# Making the Earth Count: From Living Laboratory to Laboratory Planet

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29 October 1965 2 1:00:00.08 Bering Daylight Time [51° 26′ 13.52″ N, 179° 10′ 49.15″ E]: the US Atomic Energy Commission executes Operation Long Shot, detonating an 80-kiloton nuclear weapon drilled 2,300 feet deep into the island of Amchitka in the Aleutian archipelago, over 1,000 miles east from the Alaskan mainland, less than 800 miles west of Russia, and 2,500 miles north of Hawai'i. A second test, code-named the "Milrow Event," followed almost four years later on 2 October 1969, 22:06:00.04 [51° 24′ 56.59″ N, 179° 10′ 45.8″ E], using a 1.2-megaton warhead drilled to a depth of 4,000 feet. A final test, Project Cannikin, exploded a 4.8-megaton warhead—the largest underground weapon as yet exploded—at 6,125 feet below ground [51° 28′ 11.64″ N, 179° 6′ 24.16″ E], 6 November 1971 22:00:00.06 BST. These three tests, though independently part of Operation Flintlock (47 tests), Project Mandrel (52 tests), and Operation Grommet (34 tests), respectively, were retrospectively named the "Amchitka Program," representing 16 percent of the total nuclear tonnage detonated by the United States. Selected largely for its remoteness from human settlement, seismic activity, and geologic composition,[1] Amchitka became a space for testing the "ends of the earth" as such—geographically, geophysically, and, as an imaginary of the future, geopolitically. As the narrator of a declassified film documenting the Amchitka Program puts it: "The purpose … was to test an island, not a weapon."[2]

These were not the first tests to make Amchitka into a living laboratory.[3] As the film goes on to attest, US military and economic interests in Amchitka long inhered in and interrogated its ecological and geographic profile. In surveying the island for the Amchitka Program, the narrator notes, "particular attention was given to fish of commercial value, such as salmon, halibut, and the pacific ocean perch," and to the unique sea otter population long protected by the US's first marine wildlife reserve laws, dating back to 1913. Indeed, nearly a century before being probed by a series of thermonuclear explosions, Amchitka and its archipelagic milieu were refigured as laboratorial domains for the speculative programs of expeditionary science, mapping, resource extraction, and militarism through which the United States prosecuted its early experiments in Pacific imperialism. Having purchased Alaska from the Russian Empire in

1 The Nevada Test Site, used for most similar tests, was deemed "unsuitable" for the planned tonnage due to the effect of "ground motion effects on high-rise buildings" in Las Vegas, Reno, and Salt Lake City. Billionaire Howard Hughes did much to effect this judgment—as developer, owner, and investor on several high-value properties on the Las Vegas strip, he bribed, paid off, and otherwise "lobbied" political figures such as Richard Nixon, Ronald Reagan, and other ranking federal and state officials to move the tests to Alaska. See Dean Kohlhoff, *Amchitka and the Bomb: Nuclear Testing in Alaska* (Seattle, WA: University of Washington Press, 2002), 72–73.

2 All film quotations from: Atomic Energy Commission (AEC), Pan American World Airways, Inc., and Lawrence Livermore Laboratory, *Nuclear War Films: Atomics at War & Peace Underground. Vol. 14, Operations Cannikin & Plowshare* (2009 [1965, 1969, 1971]), earthstation1.com.

3 This is Helen Tilley's term. See Helen Tilley, *Africa as a Living Laboratory: Empire, Development, and the Problem of Scientific Knowledge, 1870–1950* (Chicago: University of Chicago Press, 2011).

