PANAMA AFTER WORLD WAR 2

PLANS FOR A NUCLEAR CANAL

Even before World War 2 had ended the defence of the Panama Canal from nuclear attack was being questioned. Its vulnerability to air attack, and the lack of adequate defences against such attack, had been highlighted before the war, with carrier aircraft, or the use of bases in neighbouring countries, then being the fear.

However, the only enemy with aircraft carriers, Japan, never did launch any such air attack during the war – although the one real threat to the Canal had been a Japanese plan to use large submarines to carry floatplanes close enough for a surprise attack.[1] Not until the late 1950s at the earliest would the new enemy, the Soviet Union, have any realistic means to launch any sort of nuclear attack on the Canal. In fact, the nuclear threat to Panama and its Canal would come not from any adversary, but rather from the US.

It had been recognised that a sea-level canal, lacking the locks of the existing one, would be far less vulnerable. During the war, the US Secretary of War Henry Stimson had concluded that the only way to increase the Canal's security, and make it much more resilient in the face of a nuclear attack, would be to build a sea-level canal with no locks. He assessed that a sea-level canal could not be destroyed by a nuclear attack. In 1946, the Governor of the Canal Zone, Brigadier General Joseph Mehaffey[2], had argued that conventional weapons could render the existing canal useless, and that two of the contemporary atomic bombs could achieve the same result.[3]

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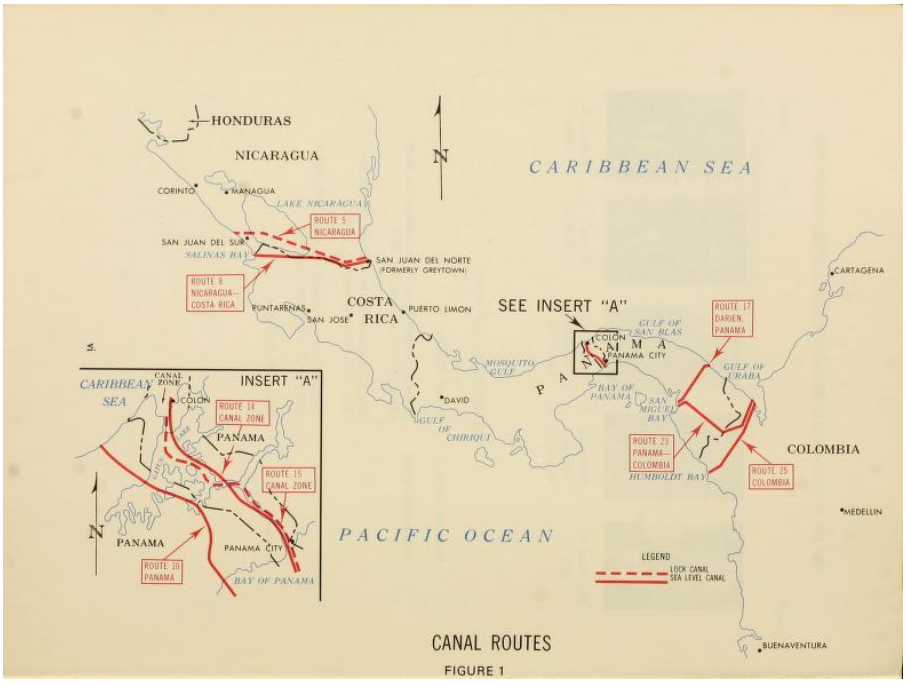
[1] For more on this proposed attack, see https://raytodd.blog/2024/06/30/panama-in-world-war-2-the-genuine-threat-the-planned-japanese-attack-on-the-panama-canal/

[2] He was a US Army Corps of Engineers officer, as had been the tradition for Governors.

[3] Mehaffey gave an example of the Canal being closed to traffic for four years from the attack using two A-bombs of 20 kilotons (as used on Nagasaki), whereas a similar attack on a sea-level canal would affect closure for not more than one month after mobilisation of the necessary equipment and personnel to effect repairs.
United States National Security Policy Towards the Panama Canal in an Era of Great Power Conflict by Nathaniel J Swank (a thesis), (Naval Postgraduate School, Monterey, California, March 2022): https://apps.dtic.mil/sti/trecms/pdf/AD1173484.pdf

Increasingly, after World War 2, there was an argument that while the Canal continued to be strategically important, it was relatively indefensible and should not be included in general military planning efforts.[4] It was also assumed that any attack would be sudden and carried out with the most advanced long-range weapons, and that distance from any potential foe would no longer offer the protection and the time for preparation as they had in the past.[5]

A sea-level would also be easier and cheaper to maintain and operate but, of course, it had been the attempt to construct a sea-level canal that had led to the failure and ruin of the original French canal attempt. Something special would be needed to carve a route though the Continental Divide – and now there was something special, in the form of nuclear weapons.[6]



Proposed sea-level routes as illustrated in final 1970 report of the Atlantic-Pacific Interoceanic Canal Study Commission[7]

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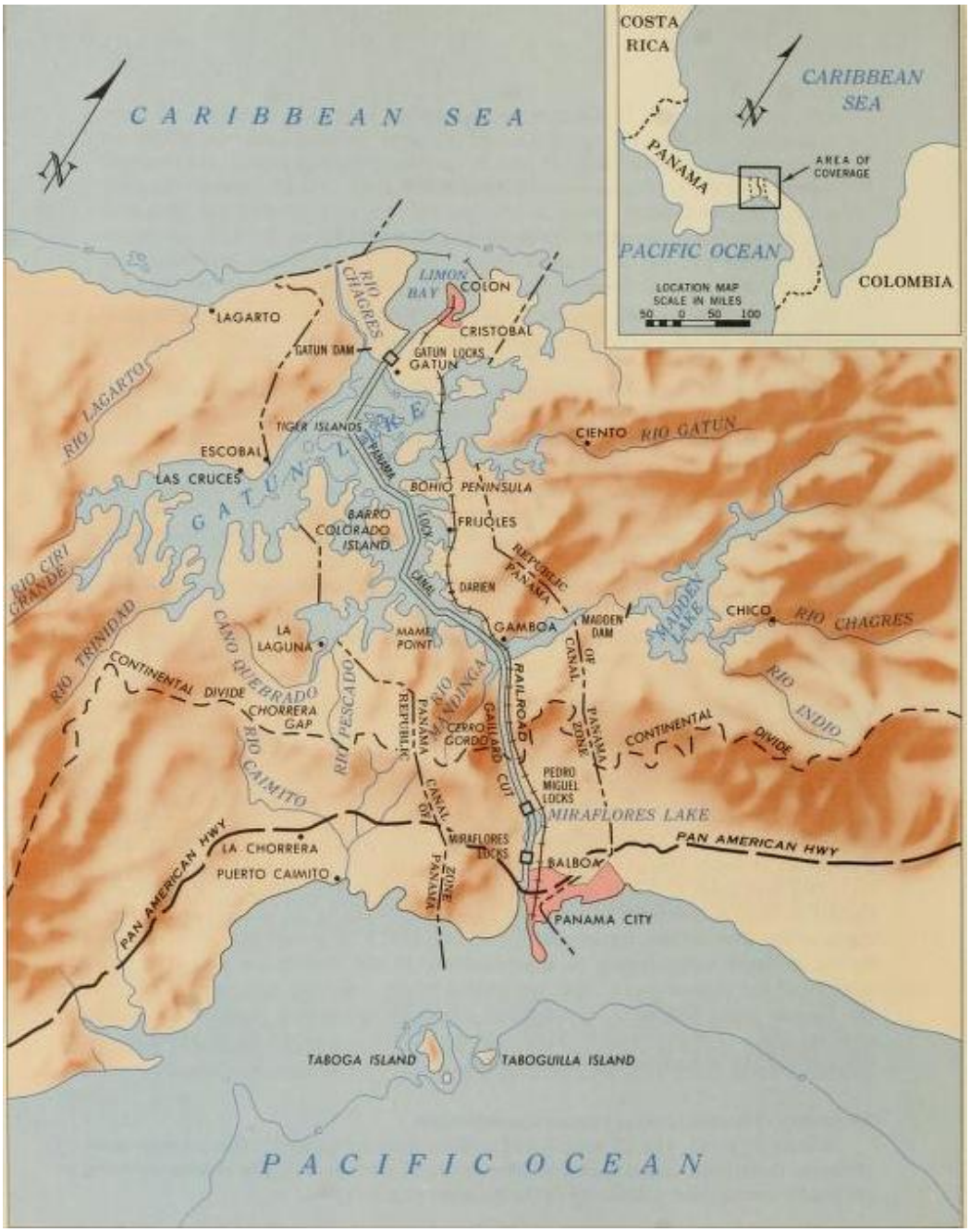
[4] See - *Wasting Asset: The US Re-assessment of the Panama Canal, 1945–1949* by John Major (Journal of Strategic Studies 3, no.2, 1980); and *United States National Security Policy Towards the Panama Canal in an Era of Great Power Conflict* by Nathaniel J. Swank (a thesis), (Naval Postgraduate School, Monterey, California, March 2022): https://apps.dtic.mil/sti/trecms/pdf/AD1173484.pdf

