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of freight transport***

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1 Summary & Approach

This report examines three pivotal factors that facilitated the exponential increase in volumes of commodities transported by sea in the last century. Firstly, the advent of fast, specialised cargo vessels, the infamous tea clippers, of the 19th century is examined. Secondly the domination of the maritime trade routes by the British steam ships in the late 19th and early 20th century is examined. This was equivalent to the industrial revolution for maritime transport services, on a global scale. Lastly the adoption of containerisation is examined in terms of its origins and its impact on freight transport.

These three paradigm shift were not the only crucial changes that occurred in maritime transport in the last two centuries, however, they are specific to freight transport. Great effort has being taken to present the changes in the context of their time. Many of these changes were slow moving and often took two or three decades to become widely accepted standard practices.

1.1 Target Stakeholders

- Transport operators and freight forwarders
- Maritime industry professions
- Maritime & logistics educational institutes

1.2 General References & Websites

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2 Introduction

Many factors affect developments in commercial shipping; political decisions, war, technological developments, domestic and international regulations, infrastructural developments, demographic change, climate change. Responding to one or several of these is the human adventurous or entrepreneurial spirit. Even without any of the above mentioned factors, the entrepreneur is constantly exploring different ways to improve the status quo.

Shipping, like any other enterprise, is continuously evolving. Compared to some other industries, it is often considered cautious and conservative, and possibly, operating in a hostile environment, there may be some inclination towards reliance on tried and tested methods to support this view. However, on closer examination, there have been several occasions where new technologies, techniques and methods have been suddenly and vigorously adopted. The use of steam power to drive ocean-going ships took about eighty

years to finally surpass the overall efficiency of sailing vessels as cargo carriers, but during this time shipping responded immediately to technological advancement in iron and steel and steam power, and even provided the vehicle and encouragement in which such development and improvements could occur. Outside sudden and dramatic changes, there is the constant, ongoing evolution of smaller changes that, over time, can have a cumulative effect of altering the situation quite dramatically. For example, automation in systems and controls have allowed major changes in crewing requirements and have at least halved the numbers require to operate an equivalent ship compared to forty years ago.

We will examine some of the more notable changes in ship design and operating practices, with a view to identifying some common factor that might help to indicate such developments for the future. The chosen headings in this study are:

- The clipper ships,
- The ubiquitous British tramp ship, and
- The container ship revolution.

It must be borne in mind however, that these changes occurred within the context of their time. Also, public perception, influencing political decisions often had (and still has even more so) an influence which distorted purely commercial influences. Any study of the development of shipping in past two hundred years cannot ignore the extraordinary ascendancy of Great Britain in the marine world. This was a result of the Napoleonic Wars, which effectively removed most shipping other than British from the seas, and the industrial revolution in Britain which again had its birth during and as a direct consequence of the Napoleonic Wars.

3 The Clipper ships



Figure-1: "Clipper Ship Lightning" by Bruce Von Stetina

The so called “clipper” ships (see Figure-1) provide an interesting study in a class and design of ship built for particular trades. It was, initially, largely an American phenomenon and represented a glorious but short lived prominence of the American merchant marine in nineteenth century world shipping. There were several factors that brought about this development; the first, and most significant was the movement of people. The second was the availability of good timber and the minimal infrastructural requirements to set up a shipyard to build timber ships. The entrepreneurial spirit of the young United States and the fact that such ships could be built quickly and provide a return on the investment, often within one round voyage was a major factor, and the repeal of certain protective legislation in the United Kingdom allowing American ships to trade there was a major factor.

After the end of the Napoleonic Wars in 1815, Europe and North America underwent considerable change, particularly in industrialisation. Coal and the steam engine brought about this change. One of the effects of this was the movement of people and the start of mass migration which had not been seen on such a scale for centuries. At the beginning of the Nineteenth Century, passenger travel by sea was dangerous, uncomfortable, and extremely uncertain in dates and times. Passengers were usually accommodated in roughly constructed partitioned parts of the ship that would at other times be used for cargo; ventilation and sanitation were extremely primitive and privacy non-existent. Passengers were expected to provide their own food for the voyage. And, as people would only undertake such a hazardous and uncertain journey under the most extreme duress, they were often exploited by the various people and agencies with which they had to deal.