1867 for its fishery,[4] access to Asian markets, and prospective Arctic passage and resources, the US sought to sketch out an oceanic empire through archipelagic footholds across the Pacific. Perpetuating the Russian legacy of violence, enslavement, and dispossession of more than 20,000 Unangan, Alutiiq, and Qagus peoples (lumped under ther misnomer "Aleut" by priests and fur-traders), a US military government ruled directly over the newly formed Alaskan territory and its waters as an ecological police state through 1884.[5] Even upon convening a non-military territorial authority, the fishery remained soveriegn government

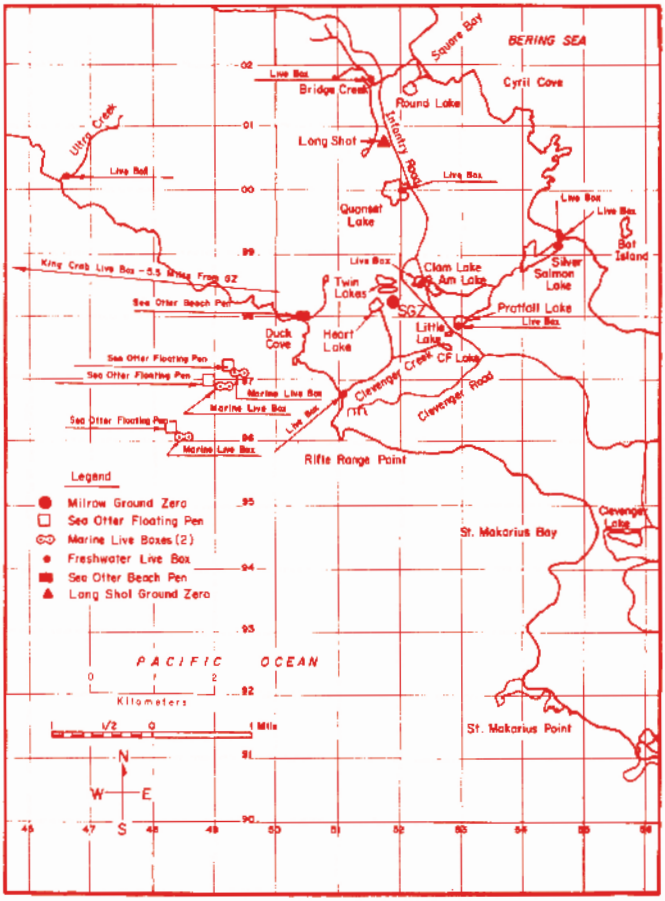


Fig 1. Locations of test-time experiments, Amchitka

space patrolled by navy and coast guard cutters; later, after establishing the Aleutian Islands National Wildlife Refuge to protect the fishery against poachers foreign and domestic (and for the government-backed monopoly Alaska Commercial Company), the reservation was declared "not to interfere with the use of the islands for lighthouse, military, or naval purposes." This co-construction of an ecological "standing reserve"[6] and militarized space set an aggressive

legal and geographic precedent for manufacturing and multiplying zones of experimental power. From the Papahānaumokuākea Marine National Monument (1.3 million square miles) and overlapping Hawaiian Island Range Complex (2 million square miles), the Pacific Remote Islands Marine National Monument (4 million square miles) and former Pacific Proving Grounds (3 million square miles) to the Mariana Trench Marine National Monument (2009, just over 1 million square miles) and the Marianas Islands Training and Testing Area (1 million square miles), American empire presents itself as a vast living laboratory made up of cyborg bioaccumulators, ubiquitous environmental sensors, geotechnical apparatuses, and logistical infrastructures of experiment.

These conditions of geographic buffering, legal protection, and legacies of infrastructural build-up over prior waves of intervention on the island framed Amchitka for further laboratorial set up. Equipping Amchitka as a Program, however, first meant grappling with its "extreme" geophysical milieu as a logistical and engineering problem. Amchitka stands, describes the narrator, in "one of the most seismically active regions of the circumpacific island arc"—popularly known as the "Ring of Fire" for its volcanic activity—where the weather is also "some of the worst … in the world." Routes between islands from major ports were characterized by "some of the roughest waters used for commercial shipping." A raft of additional tests was performed to make sense of the chaotic material conditions at and around the island: "exploratory core drilling for this investigation of underlying strata," hydrologic sampling, bathymetric

4 Then known for the "soft gold" of otter and fur seal pelts, rather than contemporary pollock or king crab, the fishery remains one of the most biophysically productive and lucrative on the planet. Dutch Harbor on Unalaska Island has long been the highest volume and most lucrative US fishing port, followed closely by additional Aleutian Island ports and Kodiak.

