners who would order green ships wait for fuel producers, who wait for orders, and the carbon price that would close the gap is still pending. Shipping decarbonizes when a global carbon price exists or green fuel is cheap, and in October 2026 neither is in place.

16e. A Global Carbon Price for Ships: The Cases as Their Advocates Make Them

The case for the price: only a global price can close the gap between fuel oil and green fuels, because ships can refuel anywhere and a regional price leaks. Its advocates, among them the Pacific island states, the EU, Brazil, and much of the shipping industry, argue that one rule for every flag gives the owners of 30-year assets the certainty to order green ships. The revenue can pay for the new fuels and help the poorer countries hit hardest.

The case against: its opponents, led by the United States and Saudi Arabia, call it a global tax set by a UN agency. They argue that it raises the cost of trade for consumers and for exporters far from their markets, and that the fuels it would reward do not yet exist at scale, so for years it would tax trade without cutting much carbon. Some governments that back action, Japan among them, want softer targets after 2030 to hold down the cost.

What the evidence says: at $100 a tonne of carbon dioxide, a tonne of fuel oil, which emits about 3.1 tonnes when burned, would carry about $310 more, on fuel this course prices at about $700 a tonne. The framework charges only for the shortfall against each year's limit, so the average charge in its early years is far smaller. The IMO's 2024 impact assessment found the effect on world output small and the burden heaviest on small island and least-developed countries, which is why part of the revenue is set aside for them. Europe's price already reaches shippers as a surcharge on each container.

The course's reading, stated once: a global price is the better instrument, because it reaches every flag and could supersede a patchwork that carries the costs of a price without its reach, and its early charges are modest. Its weakness is timing: the fuels it would reward are years from scale, so its first decade buys mostly efficiency, LNG, and biofuel blends, which is what the 2026 orderbook has already chosen.

Module 16 Key Points

Fuels and Decarbonization

• Ships burn about 300 million tonnes of fuel a year and emit roughly 3% of the world's carbon dioxide, more than Germany.

• The IMO's Net-Zero Framework, the first global carbon price on an industry, goes to a vote on December 4, 2026.

• The EU prices all 2026 shipping emissions within Europe, and half of voyages in or out, at about €82 ($95) a tonne.

• LNG leads the alternatives, with 73 ships ordered in the first half of 2026; green methanol and ammonia barely exist.

• A ship lasts 25-30 years, so the 2026 orderbook's fuel choices are the industry's real climate policy.

Module 16 Quiz

Check Your Understanding

1. What share of the world's carbon dioxide comes from shipping?

A) Under half a percent
B) About 15%, more than all trucks
C) About 30%, the largest single source
D) About 3%, more than Germany

2. What happened to the IMO's Net-Zero Framework in October 2025?

A) Its adoption was put off
B) It was adopted unanimously
C) It took effect at once, in 2026
D) It was rejected for good, after the EU withdrew its support and backed its own carbon market instead

3. How does the EU stop lines from dodging its carbon price with a call just outside Europe?

A) It bans non-EU ships
B) Stops at Tanger Med and East Port Said do not count
C) It taxes all ship fuel sold in Morocco and in Egypt at EU rates
D) It charges a fee on every container landed in the EU, whatever the route

4. What is the risk with LNG as a marine fuel?

A) It is banned in Europe
B) It cannot be stored
C) It costs ten times as much as oil
D) Unburned methane escaping

5. Why are the 2026 orderbook's fuel choices the industry's real climate policy?

A) Regulators pick the fuels
B) Fuel is free at sea
C) Ships ordered now will still sail in 2050
D) Orders are few this year

Module 17 — The Geopolitics of Shipping

Maritime Power as State Power

Recommended Reading / Reference

Reference: The Center for Strategic and International Studies, *Ship Wars: Confronting China's Dual-Use Shipbuilding Empire* (2025); Isaac Kardon, *China's Law of the Sea* (2023); the US Department of Defense's annual report on China's military power; the Office of Naval Intelligence's fleet comparisons; Rosatom and the Centre for High North Logistics on the Northern Sea Route

