The expansion of the Panama Canal, set for completion in 2014—the canal’s centennial—could become a point of inflection for trans-Pacific goods movement. Many stakeholders believe the expansion offers a game-changing opportunity, and there has been a great deal of speculation, analysis, and publicity regarding its anticipated benefits.

There is no doubt that an expanded canal will allow larger vessels to ply the all-water route from Asia to the East and Gulf Coast regions of North America. It’s also clear that the expansion will significantly increase the canal’s capacity and will support continued volume growth in this trade. However, cargo routing ultimately is a function of shippers’ supply chain optimization, not of ocean carriers’ linehaul economics. In addition, the canal expansion will not provide any benefits to shippers that are not already available today, so there will be no unfulfilled demand for East Coast ports to fulfill. For that reason, many ports that are relying on the canal expansion to generate astronomical post-2014 growth will be very disappointed. A look at this issue from both the shipper’s and the carrier’s point of view explains why.

Why expansion is vital
To comprehend post-2014 economics, it is necessary to understand the basis for the canal expansion. The Panama Canal was begun by the French in 1880 as a sea-level canal (the method used to build Suez) and completed by the United States in 1914 with two sets of three locks, one at the Atlantic and one at the Pacific end of the canal. Since then, many ships have been built to accommodate “Panamax” dimensions—sometimes fitting within the canal with just inches to spare.

While 2014 is viewed as a watershed date, 1999 is equally important. Based on the Torrijos-Carter Treaties of 1977,1 the Hay-Bunau Varilla Treaty of 1903 was abrogated and Panama was granted control of the canal after 1999. Alberto Alemán Zubieta was appointed Administrator of the new Panama Canal Authority (ACP); he and the entire professional staff had been with the Panama Canal Commission, the
United States government agency responsible for operating the canal for the benefit of the public. The canal had now a new raison d’être. Under U.S. control, it had been administered like a utility. Prices had been regulated to break-even after all expenses and a slight return had been recouped. Under the ACP, by contrast, the Canal was viewed as an economic engine, and a number of innovative ideas were forthcoming. The canal (for trade and transportation) and dry port (for warehousing and logistics) became a logistics hub; enlightened (so the canal could increase economic growth and diversify economic activity); and creative (become an eco-tourism center). The political and economic goal often cited by ACP executives was “Panama to become the “Singapore of the Western Hemisphere.”

Consequently, for the benefit of the public, the canal’s container traffic began to significantly increase. This was due to three factors. First, the primacy of the U.S. West Coast (USWC) route was being challenged. For 25 years, the preferred routing for trans-Paciﬁc containers had been intermodal shipment over the USWC. However, by the mid-1990s, that system was beginning to show strain. Railroad capacity—which had appeared to be increasing during the 1980s—was becoming problematic because the railroads had reached network equilibrium after reducing trackage and reducing train frequency. The 1995 floods and railroad network meltdowns from 1995 through 1999 highlighted this weakness.

Second, the new gateway of Los Angeles-Long Beach in California’s San Pedro Bay (hereafter referred to as “San Pedro”) was becoming congested at the same time the political environment was becoming less welcoming to port expansion.2 And at the same time the political environment was referred to as “San Pedro”) was becoming congested. The railroad network meltdowns from 1995 through 1999 reached network equilibrium after reducing trackage and reducing train frequency. The 1995 floods and railroad network meltdowns from 1995 through 1999 highlighted this weakness.

Finally, water-ﬁll on the West Coast had become troublesome. The 2002 lockout, which shut down major ports for 10 days, was extremely costly for shippers.

Shippers wanted to diversify routes in order to mitigate their exposure to problems related to the USWC’s water carrier service via the U.S. East Coast (USUEC). There were a number of reasons why the ACP was attractive. Foremost was the pas- sage of the Ocean Shipping Reform Act (OSRA) in 1998, which introduced conﬁdentiality into the deals- ing between shipping lines and customers. As contract carriage replaced common carriage, carrier conferences dissolved, and all carriers became distinct from those for intermodal service over the USWC.

