WORLD SHIPPING COUNCIL
PARTNERS IN TRADE

Some Observations on Port Congestion, Vessel Size and Vessel Sharing Agreements

May 28, 2015

Following labor disruptions on the U.S. West Coast in late 2014 and early 2015, as well as less dramatic port congestion issues in Europe and Asia, delays to containerized cargo movement and port congestion have been a subject of understandable interest. The efficiency of the international containerized cargo transportation system is an important economic issue, and there are many elements that affect the continued efficient flow of containerized cargo.

Some recent discussions of port congestion have cited the increase in average vessel size and the rise of multi-partner shipping alliances as causes of port congestion. The aim of this short paper is to support a fact driven analysis of the impact of vessel size and alliances on port congestion. Port congestion can and does arise from multiple causes. Closer dialogue and joint problem solving is what is needed to address those issues, and solutions will not be found by pointing fingers. Every participant in the supply chain will have a role to play.

1. Port Congestion is a Multi-Faceted Issue

Justifiable frustration over port congestion, especially on the U.S. West Coast, exists within all segments of the transportation community. Exporters, importers, ocean carriers, marine terminal operators, truckers, and railroads all experience additional costs when cargo and equipment does not move efficiently through the terminals and when there is congestion. Ocean carriers, port authorities, marine terminal operators and others are actively working to reduce congestion pressures.

Port congestion can arise from multiple causes, and those causes may vary by port or by marine terminal. These include:

- Labor productivity issues, as has been vividly demonstrated recently on the U.S. West Coast

    - During the U.S. West Coast labor difficulties, port productivity at some terminals fell by 73% from September 2014 to February 2015, delaying cargo and resulting in vessels waiting for a berth.
    - Accountability for chassis inspection at U.S. West Coast ports under the new ILWU-PMA labor agreement is another controversy affecting the efficiency of port operations.
- Unexpected surges in cargo volumes, as occurred in New York/New Jersey when carriers and shippers diverted cargo from West Coast ports dealing with labor difficulties to East Coast ports
- Inconsistent marine terminal productivity
    - The same vessel may be served with more efficient terminal productivity in Asian ports than in U.S. ports. Poorer and/or inconsistent productivity levels have existed at U.S. ports/terminals for years.
- The efficiency of vessel operators' cargo stowage planning
- Vessel operators' schedule reliability
- A terminal's ability to avoid berth congestion
- Inefficiency of the transportation infrastructure connecting a marine terminal to rail and roadways
- Disruptions to intermodal rail networks that serve ports
- The lack of on-dock rail capacity at some marine terminals, or the inability of more than one railroad to access an on-dock rail facility
- The amount of land that the port facility has to store containers and conduct operations, how wide and deep the container stacks are in the facility, and how many container moves are required to retrieve a container from a stack
- Shortages of various types of equipment (e.g., yard cranes, chassis, railcars, etc.)
- The recent transition in North America from reliance on ocean carriers providing container chassis to reliance on other parties to provide the chassis, as they do in other parts of the world.
- Hours of marine terminal operation
- The time chosen by shippers or truckers to pick up their shipments
- Hours when warehouses or distribution centers are open to receive or discharge containers
- Weather, such as the bad 2014 winter weather affecting U.S. north Atlantic ports, and
- Whether there are efficient alternatives to storing empty containers within the port terminal facility.