5 Though I omit this history from the scope of this piece, and do much violence to it here by "footnoting," it is important to briefly present how this history is bound up with ongoing dispossession and capital accumulation in the North Pacific. Specifically, this history of militarized, racialized, and imperial capital involves the effective enslavement of Unangan, Alutiiq, and Qagus peoples as hunters, trackers, and navigators by eighteenth-nineteenth fur-traders from Russia, British Columbia, and the United States. The deep geotechnic memory—"expertise"—of the Aleutian archipelagic milieu practiced by the Unangan, Alutiiq, and Qagus peoples was expropriated into a kind of forced phenomenological labour of what James J. Gibson might have called "ecological perception." This expropriation generated the coerced cognitive capital foundational to the making of an imperial-capitalist Pacific. The extraordinary accumulation of capital congealed in the commodity form of seal, otter, and other fur-animal pelts catalyzed the stabilization of capital flows in the North Pacific through the Aleutians, triggering trans-oceanic land speculation, labour migration, and attendant military operations from Manchuria and Korea to Alta California, preceding the Gold Rush by decades. The securitization of this space continued through the sale of "Alaska"—derived from an Unangan word meaning, simply, "not island"— to the US in 1867. The video narrator glosses this history thus: "Amchitka has not had full-time inhabitants for a hundred years or more, but twice before has been used by agencies of the federal government for defense purposes"—for which Unangaŝ were forcibly relocated and interned at mainland camps, where several died due to malnutrition, exposure, and neglect. The US government officially apologized for their internment on 17 June 2017.

6 Writing in the context of nuclear weapons technology and research, Heidegger famously writes that "Everywhere everything is ordered to stand by, to be immediately at hand, indeed to stand there just so that it may be on call for a further ordering. Whatever is ordered about in this way has its own standing. We call it the standing-reserve [*Bestand*]." See Martin Heidegger, "On the Question Concerning Technology," in *The Question Concerning Technology and Other Essays*, trans. William Lovitt (New York: Harper, 1977).

**soundings, currents tracked and measured, and geomagnetic fields diagrammed. "An intensive program of studies began to test the possible effects of a nuclear detonation on the ecology of the island … Tundra, wildfowl, and the fish and other life [inhabiting] … coastal waters surrounding it" were mirrored by "scientists and technical people from many federal agencies, universities, the state of Alaska, and private consulting firms." All such milieux "were found to be satisfactory for testing"—a perfect tautology of encryption and equipment, of classification and desire, of human and non-human populations.**



