EXPANSION PROGRAM
PANAMA CANAL
THIRD SET OF LOCKS

The Greatest Engineering Works of the XXI Century
The New Panama Canal

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August 15, 1914. On that day, the Panama Canal opened with the transit of the steamboat “Ancón”. The Americans’ support was essential to push forward a project that France had attempted to lead in 1879 which ended in bankruptcy, making clear that the solution for Panama could not be a sea level canal, but rather a Canal with locks. Under the American leadership, within ten years and with more than 75,000 people working around the clock, one of the engineering wonders of the World was completed.
The Panama Canal Expansion Project is one of the largest and most ambitious infrastructure works in modern engineering.

The key project is the construction of the so-called Third Set of Locks. This is a new transit way which runs parallel to the current locks. It consists in two enormous and complex construction works, one located in the Atlantic and the other on the Pacific, each stretching almost two kilometers in length.

The Third Set of Locks is being built by the international consortium called Grupo Unidos por el Canal (GUPC), led by the Spanish infrastructure firm Sacyr, which is responsible for the new locks’ design and construction. The project, that is being strategically and meticulously designed, will allow the Panama Canal to reach more than twice its current capacity, in order to be able to attend the ever increasing demand of international trade. The Third Set of Locks will reduce ships’ transit time and will allow bigger vessels, known as Post-Panamax, to transit the water way.

Panama needed to undertake the expansion of the Panama Canal in order to preserve its hegemony in international trade. And the new locks are, without a doubt, the most efficient and effective solution.
The complexity of the Third Set of Locks Project lies not only in its spectacular dimensions but also in the significant challenges created by the zone from a technical, geographic, geological and climate-related point of view.

The construction works presented major new challenges: the models responding to seismic events, the selection of the best materials and their combination, and the most suitable, efficient and sustainable structural design.

This was quite a challenge for engineers, who had to design a special type of concrete. No regular concrete would do: in other respects, it required the maximum strength and no permeability whatsoever. There was also the added complexity of having to transport via barge and through the Canal the aggregates, which were extracted in the Pacific, to the Atlantic side.

The design, production, movement and installation of the enormous lock gates (16 in total) that were brought in from Italy to the Panama Canal for their precise installation, down to the millimeter, has been a no less complex operation.

It has definitely been a construction work creating great challenges for modern engineering.
03_ **Key Figures**

The earthworks carried out to build the Panama Canal Third Set of Locks Project have also surpassed important infrastructure works such as New York Subway system and the majestic Three Gorges Dam in China.

In addition to the colossal amounts of dredging, excavation, steel and concrete used, the Third Set of Locks has required 24 million cubic meters of fillings; 1.6 million tons of cement; 50,000 tons of steel used to make the 16 lock gates in both complexes, and another 20,000 tons of steel in water entry and exit valves.

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**Dredging**

7.1 million m$^3$ of sediments, mud, water...

~ enough to fill 2,840 Olympic swimming pools

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**Excavation**

62 million m$^3$ of earth, sandstone, basalt...

~ 2.6 million loaded dumpers which, placed one end to the next, would reach around almost the entire world.
Concrete
4.5 million m³ of structural concrete
~ 2 Egyptian pyramids

Steel
220,000 tons of reinforcement steel
~ 22 Eiffel Towers
How it Works

The operation of the Third Set of Locks is similar to that of the existing locks: there are gigantic lock gates which allow the vessels to enter and exit towards the chambers, which are filled with water and act as elevators, raising and lowering the vessels to the different levels existing between the ocean and Gatun Lake until their transit is completed. But there are important differences between the current and the new locks.

- The new locks have a higher capacity, therefore allowing the transit of larger vessels.

- They are also faster: they require less time to be filled and emptied and use 7% less water than the current locks.

- They have nine basins on the side for recycling water, which makes it possible to save up to 60% of this precious resource.

- The lock gates include a set of eight sliding gates, which are not hinged V-shaped like the current ones but rolling gates instead, which are placed and move perpendicularly to the chambers.

Without a doubt, it is a project designed to increase efficiency, effectiveness and flexibility.
The environmental aspects have formed part of the Project since the very beginning and conception of the Third Set of Locks. Not only in the design process –less water consumption- but also to ensure the environmental and wildlife preservation.

Preserving the environment is essential to protect the biodiversity of the lake through which the canal runs, Lake Gatun, which, we must not forget, is an artificial lake and therefore requires special care.

Furthermore, before the machinery made its way onto land, environmental specialists undertook responsibility for rescuing and relocating wildlife to maintain the diversity and wealth of the Panamanian fauna: turtles, alligators, sloths, boas… they were all rescued and relocated within their natural environment.

It is calculated that, with the Third Set of Locks, over the next ten years there may be a reduction of more than 160 million tons of CO₂ emitted into the atmosphere by the maritime sector.
Reality and Posterity

The Third Set of Locks would not have been possible without the great human resources that have taken part in the project, from its beginning and conceptual design to its final construction.

More than 10,000 workers of 40 different nationalities, with high qualifications at every level, have made this extraordinary project a reality.

The Third Set of Locks is an amazing project that has required a great deal of work and effort, creating significant challenges and unforeseeable difficulties, for which the professionals involved have provided fast, effective responses.

A titanic project of tremendous technical complexity, because of its scope and because it required the use of great amounts of innovation to design and execute the best solution.

The Third Set of Locks is a key mega-project designed to allow the Panama Canal to double its current capacity and meet the increasing international traffic and trade demand.

Without a doubt, The Third Set of Locks is a colossal project that will forever go down in the history of engineering… …and humankind.