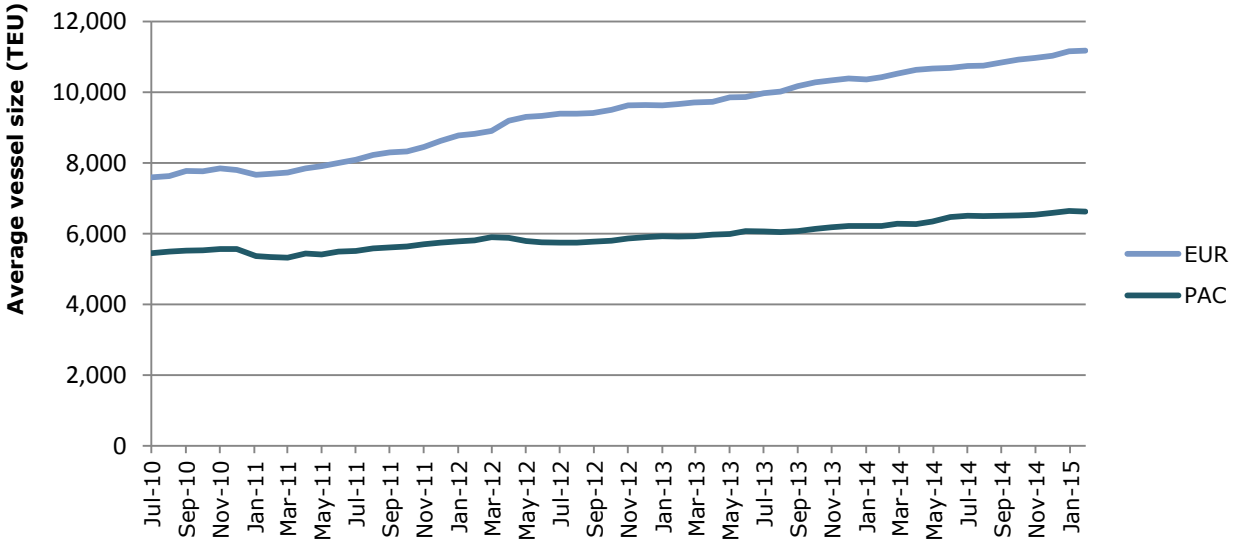
One carrier's efficiency in port can be affected by the actions of another ocean carrier using the same marine terminal. Congestion at a marine terminal gate may have nothing to do with whether an ocean carrier has a container prepared for shipper pick-up. Some port congestion problems can be a result of a combination of factors, and most probably are.

The above is hardly an exclusive or exhaustive list of reasons for port congestion, but it illustrates that the problem is not caused by a single or simple set of factors. These factors may vary by country, port and terminal, and they usually do. Resolution of the problems requires a concerted set of actions involving all parties. Those solutions will need to be tailored to the specific problems in specific locations.

While larger ships do require operational adjustments from carriers and from port facilities, larger ships also handle commerce with more energy efficiency and with less environmental impact. The problems of port congestion cannot be accurately explained as simply a matter of the size of ships or vessel sharing alliances.

2. Understanding Changes in Vessel Size

The growth of large and ultra large vessels in the container industry has affected the Asia-Europe routes more than the Trans-Pacific and other trades. The largest container ships (18,000 TEU +) are deployed only in the Asia-Europe trade. For example, the vessels in Maersk Line´s Asia-Europe AE10 service increased from 8,500 TEU vessels in the second half of 2010 to 18,000 TEU in August 2013, while the vessels in its TP6 Trans Pacific service increased from 8,600 TEU to 9,400 TEU.



Average vessel size deployment for Asia-Europe and Trans-Pacific markets. Graph courtesy of Maersk Line.

Ships with a capacity in the range of 8,000+ TEU have called U.S. ports for a number of years. More recently, containerships of roughly 12,000 – 14,000 TEU size have begun calling at California ports. In 2016, the new locks of the Panama Canal will allow passage of container

ships of up to 13,000 TEU. When those locks open, there will be a strong incentive to replace current "Panamax" ships[1] transiting the Canal with more efficient, larger ships.

As Federal Maritime Commission Chairman Mario Cordero has noted, this development in increased vessel size is no surprise, and port authorities and port operators have known that larger ships are being built and deployed for some time. Major U.S. container ports have been dredging to 50 feet channel and berth depth for years and adding cranes with the height and reach in order to serve larger vessels. Their arrival is not an unforeseen event.

The number of container ships that are 10,000 TEU or larger currently represents less than 10% of the total global fleet. Most of those ships do not currently call the United States.

Ships of the 12,000 TEU size range currently represent a small percentage of U.S. port calls. There are about 105 weekly container liner shipping services in the main U.S. international trades, namely: US - Northern Europe, U.S. – Mediterranean, and U.S. - Asia. Of those, only nine (8.6%) are operating with ships 9,000 TEU or larger. There are another eleven services operating with vessels having a capacity between 8,000 and 9,000 TEU. The average size of a container ship calling U.S. ports is still less than 6,000 TEU.

