A two-way, sea-level canal: the biggest excavation project in history

The optimal plan for a second Panama Canal would involve the construction of a two-way, sea-level canal crossing the isthmus from the Chorrera district on the Pacific to a point near the mouth of the Lagarto River on the Caribbean. The canal could be finished within 12-14 years at a cost of $15-18 billion, and would allow the simultaneous passage in opposite directions of two ships of a little more than 300,000 tons apiece. Its construction will require the biggest excavation in history, employing 10,000 workers in direct construction work and another 5,000 in subsidiary work.

Two industrial complexes should also be built, one at each end of the new canal, to transform domestic and foreign raw material into finished and semifinished goods for internal consumption and export. For example, Cerro Colorado copper could be turned into wire and electrical motors.

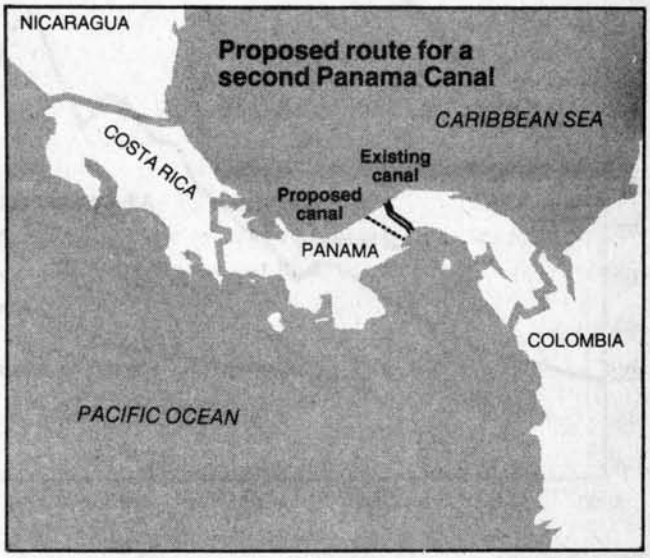
The sea-level canal is the key to the economic recovery of Panama, because it offers immediate possibilities of resolving the country's serious unemployment problem and will introduce new advanced technologies to the country. The main source of investments in the new canal would be from abroad, but the canal would be built, managed, and owned by Panamanians.

The canal design

Panama's present lock canal is one of the engineering marvels of the 19th century, yet today it is becoming more and more a bottleneck to expanding interoceanic traffic (**Figures 1 and 2**). Various competent proposals exist for excavating a sea-level canal, ranging from the use of nuclear explosives to conventional excavation, and the plan for "dredging the mountain," proposed by Panamanian engineer Demostenes Vergara Stanziola. We are ruling out nuclear explosives because the chosen route, known as Route 10, passes close to Panama's major population centers.

A detailed analysis of the various plans and studies led to the conclusion that the immediate start of the construction work is technically feasible, and the cost of building it can be paid off with toll revenues in a period no longer than 30 years after the canal opens.

Route 10 is judged by various experts to be the best for conventional means of excavation. One of the route's advantages is that it is only 13 kilometers from the present canal, and is accessible by the national highway and the Chorrera road, which facilitates supervision and logistical supplies to the project. The highest point is only 125 meters. From 15 to 20% of the route's surface consists of basalt and other hard materials, which would have to be blasted away, while the rest is soft material, removable with mechanical shovels.



The optimal configuration is a sea-level two lane canal, with each lane capable of admitting a ship up to 300,000 deadweight tons, at an average speed of 7 knots or 13 km/hour. Not including the entrance passages on the Caribbean and Pacific, the total length would be about 82 km, and the crossing through the land part would take only about six hours. (See **Figure 3** for more details on the design). The only design problem presented by a sea-level canal is the difference in tide levels between the Caribbean and the Pacific, a problem resolved with tide gates or by creating big artifical inlets using the material from the dredging and excavation, as proposed by Vergara Stanziola.

The building of the new canal would employ some 10,000 workers, 40% of them engineers and skilled workers, and 60% semiskilled. In the first two years, the period of feasibility studies and design, 500 would be employed. By the third year, when the actual construction begins, the crew goes up to 5,000. From the fifth year to finish, 10,000 would be employed.

Support personnel would also have to be hired, who would not take part directly in the construction but in complementary jobs. It is estimated that these indirect workers would add up to 50% of the personnel hired for the project itself, or 5,000 workers in the period of most intense activity.

Financing the project

The cost of building a two-lane level canal for ships of 300,000 tons is calculated at $18 billion in 1984 U.S. dollars. Financing would come mainly from four sources: 1) export-import banks, or similar institutions, in Japan, the United States, and elsewhere; 2) interested governments; 3) multilateral loan institutions, such as the Inter-American Development Bank, World Bank, etc.; 4) commercial banks.

A short time ago, Japan offered to pay for much of the construction if the contract for all the work were given to Japanese firms. Recent information has it that the Japanese are still very interested, since the canal would facilitate shipping their goods to Europe and the U.S. Atlantic coast. The United Kingdom, Netherlands, West Germany, France, and Italy, have also shown a marked interst in participated with technical aid and financial backing.

The export-import banks would participate via loans to the constructing firms to buy equipment in the loaning country. Governments could supply loans which might later be remitted, while the multilateral institutions and commercial banks would give loans to the Sea-Level Canal Entity of Panama—an autnomous state firm which would be set up to build and manage the canal—backed up by the toll revenues. We calculated that commercial bank loans would be under 50% of the total. But since bank loans have an average term of seven to eight years, with very few exceptions, the financing package has to be structured such that the bank loans are the first to be paid or refinanced.

