

Panama Canal Study

Final Report

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Prepared for:



Part of the  **NOL** Group

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1. Summary & Conclusions

1.1 Transit activity, capacity and utilisation

The United States is by far the largest user of the Canal, with about 65% of all cargo either originating from, or destined to, US ports – amounting to 135 million tons of cargo in FY 2004, of which 85 million tons was US export traffic, 54 million tons imports, and 2 million tons inter-coastal (ie domestic). In the case of container traffic, almost 70% of Canal traffic relates to the USA, with well over 3.5 million teu of US import and export cargo now moving through the waterway annually. For container cargo alone, this could well represent goods with a value of close to US\$100 billion.

The other main users of the Canal are either Asian (Japan, China, South Korea, Taiwan etc), or West Coast Central/South American countries. The Canal is particularly important for the economies and international trade of the WCSA nations of Ecuador, Peru and Chile.

The total number of vessel transits has been falling in recent years, but this slow decline was sharply reversed in FY2004, when transits rose by almost 7%.

Total vessel tonnage using the Canal, however, has been growing over this same period, so that average ship size has been increasing in virtually every vessel category. The number of Panamax vessels transiting the Canal now represents about 40% of all ocean-going transits. Average vessel size transiting the waterway has more than tripled in the last 45 years and more than doubled in the last 15 years.

Cargo growth has been almost exclusively generated by the liner trades – containers (+8.2% pa since 1993) and reefer (+5.2% pa). Bulk cargo trades have been either flat or in decline. Again, however, 2004 saw a recovery in many sectors which reversed the trends of the last decade.

From 1995 to 2003, total container cargo transiting through the Canal has almost doubled, from an estimated 2.76 million teu to 5.22 million teu (converted from long tons at an assumed average of 10 tons per teu) – and over half the traffic is now generated by the transpacific trade between Asia and the USEC.

Canal capacity is highly variable, dependent upon such factors as:-

- Vessel size mix
- Vessel arrival patterns
- Weather (especially as it affects water depth)
- Lock/waterway maintenance and repair schedule
- Labour and equipment resources

In general, however, with a typical mix of vessels a total of 38 transits per day is considered the practical capacity of the Canal – though the figure is exceeded regularly when vessel mix conditions are favourable (a high number of small craft which can be moved through the locks together).

Utilisation was well above 100% during the 1990's. Then, as ship size increased, the total number of transits fell, which was reflected in a decrease in the utilisation level. But with the trade boom in FY2004, utilisation went over the 100% level again, for the first time in five years, and with world trade volumes still growing robustly, this poses a serious problem for the Canal.

In 2004, average utilisation (against the 38 transit ceiling) reached 101% - sharply up from the 95% recorded in the two previous years. Early returns for 2005 indicate monthly transits running in excess of 2004 levels, so that utilisation may be around 105%. While such numbers are seemingly achievable in the short term, they would be likely to prove unsustainable over any prolonged period.

Moreover, the average transit figure covers wide seasonal fluctuations, with activity peaking during the October to April period, due to, first high levels of US imports from Asia before Christmas, and then the South American fruit export season after Christmas. Thus, while the daily low in May 2003 was recorded at 20 transits, the daily high for April 2005 was 51.

Current modernisations and improvements to systems, equipment and facilities should increase capacity by about 10%, so that by 2007 the capacity benchmark should have risen to 42 transits per day.

1.2 Transit time, pre-booking and the outlook for container services

Average annual Canal Waters Time (CWT) increased during the second half of the 1990s to reach 30.79 hours by 1999, but the ACP managed to reduce this by 24% to 23.47 hours by 2003. The increased level of transit activity in 2004, however, resulted in a 16% increase to 27.32 hours. For the first half of 2005, CWT has once again reduced (average 22.15 hours) but this does, however, take into account only part of the summer months of May to September, when maintenance work is carried out, resulting in lock outage and higher CWT. Consequently, an increase can be expected as the year progresses.

CWT has been decreasing over the past 5 years, mainly because of the increasing numbers of containerships and other large vessels which all use the reservation system so as to be able to cross during daylight. But while CWT is decreasing for large ships, CWT for smaller ones, which do not use the booking system, is tending to increase significantly.

16 transit slots per day are reserved for vessels that pre-book, and this reservation system (which costs about \$5.3 per teu of vessel capacity) is now over 90% utilised – up from just 74.8% in 2003. The current average of 10 daily transits by containerships alone, means that this single ship type takes up 62.5% of available reservations. This leaves an average of only 6 booking slots per day (ie 3 each way) for non-containerships.

