

The Panama Canal, which enables boats to travel through the country of Panama instead of sailing around South America, is one of the most famous structures in the world. Read the article about how it was built and answer the questions that follow.

PANAMA CANAL

1 **A** jungle, an untamed river and disease — a formidable trio that made building a canal across the country of Panama an almost impossible dream.

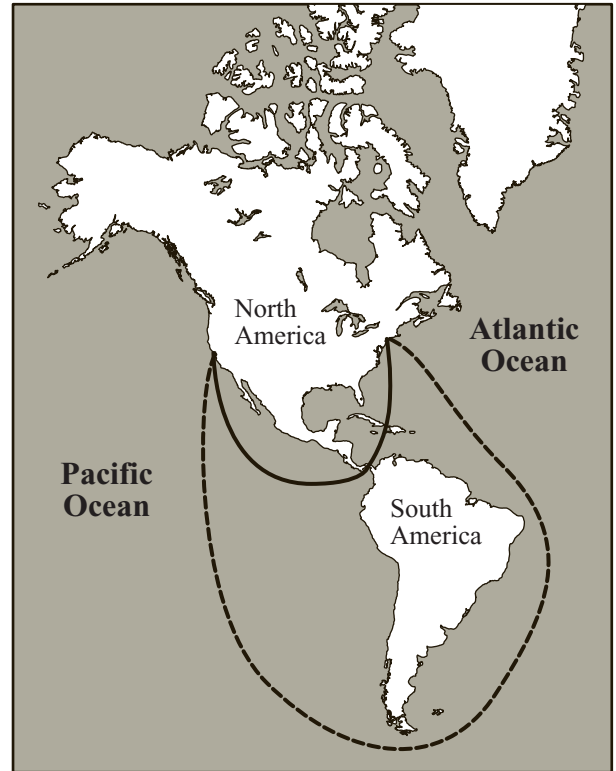
2 Construction was impossible for a French company already famous for building the Suez Canal in Egypt. They had tried it and failed in the late 1880s. The Americans took over in 1904, and it took ten years to complete the 82 km (51 mi.) long canal through Panama. For ships, it was a huge improvement — instead of traveling around the tip of South America, they could travel across Panama and shave 14,400 km (9000 mi.) from trips between New York and San Francisco.

3 How did engineers pull off this amazing feat? Window screens, for starters.

Little Insects, Big Problems

4 During the French canal effort, yellow fever and malaria killed thousands of workers. There's definitely a problem with a building project when three out of four workers die from disease.

5 When the Americans took over, they ran into the same problem. In fact, most of the American workers booked passage home. That's where the window screens came in. The canal's Chief Sanitary Officer, Dr. William Gorgas, believed in a new theory — mosquitoes spread the diseases.



The dotted line shows the route ships had to take before the Panama Canal was built. The solid line shows the new, faster route.

6 His team first attacked the mosquito that carries yellow fever. It likes to live near humans, so Dr. Gorgas targeted Panama City. All standing water — a great place for mosquitoes to lay eggs — was eradicated, and mosquito netting and running water were provided to workers. Windows and doors were screened, and in

a matter of months yellow fever was wiped out in the city.

- 7 Attacking malaria-carrying mosquitoes, however, was like going after a jungle of beasts, Dr. Gorgas said. They live just about everywhere, and the malaria they carry kills more people than yellow fever. After researching the mosquito's habits, the team drained swamps, cleared vegetation, sprayed oil on standing water, released minnows to eat mosquito larvae and bred spiders, ants and lizards to feed on the adult insects. Malaria cases dropped.

- 8 With disease under control, Chief Engineer John Stevens turned to keeping the workers happy. While half of the 24,000 laborers were digging a giant "ditch" across Panama, the other half were constructing towns complete with houses, dining halls, hospitals, hotels, churches and schools for workers and their families. They even started a baseball league.

The Big Ditch

- 9 Some canals are literally big ditches. Ships sail in one end and out the other. But a different solution was needed in Panama. A "lake and lock" design was adopted. Panama's Chagres River would be dammed to create a new lake, called Gatún Lake, in the interior. A series of locks would raise ships from the Atlantic Ocean to the lake

level. Ships would cross Gatún Lake, then descend another set of locks to the Pacific Ocean. It would be a bit like climbing steps, crossing a field and going down another set of steps on the other side.