[5] In fact, a 2008 book revealed that President Truman tried to give the Panama Canal to the United Nations in 1945:
What T. R. Took: The Economic Impact of the Panama Canal, 1903– 1937 by Noel Maurer and Carlos Yu (2008).

[6] For much more detail on the nuclear plans, and other alarming activities in the Canal Zone during the US presence, I cannot recommend enough *Emperors in the Jungle: the Hidden History of the US in Panama* by John Lindsay Poland (Duke University Press, 2003).

[7] https://archive.org/details/interoceaniccana00unit/page/n9/mode/2up?ref=ol&view=theater



The Canal Zone in 1970[8]

A SEA-LEVEL CANAL?

As mentioned, in the early postwar years the Soviet Union would not have been able to mount a nuclear, or any other form, or attack on the Canal – it lacked the ocean-going fleet necessary, and would not have operational nuclear weapons, or the means of delivery, for many years.

[8] https://archive.org/details/interoceaniccana00unit/page/n73/mode/2up?ref=ol&view=theater

Indeed, in 1947, the US Joint Chiefs of Staff concluded that there was "*little likelihood of attack on the canal within the foreseeable future – ten years*".[9]

In 1948, the only bomber aircraft with the range and capacity to carry a nuclear weapon to strike the Canal from the Soviet Union was the enormous new B-36, and that was a US bomber, and the first were only being delivered to the United States Air Force that summer.[10]

As well as being less vulnerable to attack and disruption, a sea-level canal would likely also be more efficient in terms of number and length of transits, and require less maintenance and management.

Consequently, in the immediate postwar years the planning debate about the Canal's future came to focus on two things –

- a sea-level canal (like Suez), instead of one with locks and their supporting framework; and
- protection of the Canal from a nuclear strike (and/or its ability to withstand or recover from one).[11]

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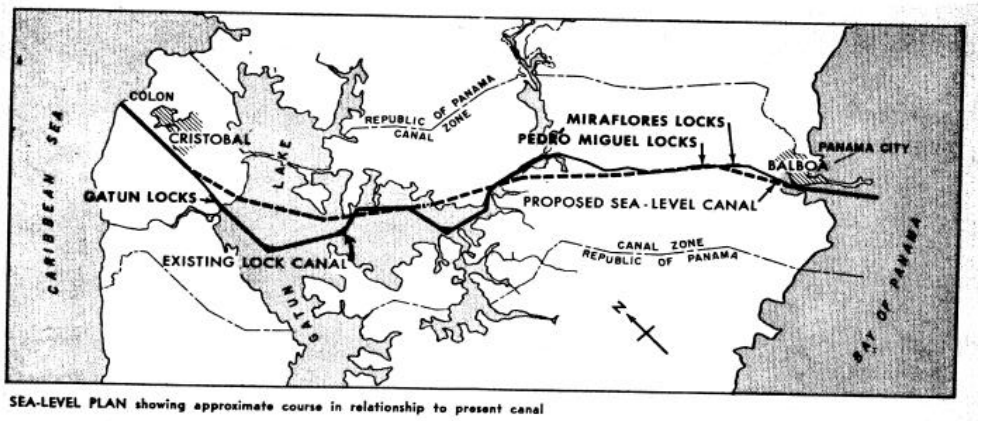
[9] However, in 1953, a simulated nuclear strike during exercises near Miraflores Locks demonstrated the locks' extreme vulnerability to such an attack.
http://www.country-data.com/cgi-bin/query/r-10053.html
Four years later in Operation *Caribbean*, US war gamers found the Canal's defences inadequate and asked Panama for missile sites outside the Canal Zone. The Panamanians, however, feared that US missile sites would only make their country more of a target for someone else's missiles; and in addition, they did not want to give up any more territory to the US.

[1010] First delivered in 1948, the Convair B-36 had eight piston engines (later supplemented by turbojets), this giant aircraft, the largest ever to serve with the USAF, and had a 10,000-mile (16,000 km) range. It served until replaced by the B-47 and B-52 during the 1950s.

[11] https://econweb.ucsd.edu/~vramey/research/The-Big-Ditch-Review-Published.pdf



SEA-LEVEL PLAN showing approximate course in relationship to present canal

THE DOTTED LINE INDICATES SEA-LEVEL CANAL SUGGESTED IN 1947. IT WOULD REQUIRE A NEW TREATY, SINCE CANAL ZONE LIMITS WOULD BE CHANGED. PANAMA COULD EXACT ANY PRICE.

In December 1945, the Governor of the Canal Zone, Joseph C Mehaffey,[12] was authorised by the US Congress[13] to report on how best the Canal could be adapted to meet the needs of merchant shipping and national defence, and to report his conclusions by December I947.[14]

Canal engineers were sent as one of the US teams which observed the atomic tests at Bikini Atoll in 1946. These demonstrated what such a weapon could do to ships and other military hardware.[15]

The studies in 1947 were conducted by the Panama Canal Special Engineering Division, first established in 1940 for the Third Locks Project.[16] This Division had the assistance and advice of both Government, Army and Navy, and private agencies and a Board of Consulting Engineers was appointed to serve in an advisory capacity on the studies and

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[12] Governor 1944-48.

[13] Public Law 280, 79th Congress, approved December 28, 1945 (59 Stat. 663).

[14] *Wasting Asset: The U.S. Re-Assessment of the Panama Canal, 1945-1949* by John Major (Journal of Strategic Studies), 2008.
The legislation also provided for a restudy of the Third Locks Project, a study of canals at other locations, and for consideration of any new means for transporting ships across land.
https://www.usni.org/magazines/proceedings/1955/march/isthmian-canal-policy-evaluation

[15] *A Hot Idea? Planning a Nuclear Canal in Panama* by Stephen Frenkel (Ecumene, Vol 5, No 3, July 1998).

