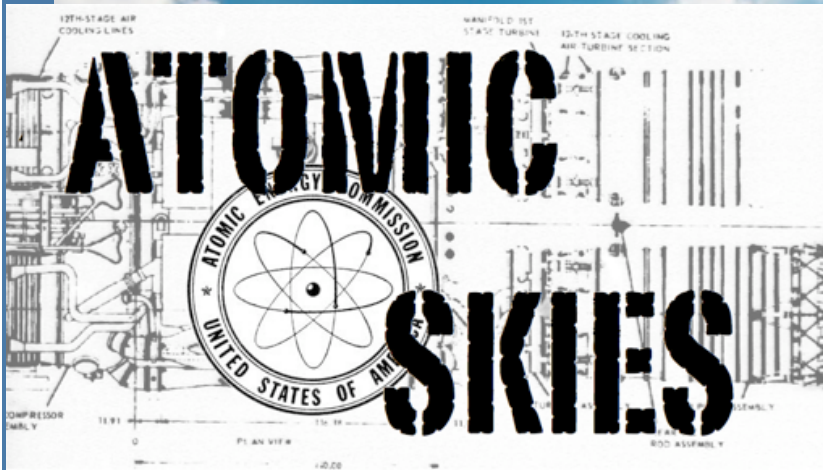




FRIDAY, FEBRUARY 14, 2014

Project CARRYALL

In 1962, the [Atchison, Topeka, and Santa Fe Railway](#) began planning a new railway between Needles and Barstow through the Bristol mountains in California. The straighter, more level route would be 15 miles shorter than the old line, shaving 50 minutes off the trip. But getting through the mountains would require either drilling a tunnel or excavating a new pass; the railway judged the cost of doing either with conventional means to be prohibitive. So, in December of 1962, the Santa Fe Railway contacted the US Atomic Energy Commission (AEC), to ask if the job could instead be done with hydrogen bombs.

That inquiry was just what the AEC had been waiting for.^[K]

The AEC began investigating the peaceful use of nuclear explosions in 1957. The [Plowshare program](#) studied [many, many possible uses](#) for the peaceful nuke, but nuclear excavation – “geographical engineering” as [Edward Teller](#) put it^[T] – was what fired the dreams of Plowshare's supporters. Since that included the politicians who decided the AEC's budgets, excavation was where the AEC put the bulk of its effort.

The excavation program's primary objective was digging a sea-level replacement for the Panama Canal. A new canal was one of the few projects *big* enough to justify the expense of developing the technology in the first place and remote enough to perhaps be doable. (And, even if it was never actually built, the State Department found the *possibility* of a new canal in some other country to be helpful in [dealing](#) with the Panamanians.) But, before the AEC could ask other countries to host a nuclear excavation blast, they needed to do at least one real project on American soil. So the AEC was looking for partners, governmental or private, who needed the sort of holes dug that only nuclear bombs can dig.^[Ka]

That was when the Santa Fe Railway contacted them.

The California Department of Public Works (DPW) was also planning a new road through the area to shorten US Highway 66, and they joined the project as well. The AEC, DPW, and the railway together published a feasibility study in November of 1963 proposing to use 23 nuclear bombs, totaling 1,830 kilotons, to blast the new pass through the Bristols. They called the plan Project CARRYALL.^[PCFS]

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Figure 1: *CARRYALL Mode*^[GHH]
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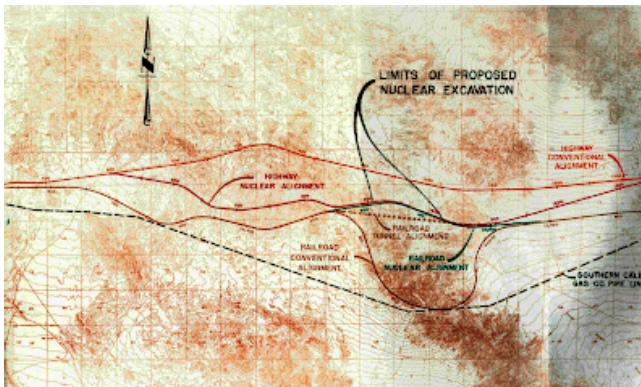


Figure 2: *CARRYALL Map*^[PCFS]
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Twenty-two devices of 20 to 200 kilotons yield would be set off 340 to 780 feet underground. The explosions would remove 68,000,000 cubic yards of earth, creating a roughly parabolic cut 11,000 feet long, 360 feet deep, and from 600 to 1,300 feet wide. A final 100-kiloton device would dig a drainage crater to hold rainwater runoff from the new pass.^{[PCFS][Pr]}

