Reversals of fortune

US ports face a range of difficult – but not intractable – problems, related to capacity, capability and connectivity. **Dr Asaf Ashar**, of the US-based National Ports & Waterways Institute, suggests a range of measures that would enable them to cope with future traffic growth.

There is a wide perception that US ports are facing 'intractable problems' in the long run, with the main areas of concern being capacity, capability, and connectivity. The first concern, port capacity, stems from prevailing trade forecasts, indicating long-term growth rates of 5% to 6% annually. These growth rates may seem modest in light of the 13.5% reported last year (see *CI Regional Review: North American Ports – August 2003*). However, when extended over 20 years, they amount to an overall growth of 300% to 400%.

The port capacity for handling the trade is determined by the physical size of terminals, usually measured by terminal acres, and their productivity, usually measured by TEU/acre. Port experts claim that operational and technological improvements could boost present productivity of 4,000 to 5,000TEU/acre to, perhaps, 8,000 to 10,000TEU/acre. A more realistic figure would be 6,000TEU/acre, or 150% of the present productivity.

The rest of the capacity is expected to be provided by adding terminal acres, which means that there is a need to at least double the current amount of terminal acres. But adding terminal acres is becoming increasingly difficult in light of the severe shortage in developable waterfront land and growing environmental resistance. Hence, the growing gap between demand and supply for terminal capacity, especially in the long run, and the respective perception of an 'intractable problem'.

The second concern, capability, hinges around large post-panamax ships expected in the future and their requirements for deeper and wider channels and turning basins. For convenience of this discussion, post-panamax ships are divided into three generations: Post I, with 14 to 15 rows across and on-board capacity of up to 5,500TEU; Post II, with 16 to 18 rows and capacity of up to 10,000TEU; Post III, with 19 to 22 rows and capacity greater than 10,000TEU. Post II ships, with 17 rows across and capacity of 8,000TEU, are the largest ships presently in operation.

Following the recent wave of new buildings, Post II are also becoming dominant in the Asia-North America transpacific trade. Post III are not in existence yet, although there is wide agreement that they will emerge within five to10 years. The channel depth requirements for unrestricted handling of Post II and III are 50ft and 52ft respectively. While some US ports already have channels of these dimensions (or close), the majority fall short.

The third concern, connectivity, mainly relates to the US West Coast (USWC) ports and their landbridge services to the US hinterland. There are no reliable statistics of the amount of cargo handled by these bridges. An estimate, based on ship capacity, is that about 75% of the non-local cargo is handled by USWC ports, with the rest handled by US East Coast (USEC) ports. Accordingly, close to 60% is handled by the bridges. This vast cargo flow moving to the hinterland creates severe congestion in and around USWC ports, which might become unbearable in light of the above-mentioned forecast.

Assessing the capacity, capability and connectivity concerns and the related perception of 'intractable problems' is the objective of this article. Three general long-term trends are incorporated into this assessment: the increasing influence on cargo routeing of large retailers and importers with integrated supply chains and large distribution centres in port regions; the emergence of the 53ft trailer and, especially, the 53ft domestic container as the dominant intermodal transport unit; and the proliferation of transhipment and the influence of large and efficient 'pure' transhipment hubs on service patterns. The following sections review the port situation in each of the three US coasts.

The USEC has a favourable geography for ports, with many river estuaries, barrier islands and natural bays. As a result, USEC ports are almost evenly distributed along the coast, roughly 100 miles apart. Altogether, there are 11 ports: Halifax (Canada), Boston, New York, Philadelphia, Baltimore, Norfolk, Wilmington, Charleston, Savannah, Jacksonville, and Port Everglades/Miami. Most of the USEC traffic and, especially, the Asian trade, is handled by four major ports, each handling 1 million TEU and more annually: New York, Norfolk, Charleston and Savannah. The rest can be considered for the purpose of the following analysis as secondary.

The expansion plans of USEC ports involve the minor enlargement of existing terminals, the conversion of existing breakbulk terminals and the development of 'greenfield' terminals. The first measure is taken by New York and Miami, since both suffer shortage of waterfront land. Charleston and Savannah both have large non-container terminals, so prefer the second option, including the conversion of the 250-acre Navy Base in Charleston. Two ports are currently pursuing large new terminals – Norfolk and Jasper County terminal, near Savannah. Two additional ports have sites that may re-emerge in the future.