Nevertheless, ocean carriers will continue to deploy the most efficient size of ships that the cargo volume of their customers for a particular trade route will support. The economic, structural, and regulatory reasons why liner shipping companies must pursue all available efficiencies are discussed in more detail below. It seems likely that larger ships will be used in the future, and carriers, port facilities and others should plan for their increased deployment.

3. Intense Competition, Fuel Costs, and Environmental Policy Are Driving the Decision to Use Bigger Ships

The container shipping industry is an extremely competitive industry with thin financial margins. Shipping rates are under constant market pressure. When carriers are able to obtain cost savings and efficiencies, market forces cause those savings to be shared with customers.

According to industry analyst Alphaliner, between 1998 and 2013, fuel prices increased by 790%. During the same period, average nominal container freight rates (as measured by the China Container Freight Index) increased by only 3%, while real container freight rates declined by over 20% during that fifteen year period.

This challenging profitability landscape requires a strong drive for operating efficiency and cost containment. Increasing the economies of scale achieved through the use of larger ships

[1] "Panamax" is a term for the size limit for ships currently traveling through the Panama Canal. The allowable size is limited by the width and length of the available lock chambers, by the depth of water in the canal, and by the height of the Bridge of the Americas since that bridge's construction. For containerships, this equates to a capacity size restriction of approximately 5,000 TEU or less.

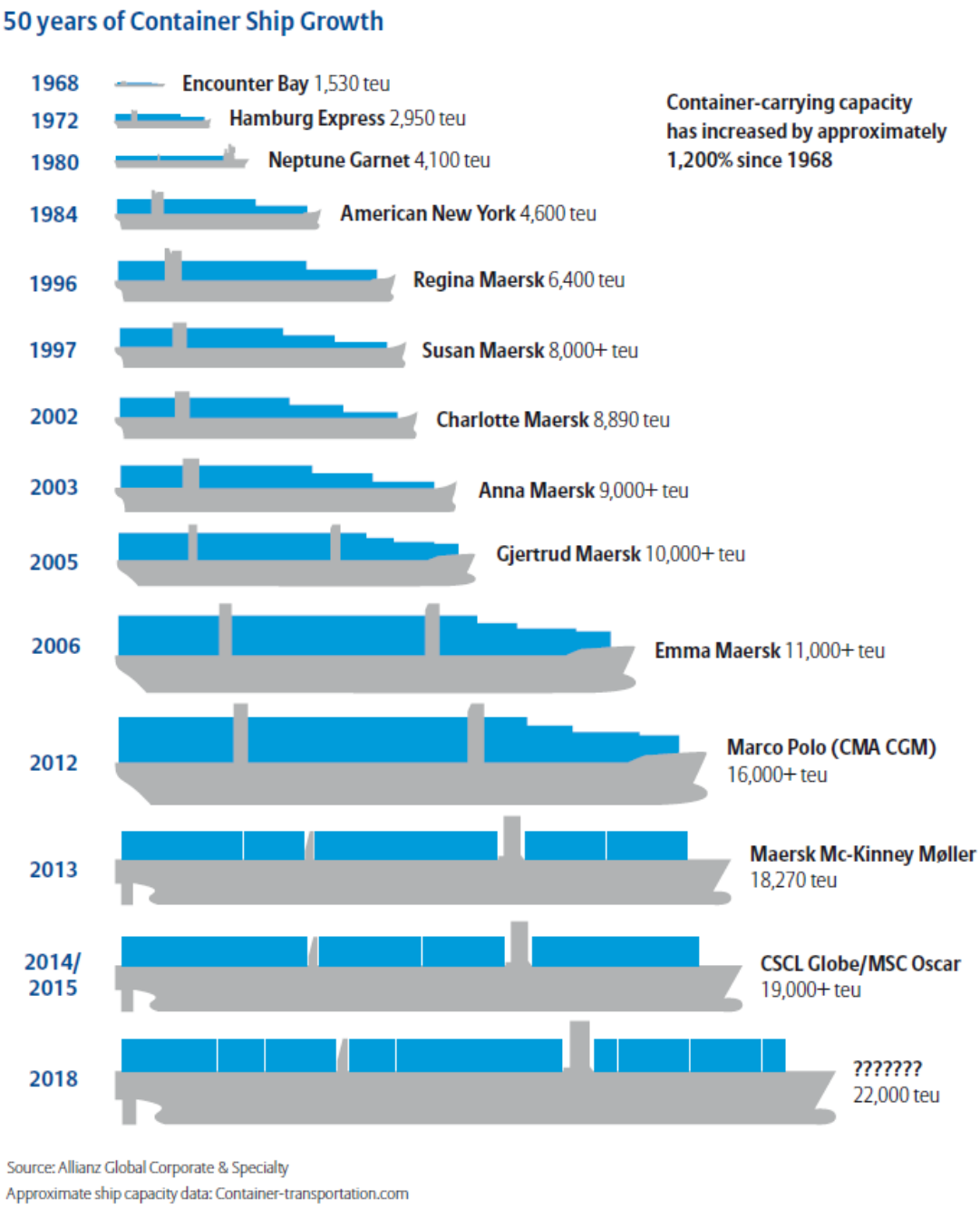
and reducing fuel costs are two tools that ocean carriers can consider, and both have contributed to the large-vessel new-building programs in recent years.