In spite of these drawbacks, the demand for travel increased, most notably between Europe and North America and between the East and West coasts of the North American continent.

It was not only the migrants, the requirements of increasing international commerce required merchants and “businessmen” to establish and maintain contact largely between the New World and the Old. The California gold rush was also a contributing factor and it is difficult to visualise at this time that the long sea voyage down the full length of the American Continents, around Cape Horn, and up the West coast was the easiest way to get from New York to California.

Like many other new ideas, particularly in the conservative world of shipping, it was people with little experience in the business, but with a clear mind to identify the opportunities and the obstacles, that introduced the design of the “Clipper”. Launched in New York in 1845, the “Rainbow” was generally considered to be the first of the “Clippers”. Her design, and that of future ships was based on the “Baltimore Clipper”, a type of small fast sailing vessel, designed for particular trades for small valuable cargoes or for privateering in times of war; such ships had done very well for their owners in the war between Britain and the US in 1812.

In order to benefit from the design of the ships, a new breed of shipmaster was required. Traditionally the master of a merchant ship was a careful and cautious individual. He was very conscious of the financial investment involved in the ship and her cargo, and no undue risks were expected of him. Undue wear and tear on the ship, fittings and riggings were to be avoided. Sail would be shortened at the hint of bad weather and very often, at night, sail would be shortened even when no bad weather was expected. Routes, procedures and the navigation of the ship complied with traditional and well established routines and “new” gadgets or methods were treated with the greatest suspicion. This was an age of the domination of the slow, lumbering East Indiaman ships (see Figure-2).

The investors in the “clippers” as we have seen were not tied to tradition, and a new breed of shipmaster appeared. These were young men, hard drivers of themselves, the ship and the crew. Speed was the god, and even though these ships carried considerably more sail than the equivalent sized traditional ships, sail was carried to the limit of safety, and often beyond. The new sciences of meteorology and oceanography were making themselves felt and clipper ship masters became experts on wind systems, ocean currents and weather observations.



Figure-2: East Indiaman in Sidney Harbour, National Library of Australia

Competition between such ships was fierce in the matter of voyage times and speed, and the trade soon took hold of the public interest. The names of the ships were designed to be attractive and suggestive of quality and speed. To a certain extent it was this public interest which probably gave the “clippers” an apparent importance out of proportion to their actual impact on world shipping.

While the trade to California from the United States was the main impetus to the “clippers” (in the first four months of 1848, 4 ships cleared New York for San Francisco, in 1849, 774 cleared for the same destination), it was almost an entirely American trade. The opening of trade to the United Kingdom of Great Britain and Ireland, and the tea trade from China brought the ship design and sailing methods into competition internationally. An American company, the Black Ball Line, established the first transatlantic scheduled service with a ship sailing on the first of each month from both New York and Liverpool. British shipping interests were soon to respond, and while timber was not as readily available in Europe, British engineering partially helped and ships with iron frames became common. These improved strength and increased available cargo space and dead weight for the same size of ship. American “timber-only” shipyards could not compete with these advances in ship engineering.

After about ten years, freight rates had fallen. The California gold rush was over. Public interest had moved on and was not so interested in the passage times of the romantically named ships. Powered ships were largely taking over the transatlantic passenger trade. In

1859 the *Flying Cloud* one of the most famous of American clippers had lain idle in New York for two years. The British shipyards and owners were now building and operating “clippers” and the tea trade to and from the Far East now took the public interest. But this was not the only trade in which ships described as “clippers” were used. All of what might be called “liner” services used them in services to all parts of the world and particularly the expanding British Empire. In 1854 Lloyds List carried the following advertisement:

FOR CALCUTTA direct; has all dead weight already engaged, and will sail immediately, the fine fast-sailing clipper ship THOMAS MITCHELL , 578 tons register, W.M. Grange, Commander; lying in West India Docks. This ship has superior accommodation for passengers. For freight or passage apply to J.F. Campbell & Co. 2, St. Pater's alley, Cornhill.

This was typical of the advertisements and ships on services to all parts of the world. Even as the use of steam vessels increased in most routes, and particularly after the opening of the Suez canal in 1869, ships, advertised as “clippers”, were trading on many routes, for example from the United Kingdom to Vancouver in British Columbia. The clipper *Titania* , owned by the Hudson Bay Company, and commanded by Captain J.L. Dunn from 1886 to 1890, was on the UK to Vancouver service at that time.