In total, there are five possible sites: Craney Island, Norfolk, an artificial island created by dredged materials with a total of 800 acres; Cox property, Norfolk, recently acquired by APM Terminals, part of AP Møller-Maersk, with 570 acres; Stevedoring Services of America (SSA) site near Savannah, with 800 acres for first phase out of a total of 1,800 acres; Charleston's Daniel Island with 1,200 acres; and Quonset Point Davisville Complex (RI) north of New York, with a total of 3,000 acres. Altogether, the combination of expanded, converted and new terminals could triple the area of USEC major ports. Hence, considering operational and technological improvements, these ports seem to have sufficient capacity to cope with future demand.

Unlike the case with capacity, USEC ports are severely constrained in their capability. Only

US EAST AND WEST COAST PORTS – HOSTAGES TO FORTUNE?

- **US East Coast (USEC) and West Coast (USWC) ports are perceived to face a range of 'intractable problems'.**
- **The main areas of concern are the capacity of their terminals, their capability to handle ever larger container ships and their connections with their hinterlands.**
- **On the USEC, solutions include development of new facilities, deepening of navigation channels, the creation of offshore hubs and the dispersal of cargo to secondary ports.**
- **On the USWC, possible solutions focus on the diversion of non-local cargo from the Pacific South West to the Pacific North West and on all-water services to USEC, the development of inland ports and shuttle trains.**

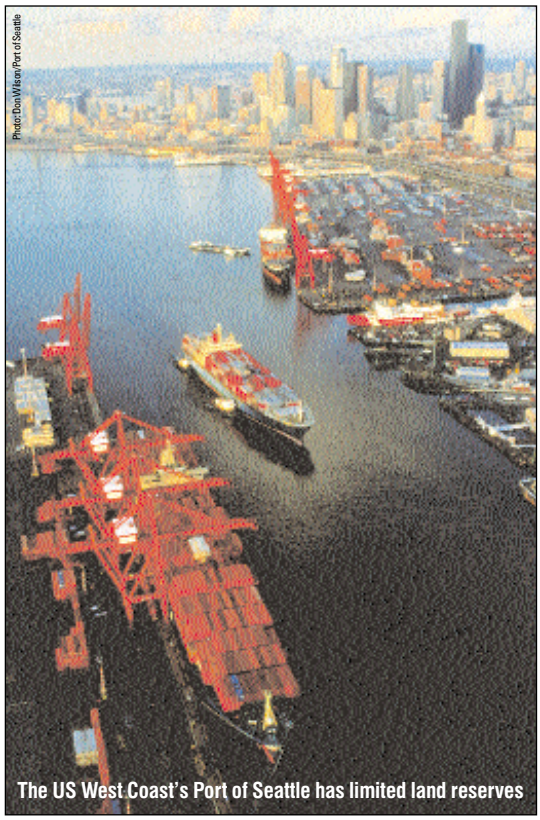
Photo: Don Wilson/Port of Seattle

The US West Coast's Port of Seattle has limited land reserves

two ports on the USEC, Norfolk and Halifax, can currently accommodate Post II. These two also seem to be the only ones capable of handling Post III in the long run. The rest expect that following the implementation of pending dredging programmes, they will be able to handle Post II, albeit with difficulties. The most notable of these projects is New York's 50ft channel, expected to cost $1.8 billion.

Following the Panama Canal expansion, lines are likely to deploy Post III on their main all-water services, the preferred route for the growing Chinese trade, and to a lesser extent on Suez's all-water services. Because of constraints in USEC port capability, deploying Post III would trigger a change in the existing service patterns of Asia-North America services, which typically call at three USEC ports, usually – but not always – New York, Norfolk and Savannah. In the long term, following the canal's expansion to allow Post III, lines attempting to deploy these ships on their cross-canal services will be unable to maintain their present service patterns, especially direct calls in New York and Savannah.

One possibility is to develop a USEC-based transhipment hub, perhaps using one of the new greenfield terminals. This, however, would be cost-prohibitive due to the combination of Jones Act requirements for high-cost US-flag feeders and high-cost handling in US ports. Coastal distribution by trucks – the common practice now – is already expensive, and will be even more expensive in the future as congestion grows in coastal arteries.