The majority of a container ship's operating cost is the cost of fuel. When the focus is on efficiency and cost reduction, the largest cost "target" is fuel. Some savings have been derived from "slow steaming" which consumes less fuel; however, larger ships are more energy efficient per container transported, and thus their use is economically inevitable.

Environmental regulations are also encouraging and rewarding larger vessel sizes. Environmental regulations designed to reduce vessel air emissions (including Emission Control Areas requiring low sulfur fuel, additional global low sulfur fuel regulatory requirements scheduled for 2020/2025, and efforts to monitor and reduce vessels' CO_2 emissions) have imposed higher cost fuels on the industry, will continue to require even greater use of higher cost fuels, and will incentivize further emission reductions and energy efficiency from vessels. These environmental regulations only amplify the reasons for the industry to utilize bigger and more efficient ships. The environmental benefit of such ships is that they produce fewer emissions per TEU of cargo transported. This environmental regulatory dynamic is unlikely to diminish, and in fact is likely to become stronger.

4. Increasing Vessel Size is Not a New Development. It Has Been a Continuous Trend Since Containerization Was Invented.

One of the most consistent trends in container shipping since 1970 has been the increasing size of container ships. The average size of new containerships delivered in the 1970s was 1,100 TEU. As of April 2015, the average size of new containership orders is 7,900 TEU; more than half of the containerships on order are larger than 5,000 TEU. The following chart illustrates the consistent growth in containership size over the past fifty years.



5. Large Ships Do Not Reduce Schedule Reliability, and There Will Always Be a Mix of Vessel Sizes to Match Market Conditions.

Because schedule reliability is an important element of both service and efficient port operation planning, some have asked whether larger ships are late more often than smaller vessels, thus making it more difficult to plan for their effective handling. In North Europe, for example, draft restrictions are also an issue if the larger vessels do not arrive on time, because when the tide is at its lowest the largest vessels may not be able to enter ports such as

Hamburg and Rotterdam. SeaIntel´s research on this issue (SeaIntel Maritime Analysis, Issue 209, 03-05-2015) found "absolutely no relationship between vessel size and reliability".

While efforts to obtain greater efficiencies of scale and to reduce fuel costs per TEU transported are obvious causes of many carriers' decisions about their fleet composition, it is also true that not every container shipping service uses or needs to use the very large vessels. Different markets can be served by carriers with smaller vessels. Some trades do not have cargo volumes that would justify very large ships (e.g., U.S- Caribbean trades). Some trades have niches that are well served by smaller, specialized vessels (e.g., Atlantic Container Line's combination container–ro/ro vessels in the Trans-Atlantic, or Independent Container Line's Trans-Atlantic services to smaller U.S. ports). Even within the huge volume trades being served by larger vessels, niche services can be served profitably by smaller vessels, as Matson's five vessel trans-Pacific service (which also serves the protected U.S.-Guam trade) using 2,750 TEU vessels shows. But in the high volume trades between the largest ports, economies of scale and lower fuel costs using more efficient vessels create potential economic advantages that neither the marketplace nor ocean carriers can ignore.