With the introduction of larger vessels in the Asia- Europe and trans-Paciﬁc services sector, the volume of Panamanian-size vessels shifted to the all-water route. Meanwhile, western U.S. railroads were steadily increasing their rates, leading ocean carriers to encourage cargo to shift to all-water routes by dis- counting those rates compared to rates for transcon- tinental intermodal service. At that time, the labor disputes, problems with rail cars, and shipping con- cerns, and the fear of railroad failures that troubled the West Coast were largely absent on the USUEC.

All of those developments led to an increase in the volume of cargo and the number of daily transits through the canal.3 The ACP recognized that the canal was becoming capacity-constrained and that without an expan- sion, the canal would eventually become obsolete.

Accordingly, a US $5.2 billion expansion of the Panama Canal was approved in a national referendum in 2006. It includes a third, larger set of locks that will be wide enough and deep enough to accommodate larger vessels. This will signiﬁcantly increase the number of canal transits while allowing larger ships to transit the canal. After extensive study, the ACP decided upon a lock size that would accommodate date ships of 12,600 TEUs (20-foot equivalent units).5 Clearly, a canal expansion is of critical importance to the international container trade, which currently generates about 50 percent of the canal’s toll revenue, but they represent only 25 percent to 30 percent of total transits. The major- ity of canal transits are ships carrying noncontainerized cargoes. In 2009, in fact, the fastest-growing type of canal transit is the Ro-Ro (Roll on/Roll off, 15-18 knots) and “super-slow steaming” (10-15 knots). While this strategy required them to add vessels, there were plenty available at a reasonable price.

The container (liner) trade is not the only segment of the maritime shipping industry that is likely to beneﬁt from the Panama Canal expansion. The container ship trade is growing at a rate of approximately 8 percent a year. The total number of containers shipped grew from 185 million in 1980 to 1 billion in 2005.

The U.S. Gulf may source oil from Ecuador (instead of Nigeria) and liquid natural gas (LNG) from Peru. U.S. grain exports—currently moving by rail over the USWC—are now moved by barge to southern Louisiana and then through the Panama Canal en route to Asia.3

The trans-Panama pipeline may become obso- lete once larger tankers are able to transit the canal. Refrigerated vessels may be displaced by con- tainerized movement, provided loading ports have the proper terminal infrastructure.
8,000-TEU vessels now call only at Los Angeles and Long Beach. In the South American trades, load centering has occurred as port infrastructure has improved. In short, with the exception of North America, most minor ports worldwide are primarily served by transshipment at the larger ports to smaller ships.

Figure 1 illustrates import port calls and vessel sizes for USEC and USWC services as of January 2011. It clearly demonstrates the dichotomy between USEC’s U.S. East Coast (smaller vessels/more port calls) and U.S. West Coast (larger vessels/fewer port calls). As USEC vessel size increases, then, the number of port calls can be expected to decrease.

“Shipper math” versus “carrier math”

All enterprises seek to optimize their results, generally by maximizing or minimizing a specific objective, subject to inputs. Depending on what you calculate they use to define success, different types of organizations will have different objectives. While this may seem blindingly obvious, participants in the debate over the impact of the expanded Panama Canal generally fail to consider the significant differences between shippers’ and carriers’ objectives, and how they shape each party’s saving decisions. Consider the shippers’ objectives:

- **Maximize revenue.** For retailers, this can translate into never losing a sale. This objective manifests itself as holding large safety stocks and always choosing the fastest transit times.
- **Minimize transportation expense.** Many shippers still measure transportation expenses a standalone goal. This may be appropriate for low-value, traded commodities, where transportation is a major component of delivered cost, but it may be less important for high-value imports.
- **Optimize the supply chain.** In this textbook case, all factors are integrated into a strategy that aims to achieve what is best for the overall enterprise.

