THE POTENTIAL OF SAILING CARGO

ALBATROSS CLIPPER COMPANY

In omnibus celeritas

The Potential of Sailing Cargo

The Albatross Clipper Company is developing an advanced sailing ship which will match the speeds of conventional shipping while using a small fraction of the fuel, sharply reducing the largest cost center of the industry while at the same time reducing regulatory exposure, reducing environmental impact, addressing investor concerns, and serving secondary and tertiary ports. Only sailing offers the potential to radically reduce environmental impacts and costs, paving the way for further, sustainable growth in the shipping industry.

1 Problems in Shipping

Seaborne trade represents over 80% of all trade globally[1] and is currently beset by high fuel costs, regulatory uncertainty, a terrible environmental track record, and investor skepticism. These have led to a shift to lower speeds that reduce capital efficiency, a tremendous regulatory threat, an unsatisfied green shipping market, and a higher cost of capital. Shipping therefore faces a crisis of increasing costs that requires dramatic change.

1.1 *High and Uncertain Fuel Costs*

At present fuel costs are between 30% and 60% of the TCO for cargo ships, and fuel prices are expected to rise with time as reserves are depleted. In the late 1960's and early 1970's container ships reached speeds of up to 33 knots,※ and those high speeds were ultimately killed in the 70's by the oil crisis, which represented the start of a trend in oil market volatility that continues to today. Fuel prices have steadily risen to well over half of the TCO for container shipping[2, 3] while speeds have plummeted to manage their rise, resulting in lower capital efficiency. Fuel prices are not expected to decline with time[4] and are likely to rise

※ The Sea-Land Exchange, the first SL-7 was laid down in 1 November 1971 and launched launched in 1st Septermber 1972, but one year before the oil crisis hit. Ultimately all of the vessels in the class were unprofitable and would later be sold to the US military, who operate them on a ready reserve due to their immense fuel costs.

1.2 *Regulatory Uncertainty*

(a) At present the deep uncertainty regarding future fuel taxes and environmental regulation presents the greatest overall single source of risk to the shipping industry. This uncertainty raises the cost of capital and presents a tremendous risk to the viability of the industry as a whole. In a survey done by Lloyd's List regulatory uncertainty topped the list of industry risks.[5]

(b) As IMO Net-Zero and FuelEU Maritime regulations come online the cost of fuel is expected to skyrocket, more than doubling in 2040, and quadrupling by 2050.[6] If this occurs, the cost of motorized shipping will be 2.5 times higher than it is today and fuel will make up 80% of the TCO for container ships. However it is uncertain if these will actually be implemented in full, making it hard to justify the deployment of mitigation that have a cost above that of conventional shipping. Regulators are themselves unclear about what they will do and what their long term plans are while the political climate shifts rapidly in many different directions.

1.3 Pollution

(a) Pollution from shipping is a major problem for the industry, emitting 2.9% of global CO_2 emissions,[7] or similar to those of Japan and are comparable to the emissions produced by aviation. Despite being a smaller fraction of shipping by tonnage container ships produce a plurality of all CO_2 emissions[6] despite less tonnage than tankers and bulkers due to their higher average speed. However decarbonization is not viable with motorized shipping.

(b) The difficulty of decarbonizing the shipping industry and the resultant slow progress have negatively impacted the reputation of the industry and are likely to continue to do so. If regulatory uncertainty continues to hold back clear and actionable targets and policies, this is unlikely to improve on its own. At the same time it will continue to drive capital away and worsen public perception.

(c) The appetite for green shipping is also seeing a period of rapid growth driven by shifts in consumer demand. Amazon, Ikea, and Unilever have all made commitments to zero carbon shipping by 2040, one decade ahead of IMO requirements.[9] 70% of all shippers have indicated a willingness to pay more for carbon neutral shipping, and a third have indicated a willingness to pay more than 10% greater fees.[10] Consumers too are overwhelmingly positive.[11] However this growing demand is stymied by the lack of low carbon shipping capacity. It doesn't particularly matter how much any customer desires carbon free shipping if none exists in the first place.

1.4 Investor Concerns

Financial institutions are increasingly considering divestment from maritime industries due to both risk and ESG concerns, with 60% of investors considering divestment.[12] Larger institutions and ones with higher maritime exposure have higher levels of concern. This is already affecting financing costs for companies that score poorly on environmental metrics. These worsen the already uncertain cost basis of the industry and raise the cost of capital.