The demise of the “clippers” was not so much a sudden and definable event as more of a gradual change except in the United States. Here, several factors were involved. One was the fall in freight rates on the East to West coasts trade. However, this fall was not as catastrophic as is often suggested, and even in the late 1850s, although rates were considerably less than at the high point of the late 1840s, they were still comparable to those at the start of the “clipper” era. Another factor was the expansion of the United States westward, and this, coupled with the development of the railways absorbed the entrepreneurial focus of the country. British shipbuilding, engineering and ship operation must be given credit for taking up the commercial challenge posed by the Americans and winning at it. The intervention of the American Civil war probably was the final coffin-nail in American deep sea shipping. Even after the war, America never operated a commercially competitive foreign going mercantile marine again.

Like America and the west coast trade, the tea trade from China to London took the public interest for a few years in Britain. Each year, the first ship in with tea commanded the best price for this increasingly popular commodity. The names of ships, designed to be attractive

and romantic, and their commanders became household names; speeds and passage times were published in the press and discussed with interest by the population. The opening of the Suez Canal in 1869 brought a sudden end to the clippers involvement in this trade, and even though as discussed above it was only one of the routes where fast sailing ships were used, the others did not have the attraction of an annual race like the tea route. With this, popular interest in fast sailing ships ceased and although the transatlantic Blue Riband became a prized achievement for steam passenger ships it never had quite the romantic attraction as the racing clippers from the Far East.

Many of the lines operating “clippers” on regular services gradually replaced their ships with steamers as the technology developed. But once again, it was a non marine person that precipitated the move. Shortly after the opening of the Suez Canal, Alfred Holt, a civil engineer, commissioned the first steamship line, using a new efficient “compound” engine to provide a Service to the Far East. As the steam-ship gradually took over the passenger and cargo liner routes, the displaced sailing ships moved into the increasing bulk shipping market, such as Australian wool and underwent further technological transformations.

The size of sailing ship increased considerably, iron and later steel were used for hull construction and in due course steel for masts, yards and rigging and increasing use of technology transformed the “clippers” into the “windjammers” and the final phase of commercial deep sea sailing ships. The response of sailing ship designers has become known as the “sailing effect”; when competition from a dominant player produces innovative responses among competitors.

4 The Ubiquitous British Tramp Ship

By the first decade of the Twentieth Century Britain had an extraordinary dominance in world shipping. The expression “Britannia Rules the Waves” was in fact borne out by this dominance. Britain possessed a navy which in size and power exceeded all the other navies combined. Britain’s marine engineering and shipbuilding establishments led the world in output and in technical innovation. An empire which stretched across the world and a highly industrialised island economy absolutely dependant on sea communications, were the factors which brought about this situation.

Credit must also be given to an entrepreneurial spirit that invested in ships and shipping and a government policy that provided the regulatory framework that allowed and encouraged investment and development in shipping services. It is also noteworthy that government action extended to investing directly in certain shipping services considered essential to the country and the empire. This was seen in the subsidy to steamship liner services carrying mails, and in the 1850s this, in some cases, amounted to almost 50% of the total investment in relevant shipping services. This percentage fell over subsequent years, but even into the mid twentieth century was considerable, as was the publicity value of ships having the title RMS (for “Royal Mail Ship”) suggesting speed, safety and excellence.

Some figures which indicate the global position of British shipping at the turn of the Twentieth Century are as follows. More than half of the worlds sea carrying trade was carried in British ships, and nearly one third in British tramp ships. The movement of the world’s surplus seasonal crops was almost entirely dependant on this class of vessel. These ships not only traded between the UK and other ports and countries, but carried the lion’s share of trade between other countries. In 1913, the UK (including Ireland) with a population of close to 40 million, imported 55 million tons of various cargoes, values at £769 million. Exports were 100 million tons, valued at £635 million.

Most of these imports and exports were carried in tramp ships; it is notable that of the exports, 76 million tons was coal. British shipbuilding, supporting this huge enterprise was equally dominant. Even though both Germany and the US had outstripped the UK in the production of steel, between 1910 and 1914 British and Irish shipyards launched 1,660,000 gross tons of new merchant shipping, more than all other countries of the world put together.