The shipping lines that serve shippers have their own objectives:

- **Maximize profitability.** Although this could be a goal for ocean carriers, in recent years the industry has focused on the other three objectives.
- **Maximize load factor.** This is a combination of the first two. It seeks to handle as much business as possible (that is, maximize revenue), but to do so with existing vessels so as to avoid paying for commercial feeders (minimize expense). Some have referred to this strategy as “going broke with full ships.”
- **Maximize market share.** Although this strategy seeks to avoid expenses, especially when payments to outside vendors. For many ship lines, this involves controlling payments to North American railroads and trucking companies.8
- **Maximize market share.** Although this could be a goal for ocean carriers, in recent years the industry has focused on the other three objectives.

Some of these objectives appear to be similar, but shippers and carriers’ goals may not be the same under different transportation outcomes. In other words, what is beneficial to shippers may be costly to carriers, and vice versa.

One of the complexities confronting ship lines is that in the inbound trans-Pacific trade to North America, services are not just port-to-port. A great deal of cargo is handled by the line beyond the port of discharge, with the ocean carriers contracting and paying for the inland transportation. In the problem is that marginal inland revenue is less than marginal inland expense. In other words, over time, the lines pay more in inland expense than the additional revenue they collect for movement to the discharge port. The result is a steadily decreasing financial contribution the further inland a container moves. For this reason, ocean carriers are looking to reduce their inland expenses—and using the post-2014 canal would appear to offer that opportunity. But what is optimal costwise for the ship line is not necessarily optimal for its customer. Since ocean carriers subsidize inland movement, the lowest transportation expense for intermodal cargo can be achieved by loading containers at the factory and moving them intact to the warehouse or distribution center (DC) in North America. But this approach frequently raises the landed cost for the shipper because it requires higher levels of inventory. This is quite significant because for many importers, inventory-related costs often exceed the total cost of transporting their goods from Asia.

As an alternative, many importers utilize a transloading strategy characterized by inventory deferral. Rather than determine the final U.S. destination when issuing purchase orders or consolidating cargo in Asia, importers defer the inventory-deploy- ment decision—often at the stock-keeping unit (SKU) level, facilitated by real-time sales reporting that identifies demand fluctuations—until arrival in the United States. Then the cargo is transloaded from marine containers to domestic equipment for either local markets or further movement. The shipper’s savings from inventory deferral depends on the mix of inland destinations and the value of the cargo. In benefit of this transloading strategy is the ability to reduce safety stock without losing sales. This is a complex, nonlinear decision based on the variability in lead times and transit times of the routes selected, the volume assigned to each route, and the statistical error in sales forecasts. Because sales forecast errors increase exponentially with time, the time component of shipment routing will necessarily impact the safety stock calculation.9

The number of destinations also affects safety stock. The more destinations a shipper can consolidate and then apply inventory deferral, the greater the opportunity to reduce safety stocks. The potential savings for an importer with one or two DCs, therefore, would be less than for an importer with 30 or 40 facilities. While this transloading strategy started in southern California, many importers have implemented a “four corners” version. In addition to transloading in the Pacific Southwest, inventory deployment operations have been established in the U.S. Northwest and Midwest and South Central (Pennsylvania); and Southeast (Georgia). Transloading also benefits ship lines, because it eliminates the cost and effort of inland movement and allows their containers to return to Asia much faster. It is my opinion that transloading is much more prevalent than previously understood. In 1980, the east-coasting freight flow in the U.S. was about 15% of total: from Chicago to Los Angeles. Today, it is completely reversed. The only way to explain this transformation is that eastbound movement is driven by import transloading.

There is plenty of evidence of an increase in transloading. Figure 2 examines USEC 40-foot container imports and subsequent inland movement. The 11 states west of the Rocky Mountains comprise