[16] The project for new, larger locks was authorised by Congress in 1939, with excavation begun in 1940, but was effectively suspended in May 1942. For more on the project, see –
https://raytodd.blog/2024/06/30/panama-in-world-war-2-the-wartime-panama-third-locks-project/

evaluation of the results. Model testing and laboratory investigations were employed on a wide scale both on the Isthmus and in the US.

Meanwhile, a separate study was initiated by the US Navy. This was headed by Captain Miles P DuVal. Captain DuVal had previously published a book on the Canal, and in 1943 had proposed[17] the creation of a summit-level anchorage in Miraflores Lake to remove the bottleneck that could be created by waiting ships at the Pedro Miguel locks.[18] DuVal was opposed to the idea of a sea-level canal and would clash with Mehaffy.[19]

The DuVal plan was forwarded by the Secretary of the Navy to President Roosevelt, and subsequently approved in principle by the Governor for a major modification of the existing canal at "comparatively low cost".[20]

In November 1946, the US Navy referred the question of the size of the locks and any expansion of the Canal to the advisory General Board.[21] The response from the General Board effectively ended the idea of a sea-level canal in the view of the Navy. It was felt to offer no real advantage over the existing canal system which, once modernised, would suit the requirements of the Navy perfectly well.[22]

The Secretary of the Navy then announced that he would prefer locks with a width of 200-feet (61 metres), this being big enough to accommodate even the largest ships being contemplated. If, however, this would involve exorbitant costs then the Navy

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[17] In an address before the Panama Section of the American Society of Civil Engineers.

[18] In 1955, his 1943 proposals on how to improve the existing Canal were published, which again included removing the "bottleneck" at the Pedro Miguel Locks: https://www.usni.org/magazines/proceedings/1955/march/isthmian-canal-policy-evaluation

[19] Captain DuVal was Captain of the Port of Balboa in the Canal Zone 1941-44, in charge of marine operations in the Pacific Sector of the Canal. From 1946 to 1949, he was Navy Department Liaison Officer and Coordinator of Isthmian Canal Studies, under the Chief of Naval Operations. He was to write two books on the Canal, *And The Mountains Will Move* and *Cadiz to Cathay*.

[20] https://www.usni.org/magazines/proceedings/1955/march/isthmian-canal-policy-evaluation

[21] Abolished in 1951, the General Board was an advisory body originally established in 1900, and composed of senior admirals who, without operational responsibilities and nearing the end of their careers, were relied on to provide expert, but dispassionate advice.

[22] *Wasting Asset: The U.S. Re-Assessment of the Panama Canal, 1945-1949* by John Major (Journal of Strategic Studies), 2008

would have to be content with the existing system. He made no mention of a sea-level canal.[23]

Only four days after the Secretary of the Navy had made his pronouncement, the preliminary report of an advisory committee which undertook the Isthmian Canal Studies said that a sea-level canal would be a less attractive target for an enemy, would be inherently more secure, require less equipment, and would be easier to defend. The proposal soon received a further boost as it became clear that the required additional funds would not be available for defences of the Canal (then considered necessary if the existing lock system Canal was to remain in use).[24]

James C Mehaffey (centre) in 1948

In June 1947, the report from Governor Mehaffey unequivocally came down in favour of a sea-level canal (despite it being the most expensive option at $2.483 billion).[25] Mehaffey said that it offered the necessary security and that US strategic plans must be based on "a dependable canal during war".[26]

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[23] Ibid.

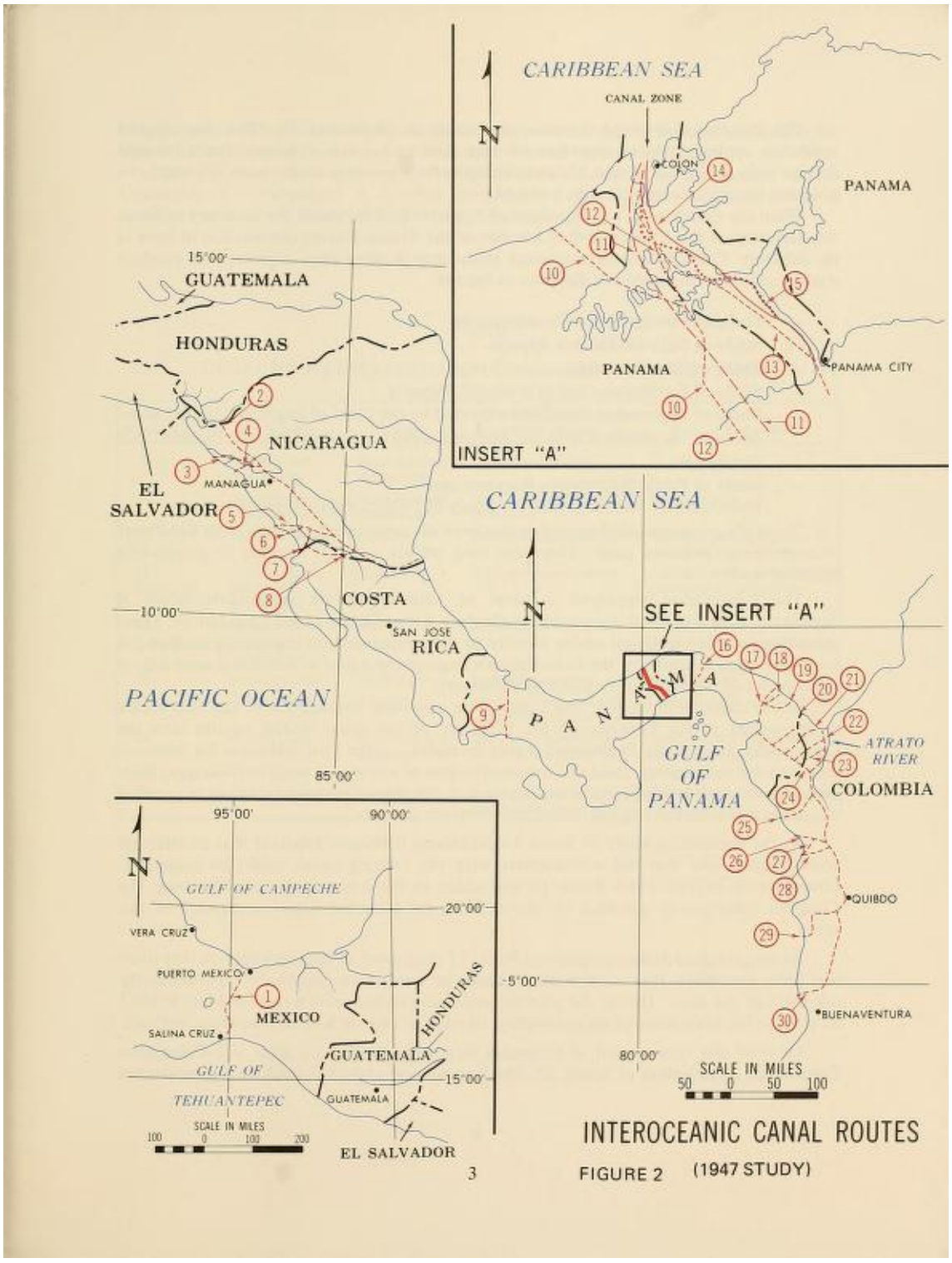
[24] As the Republicans controlled both houses of Congress and were opposed to Truman's spending plans. In September 1947, Secretary of State George Marshall told Provisional President Jiminez that an economy-minded US Congress would not grant funds for short leases, although he seemed to change his mind shortly afterwards. In any case, with the containment of the Soviet Union in Europe and the Mediterranean, the greater part of any available funds would, of necessity, be spent there.