1.5 Port Congestion

Due to increased shipping demand and larger vessels in a hub-and-spoke model, shipping has been concentrated into large ports, leading to greater congestion. This has resulted in an imbalance in capacity across the system. Larger ports need to do expensive expansions to manage the increased demand while smaller ones are left with excess capacity that must be either maintained or decommissioned. This has led to a reduction in capital efficiency and waste.

2 Proposed Solutions

2.1 WAP and Other Slight Modifications

Many kinds of efficiency improvements to motor ships have been proposed, and some have been deployed in small numbers, but they do nothing to solve the fundamental economic and environmental problems of shipping. They often rely on complex systems whose benefits are at best marginal. Developing yet another incremental improvement takes a number of years, and during that time decarbonisation mandates, harsh emission fees and high fuel costs inch ever closer.

2.1.1 Fuel Costs Only Slightly Reduced

Wind-assisted propulsion devices offering 10-30% reductions in fuel costs may pay themselves back in a few years, but are only prolonging the decline of the fossil fuel powered shipping industry. No combination of 10-30% improvements can meet the 100% emissions reduction targets of 2050, and wind-assisted propulsion works best in combination with even slower steaming, further degrading service quality.

2.1.2 Regulatory Exposure Remains High

As per the above regulatory risks are not abated by the development of WAP and other partial solutions. At most they serve as a slight hedge against them, but an at most 30% increase in fuel efficiency will do nothing to solve a potential regulatory induced doubling of fuel costs for container ships operating within the EU during the coming decade.[6]

2.1.3 Pollution Remains High

As a consequence of their marginal improvements pollution remains high and they do not satisfy the fundamental demands of environmental groups or customers. Companies cannot effectively sell a 20% reduction as a revolutionary change to environmental groups that demand commitments to zero carbon shipping, nor can they charge a premium for such a marginal improvement.

2.1.4 Investor Concerns are Not Abated

Ultimately the various projects for WAP solve none of the concerns investors have. At most they serve to temporarily placate them by providing an illusion that the fundamental risks and problems of the industry are being solved. However instead of providing sustainable innovation and a better risk profile for investors they serve as expensive bandaids.

2.1.5 Port Congestion is Not Eased

WAP and other modificationss furthermore do nothing to solve port congestion or enable more direct routes they do not solve the fundamental economic problems that cause congestion in the first place. At best they can be a minor tool used by a more complete solution. But they themselves, by not solving fuel costs, do not allow for the construction of more reasonable container vessels.

2.2 Ultra-Large Container Vessels (ULCVs)

ULCVs are an increasingly popular solution for long distance cargo transportation but do not solve the fuel cost problem, create greater risks for investors, cause severe environmental damage at hub ports, and induce further port congestion.

2.2.1 *Fuel Costs Remain Significant*

Both ULCVs and slow steaming do not fundamentally solve the fuel cost problems of motorized shipping. ULCVs for a given speed approach asymptotically a 40% limit in the reduction in fuel costs relative to smaller vessels. In a world where fuel costs are expected to more than double, moving to ULCVs does not fundamentally solve the economic problems of container shipping.

2.2.2 *ULCVs Have Greater Regulatory Exposure*

Due to their outsized negative effect on ports and limited number of ports that can take them, ULCVs are exposed to greater regulatory risk than smaller conventional ships. A single accident, a port banning them, or other such incident can cost billions to lines that invest in them. Likewise with expensive and environmentally damaging projects necessary to allow them to use ports in the first place their expansion is limited by the willingness of ports and other stakeholders to expand for them.

2.2.3 *Pollution Remains High*

ULCVs can at most moderately reduce emissions and add additional environmental costs, such as the need for deep dredging in ports and the destruction of wetlands for the construction of large container terminals.[13] Without the ability to provide the deep decarbonization consumers desire they cannot obtain any premium over other shipping options, nor can they avoid regulation focused on polluting shipping.

