

## The Rising Tide of Large Ships

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In 1988, a new class of container ships, the American President Lines (APL) C-10, came on the market — the first class of ships that was too large to pass through the Panama Canal. Eighteen years later, in 2006, the Panama Canal Authority began a multiyear project to expand the canal so that these and other large ships will be able to make the passage between the Atlantic and Pacific oceans.

The expansion of the Panama Canal, expected to reach completion in late 2015, heralds much-anticipated shifts in the routes that goods take to arrive at their final destinations in the United States. This is because larger ships, up to double the size of those that can transit the Panama Canal today, will be able to navigate the canal once its new locks are opened. From the growing markets of Northeast Asia, Southeast Asia, and the Indian subcontinent, the first leg of the journey for most traded goods is the long maritime trip from overseas ports to U.S. ports on the East Coast, the West Coast, and the Gulf of Mexico. In particular, container shipments to East Coast ports, which include the ports of the Fifth District, may increase, particularly with respect to goods arriving from Northeast Asia (China and Japan).

The opportunity for East Coast ports to gain from the expansion of the Panama Canal depends on many factors, not the least of which is the depth of their channels. Several East Coast ports, including Norfolk, Baltimore, and New York, have channels that are deep enough to accommodate the larger ships today; Charleston, S.C., can also handle them, though only at high tide. But the Panama Canal project will not be the only source of growth for these ports. Larger ships making their passages through the Suez Canal, the other primary route for Asian trade, are already calling at East Coast ports that can accommodate them. The expansion of the Panama Canal may accelerate this trend, but the use of big ships is already well under way.

### Waterborne Trade is Growing

Merchandise trade between the United States and the rest of the world is expected to more than double between 2012 and 2040, according to estimates from the Federal Highway Administration's Freight Analysis Framework. Over this period, imports are expected to grow at a compound average annual growth rate of 2.9 percent, while exports will grow even faster, by 3.9 percent.

With this growth will come growth in oceangoing freight. Measured by volume, the majority of U.S. trade is carried on oceangoing vessels, with the exception of trade with Canada and Mexico, which is transported mostly by truck or rail, or by water via the Great Lakes. Among U.S. major trading partners, imports from China are expected to grow faster than those of any other region of the world; nearly all

trade with China is transported by water. Indeed, the push for shipping lines to use larger ships has been motivated by China's growing trade with the United States, Europe, and other regions of the world. Because waterborne shipping is so critical to the movement of goods from China to the United States, the Panama Canal expansion will have its greatest potential effect on this aspect of U.S. international trade, primarily by increasing volume in the trade route from Northeast Asia to the East Coast.

### Ships are Getting Bigger

In 2011, nearly 84 percent of oceangoing commodity trade between Northeast Asia and the United States was containerized. This has not always been the case, though. Since the inception of containerized cargo transport in the mid-1950s, the use of containers and dedicated container-carrying ships has grown dramatically, with clear cost advantages for many types of cargo that had previously been shipped by break-bulk methods, requiring each item to be loaded individually. In addition to the reduced cost of handling and avoidance of potential vandalism or waste, the use of intermodal containers allows for delivery of smaller shipments directly to customers via transfer to truck or rail. (See "The Voyage to Containerization," *Region Focus*, Second/Third Quarter 2012.) Initially, containers were used primarily for manufactured goods, but starting in the 1980s, certain agricultural products also switched to the containerized mode of shipment. From 2002 to 2012, the number of container vessel calls at U.S. ports rose by 16.6 percent. During this time, Fifth District ports saw an increase in container vessel calls of 11.7 percent. (See chart.)

As the number of container vessel calls has risen, so has the average size of container ships. Vessel size is typically measured by TEUs, 20-foot equivalent units, which references the standard length of a container. In 2006, container ships of size 5,000 TEU or greater accounted for just 17 percent of container ship calls at U.S. ports, but by 2011, this share had grown to 27 percent. (See table.) Because of the importance of the Panama Canal as a transit between the Pacific and Atlantic oceans, size categories for vessels have used the maximum size of ships that can fit through the Panama Canal as a reference point, defining the Panamax size as a vessel that can carry 4,000 to 5,000 TEU. Similarly, when the Panama Canal expansion project is complete, the new size limit will be 13,000 TEU, establishing a new size category called Post-Panamax or New Panamax (5,001 to 13,000 TEU). Finally, beyond the limits of the newly expanded Panama Canal, there are ships that will push the limits of the Suez Canal called Suezmax (from 13,001 to 18,000 + TEU).