[25] $2.483 billion – compared to $2.308 for modernised lock canal and $1.632 billion for DuVal's Pacific lake concept. In 1955, the costings of Mehaffey's canal were revised at $3.688 billion. https://www.czbrats.com/Articles/sealevel.htm
The plan was for a virtually new canal of at least 60-feet (18.28 metres) depth in navigation lanes and of 600-feet (182.9 metres) width between sloping sides on a new alignment somewhat removed from the present channel, which it crossed several times. Surprisingly perhaps, an apparent inability of nuclear blasts to create the necessary gradual sloping sides was a major problem, see: https://www.environmentandsociety.org/arcadia/searching-stability-energy-entropy-and-abandoning-panatomic-canal

[26] *Wasting Asset: The U.S. Re-Assessment of the Panama Canal, 1945-1949* by John Major (Journal of Strategic Studies), 2008.

Mehaffey made the point that, to avoid another Pearl Harbor, the Navy should be both widely dispersed, yet able to concentrate quickly. The Canal would facilitate this, and he argued that the creation of a two-ocean navy[27] had not removed the need for the Canal in Naval planning.

[27] Congress passed the Two Ocean Act in 1940, one of the largest procurement Bills in the history of the US Navy. It increased by 70% the Navy's size for combat tonnage at a cost of $4 billion. It also set into motion a strategy that is still relevant today – basing US fleets in both the Pacific and Atlantic Oceans



INTEROCEANIC CANAL ROUTES

FIGURE 2 (1947 STUDY)

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The report and recommendation were reviewed in draft form by the Joint Chiefs of Staff, the Department of the Navy, and the Atomic Energy Commission, all of which fully concurred in the main premises of the final report. However, one should note that the first meeting of the Board of Consultants a resolution was adopted to the effect that no plan affecting the Canal would be approved under which the capacity of

the Canal would be impaired or seriously reduced during the course of such changes. There is obviously the question of how this position could be reconciled with the possible use of nuclear explosions when they were suggested as a means of excavation.[28]

The Navy referred the Mehaffey report to its General Board, and posed three preliminary questions –

1. How vital is the Canal to the US in a war with the Soviet Union?[29]
2. How liable is it to be attacked in the event of war?
3. Based on answers to the above questions, how much is would the increased resistance to long-term closure be worth to the US in dollar terms?

When the General Board held hearings in September 1947, it heard it argued that money required for the sea-level canal project would be better spent on missile research and development.[30] Doubts were also raised about claims of a sea-level canal's ability to survive or recover from an A-bomb attack.[31] Nevertheless, a majority of admirals giving evidence favoured a sea-level canal – although it was pointed out that an attacker would probably rather target US ports and concentrations of ships, rendering the use of the Canal largely irrelevant.[32]

On the other hand, regardless of the requirements of naval warships, the Canal would remain crucial as a link in US supply lines, and one admiral predicted that in any

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[28] The Panama Canal Review (7 June 1957): https://www.czbrats.com/Articles/sealevel.htm

[29] Referred to as "Russia" in the referral.

[30] This latter view was not surprising, as having put forward by Rear Admiral Dan V. Gallery, head of the Navy's missile programme.

[31] Incidentally, at the time the USSR was busy adapting interned US B-29 bombers, reverse-engineering them to become its Tupolev Tu 4 (NATO codename "Bull"), which was only introduced in 1949 and would remain its standard long-range bomber into at least late-1950s. Whether it could have mounted an attack on the Canal from Soviet bases in Europe, given the distances involves, may be open to doubt, although (as with concerns over German plans pre-war), any operation could have been mounted from another, closer country. Indeed, one admiral told the General Board that, pending Soviet acquisition of the A-Bomb and the means to deliver it, the current threats against the Canal were estimated to be 'from missiles fired from submarines approaching by stealth or from a surreptitious air attack from South America".

[32] *Wasting Asset: The U.S. Re-Assessment of the Panama Canal, 1945-1949* by John Major (Journal of Strategic Studies), 2008.

Europea-based conflict as much shipping would flow through the Canal as had done in World War 2.[33]

On 26 September 1947, the General Board reported its findings, which were endorsed by the Joint Chiefs of Staff –

> "*At some unpredictable future time*", missiles with nuclear warheads would be developed, "*at which time the strategic importance of an isthmian canal will diminish, but that meanwhile the Canal remained essential, to provide the Navy with more flexibility and to handle the industrial goods passing from coast to coast within the* US".[34] [35]

The report was sent by the President to the Congress on 1 December 1947, without Presidential approval, comment or recommendation, and encountered sharp opposition. The Congress took no action on the report, but instead it authorised an investigation in 1949 into the organisation and financing of the Canal as a whole.[36]

Of course, all these discussions faced the facts that, if a new sea-level canal was built, this would need the original 1903 Treaty with Panama to be renegotiated, and probably also addition territory. Given the situation at the time, with the US forces having to withdraw from its bases outside the Canal Zone, and the political environment in Panama, with heightened nationalism, any negotiations would be lengthy, difficult (and possibly fruitless).[37] What also seemed certain was the likely destruction of both the existing Canal and the trans-isthmus railway if a new sea-level canal was constructed.

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[33] One, presumably pessimistic, witness said that it would be best to have logistics plans predicated on there being no canal at all.

[34] It was noted that the alternative to a sea-level canal, that of expanding the capacity of the US transcontinental railways would be 2 or 3 times more expensive.

[35] *Wasting Asset: The U.S. Re-Assessment of the Panama Canal, 1945-1949* by John Major (Journal of Strategic Studies), 2008

[36] The action of the Congress would result in significant changes to how the Canal was managed and run from 1950.
https://www.usni.org/magazines/proceedings/1955/march/isthmian-canal-policy-evaluation

[37] The War Department had argued that a sea-level canal would not need any defence sites outside the Canal Zone.
A 1936 amendment of the original 1903 Treaty with Panama had removed the effectively automatic right of the US to acquire additional territory for use in connection with the Canal.

By 1948, it seemed that plans for a nuclear-resistant sea-level canal had been planned, only to be revived in the 1950s.[38]

Indeed, in May 1949, a State Department diplomat, William Tapley Bennet Jr, reviewed the issue of a possible new treaty to facilitate a sea-level canal, with pessimistic conclusions. With any project requiring even greater access to territory in Panama, he concluded that it was "*extremely unlikely that we would be able to obtain in any new area rights and privileges of the scope that we now enjoy in the Canal Zone*".

In March 1949, in a revised paper, Joint Chiefs of Staff planners said that that the restrictions imposed by narrow lock dimensions of the existing Canal were no longer enough to justify large appropriations for widening, and that the cost of any modernisation programme was likely to be high.
Even Captain DuVal conceded in June 1949 that the security of the US did not depend on an impregnable trans-isthmian canal; on the contrary, the security of the Canal hinged on US military and industrial might.

As late as 1956, the Joint Chiefs of Staff concluded that, while a sea-level canal was desirable, it was not politically feasible.[39]

Another factor that needed to be taken into account when considering whether a new canal was feasible was that, between 1959 and 1964, US policy in and towards Latin America was dominated by fears that followed the successful Cuban Revolution. Panama was increasingly dissatisfied with its role as 'host' of the Canal and Canal Zone.[40] This was the background to the growing unrest in Panama in the late 1950s

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[38] *A Hot Idea? Planning a Nuclear Canal in Panama* by Stephen Frenkel (Ecumene, Vol 5, No 3, July 1998).
[39] *Emperors in the Jungle: the Hidden History of the US in Panama* by John Lindsay Poland (Duke University Press, 2003).
[40] *A Hot Idea? Planning a Nuclear Canal in Panama* by Stephen Frenkel (Ecumene, Vol 5, No 3, July 1998).

that reached a peak in the riots of January 1964 which led to the remarkable situation involving a break in diplomatic relations between Panama and the US.