17a. China's Maritime Rise

Element	China's position, 2026	Comparison
Shipbuilding	76% of new orders in January-September 2026 and 68% of the orderbook; capacity estimated at over 200 times America's	South Korea 15% of orders; the United States under 1%
Navy	Over 370 ships and submarines, the largest by count, and growing	The US Navy had about 295 battle-force ships at the end of 2024, with more tonnage and aircraft carriers
Coast guard	The largest, with over 150 ocean-going cutters	Used against the Philippines in the South China Sea
Fishing fleet	The largest distant-water fleet, with a maritime militia	Documented off West Africa, the Galápagos, and Argentina
Ports	Six of the ten busiest container ports; state operators with stakes in over 90 ports abroad, from Piraeus to Chancay in Peru	CK Hutchison's sale of its foreign ports stalled, and it lost its Panama terminals outright
Container lines	COSCO, the fourth-largest, is state-owned	MSC, Maersk, and CMA CGM are not state-owned
Merchant fleet	The second-largest owner after Greece by deadweight	Greek owners hold about a sixth to a fifth
Containers and cranes	About 95% of new containers; about 70% of port cranes	American tariffs and laws against Chinese cranes
Bases abroad	Djibouti since 2017; access at Ream in Cambodia	The United States has hundreds
Weakness	Most of its oil imports pass through Malacca, and much of them through Hormuz	The 'Malacca dilemma': a blockade is its planners' fear

Clarksons Research (October 2026); US Department of Defense (2024); Alphaliner (June 2026); company and press reports, approximate.

China has built, in a generation, the most complete maritime power of the modern era. It has the largest shipbuilding industry, the largest navy by count, the largest coast guard and fishing fleet, most of the busiest ports, a state container line in the top four, and the factories that make the containers and the cranes. 'Maritime power' has been a stated national goal since 2012.

The strategy links commerce and defense: the same groups build merchant ships and warships, and a 2016 law requires civilian ships and transport to serve military needs. Its weakness is just as plain: China imports most of its oil and much of its food by sea, through Malacca and Hormuz, and a blockade is the scenario its planners fear most.

17b. The American Response

The United States won the Second World War on shipbuilding and then let the industry wither. Its response to China, set out in Module 9, combines port fees on Chinese ships, suspended until November 9, 2026, with the Maritime Action Plan of February 2026, tariffs on Chinese cranes, pressure on Panama, and Korean investment in American yards.

The response has produced more announcements than ships, and its central contradiction is that the American economy runs on the Chinese-built, Chinese-equipped, Chinese-ported system it seeks to escape. The most concrete results so far have come from allies, above all Korea's yards and capital.

17c. Russia and the Arctic

Russia's maritime strategy is the shadow fleet (Module 7) and the Arctic, where the Northern Sea Route along its coast is Moscow's bet on a warming world: a shortcut between Asia and Europe that Russia controls, escorted by the world's only fleet of nuclear icebreakers. China, calling itself a 'near-Arctic state', has joined the effort.

The route carried 103 transit voyages and 3.2 million tonnes of transit cargo in 2025, a rounding error beside Suez, so the ambition matters more than the traffic. Greenland, which the United States pressed Denmark over in 2025 and early 2026, is the same logic from the other side.

17d. The Navies and the Guarantee

The system that moves most of the world's trade rests on navies, above all America's, to keep the sea lanes open, and the 2020s showed the limits of that guarantee. The US Navy and its partners could not reopen the Red Sea by force. Operation Prosperity Guardian from December 2023 and the strikes of 2024-25 degraded the Houthis without ending the attacks, a truce in May 2025 covered only American ships, and European frigates escorted ships without solving the problem.

In 2026 the US Navy blockaded Iran's ports but did not hold Hormuz open. No navy currently provides the guarantee in full, the 2026 closures measured the gap, and a crisis over Taiwan would test it in the busiest waters of all.

Module 17 Key Points

The Geopolitics of Shipping

• China leads in shipbuilding, naval hulls, coast guard, fishing, ports, containers, and cranes, tied to military needs by a 2016 law.