6. Vessel Alliances Allow Carriers to More Efficiently Use Ships' Capacity

For decades, vessel sharing agreements (VSAs) have allowed ocean carriers to reap the efficiency benefits of larger vessels by sharing space. For example, in 1988, when Sea-Land first deployed the then gigantic 4,000 TEU "Econ" ships in the Trans-Atlantic, it did so based on a VSA structure with two other ocean carriers -- P&O Container Line and Nedlloyd. VSAs today continue to enable lines to capture the efficiency benefits of scale by enabling large vessels to be efficiently used by customers of more than one line.

The equation of larger vessels delivering efficiency gains, however, only produces the desired result if those vessels' capacity is efficiently utilized to carry cargo. A 14,000 TEU ship burns less fuel on a per-unit basis than a 7,000 TEU ship, but it still burns more fuel overall. Thus, a 14,000 TEU ship that is half full is less efficient than a 7,000 TEU ship that is full. The utilization rate is critical to realizing the designed efficiency of the larger vessels, and vessel sharing arrangements are an important tool in attaining efficient utilization rates. In many cases a single carrier simply does not have enough customers or cargo to fill ships of this size on its own in the framework of a weekly service, which is the norm in the industry and what is required by customers.

In addition to allowing carriers to more efficiently use the cargo carrying space of larger, more efficient vessels, VSA cooperation allows participating carriers to offer and provide greater service scope. By sharing multiple loops, each carrier in a VSA is able to offer its customers a much broader scope of service offering than it could on its own, which is pro-competitive. There are carriers in VSAs that would simply not be able to make the investments

required to serve every port they cover pursuant to VSA space sharing arrangements if they had to serve that network with their own assets.

In short, with multiple carriers using more efficient vessels in larger networks with greater service scope, VSAs allow each carrier to offer a broader scope of more frequent, more efficient services.

Two highly respected, independent international business consultants (Boston Consulting Group and McKinsey & Company) have recently issued reports discussing how much greater potential transportation efficiency gains may be obtainable by VSAs expanding their cooperative efforts from traditional vessel sharing operations to landside operations. *See*,

- http://www.mckinsey.com/insights/globalization/landside_operations_the_next_frontier_for_container-shipping_alliances , and
- https://www.bcgperspectives.com/content/articles/transportation_travel_tourism_transformation_imperative_container_shipping/.

It seems highly logical and likely that carriers are examining such opportunities more closely.

7. Dealing with Port Congestion

As noted in Section 1, there are many factors within the control of different parties that can cause port congestion. Those factors are often within the control of various, different commercial or governmental parties.

Inadequate port/terminal/road/rail infrastructure has been a problem in many countries for many years, and many countries continuously fail to address the problems with the necessary investment. If the growth of trade volumes had not diminished in recent years due to the global economic slowdown, the U.S. and other nations would have faced severe congestion problems regardless of the size of ships deployed. Government policy makers must not lose sight of the fact that continued levels of substantial investment are needed to build and maintain an efficient public transportation infrastructure. There are many transportation studies that forecast worsening freight congestion, independent of the actions of vessel sharing alliances, larger ships, or labor unions. These warnings are ignored at the peril of a nation's economic health.

Larger vessels allow ocean carriers to share vessel space and increase the efficient use of the vessels to transport importers' and exporters' cargo, while at the same time reducing fuel consumed and air emissions per TEU. To efficiently handle larger vessels, marine terminals will have expectations that ocean carriers work to stow ships efficiently, provide reasonably reliable cargo volume forecasts, and try to keep vessel arrivals on schedule so that berth availability can be managed in an efficient, predictable manner. Ocean carriers will have expectations that marine terminals invest in proper levels of cranes and yard equipment to efficiently handle forecasted cargo volumes.