The US Government appeared to operate (arrogantly) under the assumption that it would be able to build a canal on foreign land, and that any Central American country involved (or affected) would agree, once the project was explained to them. Astounding as it might appear to us today, from the beginning it was assumed that people would have to be removed for a period of years from the areas where nuclear devices were to be detonated. In fact, plans called for removing somewhere between 10,000 and 650,000 people depending on the project (as happened in the Pacific tests). For example, for the Darién route-

> "*It would be necessary to move about 30,000 rather primitive people away from their jungle for some years to avoid the radioactivity*".[41]

Little account appears to be taken of the likely environmental effects of any plan. The Smithsonian Institution (which maintained a research station in Panama) raised biological issues as early as 1966, but its studies were not formally considered until 1969. Indeed, only four pages of the 109-page technical report published in 1970 were devoted to environmental issues. The journal *Science* in 1971 observed that "the thrust of its conclusions was that whatever ecological risk might exist is 'acceptable'".[42]

THE NUCLEAR OPTION

While one might imagine that it was only in years immediately following World War 2, with naivety of the longer-term effects of nuclear weapons and fallout, that the idea of using nuclear "explosives" was contemplated, in fact (as we shall see) it was only in December 1970 that a commission established to examine options for a new or altered canal concluded definitively that a canal built using "nuclear excavation" (in Panama or

[41] Ibid.
[42] *A Hot Idea? Planning a Nuclear Canal in Panama* by Stephen Frenkel (Ecumene, Vol 5, No 3, July 1998).

Colombia) was not viable.[43] Without use of a nuclear device, no means of constructing a sea-level canal was considered viable.

Project *Plowshare*, was established by the Atomic Energy Commission (AEC) in June 1957 to explore the peaceful uses of nuclear energy, and was instituted by the Lawrence Livermore National Laboratory.[44] The sort of uses envisaged were civil and industrial projects, such as the creation of harbours and canals and the stimulation of natural gas reservoirs.[45]

As we have seen, in the immediate postwar years, it had been considered that a sea-level canal could better recover from any enemy attack, as well as probably less vulnerable than a canal with locks to damage in the first place.

The postwar period had seen the idea of the use of the "peaceful atom", and one use was in "excavation", and that using a nuclear weapon to "excavate" a sea-level canal was a cheaper option than others.[46]

As many as 30 routes had been considered – in areas stretching from Ecuador to Mexico. However, all but eight were soon discarded as impractical. One route that seemed to offer prospects crossed the Darién region bordering Colombia (so between the Colombian border and the existing Canal Zone, and would involve the acquisition of considerable additional territory, all well outside the Canal Zone). The cost of this

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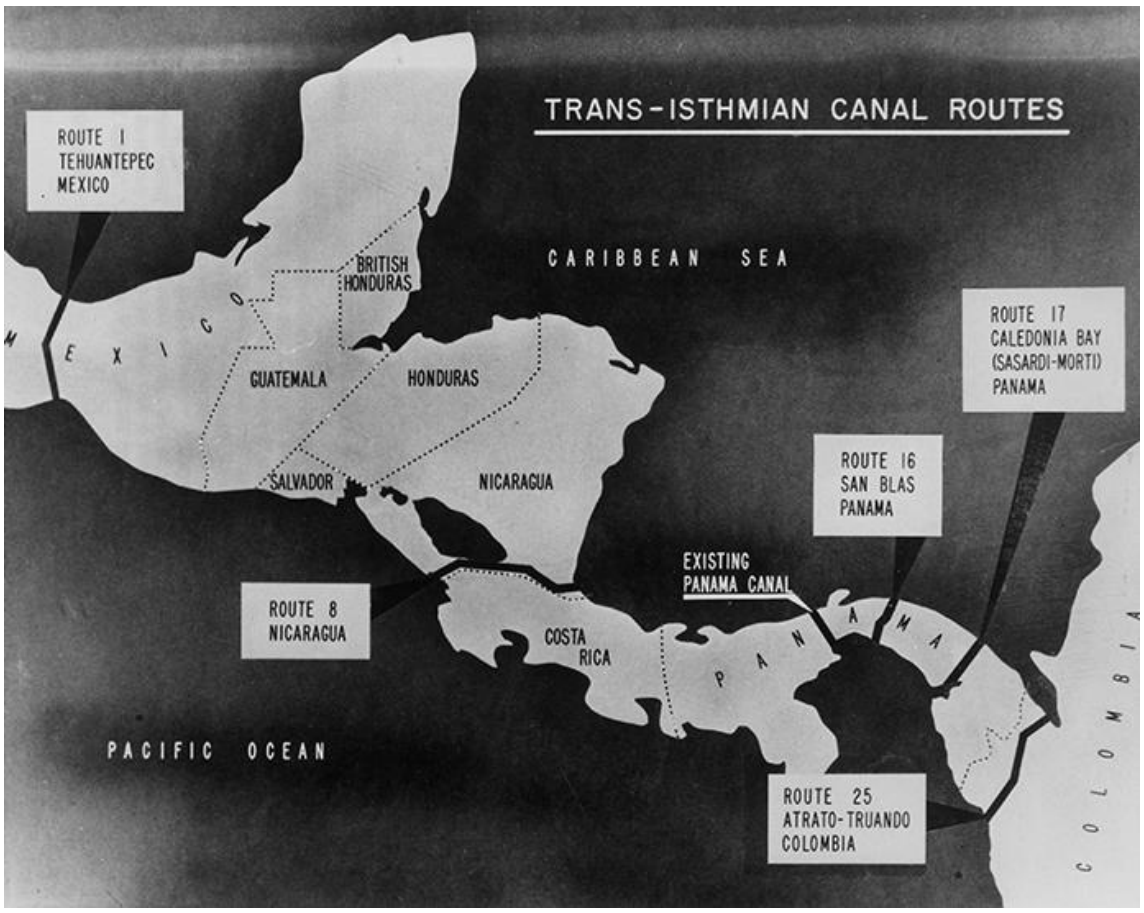
[43] After 14 years of research and tens of millions of dollars. The Interoceanic Canal Study Commission, also known as the Sea Level Canal Study Commission, had been established in 1964 by Act of Congress to provide for an investigation and study to determine the feasibility of and the most suitable site for a sea-level canal connecting the Atlantic and Pacific Oceans, its cost, and the best means of constructing such a canal, including consideration of nuclear excavation.
Emperors in the Jungle: the Hidden History of the US in Panama by John Lindsay Poland (Duke University Press, 2003).

[44] Then the University of California Radiation Laboratory at Livermore. The Lawrence Livermore National Laboratory is located close to San Francisco. It had been established in 1952, in the early days of the Cold War, as a branch of the University of California Radiation Laboratory, to meet urgent national security needs by advancing nuclear weapons science and technology. One of its 2 co-founders was Edward Teller (the "father of the bomb").

[45] https://st.llnl.gov/news/look-back/plowshare-program

[46] The Chairman of the Joint Committee on Atomic Energy said in 1965 that using a nuclear explosion to build a sea-level canal was the main proposal that generated real enthusiasm, and the associated funds.

route was estimated to cost $5.1 billion, this seeming to offer a $1.74 billion saving on the use of conventional excavation methods.