2.2.4 *ULCVs Increase Risks for Investors*

ULCVs also concentrate risks. When something goes wrong, it can go wrong in a spectacular and expensive way. The Ever Given's size was a major contributing factor in the severity and duration of its blockage of the Suez Canal. ONE Apus lost over 1,800 containers in a single stack collapse. The sinking of the MOL Comfort lost over 4,000 containers in a single event; an ULCV could lose six times as many. Allianz has said that insurers should prepare for losses of up to $4 billion in the event of a ULCVs and a cruise ship colliding.[14]

2.2.5 *Port Congestion is Worsened*

ULCVs are the leading cause of port congestion. Not only are they massive ships that carry an order of magnitude more containers per ship than the average feeder, they also are less efficient during unloading due to their greater beams, requiring more time for cranes to move containers from the ship to the docks. Their inefficiency is only tolerated since they slightly reduce fuel costs which present the main cost center for motorized shipping.

2.3 Alternative Chemical Fuels

Alternative chemical fuels are favored by many in the industry as a potential drop-in replacement for fossil fuels, but unfortunately they not only have universally greater CAPEX and OPEX than fossil fuels[3, 6, 15], many of the most popular ones such as ammonia are likely to have greater emissions with current technology. Therefore they are unattractive as practical solutions to the problems of the industry.

2.3.1 Fuel Costs Increase

(a) Alternative fuels have a TCO that is 1.5-2 times greater than conventional fuels[15] and are themselves coupled to the volatile oil market. In essence, due to the greater complexity of alternative chemical fuel systems and the difficulties in their manufacture not only are the fuel costs greater, the cost of the ships themselves is far greater.

(b) It is also the case that with multi-fuel engines the price of alternative fuels will be coupled to the volatile oil market as ships and other consumers switch between them and oil, whichever is cheaper. Worse, the better alternative fuels such as HVO are attractive to aviation and other industries,[16] increasing prices. The varying storage demands of alternative fuels also present something of a problem, as there are many different ones under development at present. This means either duplicated port infrastructure, expensive multi-fuel vessels.

(c) It is also the case that scaling alternative fuels is nearly impossible. For biofuels their expansion is overall unlikely to be practical. At present their expansion can barely meet the demand of sustainable aviation,[16] which has a similar total demand for biofuels, a much greater willingness to pay, and competes for the development of biofuel production.

2.3.2 Regulatory Exposure Remains High

Alternative chemical fuels have inversely correlated though greater regulatory volatility. As they are considerably more expensive the market for alternative fuels exists entirely by regulatory fiat and the appetite of a relatively small number of consumers. Therefore any bet on alternative fuels will depend on a favorable regulatory environment, which given the current instability of the regulatory environment is deeply uncertain. As such the adoption of alternative fuels would result in a higher cost of capital due to longer payoff times from more expensive equipment. Worse yet, should the severe detrimental impacts of synfuels become popularly understood there is a good chance that regulators will apply a greater degree of scrutiny to them as well.

2.3.3 A Continuation of Severe Environmental Impacts

(a) Synfuels require hydrogen, which is currently mostly produced by steam reforming natural gas, releasing carbon dioxide. Around 74% of the energy in the natural gas remains in the produced hydrogen, with the remainder being wasted. Using this hydrogen to synthesize new fuels from e.g. atmospheric CO_2※ is simply a roundabout and inefficient way to launder the use of natural gas as a fuel.

※ By mass balance, largely the same CO_2 that was previously emitted.

(b) Carbon Capture and Storage, the practice of injecting CO_2 into geological reservoirs, is largely used to stimulate oil well production; 80% of ccs presently serves as a way to produce more oil. Between 50-66% of the CO_2 injected into the oil wells returns to the surface with the oil, where it is either released or recycled and injected back into the oil well to stimulate more production. Geological storage of CO_2 also creates potential risks to human and animal life and health. The practice of injecting CO_2 is known to cause small earthquakes that are unlikely to damage property, but their effect on the safety of the containment is uncertain.

(c) Unlike the storage of spent nuclear fuel, which can be made into a chemically inert solid and stored in a safe manner for the time period the fuel remains at an elevated level of activity, CO_2 is a gas that must remain underground permanently so that it is not re-emitted into the atmosphere. If the supercritical fluid is not incorporated in the rocks themselves to form carbonate minerals, which is an extremely slow process, the CO_2 remains volatile. Current estimates suggest only a 66-90% probability of even a well-managed sequestration site containing over 99% of the CO_2 for a mere 1000 years, which compares extremely unfavorably with the reliability of geological storage of nuclear waste.