There are now 40 regular deep-sea container services scheduled through the Canal, and these make a total of 70 transits per week.

Transpacific services are almost exclusively operated by Panamax vessels. Average vessel size is more than 4,000 teu on this route. Design advances on modern Panamax containerships do mean that new Maxi-Panamax vessels are (nominally) able to stow up to 5,000 teu (dependent upon cargo weights), and it may well be that operators have to

direct such vessels to Panama Canal routes, as this represents the only further upsizing option available at present. Other than that, further increases in cargo volume will only be able to be met by an increase in the number of services.

The average vessel size for West Coast South America trade services is 1,560 teu, while Australasian services have an average vessel size of just over 2,700 teu.

While WCNA services retain a clear dominance amongst Transpacific services (74.3% of the total), all-water routeings via the Canal have shown a slightly higher rate of growth over the last two years, and now account for 24% of all transpacific services. It is highly likely, moreover, that this shift of services towards the Panama route would have been even more pronounced in 2004 if more Panamax vessels had been available.

Carriers' scheduling strategies and shipper/importer preferences are presently undergoing significant changes of priority following the very bad performance of the southern California ports and the transcontinental railroads in 2004, and lowest cost and/or fastest transit are no longer the sole drivers of routeing decisions. This is promoting the Panama routeing as an increasingly important element in the portfolio of service options available on the Transpacific trade. The potential lack of reserved transit slots could be a major impediment to the ability of container lines to increase service frequency on the all-water route in the future.

Confirmed WCNA terminal capacity expansion indicates an average annual increase of 2.3% to 2010, which is well below the double digit growth rates recorded in WCNA port traffic over the last decade. Given the long lead times for terminal expansion, short term enhancement of the projected capacity can only come about through improvements in the "soft" (non-infrastructure) elements of container port operations, such as labour supply, productivity and operating practices. But the degree to which improvements in these areas can increase effective port capacity, and over what time period, are unknown.

Without such systemic capacity increases (as opposed to infrastructural increases), all reasonable projections of WCNA container trade growth imply an impending capacity shortage at WCNA ports – to the extent of 1.8 million teu by 2008 under most likely case conditions, rising to 6.5 million teu by 2010.

The analysis indicates:-

- 1) the urgency of the need for additional capacity if trade volumes are to be handled in an optimum fashion.
- 2) the longer term need for additional infrastructure investment.
- 3) the likelihood that substantial traffic diversion via other North American gateways will be needed in the immediate future. Some diversion via Mexico and the US Gulf may be possible, but the most natural alternative will be still greater use of East Coast ports, and of the Panama Canal.

Upsizing of the existing fleet deployed on Asia-ECNA via Panama routeings might, under optimum conditions, generate an additional 700,000 teu of annual capacity.

Each additional Panama string of 5,000 teu vessels would add an absolute maximum of around 225,000 teu pa, but with utilisation of the pre-booked transit slots now in excess of 90%, then even if all the remaining slots were allocated to transpacific container services

(which may not be possible), an absolute maximum of 5 additional weekly services would appear to be achievable. This is equivalent to just the last two years' increase in transpacific all water services.

The potential traffic volume which could be diverted to ECNA/USG ports by a combination of additional and enhanced Panama strings is estimated at an absolute maximum of 1.825 million teu. This is almost equivalent to the projected WCNA capacity shortage in the most likely case scenario in 2008 – but in reality the Panama Canal may not be able to accommodate any additional container services beyond 2007, and that the full cargo overflow from WCNA ports will likewise not be able to be handled beyond that year.

The most natural alternative supply chain solution would be the Suez routing from Asia to ECNA ports. The further north the first Asian loading port and/or the further south the last North American discharge port, the shorter the transit time becomes on Panama routings, while the exact reverse is true of Suez routings.

In terms of pure distance to/from New York, the break-even point in Asia between Suez and Panama routings is somewhere slightly south of Hong Kong, from which port there is an extra 331 miles via Suez – equivalent to less than 1 extra steaming day. The first major port in Asia to indicate a clear advantage to the Suez option is Laem Chabang in Thailand.

1.3 Transit fees and the new locks scheme

As well as capacity concerns, containership operators have also been confronted by a significant rise in transit fees, and the certainty of further increases to come over the next two years. Transit fees have already been raised from the equivalent of \$32 per teu of capacity under the previous charging methodology to \$42 per teu, with increases on May 1 of the next two years to \$49 and \$54 respectively – an increase of almost 69%.