Alternate routes for an alternative to the Panama Canal to be built using nuclear weapons considered by US officials (US Department of Energy)[47]

In July 1958, engineers for the Panama Canal Company (then still wholly a US-run organisation with no Panamanian involvement) met with the Atomic Energy Commission. At this meeting it was said that the nuclear explosion involved in any excavation would require the evacuation of people up to five miles (8 km) from the site, and a further "buffer zone" of 25 miles (40.2 km) from large towns and cities. This requirement would have obviously ruled out the existing Canal route, where the isthmus was only around 40 miles (64.3 km) wide, with major cities at each end. Following this meeting, an associate director at the Livermore Laboratory was made the key contact for "canal studies".

[47] https://www.enr.com/articles/59202-project-plowshare-nuclear-bombs-as-potential-construction-tools

By 1959, despite President Eisenhower having ordered a moratorium on nuclear tests in the atmosphere,[48] he did not end the canal studies, and even directed the Army to incorporate the nuclear approach to engineering studies into a new sea-level canal. In June 1959, he also approved an agreement with Panama for cooperation on research in industrial uses of atomic energy.[49]

However, the late 1950s saw complications for any plans due to the worsening relations with Panama, and the increasing protests.[50] Hence the agreement with Panama on nuclear cooperation was kept quiet, and the Canal Zone Governor was told not to refer to the nuclear plans at Congressional hearings. Despite these complications, the Panama Canal Company continued with its studies, and the collaboration with the Livermore Laboratory.

In 1960, the Panama Canal Company hired an engineering firm, Parsons, Brinckerhoff, Quade & Douglas, to study nuclear weapons use to in excavating a new canal route.[51]

The Panama Canal Company studies resulted in a report: *Isthmian Canal Plans – 1960s*. This looked at five possible routes, in Mexico, Nicaragua and northern Colombia and with two in Panama.[52] The Panamanian routes were the "Sasardi-Morti route" (or "Route 17") in the Darién, and the "San Blas route", some 40 miles (64.3 km) east of the existing Canal.

The report recommended that the first priority would be a sea-level canal created using nuclear excavation, and a sea-level canal in the Canal Zone using conventional

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[48] On 1 November 1958, this was intended to last for 3 years.

[49] It has to be said that, at the time, when Panamanian Government ministers were involved in any discussions they were not as hostile to proposals as one would now have expected. However, general relations between the two countries were quickly deteriorating, due to popular protests that would culminate in the riots and deaths of January 1964.

[50] In November 1959 (November being when independence days occur in Panama), 40 locals were injured in clashes with US troops.

[51] https://www.enr.com/articles/59202-project-plowshare-nuclear-bombs-as-potential-construction-tools

[52] Interestingly, in the mid-19th Century a countryman of mine explored a route for a canal across northern Colombia, connecting rivers. When I presented a biography of William Kennish to the Canal Museum, the curator had to admit that she had not heard of him.

excavation methods was only a second priority. It also expressed a strong preference for a route through Panama, quoting a cost of $750 million for the Sasardi-Morti route.

While the report remaining classified, in April 1960, the Cabinet approved the recommendations of the study, including the exploring of sea-level routes in Panama, Colombia, Mexico and Nicaragua. In 1960, the National Security Council, which advises the President on issues of foreign policy and national security, recommended going ahead with a nuclear-excavated canal, but with a greater safety zone of 50 miles (80.4 km) (which would seem to effectively rule out using the narrow part of the isthmus through which the existing Canal ran). President Eisenhower also separately approved a policy to develop nuclear explosives for excavations.

At the same time, a study into the Canal's long-term future had been requested by the US Congress.[53] This being focused on traffic predictions and the costs of various options (it did not have access to the studies on nuclear excavations). The Congress study found that the least expensive option for a sea-level canal was in the Canal Zone, with an estimated cost (using conventional methods) of $2.287 billion. However, it also concluded that this could not be justified, and that the only hope would be for use of the "*as yet unproven nuclear means*".

In 1962, Eisenhower's successor, President Kennedy, allowed research into a sea-level canal built using nuclear explosions, and ordered a five-year technical and economic investigation into a sea-level canal, to be jointly funded by the Atomic Energy Commission and the Department of Defense. The Army submitted funding requests for studies into routes in Panama and northern Colombia, and the Army's Corps of Engineers created a Nuclear Cratering Group.[54] In addition, and after several years of informal consultation between the Atomic Energy Commission and the Corps of

[53] Chaired by Representative Herbert C Bonner who, in 1963, introduced legislation that would authorise the Panama Canal Company and AEC to conduct site surveys for possible routes for a new sea-level canal.

[54] The first test "cratering" was carried out in Nevada in 1962. The largest of the Project *Plowshare* experiments, it used a device with a yield of about 100 kilotons, and produced a crater approximately 1,200 feet (365.7 metres) in diameter with a depth of 320 feet (97.5 metres). https://www.llnl.gov/purpose/history/1960s#event-the-sedan-crater

Engineers, the two formed a joint program in 1962 to study construction problems related to nuclear weapons.[55]

The US signing the Limited Test Ban Treaty in 1963[56] was seen as changing the political and legal context for the use of nuclear excavation envisaged in Project *Plowshare*. This treaty banned the spread of radiation outside the territory of the US, or territory that it controlled, which would be difficult when the US only controlled the 10-mile (16.1 km)-wide strip of the Canal Zone in Panama.

On the other hand, Canal Zone Governor Robert Fleming was told in late 1963 by the Livermore Laboratory that a nuclear-excavated canal could cost as little as $400 million, nearly half the estimates of the 1960 study.

A Corps of Engineers officer sent to the Darién in 1963 became concerned if the planned route there, known as Route 17, was used. He warned of "devastating" earthquakes resulting from a 35-megaton nuclear blast, and that the clay shale along much of the route was highly unstable and liable to landslide (a problem that had dogged the original French canal, and was something that affected the US one).[57]

Another problem he identified was that, because of the heavy rain encountered in the region,[58] the canal sides would need to be wider and flatter than planned, which was not envisaged in the planning. His final report recommended not conducting further tests or experiments in the area, as they would be unlikely to produce a satisfactory result.

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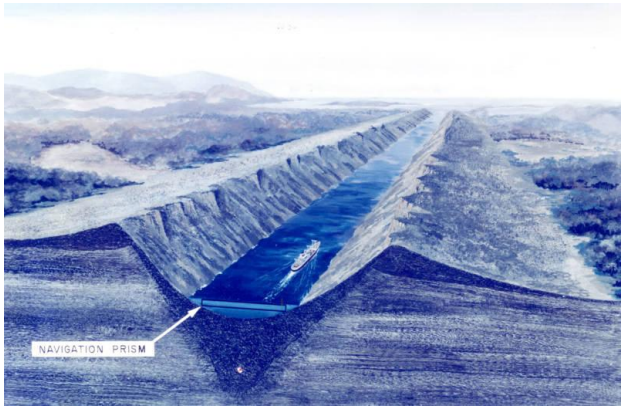
[55] https://www.enr.com/articles/59202-project-plowshare-nuclear-bombs-as-potential-construction-tools

[56] The Limited Test Ban Treaty was signed by the US, the Soviet Union, and Great Britain in 1963, and it banned all nuclear tests in the atmosphere, in space, or underwater. https://history.state.gov/milestones/1961-1968/limited-ban

[57] A landslip closed the new Canal for several months in 1915, the year after its opening.

[58] Panama has at least eight months of rainy season every year.