• China's weakness is the sea itself: most of its oil imports pass Malacca, and a blockade is its planners' fear.

• America's response has produced more announcements than ships; its economy runs on the system it wants to escape.

• Russia's bets are the shadow fleet and the Northern Sea Route, only 103 transits in 2025 but escorted by nuclear icebreakers.

• No navy guarantees the lanes in full: the Red Sea stayed shut for nearly three years, and Hormuz stayed crippled in 2026.

Module 17 Quiz

Check Your Understanding

1. What makes China's maritime power the most complete of the modern era?

A) Its navy, its Arctic fleet, and Panama's ports
B) Its navy and coast guard, though not its shipyards
C) Shipbuilding, navy, coast guard, fishing fleet, ports, containers, and cranes together
D) Its aircraft carriers and its many overseas bases

2. What is the central contradiction in the American maritime response?

A) The economy runs on the system it wants to escape
B) Korea refuses to help
C) The Navy opposes subsidies for commercial yards, so the plan has no sponsor
D) America already has more ships than its crews can sail

3. What is Russia's Northern Sea Route?

A) A Baltic route that carries the shadow fleet's oil
B) A northern rail and river route across Siberia
C) A route around Scandinavia into the Barents Sea
D) An Arctic shortcut between Asia and Europe

4. What did American and allied naval operations in the Red Sea achieve in 2024-25?

A) They reopened it fully
B) They degraded the Houthis without ending the attacks
C) They sank the Houthi navy
D) They were called off before they began, after Egypt refused to allow warships through the canal

5. What is China's 'Malacca dilemma'?

A) It disputes Singapore's port fees.
B) It lacks ships to use the strait.
C) A treaty closes the strait to its warships.
D) Most of its oil imports pass through a strait others could block.

Module 18 — Where Things Stand, and What to Watch

The Pattern, the Open Questions, and the Dates Ahead

Recommended Reading / Reference

Reference: UNCTAD's *Review of Maritime Transport 2025*; Clarksons Research; Drewry, Sea-Intelligence, and Linerlytica on the container market; BIMCO's market reports; the Lloyd's List Intelligence briefs on Hormuz (2026)

18a. What a Decade of Shocks Taught

Shock	When	Covered in	The lesson
The Suez crisis	1956-57	Module 2	A blocked chokepoint invents its own bypass, the giant tanker, and the invention outlasts the crisis
Hanjin's collapse	2016	Module 3	A line's failure strands the world's goods at sea
NotPetya	2017	Module 14	The system runs on software that can be switched off
The pandemic	2020-22	Module 4	Demand can break a system with no slack as surely as supply can
The *Ever Given*	2021	Module 2	One ship in one canal can stop a continent's supply
The Red Sea closure	November 2023-August 2026	Modules 2 and 4	A militia with no navy can close a chokepoint when insuring the passage costs more than going around
Panama's droughts	2023-24 and 2026	Module 2	Climate now constrains the canals themselves
The Baltimore bridge	March 2024	Module 8	Ships have outgrown infrastructure built for smaller ones
The US port strike	October 2024	Module 8	Labor holds a chokepoint too
The tariff wave	2025-26	Module 14	Policy is now the largest single demand shock
The Hormuz closure	Since February 28, 2026	Module 6	The chokepoint the world most feared losing can close, and food and fertilizer prices feel it within weeks

Ten of these eleven shocks came in the decade from 2016, from every cause: insolvency, malware, disease, accident, militia, drought, labor, policy, and war. Each landed on a system built for efficiency rather than slack, and the costs reached shippers and consumers within weeks, while the carriers, who profit from tight capacity, often gained.

The buffers adopted in each crisis, from higher inventories to second suppliers, were dropped in the recovery. The four passages constrained at once in 2026 are what the pattern looks like when the shocks stop taking turns.

18b. Overcapacity Meets Disruption

The structural fact of the next few years is a record container orderbook, about 15.6 million TEU or about 45% of the fleet, arriving in a market whose demand grows a few percent a year, and BIMCO expects the fleet to grow about 9% in 2027.