In line with the shift in the mix of vessels using the Canal, revenues by ship type have also undergone a major structural change. Dry bulk carriers and containerships have together always accounted for over half of total toll revenues, but while dry bulk revenue has been decreasing by around 1% pa, containership revenues have gone up by 15% pa, becoming the single largest revenue segment for the Canal in 2002. Containerships now generate a third of total Canal revenue, and the new charging system will significantly increase this share.

Because of the increasing size of ships in the world fleet – and especially in its most important sector, containerships - the Canal is now under great pressure to expand, in order to accommodate Post-Panamax vessels. If the Panama Canal does not expand, then cargo diversion and risk management strategies will be forced to consider (and use) alternatives – such as the Suez route and the use of non-US West Coast ports.

Currently, the physical limits on vessel dimensions are a draft of 12m, a length of 294m and a beam of 32.3m, but the proposed new set of locks, would increase these limits to 15+m draft, 427m length and 54.9m beam. (This would allow containerships of c10,500 teu to transit.)

Current estimates place the cost of the new locks in the range \$5-10 bn, but other estimates have ranged as high as \$13 bn - which compares to Panama's annual GDP of

\$20 bn. It is estimated that the Government would be able to provide only about \$1 bn of this, the rest having to come from loans.

The project has to be approved by the Panamanian electorate through a referendum, and this process is incurring delays, and is currently scheduled for February 2006, having initially been planned for November 2004.

While seemingly at least ten years in the future, expansion of the Panama Canal will not of itself solve the potentially persistent capacity constraint that threatens transpacific container operators in particular.

And one issue which will need to be resolved before the full advantage of the proposed new locks can be realised through significant vessel upsizing, is that the ports at each end of the services running through the Canal will have to be expanded to accept the larger vessels. While this is not likely to be a problem in Asia, where vessels of 8,000+ teu are already operating, the US East Coast ports are in an altogether different category.

While WCNA ports are primarily constrained by land availability, on the East Coast, the major limiting factor is lack of water depth, and at present no post-Panamax containerships of even relatively modest capacities are scheduled on a regular basis into ECNA ports.

New York, is now mid-way through a major dredging initiative for all of its channels and berths, that at a cost of \$930 million will see the main channel dredged to 50ft (15.2m) by 2009. At present the depth is 45ft (13.8m), so that with the 1.5m tidal range, a vessel can operate at high tide at 14m draft with 1.2m under keel clearance.

Norfolk/Hampton Roads has the deepest natural harbour on the USEC, being served by 15m (50ft) deep channels that can already handle the majority of the post-Panamax fleet at, or close to, maximum draft at all states of the tide. Depth alongside at the berths is 14m (45ft).

Charleston's entrance channel was deepened to 47 ft, and the inner harbour to 45 feet, in 2004, while at Savannah, deepening of the approach channel to 48 ft. (14.6 m) at mean low water is envisaged by 2010, while Jacksonville saw the St John's River deepened to 41ft in 2003.

Further deepening at most, if not all, USEC ports would be needed to provide the 16.5m or thereabouts water depth that 10,500 teu vessels require at full draft – although tidal conditions would provide limited berthing/sailing windows in some ports. Nevertheless, while USEC ports are essentially gearing up to handle ships of up to c7-8,000 teu, the Panama Canal expansion is set to create a requirement for further channel deepening before the full benefit of the new locks could be realised as far as vessel upsizing is concerned.

Moreover, the new generation of super post-Panamax ships which would be able to use an expanded Canal would also threaten other ECUSA infrastructure constraints through their much greater air draft. This is likely to be an especial issue at New York, where the 1931 built-Bayonne Bridge, with its central clearance of 151 ft (46.0m) across the access to the main Port Elizabeth terminals is quite restrictive in comparison to more recently built structures. The price estimate for raising the Bayonne Bridge alone is in the region of \$600 million.

The ability of ECNA ports to handle considerably greater quantities of container traffic from Asia will also be dependent upon the provision of suitable rail capacity and improved intermodal connectivity to ensure speedy despatch to inland points – since all water routeings, whether via Panama or Suez, do imply extended port to port transit times than on WCNA routed services, even before the additional time for distribution to the interior USA is considered.

This seems to constitute a triple challenge for ECNA ports – in order for the expanded Panama Canal to be utilised to its full extent, the ports will need to address their own provision of water depth; air draft clearance and intermodal connectivity, in addition to the basic need to provide enough terminal capacity to accommodate the higher trade volumes.

