

SACYR LEADS THE LARGEST ENGINEERING PROJECT OF THE 21ST CANAL

Panamá inaugurate expansion of the Canal

www.historiasdelcanal.sacyr.com

- The inaugural act was attended by King Emeritus, Juan Carlos I, together with 11 presidents and heads of state representing 62 countries, multilateral organizations, and shipping companies from throughout the world, in addition to 20,000 spectators.
- Juan Carlos I received a group representing Sacyr, headed by Manuel Manrique, together with directors of Sacyr, members of the Management Committee, and a distinguished group of engineers who worked on the expansion.
- Sacyr celebrated the inauguration on Saturday the 25th with a party in Madrid, which included a holographic show on the Manzanares River that allowed attendees to make an exclusive first trip through the new locks. <https://youtu.be/7nyZRdN7Vcl>



Panamá inaugurated the expansion of the Canal yesterday with the passage of the first post-panamax ship, Cosco Shipping Panama, in an event that began at 6:00 a.m. (Panama time) at the Agua Clara locks on the Atlantic side. It continued until 5:00 p.m. when the ship passed through the Cocolí locks (on the Pacific), where 15,000 people were waiting together with Panamanian authorities of the Panama Canal Authority (ACP) and 2,400 guests from 62 international delegations, including King Emeritus Juan Carlos I

Presidents Tsai Ing-Wen (Taiwan), Michelle Bachelet (Chile), Luis Guillermo Solís (Costa Rica), Daniel Medina (Dominican Republic), Juan Orlando Hernández (Honduras), Hashin Thaci (Kosovo), and Horacio Cartes (Paraguay); Prime Ministers Antonio Costa (Portugal), Freundel Stuart (Barbados), Bernard Denzil (Curaçao), and Andrew Holness (Jamaica); the Vice-Presidents of Argentina and El Salvador; Jill Biden, wife of the US Vice President, Joe Biden; and the Chairman of the Suez Canal Authority, Mohab Hussein Mamish. The event was also attended by representatives of the United Nations, of the Organization of American States (OAS), of the Central American Integration System (SICA), of the International Labour Organization (ILO), and of the Ibero-American General Secretariat (SEGIB).

“ De océano a océano

Sacyr, which leads the consortium Grupo Unidos por el Canal (GUPC) also integrated by Salini Impregilo, Jan De Nul and CUSA, has successfully completed the design and construction of the third set of locks of the Panama Canal, the largest engineering project of the 21st century, one of the most emblematic of humanity and an unprecedented challenge in the modern history of infrastructures.

Manuel Manrique, Chairman of Sacyr, noted that “the expansion works of the Panama Canal have been one of the most emblematic of humanity and have represented a true challenge for Sacyr. Since its beginning, we have had to face technical, logistic and administrative challenges of enormous complexity. Sacyr has demonstrated its management and innovation capacity by successfully concluding this magnificent project, therefore delivering an end product of top quality that positions us, not only as a company but also as a country, at the head of global civil engineering”.

Prior to the official inauguration ceremonies, King Emeritus Juan Carlos I, received a group representing Sacyr, headed by Manuel Manrique, together with directors of Sacyr, members of the Management Committee, and a distinguished group of engineers who worked on the expansion.

The project consisted in the construction of the so-called Third Set of Locks: Two complexes of three-step locks, including three basins for the reuse of water per chamber, with one set on the Pacific side and another on the Atlantic. The new locks are 427 meters long, 55 meters wide and 18.3 meters deep. Over 10,000 workers of 40 different nationalities participated on the project, all of whom were highly qualified at all levels.

It is also an environmentally responsible project, with a system of basins that save 60% in water. Likewise, the passage of larger ships with a capacity of up to 12,000 containers each reduces CO2 emissions by over 160 million tons per year.

Celebration in Madrid

On Saturday the 25th of June at Madrid Río, Sacyr celebrated the inauguration of the Panama Canal expansion with a holographic show projected over the water of the Manzanares River, which simulated the entry by a ship in the new locks.

The event included activities, attractions, and experiences for all ages to get immersed in the history of the Panama Canal and come away with a memory of the greatest engineering project of the 21st century, led by Sacyr.

Others Links of Interest

www.historiasdelcanal.sacyr.com, a web site that provides the main figures, stories, and milestones of the new Panama Canal. Users thus have access to an overview of specific data surrounding the construction of the Third Set of Locks, including the most relevant milestones regarding innovation, human resources, the lines followed regarding sustainability, and the economic importance of the expanded Canal for the future of international trade.

The Panama Canal expansion works also hide countless stories of workers who have participated on the project. Many of them are included at www.historiasdelcanal.sacyr.com, a web site created specifically by Sacyr for inauguration of the project and for telling the stories of the Canal's protagonists in first person (in text and multimedia format).

Expansion of the Panama Canal in 60 seconds: a one-minute video that provides a quick overview of the dimension of the project led by Sacyr.