One such extreme ship is the *CSCL Globe*. When delivered to China Shipping Container Lines in late 2014, it became the largest container ship in the world — and the company has four more of the 19,000 TEU ships on order. The *CSCL Globe* is as large as four soccer fields. Like other Suezmax vessels, it will be able to transit the Suez Canal, but not the expanded Panama Canal.

### The Panama Canal is Expanding

The Panama Canal expansion project will add a third traffic lane and set of locks, at an estimated cost of \$5.25 billion, to allow for the passage of ships more than twice as large as it can handle now. In addition, the expanded locks and channels will allow a greater number of ships to pass through the canal, thereby doubling capacity. The ambitious project involves deepening and widening the canal entrances, constructing two new complexes (one on each end of the canal), excavating a new north access channel for the Pacific locks, and elevating Gatun Lake’s maximum operational level. In addition, the navigational channels through Gatun Lake and the connecting waterway, Culebra Cut, will be deepened and widened to allow for two-way passage of vessels.

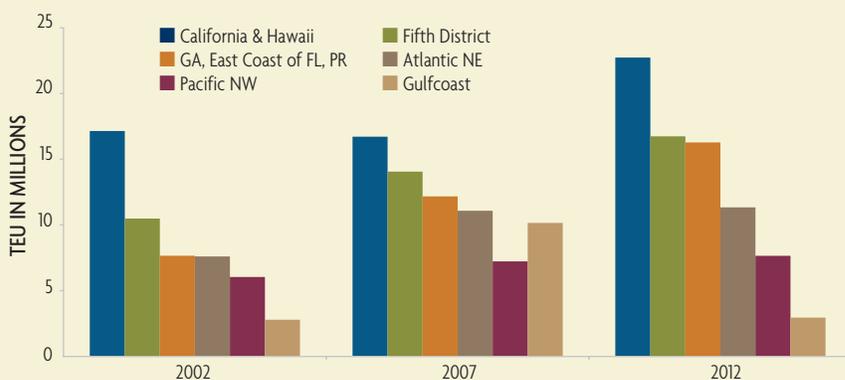
Construction for the expansion project began in 2008, with completion planned for 2014, but the project has experienced delays due to labor disputes and technical problems with the locks. Completion is now expected by the end of 2015, with the first ships making passage in January 2016.

### What Determines the Route?

The arrival of cargo at a port is only the beginning of the sophisticated multimodal freight transportation system that serves producers and consumers all over the United States, regardless of distance to a coast. Some container ships from Northeast Asia enter directly through West Coast ports to final destinations across the United States, using a network of port terminals, railways, and highways to reach points as far as the East Coast. Alternatively, shipments may enter ports on the East Coast for intermodal transport to destinations there and further inland.

Container shipments from Northeast Asia headed for the East Coast and eastern inland destinations have shifted away from West Coast ports and toward East Coast ports. From 2000 to 2011, the movement of containers by rail from the West Coast rose by 25 percent. But while the volume from West Coast ports to the Midwest and South Central regions increased by 64 percent, the volume to the East Coast declined by 49 percent. Ports on the East Coast and Gulf Coast received 31 percent of total container

### Vessel Calls (TEUs) on U.S. Ports by Region



SOURCE: U.S. Maritime Administration 2002 – 2012 Total Vessel Calls in U.S. Ports, Terminals and Lightering Areas Report: Commercial Vessels over 10,000 deadweight tons (DWT)

### Containership Calls at U.S. Ports by Size

Vessel Size (TEUs)	2006	2011	Percent change 2006-11	2006 share of total	2011 share of total
<2,000	4,143	4,547	9.8	21.2	20.6
2,000-2,999	3,985	2,856	-28.3	20.3	12.9
3,000-3,999	3,333	2,327	-30.2	17.0	10.5
4,000-4,999	4,782	6,400	33.8	24.4	29.0
>4,999	3,344	5,959	78.2	17.1	27.0
Total	19,587	22,089	12.8	100.0	100.0

NOTE: TEU = 20 foot Equivalent Unit  
SOURCE: *Vessel Calls Snapshot, 2011*, U.S. Department of Transportation Maritime Administration, November 2013

shipments from Northeast Asia in 2011.

Three factors determine how goods are moved: reliability, transit time, and transportation cost. For goods moving by container ship, reliability may be more a factor of trust and experience with a particular shipper and is therefore somewhat subjective. Transit time and transportation cost, however, are directly measurable and easy to compare across different routes. The Panama Canal expansion will generate lower shipping costs per container to East Coast ports because of the economies of scale accompanying larger ships; this may lead to a shift in routing away from West Coast ports and intermodal transit and in favor of routing to the East Coast. Although larger ships also serve West Coast ports, the longer waterborne portion of the trip through the Panama Canal to the East Coast offers relatively more savings.