Mid-20th Century scientists envisioned a new Panama Canal blasted down to sea level with thermonuclear explosives (Lawrence Livermore National Laboratory)[59]

However, there were proposals for a "calibration" test of a 100-kiloton nuclear device in the Darién (or an area with similar clay shale) to determine if use of such a device to excavate was feasible.

In September 1964, Congress approved $17.5 million for exploration of a possible sea-level canal, including studies of routes in Panama and Colombia. In 1965, it had established the Atlantic-Pacific Interoceanic Canal Study Commission, and President Johnson gave his support. This was to spend some $22 million surveying potential routes. The subsequent study, published in 1970, would be the most exhaustive US study on nuclear excavation to date. However, it also concluded that traffic demand on the Panama Canal would not exceed capacity till 1995 — effectively shelving any immediate need for a new sea-level canal.[60]
The Commission conducted hydrological, atmospheric, and public-relations studies in Panama and combined their findings with those of the Atomic Energy Commission studies.

Plans by the Interoceanic Canal Study Commission, detailed in the final 1970 report,[61] called for as many as 250 near-simultaneous atomic explosions (yielding a total of

[59] https://www.kqed.org/science/710956/the-nuclear-canal-when-scientists-thought-h-bombs-would-make-awesome-earthmovers
[60] https://st.llnl.gov/news/look-back/plowshare-program
[61] https://archive.org/details/interoceaniccana00unit/page/n1/mode/2up?ref=ol&view=theater

approximately 120 megatons) placed so as to create a series of interconnected craters. This would, in theory, produce a continuous wave of excavation from coast to coast.[62]

Between 1966 and 1968 a series of rocket launches took place from Fort Sherman, to assess wind patterns and air density high above the country – 30 to 60 miles (48.2 to 96.5 km) above. These tests showed that the blast from any nuclear detonation could have effects at a considerable distance – capable of shattering windows as far away as San José, the Costa Rica capital, and the capital of Colombia, Bogota. This did not take into account the distance any fallout might travel – some fallout being inevitable, regardless of whatever measures taken to minimise it.[63]

A working group in 1966 cast further doubt on plans. It determined that the earthquake effect, hitherto dismissed, would result in property damage, loss of life, and would put the existing Canal out of commission. Landslides were said to be likely to be triggered as far away as Venezuela, Ecuador and Costa Rica.[64]

In June 1967, the possibility of carrying out an experimental blast was raised with the Panamanian foreign minister. It was raised by a general of the Corps of Engineers who was an adviser to the Canal Study Commission. The minister[65] was, at the time, engaged in the renegotiation of the Canal Treaty on behalf of the administration of

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[62] *A Hot Idea? Planning a Nuclear Canal in Panama* by Stephen Frenkel (Ecumene, Vol 5, No 3, July 1998).
So-called Buggy tests were carried out in Nevada, using multiple low-yield nuclear weapons, buried beneath the ground several hundred meters apart, to create a ditch.
https://www.forbes.com/sites/robinandrews/2018/08/23/this-is-how-america-nearly-nuked-a-canal-through-central-america/

[63] For example, an above-ground nuclear test in Nevada in 1962 was found to have spread radioactive dust much farther than predicted, which led to the cancellation of Project *Chariot*, a plan by the Atomic Energy Commission to use nuclear explosions to excavate a harbor at Cape Thompson, Alaska. Furthermore, underground tests in the Nevada desert are said (contrary to public statements at the time) to have "deposited nearly five times as much fallout on and near the test site" than the Commission had anticipated:
https://www.enr.com/articles/59202-project-plowshare-nuclear-bombs-as-potential-construction-tools

[64] A contractor estimated the costs of damage likely to be caused by blasts of 5 to 30 megatons was up to $218 million.

[65] Fernando Eleta Almarán.

Marco Aurelio Robles,[66] and was said to be "enthusiastic" about the idea. He is said to have even suggested carrying out a nuclear test in Panama.

However, despite the response of the Panamanian minister, international pressure following atmospheric tests carried out by China and France, the latter in the Pacific, one of the Panamanians negotiating treaty changes announced that no sea-level canal would be built if nuclear explosions put Panamanians at risk.

Nevertheless, in June 1967, the foreign minister and the US negotiator initialled three draft treaties – one of these was concerned with the construction of a sea-level canal (the others dealt with the existing Canal and military bases). The sea-level agreement gave Panama the right to veto use of nuclear excavations. None of these would be signed or ratified after news of the draft was leaked to the press, and that it would have extended the US presence in Panama for another 100 years, to 2067, albeit that it was envisaged the original treaties, Canal and Canal Zone would cease by 31 December 1999.[67]

Meanwhile, during the previous year, the Kuna in the Darién complained to the Panamanian Government after US Army engineers brought in large amounts of heavy earthmoving equipment to clear a path from coast to coast. The indigenous people now came down firmly against a canal being built on their land.[68] In 1967-68, the Corps of Engineers had sent 50 geologists to look for the best possible routes through Central America.[69]

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[66] Something that continued, under successive US administrations during the 1960s and 1970s. The following year saw the National Guard mount a coup, with General Omar Torrijos eventually assuming power.

[67] Of course, the later 1977 treaties saw the US control and Canal Zone gone by that date. https://elfarodelcanal.com/el-proyecto-del-canal-nuclear/

[68] The Guna's semi-autonomous territory was located on the Caribbean coast and islands in the Darién region. It is also bordered by another indigenous region, divided into the Wounaan and the Emberá ethnic groups.

[69] https://www.forbes.com/sites/robinandrews/2018/08/23/this-is-how-america-nearly-nuked-a-canal-through-central-america/

Guna Yala indigenous territory on the coast of the Darién

The trail carved through the Darién for the prospective Route 17[70]

Somewhat at odds with the plans for a canal built using nuclear explosives, between 1965 and 1967 negotiations took place over what became the 1967 Treaty of Tlateloco[71], which entered into force in 1968 and prohibited the existence of nuclear weapons in Latin America.

While studies and experiments continued, nuclear power did make an appearance in the Canal Zone. In July 1968, an experiment was undertaken in which the Army's first floating nuclear plant, the *Sturgis*, was towed from Virginia and anchored in Lake Gatun, at the centre of the Canal.[72] The idea was for this to provide electrical power,

[70] https://archive.org/details/interoceaniccana00unit/page/n47/mode/2up?ref=ol&view=theater

[71] The Treaty for the Prohibition of Nuclear Weapons in Latin America and the Caribbean. Notably, Panama, Colombia and Costa Rica, all of which would have been affected by the nuclear excavated sea-level canal plans, are signatories.
https://www.un.org/nwfz/content/treaty-tlatelolco

[72] Created for the Army Nuclear Power Program, the Mobile High Power Reactor Number 1A, a barge named *Sturgis*, was designed to provide power where none was available, such as in war zones or scenes of natural disaster. It was a conversion of a wartime Liberty ship, and was named for the Chief of Engineers in the early days of the Program, General Samuel Sturgis.
https://www.usace.army.mil/About/History/Exhibits/Nuclear-Power-Program/Sturgis/
For a full history of the vessel, as Liberty ship and floating reactor, see
https://www.nab.usace.army.mil/Portals/63/docs/Environmental/HealthPhysics/FINAL_MH1A_STURGIS_Mitigation_Report_July_2019.pdf?ver=2020-06-04-211412-970

easing pressure on water supplies by substituting for the power generated from hydroelectric, so that more water would be made available for Canal transits – water reserves being a limitation on the number of ships that could make a transit. At the time Panama had suffered a (relative) drought,[73] but it was also thought was that by use of such a power source one could thereby delay the need for a sea-level canal. The reactor went online in October 1968 and continued to operate until 1976, when it was taken away and decommissioned, its reactor removed.[74]