(d) Electrolytic production methods are significantly more expensive, and require significant infrastructure investments; producing all of today's dedicated hydrogen output from electricity would result in an electricity demand of 3 600 TWh, more than the total annual electricity generation of the European Union,[17] and much more production would be needed to decarbonize shipping. This will compete with other consumers of green energy and slow overall decarbonization relative to sailing or nuclear energy.

(e) Further expansion of biofuels are also likely to cause environmental degradation, threatening forests and competing for cropland used to grow food. Therefore their sustainability is questionable, especially on the immense scales that would be required to decarbonize shipping. Biofuels also limit potential future growth due to their inefficient land use.

2.3.4 Investor Concerns are Not Addressed

Investors will necessarily have to bear these far greater capital costs while accepting lower overall returns and in all likelihood a continuation of the very same ESG concerns that have plagued the industry. Due to the detrimental enviro,nmental effects of alternative fuels and dependence on a favorable regulatory environment regulatory risks exceed those of conventional fuels. As such it is unclear if there are any economic benefits at all for investors.

2.3.5 Port Congestion is Worsened

As alternative chemical fuels do nothing to address the economics of motor vessel shipping (in fact making fuel costs more prominent), port congestion would increase as companies are encouraged to build ever larger container vessels to defray shipping costs on fewer direct long distance routes. Worse, due to the higher cost of shipping the total amount shipped will decline, resulting in a less profitable, smaller industry.

2.4 Nuclear Propulsion

While in the abstract nuclear shipping is both attractive and technically feasible and viable it faces a wide variety of regulatory, economic, and technical issues that make its widespread adoption infeasible.

2.4.1 Fuel Costs are Decreased But Still Higher Than Sail

Nuclear reactors scale well, which conversely means that very small reactors have far higher CAPEX and OPEX. This is because they require much of the same plant machinery, similar containment and shielding thicknesses, greater fuel enrichment, and have lower fuel burnups.※ Historical evidence bears out the higher CAPEX and OPEX of smaller reactors and consequently they have been largely phased out by most countries with larger reactors, frequently north of a gigawatt, being deployed. Therefore it is inevitable that nuclear ships will have higher fuel costs than large land based reactors. Current projections for SMR fuel costs place them at around 1.7 cents per kWh while HFO costs are at around 8 cents per kWh.[18]† While this is much better than chemical fuels in motor ships, it is only barely competitive with the fuel costs achievable by motor assisted sailing vessels.

※ This is due to the need to achieve a critical assembly, which can be done through large quantities of fissile material or a high enrichment thereof. Therefore even if CAPEX problems are eliminated nuclear OPEX will exceed that of large shore based reactors.

† Nearly five times cheaper, though ignoring the additional disposal costs associated with nuclear fuel. Or in other words equivalent to a motor assisted sailing vessel which uses its motor 20% of the time. Some present-day sailing cargo vessels use their motor less than 10% of the time.

2.4.2 Regulatory Exposure is Massively Increased

Nuclear shipping is just a single accident, terrorist, or piracy incident away from being banned from many ports around the world and is banned in some already. Countries such as New Zealand and Malaysia have forbid nuclear ships entirely and the adoption of nuclear shipping relies entirely on the views of specific countries' regulators, many of which have historically been hostile to nuclear shipping. The current unstable geopolitical climate has made attacks by various state and non-state actors a somewhat common occurrence, risking the release of nuclear material. As such concepts such as the thorium-based breeder proposals are unlikely to prove viable due to the extreme proliferation risk inherent in placing the suggested technologies on ships.※These nuclear ULCVs will also be forced onto less optimal routes due to avoid political instability and countries which forbid them, resulting in longer trip times compared to conventional vessels over some common routes.

※ Thorium produces highly enriched uranium that can be easily used to create nuclear weapons. All it needs is a trip to a reprocessing plant or (in the case of molten salt reactors) weaponizable material exists in separated form in a chemical plant attached to the coolant loop.

2.4.3 A Mixed Environmental Perspective

While nuclear propulsion does address the CO_2 emissions problems of some shipping, it is likely to be unpopular with environmentalists and may not demand the same green premium other options do. Groups like Ship It Zero, Greenpeace,[19] Friends of the Earth International,[20] and so on generally oppose the development and use of nuclear energy, even if it reduces CO_2 emissions. Likewise while nuclear energy is experiencing increasing popularity, it has considerably less popularity among environmentalists, the very groups that may want to pay a premium for low carbon transportation, with nearly 62% opposition in the US[21] and much higher levels of opposition in countries such as Germany. Therefore regardless of the actual environmental and safety merits of the adoption of nuclear propulsion it is unlikely to be received well, and therefore cannot be expected to charge any premium.