Disruption has held rates up, and each ship that returns to Suez releases capacity, as thirteen straight weeks of falling Asia-Europe rates to October 8, 2026 showed. When Hormuz calms, tanker rates and war premiums will fall too, and Module 4 weighs how fast the cycle turns. Tankers and dry bulk, with smaller orderbooks and older fleets, are better placed than containers.

18c. The China Question

Every part of the system now runs through China's decisions: three-quarters of new ship orders, most of the busiest ports, a top-four container line, nearly all new containers, most port cranes, and stakes in over 90 ports abroad. The port fees on Chinese ships return on November 10, 2026 unless the United States extends their suspension, the wider trade truce runs to January 10, 2027, and a crisis over Taiwan would close the system's busiest waters overnight.

Those who would separate the maritime system from China as fast as possible point to dual-use yards, to a 2016 law that puts civilian ships and transport at the military's service, to the cyber risk in Chinese cranes and port software, and to the leverage dependence would give Beijing in a crisis over Taiwan. Others argue that interdependence restrains both sides and that duplicating the system would cost consumers dearly. The evidence of 2025-26 is that fees and threats moved orders for a season while China's share of new orders rose to 76%. This course's reading is that the realistic goal is resilience, meaning enough allied capacity, stockpiles, and alternative routes to survive a rupture, rather than a parallel system.

18d. Decarbonization's Timing

The IMO votes on its carbon price on December 4, 2026, Europe's price stands alone for now, and the orderbook is choosing LNG. Shipping will be among the last sectors to decarbonize, because its fuel has gone untaxed, its ships last 25-30 years, and its rules need agreement among states that include those a price would hurt. The realistic path is a decade of efficiency, LNG, and biofuel blends, a slow build of methanol and ammonia supply, and a global price only if the vote passes and holds.

18e. What to Watch

Date or signal	What to watch	Why it matters
October 26, 2026	The deadline for appeals to Finland's Supreme Court in the *Eagle S* cable case	The legal precedent for prosecuting shadow-fleet crews
November 10, 2026	Whether American port fees on Chinese-operated and Chinese-built ships resume when their suspension ends at 11:59 pm on November 9, and whether China's matching fees return	Shipbuilding as industrial policy; costs on the transpacific
November 18, 2026	Comments, protests, and requests for conditions on Union Pacific's bid for Norfolk Southern are due at the STB	The shippers' and rivals' case, ahead of the decision
November 30-December 4, 2026	The IMO's environment committee meets from November 30 to December 3, and the Net-Zero Framework goes to a vote on December 4	The first global carbon price on an industry, or not
Fourth quarter of 2026	Israel's approval of Hapag-Lloyd's takeover of ZIM, and the golden share's terms	Consolidation among the top ten lines
By December 31, 2026	Whether Aurora reaches its target of 200 driverless trucks	The pace of automation in long-haul freight

Date or signal	What to watch	Why it matters
January 10, 2027	The end of the wider US-China trade truce, unless it is extended again	Tariffs, export controls, and the port fees' future
January-April 2027	Panama's dry season, with the Canal Authority preparing for an El Niño drought	The Asia-US East Coast and grain route
July 15, 2027	The EU's frozen price cap on Russian crude, $44.10, returns to automatic resets	The economics of the shadow fleet
By August 2027	Panama's tender for two long-term concessions at Balboa and Cristóbal, before the interim operators' 18 months end	Port ownership as great-power politics
Second half of 2027	The STB's decision on Union Pacific and Norfolk Southern, after final briefs on May 28, 2027	The first coast-to-coast railroad
2027	Container fleet growth of about 9%, blank-sailing waves, and a rise in idle ships	The downcycle's arrival
Weekly	Hormuz transits, attacks, and war-risk premiums; Suez transits as lines return; Drewry's index each Thursday	The energy and fertilizer chokepoint, and the largest supply event of the year
Ongoing	Taiwan Strait tensions and the insurers' listed areas	The risk no diversion can absorb

Dates as announced by the bodies concerned by October 2026; a date can move.