It has been noted that with larger vessels, container volumes must be handled in more concentrated “blocks”, which is true. This can present potential advantages as well. For example, opportunities for stowage and sorting efficiencies may exist with cargo concentration. From an export perspective, sorting efforts of matching export cargo with the respective vessels is reduced. From an import perspective, larger vessels may offer a greater opportunity for block stowing imports for rail destinations, which can provide critical mass in building trains, improving rail utilisation, and dispatching cargo more efficiently. Smaller vessels can cause underutilization of trains which subsequently are kept waiting for the discharge of several vessels to build full trains for different hub destinations.

The concentration of cargo on larger vessels rather than multiple smaller vessels may also present some operational efficiencies that the industry can take advantage of. For example, a larger vessel allows for a high crane density and increased moves per hatch. This allows crane operators to build a rhythm in their container movements, thereby reducing time lost due to moving between hatches and getting back up to speed. Capturing this opportunity for move productivity improvement can be of value to carriers and terminal operators.

Similarly, larger ships may present an opportunity to capture berth productivity improvements. A container yard absorbs the same volume whether working 14 cranes across two large vessels, or three smaller vessels. Handling two large vessels may reduce the supervision and buffer operational capacity needed compared to three small vessel berths.

Success in addressing port congestion will occur through the coordinated efforts of all the relevant parties, and all the parties have a role to play. For example, a reliable, efficient stevedoring labor force is essential. For example, if a port terminal has its gates open for 16 hours, and truckers do not choose to arrive when there are no lines, that cannot be blamed on the port facility. When shippers try to cover their uncertainties by booking the same shipment for export with multiple carriers and then cancelling at the last minute, it makes efficient equipment planning next to impossible. (The ocean container carrier industry has not matched the airline industry in its practice of charging for changed or cancelled bookings.)

If a port facility does not have sufficient acreage to handle its forecasted cargo volumes efficiently, it will need to develop alternative solutions, such as shuttling import containers to holding facilities outside the port, or implementing more sophisticated container handling technology within its existing footprint.

All parties will expect governments to make needed investments in public transportation infrastructure. It would also be helpful if ways could be found to conduct and conclude government permitting processes in a way that did not unduly delay projects that will ease freight congestion.

With economic growth comes an increased volume of containerized cargo. Whether 10,000 TEU are unloaded into a port facility from one ship or two consecutive 5,000 TEU ships, the

facility will need to be able to efficiently handle 10,000 TEU. For example, the Los Angeles/Long Beach port complex in southern California handles roughly 12 million TEU of cargo per year. A five percent annual growth in trade volume equals more than a half-million more TEU each year that need to be handled, regardless of the size of the ships transporting them. Ports and transportation infrastructure need to be prepared for greater volumes and efficient ways to handle those volumes through ports regardless of ship size.

It is also worth reflecting on how congested high-volume ports would be if all containers were transported via small vessels. For example, consider how congested the Los Angeles/Long Beach port complex would be if all 12 million TEU of cargo transported through it were carried on 2,750 TEU ships.

Ports have adapted and adjusted to increasing vessel size since containerization was invented. This is not a new or recent phenomenon or challenge. From the time that the first container ship was loaded and unloaded and revolutionized port cargo handling practices, to the very fast (33 knot) but economically unprofitable SL-7 container ships in the 1970s, to the 4,000 TEU container ships of the 1980s, to the first post-Panamax container ships, to the *Regina Maersk* in the 1990s, to the *Emma Maersk* in the 2000s, to the *MSC Oscar* in 2015, there is a constant fascination with ship size and design innovation. There is no reason to believe that the environmental and economic efficiency dynamics driving carriers to use larger ships in large volume trades are going to be reversed. At the same time, there is no reason to believe that every container service will be served by the very largest vessels. Ship ordering and deployment decisions are and will be based on each carrier's decision about optimizing operational efficiency with capital and operating expenses.

To handle the growing volume of containerized goods being shipped by importers and exporters around the world, coordinated planning and cooperation will be needed from ports, marine terminal operators, longshore labor, ocean carriers, railroads, road carriers, shippers, and the trustees of public infrastructure, just as it always has been needed.

###