The term “tramp ship” (see Figure-3) is a loose definition and refers more to the operation and trade of the ship rather than its design. However, the term also came to describe a type of functional, versatile cargo carrying ship differentiating it from other classes of ship such as cargo liners and sailing ships (with which they were immediately in competition for the bulk cargoes of the world). In its initial form it was certainly a “no frills” type of ship, basic in its construction, economical in its operation and adaptable to carrying almost any kind of cargo. It was usually a ship which could lift about 3,000 to 5,000 tons deadweight, with four holds served by four or five hatches. It had steam winches and derricks for working cargo, as had cargo liners, but usually less well equipped in this regard. Its top speed was usually in the range of 8 to 10 knots. Manning was minimal and accommodation for the crew was basic.

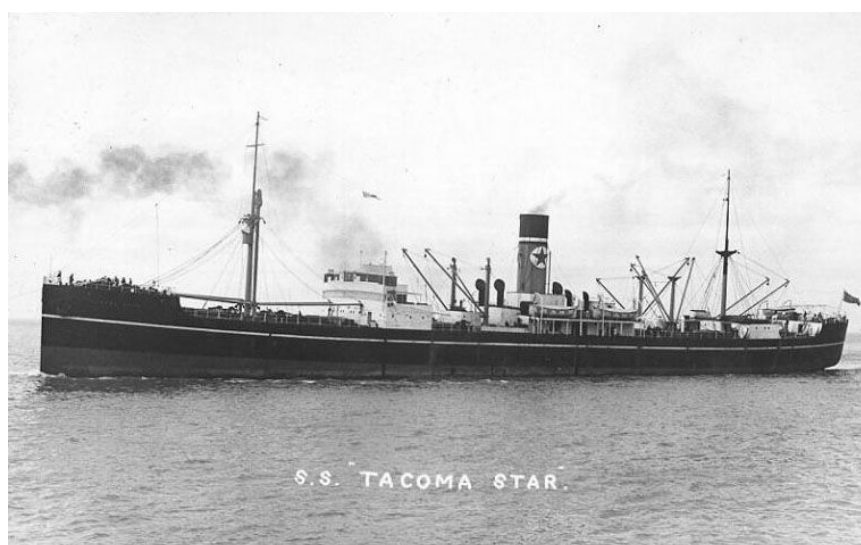


Figure-3: Tramp Cargo Liner, 1930s, John Clarkson

The story of this type of ship starts in the Northeast of England ports in the 1880s. Several factors brought about the class of ship; the development of a quality of steel allowing boilers to withstand greater steam pressure and the development of the “triple expansion” steam engine being the main ones. Now an efficiency in the energy output of coal permitted a major reduction in the amount of fuel to be carried for a given voyage, thus allowing greater cargo capacity. This brought the use of steam propulsion below the economy of equivalent sailing vessels. Another factor was of course the availability of bunker coal throughout the world. In fact coal was the underpinning factor of the tramp ship’s trade and it is notable that the majority of tramp ship companies were located in the coal exporting regions of Britain in this era.

Coupled with the design and development of the ship type and trade was innovative financing arrangements. This was based on the traditional “sixty-fourths”; the cost of a ship being divided into sixty-four shares. Initially, in the Northeast of England, ship-owners started to offer shares in new buildings to all sorts of ordinary people, farmers, tradesmen, artisans, professional people and so on. This worked well while the ship was profitable, but it fell down when shareholders found that they were also liable for losses. This was solved by forming limited companies for each ship. Another solution, which appeared later when people in the Bristol Channel ports had entered the tramp owning business was partially mortgaging the ship with the yard which built it. This reduced the capital outlay required to build the ship.

By the start of the First World War the British tramp ship dominated the oceans. Coal, wheat, ore, copra, rice, wine, fertilizer, animal feed, hides, all the commodities of the world moved in British tramp ships. As the name suggests, they voyaged on the basis of opportunity. A ship bound from Cardiff to Buenos Aires with a cargo of coal would be advertised as being available in Buenos Aires, or adjacent ports, after the date of her arrival. She might then be “fixed” for a cargo of hides to go to Calcutta. Again, she would be advertised, in the Baltic Exchange in London for whatever cargoes might be available in Calcutta or adjacent ports. The tramp ship crew never knew where they were going, beyond the next immediate port.