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20 percent of the U.S. population, so one would expect about 20 percent of imports to remain on the West Coast. Therefore, the gap between 80 percent (the expected percentage of containers moving intact) and 38 percent (the actual percentage moving intact) represents transloaded volume in 2010. This demonstrates that transloaded containers (measured in TEUs) now outnumber intact boxes. This flow, however, is a little more complicated. Figure 3 examines how import cargo discharged on the USWC is moving. In 2000, 60 percent of all cargo discharged on the USWC moved intact to inland destinations. However, a wide variance by destination developed over the past 10 years. From 2000 to 2010, the amount of cargo moving intact to the Midwest and South Central regions decreased by 5 percent, and intact cargo moving to the Northeast and Southeast declined by 37 percent. There was also a significant drop in total intact cargo movement from 2008 to 2009. This indicates an increase in transloading in response to reduced sales.10 Shippers adopted this strategy because the only way to reduce inventory without increasing sales is to reduce safety stock by transloading. It should also be noted that shippers’ routing decisions change over time based on various economic and operational factors. Consider Figure 6, which illustrates the changing itineraries of goods manufactured in China’s Pearl River Delta through delivery to a Chicago distribution center. The point here is that what makes economic sense to shippers today may not be the case in the future.

Clearly, a significant percentage of USEC container movement was diverted from intermodal to all-water. Transit time is another factor that influences the choice of intermodal over the West Coast or all-water service to the USEC. It is not unreasonable to assume, for instance, that a great deal of all-water cargo consists of lower-valued or seasonal cargo shipped well in advance of when importers anticipate it will be needed. High-value, time-sensitive cargo generally moves over the USWC, either intact or transloaded. Slow steaming has increased transit time for all shippers, however. It may also have contributed to the increase in transloading. Figure 5 compares transit times from Asia to Columbus, Ohio, over the USWC and USEC. On traffic moving over the USWC, transloading may offer better inland transit times because domestic intermodal’s off-dock departures can provide simultaneous service to many destinations, whereas international intermodal can be delayed for days waiting for sequential processing of on-dock departures for various destinations. Additionally, domestic intermodal, which has a service speed of 55 miles per hour, is viewed as having a more predictable transit time than international intermodal, which has an average speed of 40 miles per hour and is frequently delayed due to switching and train consolidation in the port area after on-dock loading.

It should also be noted that shippers’ routing decisions change over time based on various economic and operational factors. Consider Figure 6, which illustrates the changing itineraries of goods manufactured in China’s Pearl River Delta through delivery to a Chicago distribution center. The point here is that what makes economic sense to shippers today may not be the case in the future.

Shipper and carrier math applied

Figure 7 is a pro forma examination of import cargo moving from Shenzhen to Columbus, Ohio. Columbus was selected because it is frequently cited as a destination that can be “converted” to intermodal service via the USEC. The numbers shown are representative of market conditions in May 2011; however, the results should remain unchanged as rates rise and fall. The analysis, which utilizes the transit times shown in Figure 5, is as follows (all costs in U.S. dollars):

A. There is a large incentive for ship lines to move over the USEC because the intermodal rail savings of $800 ($1,300–$500) are much greater than the cost of operating the ship over the additional distance plus the Panama Canal tolls ($250).
B. However, the savings for shippers are trivial because the USWC and USEC rates are almost the same ($3,300 versus $3,200) and the transit time to the USEC is longer. For most cargo, the additional eight days will cost the shipper much more than $100.
C. Post 2014, lines could attract Columbus-bound cargo via the USEC by cutting the rate (for example, a $50 reduction, from $3,210 to $2,700).
D. If 8,000-TEU vessels start serving the USEC, it is possible that 12,000-TEU vessels could start serving the USWC. This would probably eliminate any vessel cost savings the lines would obtain on the all-water route from deploying 8,000-TEU vessels.
E. The rate reduction (envisioned in C) will reduce the line’s all-water contribution to less than it would achieve by moving the cargo over the USWC ($1,950 versus $2,000).
F. The rate reduction (envisioned in C) will also

In 1975, goods were manufactured in Hong Kong, where they were delivered to container freight stations (CFS) at the port for container stuffing and vessel loading. Upon vessel discharge in Oakland, California, the container was devanned for delivery to Chicago, Illinois. (While some cargo may have been loaded directly into trucks, a great deal was moved by boxcar.)

In 1985, goods were now being manufactured in Shenzhen, China; however, the cargo was still being delivered to a Hong Kong CFS for container stuffing and vessel loading. Upon vessel discharge in one of California’s San Pedro Bay ports (Los Angeles or Long Beach), the container was moved intact for delivery to Chicago, Illinois. (While some cargo may have been loaded directly into trucks, a great deal was moved by boxcar.)