On the other hand, total transit times may be as much as nine days longer to reach the East Coast via the Panama Canal relative to routing through the West Coast ports. For example, it could take 16 days to route goods from Northeast Asia to Chicago by way of the port of Seattle, compared to 25 days for shipment through the Panama Canal and then to Norfolk. The significance of the time difference for the routing decision depends very much on the product being shipped. For goods of relatively low value, the transit time

### Value of U.S. All Waterborne Imports from Northeast Asia – 2010

Cargo Segment	U.S. Value (Millions 2010 \$)	U.S. Tons (Thousands)	\$/kg	Percent Arriving Through a West Coast Port
Containerized	345,150	54,790	6.30	70.9
Low Value	100,762	30,103	3.35	66.2
High Value	244,388	24,687	9.90	76.5
Bulk/Other	26,410	32,524	0.81	49.9

SOURCE: Panama Canal Expansion Study, Phase I Report, U.S. Department of Transportation Maritime Administration, November 2013, p. 108

for delivery may not matter as much and this would favor the East Coast route via the Panama Canal, but for relatively high-value goods, a faster transit time is more essential: Time is money. Higher-value imports from Northeast Asia for which a waterborne route makes sense will likely continue to arrive via West Coast ports even after the Panama Canal expansion is complete. (See table.)

So, where does East meet West? Consultants and researchers have estimated a dividing line called the “transportation cost equivalence line” where it is equally cost effective to ship through West Coast ports combined with intermodal transportation as it is to ship through East Coast or Gulf ports. By recent estimates, this line runs about 300 miles from the East Coast, which means most regions of the United States are served more cheaply through West Coast ports. (See map.) With the opening of the Panama Canal, this line may shift westward as the larger capacity of post-Panamax ships lowers the cost per TEU, although efficiency gains at West Coast ports and along the intermodal routes could offset this movement.

The region near the transportation equivalence line is considered to be the most competitive for service through ports on either coast. Large metropolitan areas in this region that generate the most intense interest include Atlanta and areas up through Detroit and Ohio, where East Coast ports stand to gain share, and Chicago, where it is more likely that the West Coast route will win out. These are large metropolitan areas that drive significant demand on the part of consumers and industry.

#### The Rail Factor

West Coast ports benefit from cost efficiencies for rail on the cross-country eastbound routes. Generally, goods are transported to inland destinations such as Chicago, Memphis, and Dallas by double-stack trains, providing an obvious cost advantage over single-stack cars and trains. In addition, the large container volumes arriving in West Coast ports allow for transfer to larger unit trains, carrying a single type of commodity all bound for the same destination. Unit trains provide cost savings and faster shipping times because they can make nonstop runs between two terminals, avoiding the need to switch cars at intermediate junctions.

These efficiencies are not as easily obtained in the more congested East Coast region, which leads to a heavier

reliance on trucking as the primary mode of inland container transport for East Coast ports. For a number of eastern metropolitan markets that are 300 to 500 miles inland, rail enjoys cost advantages, and these areas would be precisely the target markets for liner operators that want to leverage the capacity of Post-Panamax vessels. The drive to provide this lower-cost rail alternative, in addition to environmental objectives and other factors, has already led to improvements in rail infrastructure.

Railroads on the East Coast, specifically Norfolk Southern and CSX, have projects underway to increase rail capacity and efficiency in anticipation of increased intermodal traffic from East Coast ports. From the railroad’s perspective, it doesn’t matter if the increase in traffic is organic or stems from growth in world trade or the Panama Canal expansion. In order to move more freight more quickly, railroads will need to be able to carry the shipping containers double-stacked — an endeavor complicated by the many tunnels and bridges that obstruct passage. Through private and public partnerships, projects to upgrade the railroad infrastructure are reducing these possible bottlenecks and better linking the ports on the East Coast with inland markets.

One such project, the Heartland Corridor, completed in 2010, was an investment project undertaken by Norfolk Southern with state government support. The Heartland Corridor connects the Port of Virginia to the Midwest states — clearing overhead obstacles from Norfolk to Lynchburg, through West Virginia and on to Columbus, Cincinnati, and Chicago. Another corridor investment project involving Norfolk Southern, the Crescent Corridor, runs from the Port of New York through Lynchburg, Charlotte, Atlanta, and Memphis to New Orleans. CSX’s National Gateway is another multistate project that parallels the I-95 corridor between North Carolina and Baltimore, then along the I-70 corridor between Washington, D.C., and Pittsburgh and on to Northwest Ohio. These projects represent significant opportunities for cost savings and stand to benefit all parties involved, from the railroad companies, to the port authorities, shippers, and finally consumers.