Another alternative is to focus future service patterns on offshore hubs, similar to that of Freeport, Bahamas. Feeder loops could also serve other mainline services, such as those coming from South America, the Mediterranean, South Asia, etc. The hub-and-spoke pattern involves double-handling, adding both cost and time. However, both could be more than offset by eliminating coastal legs and port calls of several mainline services and substituting them for a single regional feeder. Also, future hub ports are expected to be more efficient and less costly.

Even larger savings are involved in the substitution of coastal trucking, which, in the case of the 230-mile New York-Boston route, amounts to $500/box. In comparison, adding a call at Boston by a feedership calling at New York could cost about $200/box (depending on number of boxes), most of it for the extra handling in the hub. Finally, it is estimated that about 15% of New York's current cargo is destined/originated to points closer to Boston and 10% to Philadelphia/Baltimore. Serving these cargoes from Boston, Philadelphia and Baltimore could reduce New York's cargo by 25%, easing the pressure on this space-limited port.

The hub-and-spoke pattern and the related reallocation of USEC traffic over a larger number of ports – including those previously defined as secondary – have broader implications. It means that land reserves of these ports and their potential capacity could be added to those of major ports, considerably increasing overall port capacity. Another result from the 'rise' of the USEC secondary ports could be the development of distribution centres in their vicinity, taking advantage of their relatively inexpensive land and labour.

Unlike the USEC, the USWC geography is not favourable for port development. As a result, the ports are concentrated in three clusters, the largest of which is in San Pedro Bay, including the twin ports Los Angeles and Long Beach (LA/LB); the second largest is in Puget Sound, including Seattle and Tacoma; and the third in San Francisco Bay, including the ports of Oakland and San Francisco. Vancouver (BC), Canada, is close to Puget Sound, as is the much smaller river port of Portland. All above-mentioned ports (except San Francisco and Portland) are major ports, handling over 1 million TEU annually. There are almost no secondary container ports on the USWC.

For the convenience of analysis, the USWC is divided into the Pacific South West (PSW), which includes the California ports, and the Pacific North West (PNW), which includes the rest. The PSW traffic is much larger than the PNW's, which correlates with the much larger population concentration. The twin ports of LA/LB handle about 85% of the PSW cargo.

Most USWC major ports already handle Post II, and are generally capable of handling Post III containerships, with the exception of Oakland. Because of the unconstrained situation, the 'clustered' location, and the longer coast line, a hub-and-spoke shipping pattern similar to the USEC is unlikely to develop in the USWC.

Following the tremendous growth in demand, the twin ports of LA/LB have been involved in substantial planning efforts, starting with the so-called 2020 plan, first devised in the late 1980s and updated several times since. The plan involves two types of developments: consolidation and minor expansion of existing terminals to create a few 'mega-terminals'; and large-scale land reclamation and creation of large new terminals. The first mega-terminal, with 4,000ft of berthing and 292 acres of land was Pier 300 in LA, followed by the recently inaugurated Pier 400, with 7,190ft of berthing and 484 acres of terminal area (in its final stage). LB's largest terminal under construction, Pier T, has 3,700ft of berthing and about 400 acres. Altogether, both ports have about 2,300 terminal acres.

The most notable future expansion is in LB, including the 200-acre Pier S and the 400 acre-plus Pier W. LA's future expansion hinges on conversion of LACT (a coal terminal) and completing Pier 400 and Pier 300. Theoretically, there is still a vast area within the breakwater, in the Outer Harbor. However, due to environmental resistance and prohibitive cost, reclamation there should be mostly considered as unat-


Photo: Pat Robson

The US East Coast's Port of Baltimore: along with Philadelphia and Boston, the port could help to reduce New York's cargo pressure by around 25%

tainable. One especially difficult obstacle for land reclamation is the requirement to provide mitigation of a same-area wetland. Altogether, a rough, but realistic, long-term expectation would be for an addition of about 1,400 to 1,600 acres, or about 60% to 70% of existing acreage. This means that even assuming implementation of operational and technological improvements, these ports will have great difficulties in coping with future demand, as the combination of the two factors falls short of future demand.