18f. The Last Word

The throughline of all eighteen modules is that the system that moves most of what the world makes is the cheapest, most efficient transport ever built. It works because a container costs little to move, a dozen passages stay open, a few flags ask no questions, and a navy guarantees the sea lanes.

In the 2020s each of those conditions was tested, with passages closed by militias, states, and drought, ships attacked, and the guarantee unfulfilled. The system kept moving at higher cost and on longer routes, which is both its resilience and its warning. It is more concentrated in Chinese yards, ports, and factories than at any time in its history, more exposed to war than in any recent decade, and among the furthest of any large industry from decarbonizing. The container made the world small, and the 2020s were a reminder of how much of the world lies between the ports.

Module 18 Key Points

Where Things Stand, and What to Watch

• Ten major shocks since 2016 share one pattern: each hit a system without slack, and its buffers were dropped in the recovery.

• A record orderbook, about 45% of the container fleet, meets weak demand; disruption has held container rates up.

• The realistic Western goal is enough allied capacity and redundancy to survive a rupture with China, not a parallel system.

• Shipping will be among the last sectors to decarbonize: 25-30-year ships, untaxed fuel, and rules that need consensus.

• Watch November 10 for the port fees, December 4 for the IMO vote, and 2027 for Panama's tender and fleet growth.

Module 18 Quiz

Check Your Understanding

1. What structural fact will set container rates over the next few years?

A) A record orderbook
B) New emissions rules alone
C) Fuel prices, whatever the fleet does
D) Rising demand, which will outgrow the fleet by 2027

2. Which shipping markets are better placed than containers for the coming cycle, and why?

A) Cruise ships, on demand
B) Air cargo, on e-commerce growth and the end of duty-free parcels
C) Tankers and dry bulk, with smaller orderbooks
D) Ferries, because tourism will keep growing faster than trade

3. What is the realistic Western goal on maritime dependence on China, in this course's reading?

A) Banning Chinese ships
B) Enough allied capacity to survive a rupture
C) Nationalizing the ports
D) A full parallel system, built within five years with allied yards and ports

4. Why will shipping be among the last sectors to decarbonize?

A) Untaxed fuel, ships that last 25-30 years, and rules that need consensus
B) Green fuels are cheaper, so no rules are needed
C) Its emissions are too small to matter
D) Ships cannot burn any other fuel

5. When does the IMO vote on its Net-Zero Framework, according to the watch list?

A) In the second quarter of 2027
B) December 4, 2026
C) On November 10, 2026, with the port fees
D) After the trade truce ends on January 10, 2027

Answer Sheet

Answers to every module's Check Your Understanding quiz.

Module	Answers
Module 1 Quiz	1. C 2. A 3. B 4. D 5. D
Module 2 Quiz	1. A 2. C 3. B 4. B 5. A
Module 3 Quiz	1. C 2. D 3. D 4. C 5. B
Module 4 Quiz	1. A 2. D 3. A 4. B 5. C
Module 5 Quiz	1. D 2. B 3. A 4. C 5. B
Module 6 Quiz	1. D 2. C 3. A 4. D 5. B
Module 7 Quiz	1. C 2. A 3. A 4. D 5. C
Module 8 Quiz	1. B 2. A 3. B 4. C 5. D
Module 9 Quiz	1. A 2. B 3. D 4. C 5. A
Module 10 Quiz	1. C 2. B 3. D 4. B 5. D
Module 11 Quiz	1. A 2. C 3. A 4. D 5. B
Module 12 Quiz	1. C 2. C 3. B 4. A 5. D
Module 13 Quiz	1. A 2. C 3. B 4. D 5. C
Module 14 Quiz	1. B 2. D 3. A 4. B 5. D
Module 15 Quiz	1. C 2. A 3. C 4. B 5. A
Module 16 Quiz	1. D 2. A 3. B 4. D 5. C
Module 17 Quiz	1. C 2. A 3. D 4. B 5. D
Module 18 Quiz	1. A 2. C 3. B 4. A 5. B