2.4.4 *Investors Dislike Nuclear Risks*

The cost of capital for nuclear development has been historically much higher than for other types of development due to the greater regulatory and technical risks.[22] Sophisticated investors consider these risks to be far in excess of other sources of energy due to the greater potential for regulatory involvement, long project delays, and reputational hazards they present.

2.4.5 *Port Congestion is Worsened*

As nuclear energy operates optimally only at increased size, congestion is worsened relative to alternatives, just as it is with other ULCVs. Nuclear energy also does not efficiently solve the problems of smaller vessels, and so even if it is adopted it is unlikely to reduce fuel costs and the myriad of other problems the rest of the industry faces as only the largest ULCVs are likely to adopt it.

2.5 *Sailing*

Needless to say sailing cargo is the most promising of all the potential solutions as only it can provide dramatically reduced fuel costs, lower emissions, and more constrained risks to investors.

2.5.1 *An Immense and Unfulfilled Potential for Fuel Cost Reduction*

(a) Offshore wind turbines are one of the most economical ways of producing energy. A sailing ship could be thought of as a blade of an offshore wind turbine, directly connected to a payload that needs to be moved. There are no losses from generation as mechanical power is directly converted into useful mechanical work, the expense of transmission lines, foundations &c. is eliminated, and the ship can adapt its course to seek favorable winds while an offshore wind turbine is stuck in a single location. Higher sailing speeds lead to more efficient energy extraction from the wind, with the drag of the ship in the air and water being the limiting factor. Depending on what direction the wind is blowing in, sailing faster than the wind is not particularly difficult for a sufficiently efficient ship, and moving at the correct angle allows effective progress to be made even towards a destination that is directly upwind. The convenience and energy-density of fossil fuels made them the superior solution for a period of time, but just like in terrestrial power generation, they are increasingly inconvenient and expensive to use today and in the future, while better technology has improved our ability to harvest power from the wind.

(b) However, current ships and concepts do not make very effective use of this potential. They promise fuel consumption and emissions reductions of 80-90%, but usually these numbers rely on further reducing speeds to 9-11kn, not 15kn, which would result in dramatically worse service through longer voyage times and costs to cargo owners that often exceed the savings to the shipper. Slower voyages also increase the capital costs per unit of cargo delivered, as the ships can complete far fewer voyages in a given time. One company promises a 80% reduction in emissions "compared with a conventional ship sailing at 15 knots". Of this reduction, 50% is achieved by reducing the ship's speed to 11kn, implying that the sails provide only 60% of the energy the ship uses while its engines supply 40%. This can hardly be called a true sailing ship with motor assistance, but rather a wind assisted motor ship.

2.5.2 A Friendly Regulatory Environment

Unlike other propulsion technologies sailing experiences a uniquely friendly regulatory environment. It does not pollute the environment nor does it do anything that regulators find especially concerning. As other sailing vessels do not follow through with the immense promise of sail propulsion while they have reduced regulatory risk exposure they do not have nearly the reductions in regulatory risk that are possible with sailing.

2.5.3 A potential for True Decarbonization

As decarbonization is very popular with consumers even sailing vessels that go below the speeds that motor vessels travel at are profitable, purely on the basis of the premiums. This demand will ultimately be insufficient to support the market dominance of any sailing vessel design that does not stand on its merits as a pure cost and performance competitor to motorized shipping.

2.5.4 *Reduced Investor Concerns*

Only sailing can address the major investor concerns with shipping in a way that is palatable, low risk, highly profitable, and has a potential for unparalleled growth. While existing sailing ship designs fall short on providing a comparable service, sailing retains the potential to, unlike any other technology, not just clean up shipping but produce a quantitatively better product in every metric.

2.5.5 *Port Congestion Can Be Reduced*

Sailing can reduce port congestion by doing more direct routes than any alternative. By using the abundant and free energy of the wind sailing allows for ships to optimize for other things than just energy efficiency. This means that instead of building vast ULCVs sailing can allow direct routes between small ports.