An even more critical constraint for LA/LB is hinterland connectivity, especially the congestion created in the port area by trucking the non-local or intermodal cargo between marine terminals, distribution centres (DC) and intermodal railyards. Intermodal yards in the LA area can be categorised according to their relative location, as on-dock, or inside the port area, near-dock, within a three-mile radius, or off-dock, about 20 miles away, in the downtown LA area. The first two exclusively serve marine containers, and the third is mainly orientated towards domestic and 'domesticised' cargo, or import cargo that was 'cross-docked' in nearby DCs.

On-dock yards do not generate truck traffic in the port area outside the marine terminals. Truck traffic to near-dock yards can be confined to dedicated roads, and therefore has limited impact. Most of the impact is generated by flows to off-dock DCs and off-dock yards. Recently, due to a shortage in industrial lands, there has been a massive migration of DCs inland, to the 'Inland Empire', 50 to 75 miles away from the port and even beyond, where land and labour are less expensive (see 'California dreaming', *CI* September 2003, p67). Trucking of marine containers 50 to 75 miles has an even greater impact on traffic than flows to off-dock DCs and yards. In addition, some of the non-local containers are still trucked all the way across the Rocky Mountains.

The logical way to ease truck traffic congestion is to boost on-dock and near-dock at the expense of off-dock. A more far-reaching way would be to enhance inland DCs, using shuttle trains between marine terminals and inland DCs instead of trucks. In this case, containers could be moved immediately following their discharge from vessels to be stored in an inland container yard, with the latter serving as an 'inland terminal'.

The development of large inland terminals along with large warehousing/distribution complexes, cargo-processing facilities, intermodal yards, airports, and so on, is part of a broader trend of creating a national distribution hub, where major retailers/importers locate their national distribution centres, and through which they route large portions of their cargoes. The rail connection between these inland terminals and the US regions east of the Rockies will mainly be provided by double-stack trains of 53ft domestic containers. The domestic boxes hold almost twice the capacity of 40ft standard marine boxes. Also, unlike marine containers, domestic containers do not have to be returned, mostly empty, to USWC marine terminals.

The impact of inland ports and shuttle trains will not only be easing truck traffic, but also the increase in capacity of marine terminals. The inland terminals provide a substitute for the container yards of the marine terminals. A rough estimate of the impact of this substitution on terminal capacity is at about 30%.

The rail movement of containers to/from the LA/LB port area is routed through the Alameda Corridor. The corridor is a dedicated 20-mile, grade-separated triple-tracked route, developed through a joint venture between the railroads, ports, local and federal government at a cost of $2.4 billion. The corridor's maximum capacity was recently estimated at 150 trains/day, or about 3.5 times the current traffic. This might seem sufficient, as it correlates well with the overall cargo forecast, but it would not be sufficient if future shuttle trains to inland ports were included. These trains, although shorter than the cross-country trains, could require the same trackage capacity as the cross-Rockies trains.

The US West Coast's Port of Los Angeles, which, along with Long Beach, handles around 85% of the Pacific South West's cargo

Altogether, it seems that hinterland connectivity, which relates to both road and rail traffic in the port area, is the main constraint on the PSW ports' ability to handle non-local cargo. A possible solution could be a diversion of some of the non-local cargo to other port regions, including the PNW, using the so-called northern bridge, and the USEC, using all-water services. There is another possible diversion to the south, to Mexico, especially to Ensenada, about 70 miles south of San Diego, which is closer to Texas than LA. Since Ensenada lacks rail connection, this option is not discussed here.

The PNW is 600 to 750 nautical miles closer to Asia than the PSW, depending on port pair. For example, the distance from Hong Kong to Seattle is 5,768 nautical miles, against 6,380 nautical miles to LA. The rail distances between the PNW and PSW to the US Mid-West and north-east are the same. Hence, the northern bridge through PNW ports is faster than that through the PSW ports by about 1.5 days. Currently, the share of the non-local cargo in most PNW terminals already reaches 70% to 80%. However, overall traffic, as well as terminal size, is relatively small. Likewise, the two major US ports, Seattle and Tacoma, both with on-dock yards, have limited land reserves.

A recent contender for the non-local cargo is Vancouver (BC), boosted by competitive rail services of Canadian railroads to the US Mid-West and Atlantic regions. Unlike its neighbour in Puget Sound, the new Vancouver terminal in Roberts Bank, as well as other Canadian terminals, has vast expansion options.