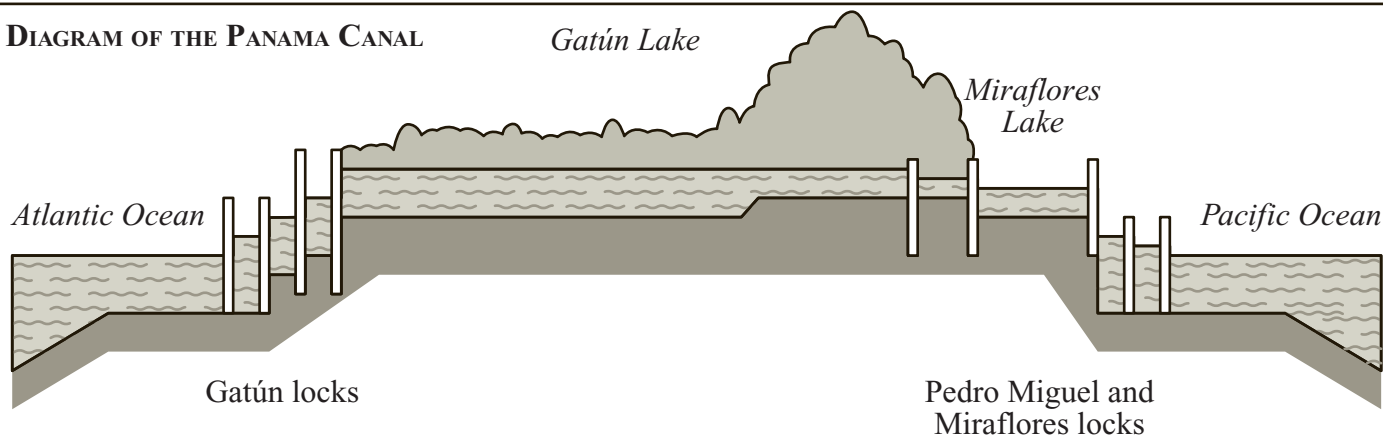
- 10 The digging began. Dynamite was used to clear rock and loosen the rock-hard clay of the canal. Then rock and soil (called "spoil") were dug out and loaded onto trains for removal.

- 11 The biggest challenge was the steep, landslide-prone Culebra Cut. There, spoil trains traveled to different levels to haul out about 76 million m³ (100 million cu. yd.) of rock and soil. That's enough to fill the Empire State Building almost 76 times. When the digging was done, the 14 km (8.75 mi.) long Culebra Cut looked like the Grand Canyon. At places its sides were as high as a 25-story building. Some of its spoil was used to build dams, a breakwater in Panama Bay, a townsite and a military base.

Layin' the Locks

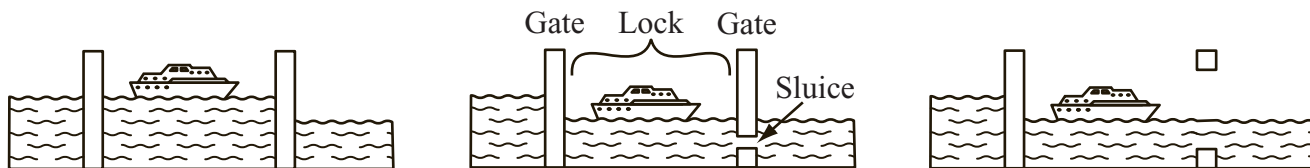
- 12 The locks — all twelve of them — are considered an engineering triumph. They were the first to be operated by electricity and the first made of a relatively new material: concrete.
- 13 The canal actually has two "traffic lanes" — six locks for ships going from

DIAGRAM OF THE PANAMA CANAL



HOW A LOCK WORKS

A lock is just two sets of doors with room big enough for a ship between them. Here's how a ship goes down through a lock.



1. A ship enters a lock and the gates close behind it.
2. Water drains out through sluices to lower the water level in the lock.
3. The gates in front open and the ship sails out.

the Pacific to the Atlantic and another six locks for ships going from the Atlantic to the Pacific.

- 14 When entering from the Atlantic side, three locks lift ships about 26 m (85 ft.) to Gatún Lake. From Gatún Lake, the ships are lowered 9.5 m (31 ft.) through one lock to Miraflores Lake. Two more locks at Miraflores lower ships to the Pacific Ocean.

A (Very Quiet) Drumroll, Please

- 15 The first trip through the canal by a self-propelled, ocean-going vessel took place on



More than 880,000 vessels have passed through the Panama Canal since it was officially opened in 1914.

January 7, 1914. The *Alexandre La Valley*, an old French crane boat, went from the Atlantic to the Pacific.

- 16 The Panama Canal was officially opened on August 15, 1914. Beginning with the French initiative, it had taken more than half a billion dollars and tens of thousands of workers to build the canal. Many thousands died. Despite all this, the news of its opening was met with little hoopla* — World War I had just erupted.

- **The Panama Canal can handle about fifty ships per day. On average, it takes a ship eight to ten hours to pass completely through the canal.**
- **Ships pay a toll — based on cargo volume and measurements — to use the canal. The highest toll ever was \$165,235.58, paid by the cruise ship *Rhapsody of the Seas* on April 15, 1998. The lowest toll was thirty-six cents, paid by Richard Halliburton who swam the canal in 1928.**

* *hoopla* — public excitement