3 Our Solution

Speeding the transition to superior shipping technology, ideally before too many misallocations of resources to fundamentally uncompetitive options are committed, requires substantial capital investments to achieve the necessary speed and scale. This in turn requires a proportionately compelling value proposition for investors, one we can uniquely provide by offering equal reliability with lower costs and CO_2 emissions.

3.1 *Reducing Fuel Costs Without Sacrificing Speed or Reliability*

(a) In contrast to other sailing ships our design is projected to consistently achieve speeds comparable to conventional motor ships with fewer weather delays and very low fuel usage. Sailing allows us to reduce fuel costs, which make up over 50% of the ship operating costs of our competitors, to a tiny fraction of operational costs, yielding a more stable and effective investment.

(b) A well-designed sailing ship is also more reliable than a motor ship. With backup engine propulsion, a sailing ship cannot fall behind schedule in unfavorable wind conditions; it only incurs higher costs on that particular voyage. Strong winds and the associated large waves slow down motor ships; the most efficient vessels that operate close to their maximum power in normal circumstances have little headroom to fight against waves. Sailing ships gain more propulsive power from those same winds and can maintain normal speeds longer. When a storm becomes too severe to sail in safely, a sailing ship can use its sails to stabilise its motion and orientation, and remains safe even in the event of loss of engine power, unlike a motor ship that loses almost all control.

3.2 Regulatory Certainty

Sailing has no regulatory risk, unlike nearly any other propulsion technology. There are no toxic fuels, potential for catastrophic accidents, nor emissions to damage the environment. Thus it is unlikely that negative learning will be experienced, particularly in a field as well established and with as few risks as sailing, nor is it likely that accidents with sailing vessels will lead to them being banned from ports. At the same time by delivering TCO we also face little risk of being undercut by conventional shipping should regulation not occur. Only sailing offers a comprehensively derisked product while lowering operational costs. Regulatory risk is absent, the technology is loved by the public, and sailing has minimal oil market exposure. While for our competitors the range of potential regulatory outcomes is dominated by an immense potential for downside for us future shifts in regulation present a potential for increased profitability but do not threaten the profitability of our fundamental model.

3.3 Unprecedented Decarbonization

(a) Our design has the potential to in a single stroke eliminate the vast majority of the emissions of the oceangoing shipping industry. Sailing is the only technology that is able to deliver scalable decarbonisation as quickly as sailing vessels can be built, without depending on any particular supporting infrastructure. Sailing ships create far less underwater noise, and minimising the need to use propeller power allows better propeller strike mitigations to be used, significantly reducing the impact shipping has on wildlife.

(b) The demand for green shipping provides a promising economic boost to any sailing company. There is a considerable potential for additional early stage profits beyond those provided by the near-elimination of fuel costs. These premiums, which could be above 20% more than the cost of conventional shipping, when combined with much lower fuel costs provide the potential for unprecedented profits.

3.4 We Address Investor Concerns

Our ships address core investor concerns about technological risk, regulatory concerns, environmental hazards, and long term profitability. We can provide a comprehensive solution that not only mitigates overall economic risk, but creates value for all stakeholders while ensuring that the industry does not just survive the decarbonization mandates, but sees a new era of growth.

3.5 Serving Underserved Ports

As sailing ships don't need to rely on size for efficiency※, they can be built to a more practical size than ULCVs. They would not need the tallest and longest cranes and deepest berths; as a result, a large number of secondary ports become viable endpoints for ocean crossings. Goods can be delivered more directly to their destinations, eliminating transshipment legs and saving time, money, and port capacity in the bypassed hubs. In areas where transshipment by sea is impractical†, delivering goods closer to their destinations distributes the load on land logistics more evenly. In many areas smaller ports have more room to grow, and investments into specialized terminals to improve cargo handling efficiency even further are conceivable. Some minor ports also have significantly lower fees than nearby hubs.

※ The resistance of an efficient hull in low speeds is roughly proportional to its surface area below the waterline, while the sail area a ship can carry effectively is proportional to its length times its mast height. If a ship's proportions are kept constant, both of these terms scale at the same rate. Motor vessels, meanwhile, benefit significantly from size; a ship's capacity grows to the cube of its length, so a smaller motor ship requires more fuel per unit of cargo.

† For example, due to local regulations limiting competition in shipping.

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