



# Engineering the future of maritime trade

**Jorge L. Quijano**

Lessons from the expansion of the Panama Canal.

**When the Panama Canal** opened for business in 1914, the 50-mile long waterway was hailed as one of the world's greatest engineering achievements. By linking the Atlantic and Pacific oceans, the canal immediately became a vital artery of international maritime trade.

As the demands of global commerce shifted, the canal had to evolve in response, for example by improving operational efficiencies. The most significant evolution, however, has been the recently completed \$5.25 billion expansion program, the largest construction project in the country's history.

The Canal connects more than 144 maritime routes. Its success has always been based on the quality and reliability of its service. But as the shipping industry began to rely more on vessels too large to enter the original Panama Canal's locks and channels, it was clear a major upgrade was needed. Following more than 100 studies on economic feasibility, market demand, environmental impact, and technical aspects, Panama voters approved the project in a national referendum in 2007.

The new and improved canal, which entered commercial service in June 2016, included the construction of wider, longer, and deeper locks, doubling the cargo capacity of the waterway. The new lane required the construction of three-step locks on both the Atlantic and Pacific sides, each 70 feet wider and 18 feet deeper than those of the original canal. The bigger locks allow the new generation of larger Neopanamax vessels to pass through, each carrying up to 14,000 twenty-foot equivalent units; these are responsible for the transit of 45 percent of the world's cargo.

It was no easy feat to complete a project hailed by many as a modern marvel. The work took nine years and included an intense and difficult gestation period. It meant bringing together a workforce of more than 40,000 people, including engineering professionals from numerous fields.

For infrastructure projects of this magnitude, it is not uncommon to run over time and for patience to wear thin. To ensure a successful outcome, it is important to maintain focus and to meet the problems that will inevitably arise, with ingenuity, creative thinking, and stamina.

During the canal expansion, for example, we faced the need to relocate up to 155 million cubic meters of material that was excavated and dredged to make way for the new lane. We devised a way to use this material to safely bury tons of unexploded munitions that the US military had left behind years ago, effectively using one problem to solve another.

Then there was a matter of water. The new wider and longer locks meant more water was needed to fill them. While the canal can draw the water it needs from surrounding lakes created for that purpose, these also serve as the main source of potable water for 55 percent of Panamanians. Maintaining these resources was critical. So we designed and installed 18 state-of-the-art water-savings basins, each with a surface area equivalent to 25 Olympic-size swimming pools. These allow the expanded canal to reuse 60 percent of the water used per transit and 7 percent less water in total than the original locks—a first for a lock complex handling ocean-going vessels.

Environmental stewardship is also imperative in undertaking major infrastructure projects. The canal expansion enables larger cargo volumes to transit with fewer vessels. That translates into fewer cargo movements, thus reducing the carbon footprint of shipping. By welcoming vessels that would otherwise have to use longer routes, fuel consumption is reduced. As a result, the new waterway is set to reduce carbon-dioxide

emissions across the shipping industry by an estimated 160 million tons in the first ten years of operation.

In the first three months of operation, the expanded canal received more than 360 reservations and transited more than 140 Neopanamax vessels. Comparing July 2015 to July 2016, we've already seen a 12 percent increase in tonnage, 7 percent in transits, and 6 percent in overall revenue. We expect annual cargo tonnage to nearly double in five years.

Already, we've seen global trade routes redrawn as major liners reroute service to capitalize on the expanded canal's considerable time and cost savings, as well as to reduce emissions. We've also begun to welcome liquefied natural gas (LNG), a new market segment that is expected to help reduce the cost of clean energy around the world. The canal can now accommodate more than 90 percent of the world's LNG tankers, which can reach more than 900 feet long and 150 feet wide.

For all these reasons, the Panama Canal's future looks bright. Plans are already in place for other enhancement projects, such as new container terminal, logistic parks, and a roll-on/roll-off cargo terminal. And the lessons we have learned we will apply to all future endeavors. 

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