The overall growth in trade, predicted at the outset to reach 300% to 400% in 20 years, will be accompanied by an increase in the number and specialisation of shipping services. It is reasonable to expect lines to concentrate their non-local, rail-bound Asian cargoes on 'pure-rail' express service, calling at the closest ports to Asia – in the PNW. This region, in turn, will specialise in handling rail cargo by developing pure-rail ports (PRP).

The PNW marine terminals already have efficient ship-to-rail transfer systems based on on-dock intermodal yards located in the rear of their container yards. The container yard could be entirely replaced by a railyard in a pure-rail terminal based on the vessel-cycle ship-to-rail direct transfer system, in which hustlers shuttle containers between shore cranes and yard cranes, with the latter handling railcars. This operating system eliminates two handlings (to/from yard), and results in faster and more cost-effective ship-to-rail transfer.

Small-scale vessel-cycle operations are already in place in several PNW terminals, such as Tacoma's Evergreen and, especially, Portland's Terminal 6. Also, since the boxes on board are destined to only a few destination points, handling 4TEU units for the entire ship-to-rail process – and doubling handling rates – would be possible.

The 'express' PNW bridge, based on pure-rail shipping services and calling at PRPs, is expected to have a substantial advantage in transit time and cost over conventional PSW bridge services. First, as noted above, the PNW is 1.5 days closer to Asia. In addition, the specialised ship-to-rail transfer would be shorter in the PRP, saving another 1.5 days, bringing the total saving in time to 3 days. Second, the cost of shipping for the shorter route would also be lower. A rough estimate of a slot cost of a Post II ship operating at 75% utilisation is $25/FEU, which amounts to $50/FEU for the two days

OVERALL ASSESSMENT OF CONSTRAINTS AND POSSIBLE SOLUTIONS

	CONSTRAINTS			
Port region	Capacity	Capability	Connectivity	POSSIBLE SOLUTIONS
US East Coast	Sufficient developable waterfront land in major and secondary ports	Cannot handle Post III	Not a constraint	Development of offshore hubs and secondary ports
US West Coast	Shortage in developable waterfront land in PSW	Can handle Post III	Road and rail congestion	Diversion of non-local cargo to PNW and USEC via all-water, development of inland ports and shuttle trains

saved. Presumably, there would be additional cost savings due to the more efficient port and intermodal handling estimated at about $50/FEU. Altogether, the specialised northern bridge could have the advantage of three days of transit time and $100/FEU in shipping and port costs, considered to be sufficient to stimulate a substantial diversion of non-local cargoes from PSW to PNW.

The second diversion of the LA/LB non-local portion of the Asian non-local cargo would be to all-water services, mainly following the expansion of the Panama Canal, allowing the transit of larger and more cost-effective containerships. This could result in a 15% reduction (to 45%) of the PSW's share of non-local cargo and gains in the respective shares of the PNW to 30% from 20% and the USEC to 25% from 20%. It is also reasonable to assume that most of the non-local cargo moving by the North Bridge (and, perhaps, the Mexican Bridge) would comprise marine ISO containers taking advantage of the efficient PRPs. In contrast, the lion's share of the PSW non-local cargo would be transported via domestic containers passing through the inland DCs.

The compounded impact of cargo diversion, increase in terminal area and enhanced productivity could provide the required increase in the PSW future capacity. A more important, complementary conclusion is that without undertaking these measures, they will not be able to do so.

The overall conclusion of the wide-ranging analysis above is that US ports face difficult, but not intractable, problems in terms of their capacity, capability and connectivity. To cope with future growth, these ports should pursue the traditional measures of developing new marine terminals and enhancing productivity, while, in parallel, encouraging several system adjustments. These include modification of shipping services patterns, development of inland ports and short shuttle trains, reallocation of cargoes between coasts and ports, and development of more efficient ship-to-rail transfer systems. The table above presents a summary of problems and possible solutions.

The reallocation of cargoes among ports and respective diversions are of special interest. The main diversion trends are, in the USEC, from major to secondary ports; in the USWC, from the PSW to the PNW. Both diversions are, in fact, reversals of fortune. In the USEC, secondary ports have been losing cargoes to the major ports for many years following the load-centring process. In the USWC, the PNW, which was the birthplace of the landbridge, has been losing market share to PSW. What goes around comes around.