An unprecedented project

The consortium led by Sacyr, GUPC, won the call for bids of the project in July 2009, and it began construction work in August of that same year. For the nearly seven years of works, Sacyr has overcome many challenges of various types, given that the project has been highly complex, not only technically, administratively, logistically and management-wise, but also due to the strict standards of quality that were required and the demanding time-line for executing the planned large volumes. Added to this were aspects such as the adverse weather during construction, with nine months of rain per year, and the obligation to not interfere with navigation in the existing canal.

In this regard, the complexity of a project of this magnitude resides not only in its large dimensions but also in its incredible figures:

- Three chambers of locks on each side, with each chamber measuring 427 meters long by 55 meters wide by 18.3 meters deep.
- 16 gates, the largest of which is 33 meters high and weighs 4,300 tons.
- 4.5 million cubic meters of structural concrete poured, the equivalent of 2 Great Pyramids of Giza.
- 220,00 tons of reinforcing steel, comparable to 22 Eiffel Towers.
- 62 million cubic meters of extracted earth, equal to 2.6 million dump trucks.
- 7.1 million cubic meters dredged, the equivalent of 2,840 Olympic-size swimming pools.
- 5,000 cubic meters of concrete poured daily on each side of the project.

Innovation to overcome the main challenges

For Sacyr, the project has represented a great challenge from the technical, orographic, geologic and climate point of view, both before beginning the project and during the

works, given that new challenges were posed in the models for responding to seismic reactions, in selecting the best materials and the combination thereof and regarding the most suitable, efficient and sustainable structural design.

These challenges were overcome through innovation, plus new contributions were worked on during development of the project. Highlights of these challenges include the design, manufacture, movement and installation of the new gates (a total of 16), which have huge dimensions and required pinpoint placement. The gates are sliding and not hinged in a V-shape like the current ones, rather they are rolling and are installed and move perpendicularly to the chambers. The gates are a prototype in many aspects: in their buoyancy system for transmitting loads to the support and travelling system at 10% of their weight, as well as in the sealing and support system of the gate in the closing phase of the chamber.

The steel structures were also optimized, which presented demanding requirements regarding fatigue and resistance to seismic loads.

The water filtration limits through the gates were restrictive and uncommon for these systems, so the GUPC developed solutions based on combinations of elements of high-density polyethylene (UHMWPE) and high-performance steels that constitute cutting-edge advances for these types of sealing elements.

One of the other major challenges that should be highlighted is the complexity of the geology in the Pacific sector (active faults, seismic activity) and the fact that only this sector had ideal rock (basalt) for concrete production, which had to be transferred from one sector to the other through the canal.

Likewise, the development of concrete mixes that complied with the requirement of water tightness against penetration by the chloride ion and responded to the guaranteed durability of 100 years meant a long and precise research process. This process included the participation of personnel from Sacyr and from the Eduardo Torroja Institute of Construction Sciences in Spain, resulting in mixes that met water tightness and strength requisites and at the same time had the necessary consistency and workability to be poured on site using means of mass production. This work has been recognized by obtaining official approval in the US. There was also the added complexity of having to transfer the aggregate material, which was extracted from the Pacific and had to be taken in large barges to the Atlantic zone.

Other innovations included the system and software for control and operation, which were completely developed and manage 70,000 signals. Furthermore, they are characterized by their robustness against incorrect switching, human error and special events.

Finally, other challenges that were successfully met included the specified reliability, safety and redundancy features with which the facilities have been equipped, plus the reduction of water consumption for each lock and the ease of maintenance.

Respect for communities and the natural environment

Development of the project was also exemplary regarding the communities that live in the vicinity of the canal and regarding the natural environment.

The consortium has maintained continuous communication with the communities, and it has kept a social and financial commitment regarding environmental impact. Before beginning the construction work, meetings were held to explain the activities of the project and provide the necessary information. Activities were created to involve the people living in nearby communities, who were also given timely information about progress of the expansion work.

There was also environmental monitoring of any eventual impact by the project regarding the natural water, air, noise and waste water, with periodic environmental and social audits.

In this regard, the expansion of the Panama Canal is the only project in the world for which all participating people had to receive initial environmental and social training. Sacyr raised the awareness of every new worker hired on the project through routine training talks on environmental and social matters and through sensitization talks for field staff. Approximately 21,800 people received the standard initial training talk of 16 hours.

Expansion objectives

The objectives of expansion were the following: increasing the navigation capacity of the canal, which had reached its maximum limit, by doubling cargo traffic from 330 million tons per year up to 600 million tons per year and increasing the capacity for ships up to 16,000 per year, versus the current 12,000; allowing the passage of larger ships, the so-called Post-Panamax ships, carrying up to 12,000 containers each; and adapting the canal to the behavior of the global maritime fleet, given that maritime commerce is growing at an annual rate of 2.4% and the containerized cargo market is increasing at 8.4%.

Currently, the Panama Canal represents the main economic activity of Panama. It directly contributes 6% of the annual GDP, it generates 13,100 direct jobs, and in 2015 it reached a total revenue figure of 2.61 billion dollars, thereby contributing 1.03 billion dollars to the state. With the expansion, revenue is expected to be increased by 12.5 billion dollars in 10 years.



N.P. Panama Canal Inauguration