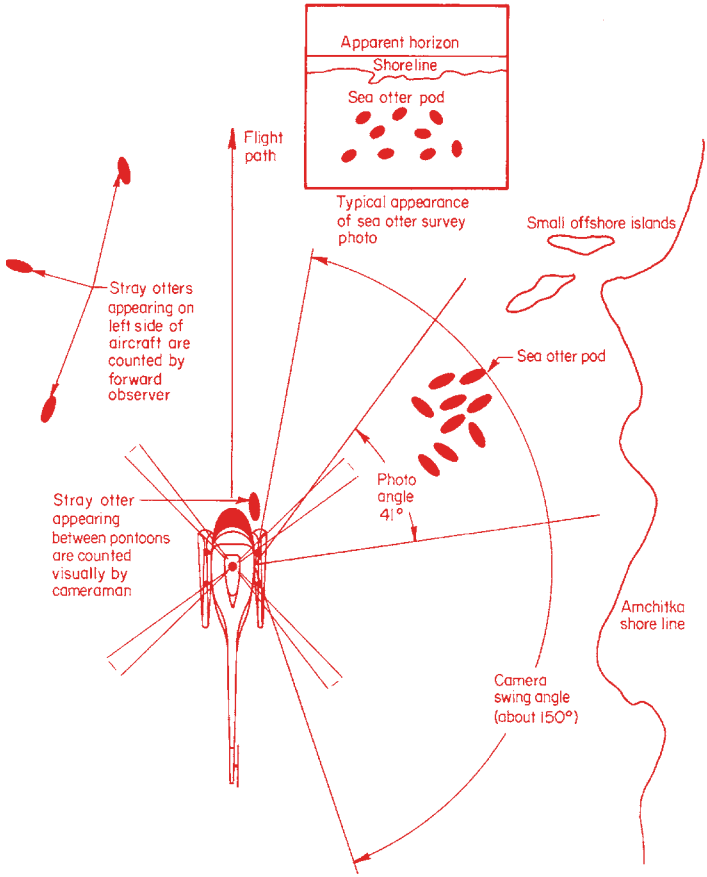


**Fig 2. Photographic/Visual Census Method**

**Lawrence Livermore National Laboratory (LLNL), responsible for "instrumenting" Amchitka, set about technoscientifically alloying the island and its oceanic, atmospheric, and ecological milieux. In preparation for Cannikin, for example, a triumphant LLNL newsletter comemmorating the Amchitka Program describes**

a massive undertaking involving hundreds of Laboratory employees and nearly five

years of effort. Test operations overcame myriad logistical hurdles, and experimenters achieved many technical firsts. Two years of drilling produced a record-breaking emplacement hole that was 6,150 feet deep and 90 inches in diameter with a 52-foot-wide cavity mined at its bottom. The diagnostics canister was 264 feet long, and altogether 400 tons of cables and equipment were lowered downhole. Cannikin was the first test in which a laser successfully aligned diagnostics downhole, and a computer system assisted field operations. A record-setting number of recording trailers, 2,000 feet from ground zero and shock-mounted to withstand a ground upheaval of 15 feet at shot time, were instrumented with 250 oscilloscopes. One hundred percent of the test data was successfully retrieved.

**Yet it was not only the first deployment of *in situ*, trailer-housed, plate-and-shock-armored computers that made Amchitka's milieu calculable, computable, and (in the eyes of the engineers) controllable. Following Jennifer Gabrys, this "becoming environmental of computation" interlocked with the "becoming biological" of computation pioneered in nuclear weapons research on bioaccumulation and physical trauma, where experimental bodies process radionuclide flows and blastwaves into discrete informatic states. Each dimension of the island and its milieu was assessed and discretized for its capacity to "compute" the device's effects, if in entirely embodied, analog form. Marine and terrestrial plants and animals, sea, stream, and lake water, soil, rock, atmospheric particulate matter: each offered distinct bodily organizations and biogeochemical media that would register the effects of the explosion in different ways. At the moment of detonation, this assemblage of organic and inorganic bodies would be transformed into a single sensor network, instantaneously conscripted as inscriptive surfaces and volumes for the bomb.**

**The data produced would depend on the bodies deployed. Amchitka's robust and legally protected resident sea otter population afforded an especially important set, offering anatomical proxies for human bodies. Another AEC film makes much of relocating otters prior to the Milrow and Cannikin nuclear tests during the incredibly named "Operation Warm Coat." Warm Coat sought to relocate hundreds of otters to scattered habitats along the coasts of Alaska, Washington and Oregon, transporting the animals in specially constructed aquatic pens carried away in C-130 Hercules aircraft delivering and emptied of test equipment. In the shadow of Warm Coat, however, scores of otters were designated not to replace the test equipment in C-130, but to become living equipment in the field. For Milrow, those otters not "rescued and relocated" were captured and caged in several floating holding pens arrayed between one and ten kilometres from "surface ground zero" or SGZ, at 127 feet above sea level. Additional "live boxes" housed fish, crab, and other marine vertebrates, ranging at similar distances from beach and sea-surface elevations down to nearly 150 metres depth. At least sixteen such pens and boxes were so**