In 1995, goods manufactured in Shenzhen were now being delivered to a local CFS for container stuffing and vessel loading. Upon vessel discharge in San Pedro, the container was moved intact by rail to Chicago.

In 2005, factories in Shenzhen were so large that goods manufactured there were loaded into full containers at the factory and delivered to a local port for vessel loading. Upon vessel discharge in San Pedro, the container could either be moved intact by rail, or it could be devanned into truck trailers or domestic containers for delivery to Chicago.
vs. vs.

6 vs. vs.

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vs.

Panama Canal Expansion: Game Changer, or More of the Same?

* = after Panama Canal expansion

USWC = U.S. West Coast

USEC = U.S. East Coast

IPI = Inland point intermodal

RIPI = Reverse inland point intermodal

(SOURCE: T. PRINCE & ASSOCIATES LLC)

Shenzhen to Columbus, Ohio

<table>
<thead>
<tr>
<th>Shippers Math</th>
<th>Carrier Math</th>
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<tbody>
<tr>
<td>Vessel Extra</td>
<td>Via USEC</td>
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<tr>
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<td>$2300</td>
</tr>
<tr>
<td>Average</td>
<td>High</td>
</tr>
</tbody>
</table>

A Line could make more money if it shifts to USWC because USWC exports to 12,000-TEU vessels.

B Today there is no such thing as the USWC because rate (vs. vs.) does not compensate for extra transit time (vs. vs.).

C After a successful Panama Canal expansion, it is time to consider shifting to USWC. Additional vessels, to attract more RIPI, will tend to reduce cost (vs. vs.), to lower the USWC load.

D No vessel cost reduction (vs. vs.) if USWC moves to 12,000-TEU vessel.

E However, reduced rate (vs. vs.) reduces contribution (vs. vs.) to lower than moving via U.S. West Coast PI (vs. vs.).

F Also, reduced rate (vs. vs.) is incremental business diluting vessel contribution (vs. vs.).

G Of course, East Coast ports will debate proper level of (vs. vs.) and railroads (eastern and western) can impact (vs. vs.).

(SOURCE: T. PRINCE & ASSOCIATES LLC)

California, and Jacksonville, Florida, will remain minor all-water players and will continue to rely on other business segments to prosper.

In the Mid-Atlantic, the Hampton Roads area of Virginia can be described as the second-largest Southeastern port, the second-largest Northeastern port, or the largest Mid-Atlantic port. None of those qualities to it become a major trans-Pacific hub.

However, the number of distribution centers located in Virginia ensures that it will remain relevant as a major regional gateway. The same probably applies for Baltimore, Maryland. Both Hampton Roads and Baltimore also have major presence in other shipping segments.

Hope for ports in the Gulf of Mexico probably is over. Tampa, Florida; Mobile, Alabama; and New Orleans, Louisiana, simply don’t have critical mass and geographic to be a trans-Pacific hub. The Port of Mobile, Florida, has a local population, but not much else. Houston, Texas, has enough local cargo to support only one vessel a week.

Convenient and transit time preclude any hinterland connectivity.

The most interesting opportunities may open up for well established Caribbean ports such as Kingston, Jamaica; Freeport, Bahamas; and Colon, Panama. (While the Panama Canal and that country’s ports are governed separately, the ACP closely coordinates with Panamanian port management.) These ports could emerge as transload centers—much like Singapore; Tanjung Pelepas, Malaysia; and Algeciras, Spain. Should this occur, carriers might deploy ships larger than 8,000 TEUs to a single Caribbean port.

Containers destined for anything other than the major East Coast gateway ports will transit these network nodes by feeder vessels. (Seaports in the United States are excluded from serving in this role because the cabotage provisions contained in the Jones Act require any vessels carrying containers between U.S. ports to be U.S.-built, owned, and crewed.)

