

Path between the Seas

(Panama Canal [1870-1914]) by David McCullough (1977)

Ferdinand De Lesseps (FL) [his cousin was Napoleon's wife] was very charismatic & determined. He met a young man who later became the Viceroy of Egypt, who paid half the cost to build the Suez Canal [he raised the rest in France]. He was the driving force that got the Suez Canal done & became a wealthy hero. His son warned him not to expect another miracle in Panama, but he would help him.

FL was a man used to having things his way. He was a promoter with an unshakable faith in his own infallibility. He would tell the public it would cost less than he knew it would & would not listen to advisors. He expected capable men to figure it out all of the problems, **but his extreme optimism [or naiveté] was his making & breaking.**

His first attempt to raise money for the Panama Canal (PC) was a major failure. Then he went on a campaign to raise public interest & national pride. Then he asked for too little [even though one share was a year's wages for the average Frenchman]. The public loved him, but it seems the big money worked against him. He was paying too much in interest alone.

The only time to be there was in Panama's dry season [Dec-Apr]. The jungle tried to reclaim the railroad & had to be trimmed back. Ten feet of annual rainfall is on the Atlantic side & half that on the Pacific side [usually at an inch per hr]. The sea levels of the Atlantic & Pacific are the same, but the Pacific has higher tides.

The French spent \$287 million, dug 10% of the final dirt & lost 20,000 men in 10 years. **Unfortunately, technology had not arrived fast enough to help.** The biggest challenges were health, the river & the sheer volume of dirt to be moved. A sea-level passage would require even more dirt to be moved, so ultimately locked were designed [original design would have been obsolete in no time].

Apart from wars, this was the most expensive project ever. US was in favor of Nicaragua for the canal [mostly due to the deaths while building the Panama railroad]. William Cromwell (WC) [for fame] & Philippe Bunau-Varilla (BV) [to save French honor] were lobbyists for the PC. BV went to Russia to sell his idea, but thankfully the US bought it. He stirred up a revolution in Panama. The US Navy prevented a bloody war.

A mosquito must suck the blood of a yellow fever patient within 3 days of the patient contracting it & then wait 12-20 days before it can transmit the infection. **Dr. Gorgas eliminated yellow fever in Havana & was called to Panama.** He installed insect screens & removed stagnate water [even pans of water at hospital bed legs to keep ants out]. Yellow fever Mosquitoes [Stegomyia] lay their eggs in clean water, while malaria mosquitoes [Anopheles] use any stagnate water. Only the females feed on blood [to mature her eggs]. Mosquitoes are susceptible to wind & strong sunshine. Congress didn't believe mosquitoes were the culprit.

Half of the buildings the French built were overgrown by the jungle by the time the Americans arrived. One of the 1st changes was a bigger steam shovel [the Bucyrus would remove 5 cy at

a time]. Most men who arrived from US found conditions unhealthy & returned home. John Wallace (JW) was the 1st chief engineer & didn't get much done due to the red tape & poor leadership. John Stevens (JS) [built the Great Northern RR] replaced him & made changes to improve morale, starting with meals [now provided at cost], then listening to the men. He built better communities [homes, bakery, cold storage, halls, etc] & organized baseball leagues. He got Gorgas to improve health conditions. Steven removed the red tape & Gorgas removed yellow fever.

PC was the largest construction project in history [to that point]. It took nearly 9 yrs of non-stop digging to create the 9-mile Culebra Cut [the cut]. JS rebuilt the Panama RR & organized trains moving in & out of the cut [deliver to Gatun Dam]. By 1906 nearly 24,000 men [mostly black from Barbados] were at work. White skilled men were paid better than the black unskilled laborers. Some had to be told a wheelbarrow is to be rolled, not carried. JS built ten times as many buildings as JW.

The biggest challenge was to control the Chagres River which was achieved by building the Gatun Dam. Three locks were built at the Atlantic side & another three at the Pacific side. A new RR route would have to be built above the new water line. Most of the new towns would end up under water. Black men were dying at 6% & white men 2% [mostly from pneumonia, then malaria]. It was often 125 degrees at the bottom of the cut & it was noisy.

JS always had a clean desk & the men loved him. CG hated waste & was a military man. He started a newspaper & court of appeals [he would see 100 men each Sunday]. Eventually he won their loyalty. Most men felt they were a part of something bigger than life. No one lived in the zone [6-miles wide] unless they worked on the PC [or their family].

They had foresight to make the locks large at 110'x1000' (81' deep) [Titanic was 94'x883']. The concrete center wall between the locks was 60' wide & side walls 38' wide at base & 6' at top [backfilled against it]. The lock concrete floors were 16' thick. 6-ton buckets of concrete were dumped in place [36' sections] by cableways. The buckets were delivered from the concrete plant by train.