1.4 Forecast transit activity and utilisation

Forecasts of future Canal traffic have been arrived at under 3 different sets of assumptions. However, the methodology adopted for these scenarios is, due to the scope and scale of this Study, very basic. Moreover, the forecasting task is complicated by the fact that in 2004, the Canal experienced a distinct reversal of the long term trends for traffic volumes and transits in a number of vessel sectors, which makes not only the scale, but even the future direction of transit numbers, somewhat problematic. The sharp increase in activity recorded in 2004 may prove to be a temporary phenomenon or it could presage a permanent reversal of recent trends.

For several years prior to 2004, traffic and vessel volumes through the Panama Canal have not behaved in line with global shipping markets and with international trade developments. While global merchandise trade was rising steadily, and the world fleet was also increasing in virtually all sectors (except general cargo vessels and reefers), the Canal saw a declining level of activity.

It is really only in the containership sector where a convincing relationship can be seen between transit activity and the level of economic activity in the main importing and exporting regions. Even here, however, it is clear that the number of transits through the Canal has also been influenced by such factors as average vessel size; shifts in routing preference in the Transpacific trade, and the development of new transshipment hubs at each end of the Panama Canal – which has particularly affected the WCSA trades.

The three scenarios adopted provide low, medium and high case forecasts of transits.

Low Case - assumes a continuation of the average rate of increase/decline in the number of transits recorded since 1993.

Medium Case - assumes that those vessel categories which have exhibited long term growth will follow the same course in the future, as would those vessel types which have exhibited consistent decline and which are contracting fleets (ie general cargo ships and reefers), but that those categories that had been in decline but which registered transit gains in 2004, will achieve constant 2004 transit numbers in future.

High Case – the same as the Medium Case, except that transits of the group of (mainly) bulk oriented vessel types that staged a recovery in 2004 will continue to grow, at an arbitrary rate of 2.5% pa over the long term. (Some of the increases in transit numbers

registered in 2004 were of unsustainable proportions – eg tankers +21.5%; passenger ships +26.1%; Ro-Ro +16.2%) and at least partly arose because activity had previously dropped so far, contrary to the global developments in each of these commodity trades.

In the **Low Case**, transit volumes would decline for all sectors except containerships, container/break-bulk vessels, gas carriers and vehicle carriers.

In the **Medium Case**, annual transit numbers will grow at just under 2% pa over the next ten years to reach 16,913 transits in 2014 – equivalent to an average of 46 transits per day, and suggesting a possible high daily transit demand of as much as 65 (ie annual average + 40%).

In the **High Case**, annual transit numbers would grow at 3.0% pa over the next ten years to reach 18,778 transits in 2014 – equivalent to an average of 51 transits per day, and suggesting a possible high daily transit demand of as much as 72 (ie annual average + 40%).

Based on a current average of 38 transits per day, the Canal is currently already operating over its nominal capacity. The only increase in the short term will arise with completion of the ACP's current round of investments, which is projected to raise capacity by 10% to 42 transits per day by 2007. Given the delays to the study/master plan phase of the new locks project, the potential financing problems, and the scale of the construction task, it has been assumed that a new set of locks (which would in any case totally transform the vessel profile and transit numbers) is unlikely to be operational within the forecast period.

In the **High Case** the additional capacity due for 2007 will only serve to reduce average utilisation below 100% in its initial year. From 2008, utilisation would again exceed 100% and would nominally reach 122.5% by 2014 – though in practice it is difficult to see how such transit volumes could be accommodated. Far more likely would be that congestion and delays would lead to massive cargo (and vessel) diversion.

In the **Medium Case**, utilisation would only fall below 100% for the 3 year period 2007-09 inclusive. By the end of the forecast period utilisation would be around 110%, which must again be considered an unrealistic practical level, especially given seasonal and daily peaking. Traffic diversion would again seem to be the only logical outcome.

Only in the **Low Case** would utilisation be less than nominal capacity following Canal expansion.

In all three forecast cases the projection indicates an average of 15 containership transits per day by 2014, with a further 3 daily transits on average from container/break-bulk vessels (ie MPPs). This combined total of 18 is in excess of the current 16 pre-bookable slots per day – though this may increase slightly in line with the expected increase in Canal capacity. Given that the services would not divide equally on each day of the week, the situation on the peak days in each week would be particularly serious, and delays to some liner services would be inevitable – and indeed, the lack of transit certainty would almost certainly place a limit on the number of container services which would be routed via Panama. Moreover, as WCSA services have little or no alternative but to use the Canal, it is likely that it would have to be Transpacific services which were alternatively scheduled, removing the ACP's chief revenue generators.