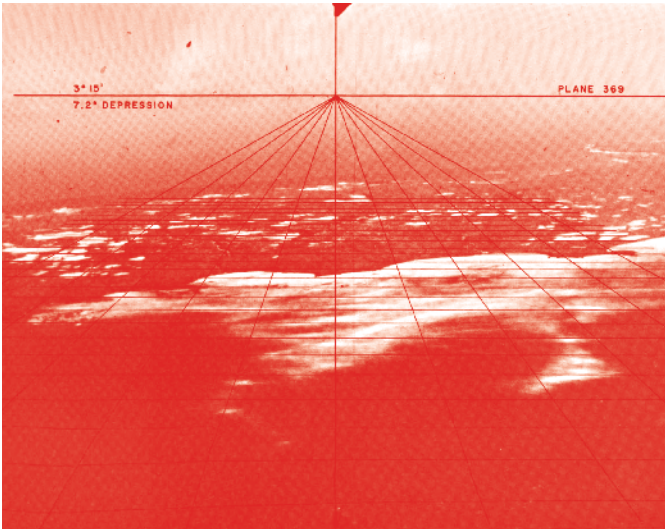


Fig 3. Plane 369, No. 6, Frame 30

located to map out the geographic and bodily effects of "overpressure"—the extreme pressure differential created by the explosion—in pressurized tissue, organs, and cavities. Supplemeting these experimental bodies were simple pressure gauges—sealed, empty beer cans afixed to the otter pens, whose collapse would