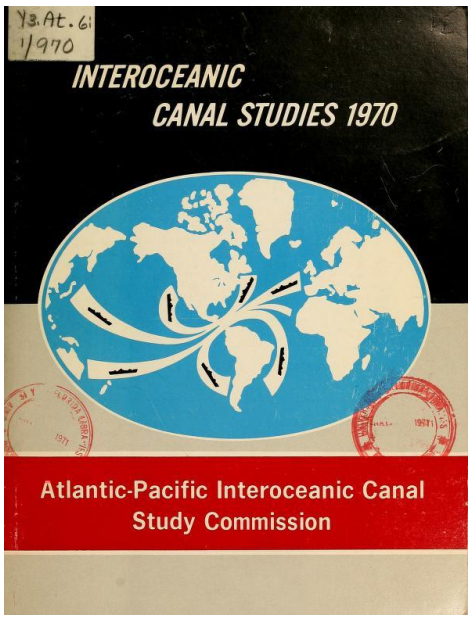
The Sturgis in Lake Gatun and providing nuclear power.

The studies approved by Congress considered the secondary effects of radioactivity and fallout. Whereas original plans called for the Pearl Islands[75] to be evacuated for just two months, this recommended exclusion period would need to be greatly extended. In addition, the Oak Ridge National Laboratory[76] concluded that "*a definitive assessment of radiological safety is not possible*" for the nuclear excavation of a sea-level canal, particularly the longer-term effects.

Finally, any idea of a new sea-level canal constructed using nuclear excavation ended following the submission of the final report of the Canal Study Commission to President Nixon in December 1970.[77] It concluded that "*nuclear excavation of a sea-*

[73] This happens from time to time, caused by the *El Niño* or *La Niña* effects.
[74] It was eventually broken up in Texas in 2015.
[75] The Islas de las Perlas are a group of 200 or more islands and islets (many tiny and uninhabited) lying about 30 miles (48 km) off the Pacific coast of Panama. These would have been affected if a nuclear-excavated canal had been built along the route across the Darién.
[76] Established in 1943 in Oak Ridge, Tennessee – a town which was created by the Army's Corps of Engineers as part of the Manhattan Project to develop the A-bomb. It is now sponsored by the Department of Energy, and since World War 2 has been one of the most important federally-funded research and development centres in the US, particularly in respect of nuclear physics. https://www.ornl.gov/
[77] https://archive.org/details/interoceaniccana00unit/page/n1/mode/2up?ref=ol&view=theater

level Isthmian Canal is not now feasible". Hence, after 14 years and millions of dollars, the idea was dropped.



In 1971, the White House stopped funding for nuclear excavation research, but it was not until 1978 that Project *Plowshare* ended.

The end of the dream of a sea-level canal was inevitable given the obvious political, environmental and health risks of the plan, which had become more and more obvious.

Ray Todd
Panama City
Republic of Panama
19 April 2025

ANNEX

SUMMARY OF ROUTE 17 FROM 1970 REPORT[78]

Route 17 Sea-Level Canal Excavated by a Combination of Nuclear and Conventional Excavation

Route 17, approximately 100 miles east of the present Panama Canal is remote from Panama's developed areas — an essential requirement for nuclear excavation. Approximately 30 miles of its length through the high elevations (that involve the greater portion of the total excavation volume) appear technically suitable for nuclear excavation. Estimated construction costs, assuming partial nuclear excavation would be feasible, total $3.1 billion — more than the estimated cost of all-conventional construction on Route 10 or Route 14.

The problems related to nuclear excavation described in Chapter IV are not the only obstacles to a Route 17 canal. Panama could be expected to object, for the Route would involve major dislocations of the economy of Panama. Panama City and Colon depend upon the present canal and its associated military bases directly and indirectly for some 74 per cent of their economic activity. Although the United States military bases could be left where they are if canal operations were transferred to Route 17, a large phasedown of employment and business activity would accompany the closure of the present canal. The Stanford Research Institute estimates that employment within 30 miles of the present canal would decline by 45,000 with the changeover to Route 17 and only 36,000 new jobs would develop in the new area. The total Panamanian GDP is also estimated to grow somewhat more slowly with the construction and operation of a Route 17 canal than with one on Route 10 or Route 14.

Route 17 offers some military advantages because of its remoteness and its partially nuclear excavated channel (Annex II, Study of Canal Defense). The wide, deep nuclear reaches, comprising three-fifths of the total land cut, would be relatively invulnerable

[78] https://archive.org/details/interoceaniccana00unit/page/n77/mode/2up?ref=ol&view=theater

to blockage by scuttled ships, making defense a less difficult problem than on other routes. However, its potential advantages do not now appear to be significant in comparison with the magnitude of the potential problems in nuclear excavation and in transfer of canal operations away from the vicinity of the present canal.

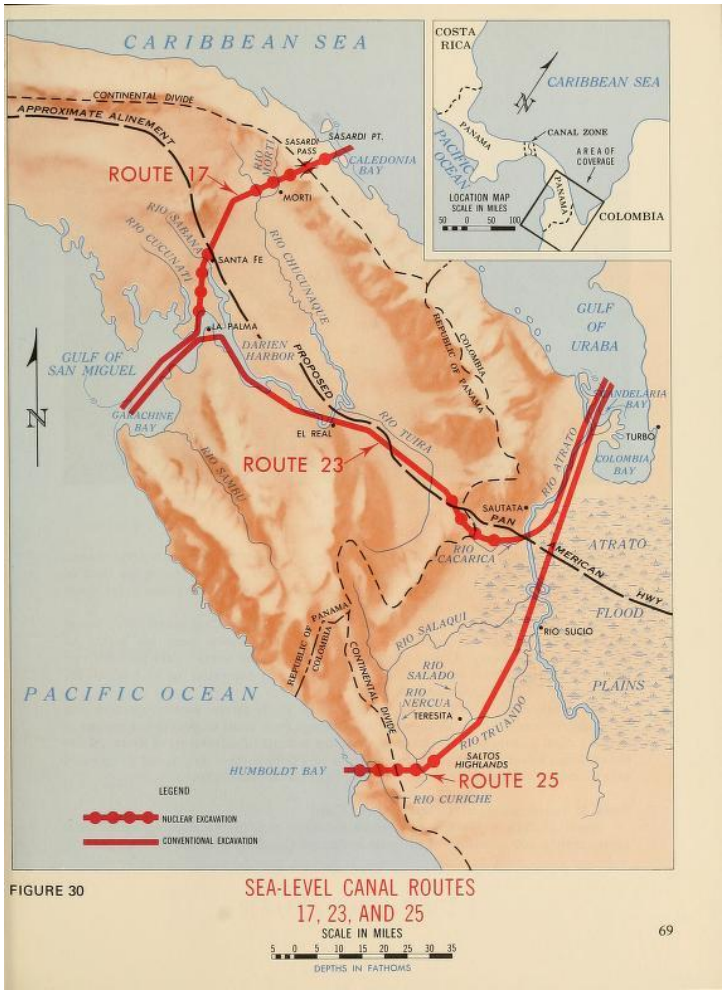


FIGURE 30 SEA-LEVEL CANAL ROUTES 17, 23, AND 25

SCALE IN MILES

5 0 5 10 15 20 25 30 35

DEPTHS IN FATHOMS

69