The spillway power plant created the power needed. (70) 18' valves would transfer water in & out of each lock to raise & lower the water level [& ships] in 15 minutes. The gates that opened each lock were 65' wide & 7' thick [the heaviest weighed 745 tons]. And there was a pair of backup gates. The gates were balanced & opened with ease.

The advent of electricity & improvement in steel quality allowed things that were not possible 25 yrs prior. Huge electric motors [by GE] opened the gates & valves [a yr before any factory had electricity]. The ships were guided in by locomotives. The control room itself was genius.

They built a breakwater to keep silt-bearing currents from clogging the Pacific entrance. They use compressed air to drill the holes for dynamite [30,000 per day]. At one time there were 7 levels [up the cut] of shovels & train tracks carrying dirt away. Mud slides were a problem [adding 25,000,000 CY to be excavated].

12% of the work force was white American skilled workers earned \$150/mo ave [steam shovel engineers made \$310/mo] + benefits. Enlisted men only received \$18/mo. The system favored

married couples. Clubs & organizations were very popular. Men rested on Sundays, went to church & day outings. Living conditions for the black workers were deplorable.

US spent \$352 million on the PC [France another \$300 m]. It cost about ten million dollars per mile to cut the Culebra. The French had about 30 MCY of useful excavation & US another 232 MCY. There was no scandal during US construction. 25,000 died during the French era & another 5600 from 1904-1914.

PC played a critical role in WWI & WWII.

- 1801 Napoleon went to Haiti & lost his men to yellow fever [then sold Louisiana to US]
- 1825 Erie Canal completed [363 miles x 40' wide x 4' deep] after 9 yrs of const
- 1846 US signed with Colombia to build the Panama railroad [47 mi done by 1855]
- 1869 Suez Canal completed after 105 miles & 10 yrs of construction
- 1869 Transcontinental railroad completed after 1777 miles in 6 yrs
- 1870 American team was sent to survey Central America to find the best canal route
- 1870 An old Napoleon surrendered to Germany & forced to pay \$1 billion indemnity
- 1878 The French did a bogus survey & signed a 99-yr lease with Colombia to build the canal
- 1879 FL had a world delegation to plan the canal [but he had controlling votes] [at sea level]
- 1881 The French began construction of the canal & bought the RR
- 1882 England gained control of the Egypt & Suez Canal
- 1883 Ten thousand men were working on the canal [\$1 per day] [2000 died that yr]
- 1884 mud slides were already a problem & 1/3 of the men were sick
- 1885 black men were leaving [before they died] faster than they could be replaced
- 1889 Eiffel Tower was built for the World's expo [only intended as temporary]
- 1892 Scandal broke out & the French canal company went broke
- 1893 US was looking at a Nicaragua canal, but Wall Street Panic made funds scarce
- 1894 FL died at age 89
- 1897 Dr. Ronald Ross found the cause of malaria & rec'd a Nobel Prize in 1902
- 1900 France signed over the building of the PC to US
- 1901 McKinley was assassinated & Theodore Roosevelt took office
- 1903 Panama revolution erupted against Colombia [US recognized the new Panama]
- 1904 US paid Panama \$10m & France \$40m & took over construction of PC
- 1906 Pres Roosevelt made a trip to see construction & took a photo on a steam shovel
- 1907 Stevens resigned [due to stress] & was replaced by Lt Col Goethals (CG)
- 1908 In one year removed half of what the French did in 17 years
- 1909 Taft became pres with the canal only half done
- 1910 40,000 men were on payroll
- 1912 One-third of the year was spent removing mud slides [even at 1 vert/5 horz slope]
- 1913 The last concrete was poured & the cut was complete
- 1914 PC officially opened & the work crews went home
- 1917 JS was sent to Russia to reorganized the Siberian RR.
- 1921 US paid Colombia \$25M indemnity
- 1915 avalanches blocked passage several times [& continue to date]
- 1936 Queen Mary was the 1st ship too big to go through the PC
- 1966 Lights were installed for night transit
- 1975 average toll was \$10,000 [10% of the cost to sail around Cape Horn]

Books: The influence of sea power upon history (A.T. Mahan); Mosquito Brigades (Ron Ross); Kings Solomon's Mines;

Quotes: "Make the dirt fly" (Ted Roosevelt) "There are 3 diseases in Panama, yellow fever, malaria & cold feet." (John Stevens)

"Far better it is to dare mighty things, to win glorious triumphs, even though checkered by failure, than to rank with those poor spirits who neither enjoy much nor suffer much, because they live in the gray twilight that knows not victory or defeat." (Theodore Roosevelt)

"A lie is an abomination unto the Lord & an ever-present help in time of need." (Mark Twain)

Notes: US paid \$15m for LA territory, \$7.2m for AK & \$20m for Philippines