After the First World War the dominance of the British Mercantile Marine started a slow decline. Other countries, notably Norway and Denmark and later Greece started to move into areas of trade previously dominated by British shipping. These countries brought innovative ideas in ship design, and particularly in propulsion into play.

Oil as a fuel has many advantages over coal whether burned in boilers for steam or in internal combustion engines. The Scandinavians became proponents of the motor ship. An evolution in the tramp ship had started. British owners in due course were affected by this, and while British yards were slow to move from steam propulsion, the use of coal for bunkers declined rapidly between the World Wars.

The Second World War had a profound effect on tramp shipping. Much tonnage was lost and replaced by rapidly built single design ships. There were several different designs, those built in British and Canadian yards being the “Forts” and the “Parks” and the American “Liberty” (see Figure-3) and “Victory” ships. All of these were oil fired steam ships with triple expansion engines. Replacing the lost tonnage, they took up the tramp ships trade as

before. However, two changes were under way. One was the new design of tramp ships being built after the War and particularly in the late 1950s and early 1960s; these were almost entirely motor ships. The era of the triple expansion engine was over and it had followed coal as a marine fuel into the pages of history. Also in the design of ship, the basic, “no frill” notion had given away to some move towards crew comfort and the speed of ships was now in the order of 12 to 14 knots. The other change which very profoundly affected the financing and ownership of tramp ships was “flag of convenience”. This affected the British tramp ship companies very substantially so that by the 1960s Britain was trailing Liberia, Greece and Norway.



Figure-4: Wartime built “Liberty” ship (<http://www.photoship.co.uk>)

In spite of all these changes, larger ships, faster speeds, “flag of convenience”, the basic design of the tramp ship had changed very little. It still was a versatile, four or five hold ship with its own cargo gear in the form of derricks and winches. It still traded in the same way. It still carried coal, ores, wheat, tobacco, rice etc. across the world, being fixed for cargoes in the traditional manner. The handling of cargo had changed very little since the 1880s, it was still labour intensive and required much work in stowage and securing, leading to long at-berth times. However, by the 1960s change was in the wind. In certain bulk trades ships designed exclusively for that trade were being built, particularly ore carriers.

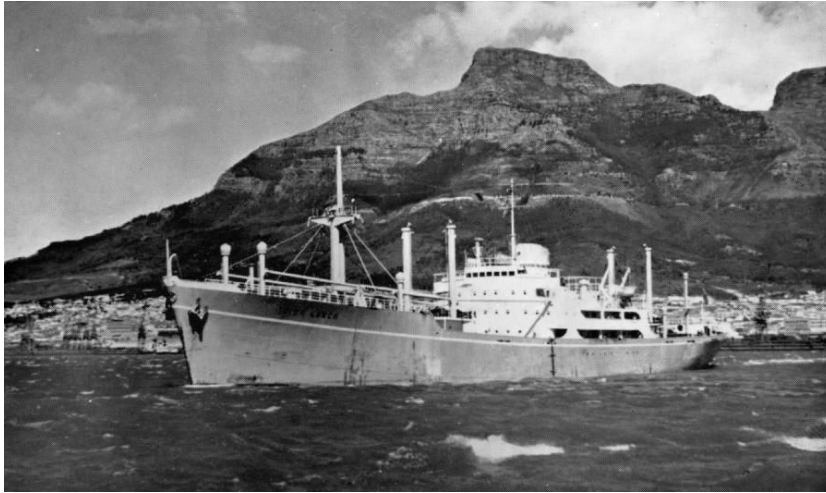


Figure-5: Tramp ship, late 1950s (<http://www.photoship.co.uk>)

Like its sister, the cargo liner, the general cargo tramp (see Figure-4) ships largely disappeared within a decade. The “universal” bulk carrier did for tramp shipping what the container ship did for cargo liners. In fact a report in a shipping paper in 1966 was alarmed at the number of these ships being built and the probable saturation of the market. The new bulk carriers had all the advantages of large size and economy of scale, ease of loading and discharging, now largely by mechanical means, and a design of hold that required a minimum of stowage, trimming and securing compared with the traditional ship.