The financing would be by stepwise loans, the usual method for development projects like this one. The money would not be disbursed at one time, but as needed, to save on interest costs. The payment of the loans would begin in the first year of the canal's operation.

The total cost of the project will depend on what interest rates can be obtained (**Figure 4**). Real interest rates (interest rates less the inflation rate) prevailing before 1979 were never more than 1.5%; but even presuming a real interest rate of 7.5%, the total debt at the end of the project will rise to a little less than $30 billion in 1984 dollars, and can be paid with the tolls of a period of 30 years or less (**Figure 5**). These calculations are based on a maximum of 39,000 crossings

Figure 1

Why the present canal is not adequate

Obsolescence	Upper limit of capacity of 65,000 tons of displacement (32 m. in width; 289.75 m. in length; 12.2 m. of draft)
	Useless for 8% of the world shipping fleet
	Panama does not attract all the traffic it should.
Saturation	Maximum saturation expected by 1985. Ships could be forced to wait in line for as long as 1-2 weeks by that time.
Security	Vulnerable to sabotage and accidents

Figure 2

Loss of potential toll income

(partial calculation, 1981 figures)

Cargo that does not go through the canal	Loss
Iron ore—27 million tons	**45**
Coal—12 million tons	**21**
Grain—12 million tons	**22** (approx.)
TOTAL	**85** (approx.)

Note: In 1983 alone, the canal lost 1,500 crossings of oil tankers, which implies a loss in the range of $50 million in tolls. It is to be expected that a level canal would not only attract this traffic, which now takes other routes, but that it would attract vessels of very large capacity, which the current canal automatically excludes.

Figure 3

Recommended canal design specifications

Optimal configuration	2 lanes for vessels of 300 tons each
Dimensions of the prism	450 meters width at the bottom, and a depth of 29 meters
Length	Approx. 82 kilometers (not including entrance stretch)
Capacity	280,000 annual crossings (almost 20 times the present canal)
Time	2 years of feasibility studies and design
	10-12 years of excavation
Speed of crossing	7 knots per hour (13 km/h)
	Duration of crossing will be 5-8 hours.

Note: The only fundamental design problem which the sea-level canal construction presents is the difference between the tide levels of the Caribbean and Pacific. This can be solved with tide gates and artificial inlets.

Figure 4
Total cost of the project at different interest-rate levels

Real interest rates	(in billions of dollars) Construction costs	Interest payments	Total debt
1.5%	18	1.80	19.80
2.5%	18	3.10	21.10
5.0%	18	6.83	24.83
7.5%	18	11.30	29.30

Figure 5
Projected canal revenues
(in millions of dollars)

Year*	Revenue
1	600
2	630
3	661
4	694
5	729
6	765
7	804
8	844
9	886
10	930
11	976
12	1,025
13	1,076
14	1,130
15	1,186
16	1,209
17	1,233
18	1,257
19	1,282
20	1,307
21	1,333
22	1,359
23	1,384
24	1,413
25	1,441
26	1,469
27	1,498
28	1,528
29	1,558
30	1,589
Total	**33,796**

*Calculated on the basis of an annual base income of $600 million which would increase by 5% per year until the 15th year, and 2% from then on. Calculations are based on toll rates prevailing before 1981.

after 30 years, which is far from the potential maximum of 280,000 crossings.

Objections to the project

We have analyzed and refuted, one by one, all the objections that can be presented against this project.

It will cost too much. We have demonstrated that even at usurious interest rates, the sea-level canal will generate sufficient income to pay off the entire debt in no more than 30 years. This money will not come from the national treasury, but from the canal itself.

Moreover,the lock canal will have to be replaced sooner or later. In 1970, when the Commission for the Study of an Interoceanic Canal (CECI) presented its study, the sea-level canal would have cost $3.5 billon; now it will cost $18 billon, if begun right away. By the year 2040, when the present lock canal will be useless, it will cost $100 billion. Doesn't it make sense to start now?

There are other alternatives. Among the "less costly" alternatives to a level canal the following are often mentioned:

1) The "Panamanian alternative," to build a third set of locks for ships of 250,000 tons or more. Its main attraction is that the cost would only be $3.5 billion. It would postpone the saturation of the canal until the year 2040, but would entail $15.5 billion in costs which the sea-level canal would not: $5 billion in wages for operation and maintenance; $2 billion for tugboats, fuel, and spare parts; $5 billion for electricity to power the lock mechanism. The savings would thus be only $2.5 billion.

2) Oil pipelines, highways, railways—These alternatives are even more problematic. First, they add various costly and lengthy steps to cargo movement, increasing the possibility of damages, losses, accidents, and environmental contamination (e.g., oil spills).

These alternatives also violate the most elementary rule of transporting goods: The most expeditious and economical means is always by sea, from the place of production to the destination.

Also, these plans do not take maximum advantage of Panama's unique geography.

The canal might contaminate the environment. One of the worries of environmentalists is that the sea-level canal would permit the passage of flora and fauna from one ocean to the other. On the contrary, this will be impossible with a sea-level canal, since the inland waterway will be mainly fresh water, and marine life will not survive the passage. Even if the canal prism were to use a great deal of water, it would be sufficent to introduce a fresh-water curtain to shut off passage to plants and animals from one ocean to the other.

The canal would create unemployment. The sea-level canal would indeed need fewer workers to function than the present lock canal, but this disadvantage will be offset by new jobs, better paid in many cases, which will be created in the industrial complexes, and by the trade boom that will be stimulated by the building of the new canal.