FIGURES 8 AND 9 analyze the port call distributions on the U.S. West and East coasts. Figure 8 (which also includes the Canadian ports of Vancouver and Prince Rupert) shows the clear dominance of the San Pedro ports of Los Angeles and Long Beach as the USWC load center. Not only does San Pedro have the most vessel calls, it also has the lowest average import cost. This is also true of the import order for all vessel calls. A value of 1.00 is the lowest possible score, and would indicate that every vessel call was a first call.

Since ports compete for discretionary intermodal cargo—which traditionally is discharged at the first import port call—the lower the average import order, the more intermodal cargo is probably being handled. Figure 9 shows a little more varied situation on the

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that this market share is protected and maintained. The canal may also become a driver of transportation and logistics growth in the Caribbean.

In all likelihood, whatever cost advantages the canal expansion facilitates for the lines will be passed through to shippers. However, as this analysis demonstrates, there is a dichotomy in how shippers route cargo. And unless routing cargo through an expanded canal helps shippers substantially improve their overall supply chain costs, they will not greatly increase their usage of all-water service from Asia to the USEC. If such savings were present, shippers would abandon the USWC today—something that is not happening. It is also likely that as the size of container ships in the U.S.-Asia trade increases, carriers will increasingly concentrate vessel calls at fewer USEC ports. It seems clear that the Panama Canal Authority and only a handful of USEC ports will benefit after 2014. The other USEC ports would do well to remember the words of former Montreal Mayor Jean Drapeau, who said, “The Olympics can no more lose money than a man can have a baby.” Following the 1976 Olympics, the city was left with a debt that took 30 years to repay. Some ports that are betting on a post-2014 cargo boom could suffer a similar fate.

Notes:
1. There were two treaties, although they are frequently referred to in the singular. The first assures the canal’s neutrality and grants the United States a permanent right to defend the canal from any threat to its continued neutral service “to ships of all nations.” The second treaty provided that Panama would assume full control of canal operations from 12 a.m. on December 31, 1999. This was later changed to December 15 due to concerns about potential “Y2K” technology problems.
2. The National Resources Defense Council led a string of legal victories over the ports that effectively halted expansion for almost a decade. However, at some point the question becomes not what physical size can be accommodated, but what size will the market profitably support?
3. These rate-setting organizations established rates that would be used by all conference member lines and a specific customer. To maintain rate discipline, prices could vary only minimally. Thus, a shipment moving over the U.S. West Coast from Asia with a 16-day transit time frequently paid the same rate as one moving between the same origin and destination with a 30-day transit. Any rate reductions for all-water service that did exist were not significant because lines insisted that the cost of the additional vessels required to provide all-water service offset the nil intermodal expense. There was also a desire by the carriers APL and SeaLand to protect West Coast rates at all cost because they did not provide all-water service to the East Coast.
4. A transit is a vessel that has paid a toll. Smaller vessels often are combined into a single lockage (passage through a set of locks), which is the scarce resource. Larger vessels must transit by themselves.
5. The “New Panamax” ship dimensions will be: draft, 15.2 meters (up from 12.04 meters); beam, 49 meters (up from 32.31); and length, 366 meters (up from 294.13).
6. This advantage will exist even after 2014. However, at some point the question becomes not what physical size can be accommodated, but what size will the market profitably support?
7. Over the past five years, daily charter rates have varied wildly, especially with the current glut of vessel capacity. As of December 2011, a 3,500-TEU Panamax vessel might cost US $3,300 a day, a dramatic drop from the $35,000 a day the same ship might have cost to charter in 2007.
8. While intermodal transportation exists elsewhere in the world, it is only in North America that the ocean carrier, rather than the shipper (or freight forwarder), pays for it.
10. This strategy is also indicated by the Inventory to Sales Ratio (ISRATIO) monitored by the Federal Reserve Bank of St. Louis, Missouri, USA. http://research.stlouisfed.org/fred2/series/ISRATIO.
11. A major exception to this strategy is Savannah, Georgia, which has marketed directly to major retailers. Those shippers routed the cargo and effectively forced lines to call at Savannah rather than at the historical load center in Charleston, South Carolina.
12. This analysis is from the perspective of USEC all-water container services to and from Asia. Many of these ports have a significant presence in other lines of business and/or container geographies.

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