General cargo ships are still to be found whether described as “cargo liner” or “tramp”. In fact they are still being built. These ships have a versatility in being able to carry a variety of cargoes, whether in bulk, in containers, or “break-bulk” where individual items are loaded piece by piece. They have cranes, large hatches and clear and unencumbered holds. They may also have tanks for certain liquid cargoes. They are to be found trading to the less developed parts of the world, where port facilities are limited or non-existent due to poor hinterland transport. The cargo consignments to these places are also likely to be small. But in spite of this lingering strand of “traditional” shipping, the tramp ship, as generally accepted as a ship type has passed into the pages of maritime history.

5 The Container-ship revolution.

The end of the Second World War saw shipping resume in the traditional manner. Much of the world's tonnage had been destroyed by belligerent action, replaced in part by rapidly built wartime ships. The major shipping companies started a massive building programme; the design of ships was very much on traditional lines, but with improvements in engine types and power and moderate improvements in cargo handling equipment. But these changes were minor, and also the availability of cheap tonnage of wartime construction meant little incentive for change. General cargo was still labour intensive, with all the major ports characterised by miles of quaysides lined with warehouses and transit sheds and employing thousands of people.

On transatlantic routes ships spent more time in port loading and discharging than at sea on passage and on the longer routes ships also spent a large proportion of their time in port. Consignments of cargo were delivered to the nearest or most convenient port to the shipper. This meant loading the freight into a road truck or railway wagon, and unloading it again into a quayside warehouse. The cargo liner would in due course call to the port, in a published schedule of calls to ports in the area. The cargo consignment, with all the other consignments assembled in the warehouse would then be brought by hand, or latterly with the aid of forklifts out onto the quayside. It would be handled piece by piece into slings or trays and then lifted by crane or ships equipment and lowered into the hold of the ship. There it would be stowed, by hand in the hold and secured in various ways to avoid damage on passage. All of this required a lot of manpower, and with all the handling there was considerable damage and pilfering in the course of a consignment from origin to destination.



Figure-6: Royal Docks, London 1950s (the central wharves, between the two docks is now the runway of London City Airport) (UK National Maritime Museum collection)



Figure-7: Cargo handling, 1910 (UK National Maritime Museum collection)

Similarly bulk cargoes were carried in general cargo tramps ships, and while mechanism was developing in such things as grain handling, the working of most cargoes still involved large labour forces.

In the 1960s several things occurred in shipping. The demand for oil by western nations was increasing exponentially, and while oil shipping is outside the scope of this paper, the developments in oil tanker construction influenced other ship types. By the beginning of the 1960s a “super tanker” was in the range of 50,000 tons deadweight. By the end of the decade, very large crude carriers (VLCCs) of 300,000 tons were in operation.

The biggest influence in general cargo operations was brought about by an enterprising trucking company operator in the United States. Malcom McLean, started his career as a truck driver, and by the 1950s had one of the biggest trucking firms in the US. Frustrated by restrictive regulations within the US on the movement between states of large trucks, he converted some old wartime tankers to carry the containment part of the truck. At the same time he redesigned the containment part into a box with a structure and lifting arrangement that allowed the box to be stowed in the ships, to be stacked one on top of another and to be secured onto a road truck or railway wagon easily. Thus the freight container was born. He operated the ships coastwise around the United States and succeeded in bringing about several changes in work practices and port operations. One was the need to convince port authorities to invest in substantial structural innovations in berthage, cranes and marshalling areas. The other was to take on the powerful longshore trade unions in American ports, where the obvious efficiency in port turn around and reduction of labour was seen as a threat to employment.

By the end of the 1960s, McLean's SeaLand Industries had twenty-seven thousand trailer-type containers, thirty-six trailer ships, and access to over thirty port cities.



Figure-8: Cargo Liner, 1980s (note the containers on deck) (<http://www.photoship.co.uk>)

By the mid 1960s, and even though the success of the intermodal cargo handling and operation was obvious, containerisation was still seen as an American coastwise and specialised shipping operation. It was when Sealand and America Lines started a transatlantic service, and the benefits in time, labour costs, and excellent condition of cargo arriving at its destination became apparent that the established shipping companies woke up to this threat to their traditional modus operandi. According to Lloyd's List, the first European container terminal was opened at Rotterdam in November 1965 and Sealand opened one in Grangemouth, Uk in 1966.