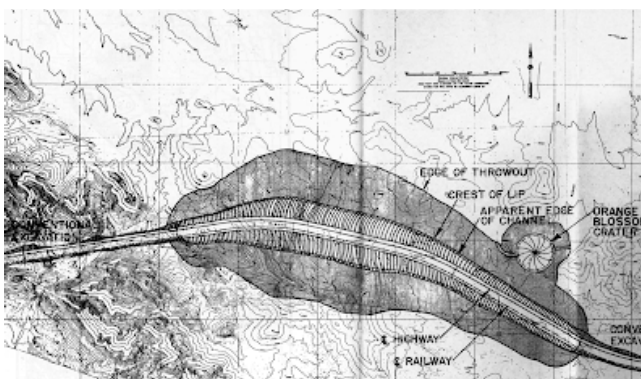


Figure 3: *CARRYALL Closeup*^[PCFS]
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Bids for highway construction needed to be gathered by the beginning of the 1968 fiscal year if the highway was to be finished on time, which put CARRYALL

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on a tight time schedule. The plan was to do site investigation through 1964, including drilling twenty-seven 3-inch exploratory holes for rock samples. Assuming they found no unexpected problems, in 1965 twenty-three of the holes would be enlarged to 36 inches to fit the nuclear devices, then lined with corrugated metal casing to ensure the charges wouldn't get stuck halfway down the shaft. The bombs would be set off in early 1966 in two separate detonations. The ensuing dust cloud was expected be thick enough to obscure vision for 100 miles downwind.^{[PCFS][P][FSC]}

The first inspection teams would enter the blast zone 24 hours after the shot. The feasibility study estimated that the radiation would die down to a level low enough to allow work in the craters "without unusual safeguards" three days later.^[PCFS] It's not clear if that means unusual for construction or unusual for nuclear explosions. The feasibility study isn't specific, but seems to imply jeans and hardhats. But a separate, preliminary report from August 1963 said workers would need protective clothing and respirators for the first year after the shots.^[K] In any event, construction was not scheduled to begin until late 1967, by which time crews could work without special gear. Contractors would build two rail lines and four highway lanes on roadbeds made of aggregate shattered by the blast.^[PCFS]

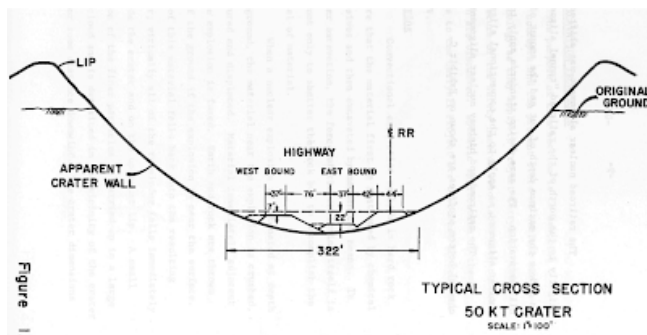


Figure 4: *CARRYALL Projected Cross-Section*^[PCFS]

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The railroad would open for traffic in April of 1969, the highway following in July.

The total cost was estimated at \$14 million (\$104 million today) - a savings of \$8 million (\$59 million) compared to conventional methods. However, this did not include the cost of the nuclear explosives themselves, since that number was still classified.^[PCFS]

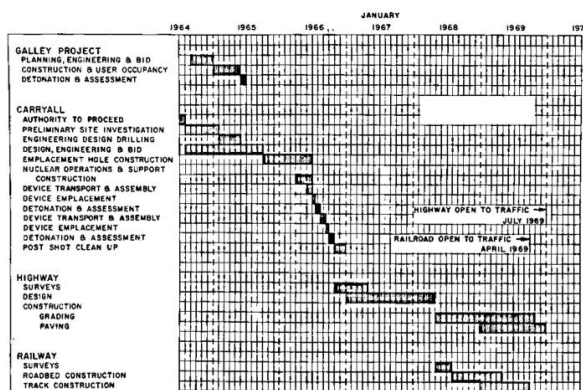


Figure 5: *CARRYALL Time Table*^[Zo]

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Based on tests at the [Nevada Test Site](#), the AEC believed most of the fallout would be trapped by the rock falling back into the crater. 90% of what did escape should return to earth within five miles of the blast site, before it reached densely settled areas:

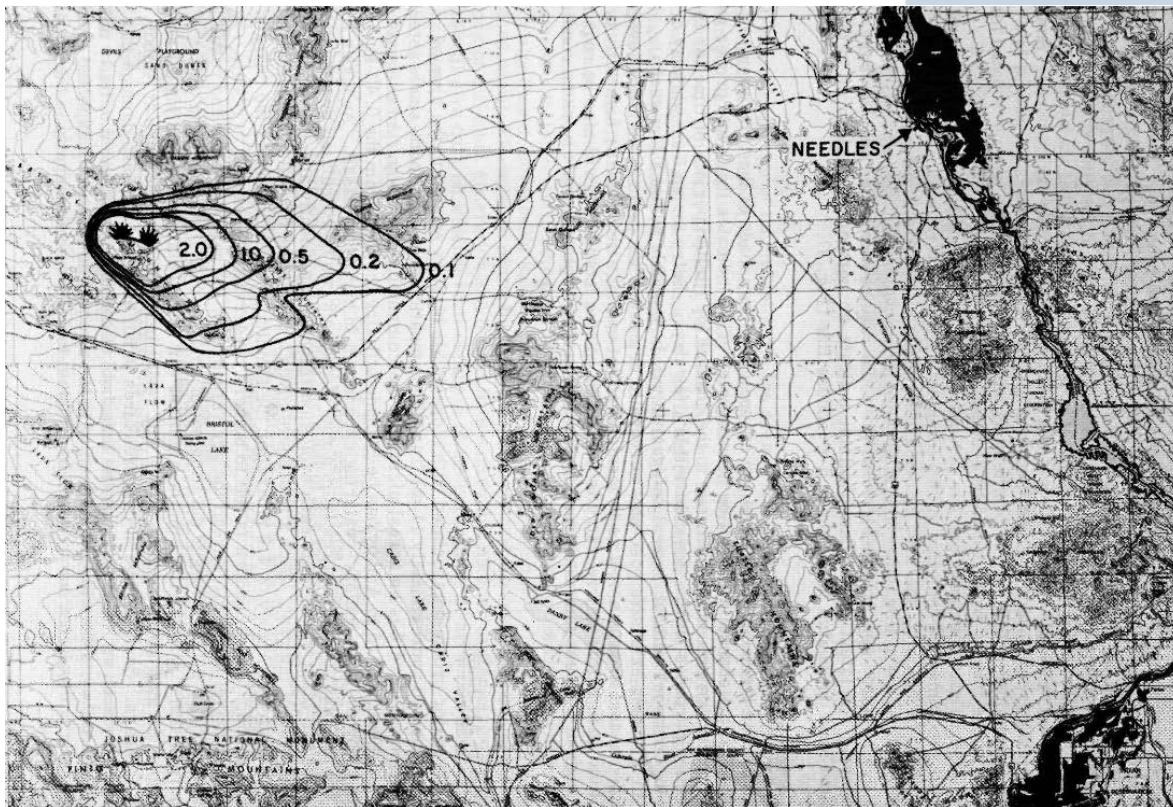


Figure 6: CARRYALL Fallout Map^[Zø]

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The contours in the above map show projected total dose in roentgens. The federal limit on public radiation exposure in 1963 was 0.5 R per year (today it's 0.1 R). But the study may have been overoptimistic: they estimated that the 1,830 kilotons of the CARRYALL blasts would release only two-thirds as much fallout as the 100-kiloton [SEDAN blast](#) of 1962, thanks to cleaner bombs and better emplacement techniques. When the AEC asked M. L. Merrit of [Sandia Lab](#) to review the study in 1964, he concluded the fallout contours would actually extend twice as far and dose rates peak at five times as high. Merrit wasn't necessarily opposed to going ahead - "under certain conditions," he said, "the project can probably be carried out safely." But, fundamentally, the AEC just didn't have enough information yet to draw firm conclusions about how much fallout would be released by the blasts - or even what the precise shape of the craters would be. The AEC had so far conducted only one nuclear excavation test and a handful of military cratering tests; they just didn't have the data to say one way or the other with certainty.^[Kj]

The AEC planned to fire several more nuclear tests to get that data before CARRYALL went forward. At least three shots would be needed: BUGGY, SCHOONER, and GALLEY. GALLEY was particularly important; it was to be a "combination of effects" test, a five-bomb row charge blast that would be almost a rehearsal for CARRYALL.^[Kj] The feasibility study proposed firing GALLEY in December of 1964.^{[Kj][PCFS]}

But GALLEY didn't happen in 1964. The United States had inconveniently signed the [Limited Test Ban Treaty](#) in 1963, banning nuclear tests that led to radioactive debris crossing international borders. The AEC had initially hoped that "radioactive debris" would be interpreted to mean amounts potentially hazardous to human health, but the rest of the US government read it as *any* fallout at all. (The Soviets' interpretation appeared to depend on whose fallout was under discussion.) The AEC proposed amending the treaty, but the politics of that never seemed quite right, and it never happened. Instead, the AEC nuclear excavation program withered on the vine as the excavation tests were delayed again and again.^[Ka]



Figure 7: *CARRYALL After Construction is Complete*^[GHH]

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The California highway division dropped out of CARRYALL in September of 1966, unwilling to wait any longer.^[BEK] BUGGY and SCHOONER were finally fired in 1968. GALLEY never took place.^[DoE] The CARRYALL project was never formally shut down, but study was put on hold in 1965, and its last official mention was in May of 1970.^{[BEK][AEC]} The Plowshare excavation program itself didn't survive much longer.

The new pass was eventually dug by more traditional means.^[BEK] All that marks the CARRYALL site today is a plaque, set up by the "Billy Holcomb Chapter of the Ancient and Honorable Order of [E Clampus Vitus](#)"^[Jo]:



Figure 8: *CARRYALL Site Plaque*^[ECV]

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2 comments:



Stillman Brown January 12, 2016 at 10:32 AM

Excellent, very well written post, which was read to me as I drove through the Bristols yesterday. Loved the parenthetical Soviet remark.

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Mark January 12, 2016 at 10:36 AM

Thanks - glad you liked it!

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