#### Are East Coast Ports Ready?

The effect of larger vessels passing through the Panama Canal from Northeast Asia to the East Coast will depend not only on the cost savings of an all-water route and efficiencies on the intermodal segment but also on the capacity of East Coast ports to accommodate the increased volume of cargo. Factors such as channel depth, terminal capacity and infrastructure, access to intermodal operations, and productivity will determine whether the East Coast ports can fully utilize the efficiency offered by post-Panamax vessels.

Many ports on the East Coast are constrained by channel depth, as post-Panamax vessels require a channel of around 50 feet. Norfolk, Baltimore, and New York are currently the only ports with 50-foot channels, although

the 45-foot channel depth at the port of Charleston can service some post-Panamax vessels at high tide. While the channel of the Port of New York/New Jersey is deep enough for the larger vessels, the ships will not be able to call at the port until the height of the Bayonne Bridge is raised to allow the high stacks of containers to pass under it — a project currently underway and expected to be open to post-Panamax vessels by the end of 2015. Other East Coast ports, such as Savannah, Miami, and Charleston, have projects underway to deepen channels and expand terminal capacity for post-Panamax vessels.

Meanwhile, the terminals at Norfolk and Baltimore are already serving post-Panamax vessels coming through the Suez Canal. Both terminals are equipped with giant super post-Panamax cranes — taller than a 14-story building and able to reach 22 containers across a container ship and lift more than 185,000 pounds of cargo. Efficiency of port operations benefits the port itself by generating higher revenues but also provides savings to shippers that want to minimize transit time for their cargo. Other efforts include expanded container storage to allow for the discharge and temporary storage of containers as well as improved gate processing to move trucks in and out more quickly. All of these improvements are essential to provide service to larger ships and increased volumes of cargo.

Clearly, policymakers believe increased port activity will generate economic benefits for the regional, and even state-wide, economy. It is difficult, however, to quantify the potential regional benefit due to the uncertainties regarding the ultimate volume of increased container traffic to the ports resulting from the Panama Canal expansion.

A study of the likely economic and fiscal effect on the Greater Baltimore region considered two possible scenarios for increased container volume at the Port of Baltimore — on the lower end, volume rises by 10 percent over current levels, while on the higher end, it rises by 25 percent. According to the study, prepared for the Economic Alliance of Greater Baltimore by Towson University's Regional Economic Studies Institute (RESI), the increase in containerized volume could, in the low-end scenario, add an estimated 107 jobs and \$5.5 million in wages; in the high-end scenario, the growth would bring 266 jobs with an additional \$13.9 million in wages. Employment growth stems from the jobs created directly at the port as additional workers are hired to handle cargo, plus other jobs created by associated businesses in

## Transportation Cost Equivalence Line

The transportation cost equivalence line defines where it is equally cost effective to ship through West Coast ports combined with intermodal transportation as it is to ship through East Coast or Gulf ports.



SOURCE: CBRE Port Logistics Group, "Transportation Cost Equivalence Line: East Coast vs. West Coast Ports" (July 2014)

warehousing and distribution and other business services.

The RESI study was motivated by a proposed public-private partnership investment in a rail intermodal facility in southwest Baltimore that would have improved rail access given the local tunnel obstructions that limit the use of double-stacked containers. Proponents believe that the facility is critical to the ability of the Port of Baltimore to capture increased container volume resulting from the expansion of the Panama Canal. In fact, the RESI study predicted a loss of 50 percent of the Port of Baltimore's containerized cargo traffic, and an associated contraction in employment, wages, and tax revenues, if the project does not proceed. In late August, the state of Maryland withdrew its funding for the project due to concerns of citizens living in the vicinity of the proposed intermodal facility.

## Conclusion

Significant investments are taking place in East Coast ports and the railways that serve them to accommodate the increase in large ships that will arrive when the Panama Canal expansion is complete. It is important to bear in mind that large ships are already coming through the Suez Canal to those ports on the East Coast that can handle them. Growing trade with Southeast Asia and the Indian subcontinent will only accelerate the trend toward larger ships calling on the East Coast. How ready ports are in terms of channel depth may not matter as much as where our growing trade is originating from, where goods are destined for in the United States, and what types of goods are being shipped. Cost savings will affect shipping routes on the margin, but trade volumes are expected to increase over the next 25 years so the East Coast ports will benefit even if they don't steal market share from the West Coast. **EF**