Throughout the late 1960s and the 1970s the general cargo ships decreased rapidly in number; shipping lines disappeared or combined into consortia, and the large docklands in most major ports became empty and derelict. Several ports declined as major general cargo ports, and those that survived developed the new port structures such as marshalling areas, specialised gantry cranes and deep, easily accessed berthage that were essential for container operations. Labour and work practices were important factors in the change, and the ability to change or otherwise affected the survival of many ports. In many cases, completely new ports were built often with a major factor in their location to be away from the influences of entrenched attitudes towards dockside employment.



Figure-9: Container terminal, Long Beach, California, 2009

Today containers rule the shipping business but are or were not the only form of unitised cargo operation. RoRo, or Roll-on Roll-off, where cargo units, on wheels are loaded into the ships through doors in the end, or sides is now very common. This form of cargo handling is mostly used in short routes although several large ocean-going services operate it, usually in conjunction with containers or as dedicated car carriers. However, such services are minor compared to container operations. Another form of unitised cargo is LASH, or “Lighter aboard ship”, where cargo barges are loaded into specially designed ships. This is a system that never developed beyond one or two special routes.



Figure-10: Modern Container ship (www.ships-info.info)

The revolution in general cargo operations brought about by containerisation was complemented by changes in the shipping of bulk cargoes such as ores, grains, coal, timber and other such cargoes. The traditional general cargo tramp ships, versatile though it was, failed in several areas in the modern world such as economy of scale, labour, port turn-around time and care and condition of cargo. At around the same time that the container revolution was taking place, the shipping world was investing in large fleets of “universal” bulk carriers. These were large ships, some of them comparing in size to ships of the tanker fleets, with large holds, clear of obstructions, and easily accessed by machinery for loading and discharging.

Like the container ships, such bulk carriers required dedicated and specialised berths and terminals to make the operation efficient. There were several variations on the general bulk carrier principle; there were, for example “OBO” ships which could carry oil, bulk or ore, hence the acronym; there were ships with fitted loading and discharging equipment; there were ships designed principally for carrying timber. Some ships were designed that could be adapted for carrying containers. Increasingly, ships were being designed and built for particular trades, and while the bulk carrier design had a certain amount of flexibility regarding cargoes which it could carry, car carriers, gas tankers, and several other ship types, now quite common, are restricted to the particular cargo for which they were built.

The other major change which came about in port operations and structures, for container operations mainly, but also applicable to bulk, was the formation of “hub” and “feeder” ports. A few major ports which had the space, structure and location close to major centres of population and industry became “hubs” where the ships on the major ocean routes operated to and from. These were (and are) fed by rail, road and smaller ships from other ports within the near geographic areas. Many ports which once were ports of call for ocean-going ships, now deal largely with “feeder” or “near continental” traffic. Some ports may have a terminal or two for ocean going ships, such as a bulk or oil or container terminal and little or no other

traffic. Like the design of ships, ports also now tend to be cargo specific and where once cargo had to be adapted and packaged to make it suitable for the ship into which it was to be loaded, now the ships and ports are designed for the cargo. This is reflected in the change from general cargo ships to speciality ships adapted to carry dedicated cargo (Liquid Natural Gas (LNG), Oil, Containers, Car Carriers, etc.). Commodities that can be unitised must, in turn, be designed to optimise the use of space within a standard container.

One aspect of cargo operation that suffered due to containerisation was that of small consignments, or small items. In the old traditional general cargo liner operation, such small consignments were handled as efficiently as larger ones. With containerisation, a consignment that did not occupy at least one full container had to be loaded into a container with other similar small consignments. This led to delays, and sometimes loss or damage. In other words, containerisation suits large consignments and two-way trade, it falls down in dealing with irregular and smaller amounts of cargo. This niche has been taken up by the many courier and freight forwarding firms which offer secure and flexible shipment services by the most appropriate means whether by sea or air.

When he set out to gamble on his idea of containerized cargo, McLean probably did not realize that he was revolutionizing an industry. McLean's vision gave the shipping industry the jolt that it needed to exponentially grow by facilitating inexpensive and efficient international transport. This reduction in transportation costs resulted in the creation of new high growth markets. By the end of the century, container shipping was transporting approximately 90 percent of the world's trade cargo.