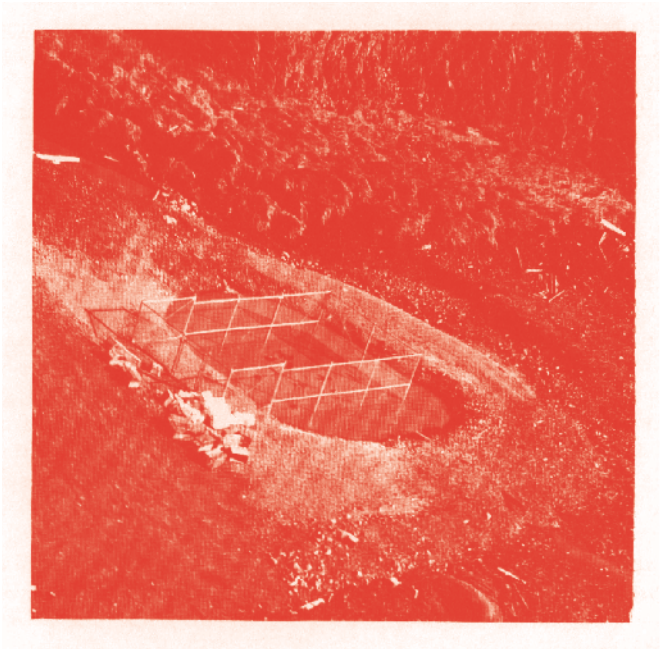

Fig 4. Live Sea Otters in Beach Pen After Milrow

indicate pressure levels over 10 psi.[7] Five deep water gauges were similarly distributed in relation to live boxes. No overpressure was predicted at sea-surface elevation, and test engineers therefore deemed otters to be safe from the blast's damaging effects; and indeed, the narrator assures us that "no overpressure was reported on any of the sea otters." Only a single otter was reported dead, "apparently from handling stress" during transportation. Yet gruesome scenes of mass bird, fish, and mammal deaths, including up to 2,000 otters, leaked out later.[8] Reports subsequently revealed that because otters spend significant time foraging at depth, most evaded capture underwater only to become unwitting experimental instruments, floating to the surface after their mortal recording of the blast. Necropsies of these collateral otters, along with those "sacrificed" after surviving the holding pens, showed overpressure damage in accordance with the particular depths the otters inhabited at the time of detonation. The interface between the internal milieu of the otter body and the external milieu of the pressure wave thus became a kind of forensic vector to recompose the intensive geometry of the blast as a function of pressure. When constellated together, the otter bodies composed a three-dimensional snapshot of the detonation event. In so doing, these instrumentally augmented, "test-time" bodies became not only a scientific but cartographic apparatus, bodily points of pressure intensity that, like spot elevations, could be interpolated to map out the intensive contours and ephemeral space of the experimental milieu.

The lives of Amchitka's animal populations were similarly mined for how they might index the bomb's radioactive milieu through their patterns, scales, and rhythms of movement.[9] "Due to the migratory patterns of much of area's wildlife, and the limited fishing season in the waters surrounding Amchitka, it was determined that testing could be conducted safely and with minimal impact on the environment." Following the Milrow event, as the film's narrator goes on to explain, "along the coastlines near ground zero, some rockfalls and debris-slides occurred, but helicopter observation and studies of shoreline photography could not detect any resultant damage to the island's fish or bird population." Such reveries were at odds with the nuclear pragmatics of rendering the living laboratory: the value of the test inhered precisely in doing spectacular damage to the island as biogeochemical media and ecological system. Only the force of the bomb could activate Amchitka's laboratorial apparatus. Its experiments could be validated only through a general

7 M.L. Merritt, *Pressures in Water on and near Amchitka Island, Milrow and Cannikin* (Albuquerque: Sandia Laboratories/Atomic Energy Commission, 1973).

8 Kohlhoff, *Amchitka and the Bomb*, 110–111.

9 This initial survey work resonates with Foucault's assertion that "milieu appears as a field of intervention which ... one tries to affect ... a population." Michel Foucault, *Security, Territory, Population: Lectures at the College du France, 1977–1978*, ed. Arnold Davidson (London: Palgrave, 2009), 20. But it only obliquely gets at the way in which "population" is here deployed. In the case of Amchitka, the relation almost appears inverted: population becomes a field of intervention to sense and affect, effecting a particular kind of experimental, testable, observable milieu.

necropsy of the living landscape and its marine milieu, tabulating the dead and cataloguing their shapes of destruction. And not only the dead; in three acts, the Amchitka Program moved island soil and seafloor sediment in atomic waves, carefully measured by accelerometers driven into marine mud, beaches and hillsides, lake and stream beds, instantaneously transforming drainage systems and watershed structures while setting off long processes of erosion, settlement, and nutrient redistribution. Long Shot, Milrow, and Cannikin reprogrammed the very ecology of the island for future forms of life—a bizarre biopolitics of the bomb. Moreover, in structurally coupling its tools (radionuclides and blastwaves) and sensing apparatus (wildlife bodies), the Milrow Event turned Amchitka's environmental milieu into a computational medium, a laboratory wherein the living and non-living alike are made to count. In such a laboratory, violence appears as the mere given—or, *strictu sensu*, "data"—insofar as it constitutes the sensible means to experiment on the living and their milieux. In short: the Amchitka Program overcoded the island to compute violence as data.

The most ambitious extension of the computational milieux is expressed in the stated objective of Operation Long Shot (1965) "to increase the United States' capability to detect, identify, and locate underground nuclear detonations." To do so, "the major instrumentation effort on Long Shot was embodied in the long-range seismic measurement program," characterized as the "heart of the project." Marshaling a global network of hundreds of permanent, temporary, and portable seismic stations located across allied territories, and supplemented by dozens of heavily instrumented holes bored deep into the island, Long Shot aimed "to determine the efficiency of explosive energy in coupling to the earth." By detonating its 80-kiloton, 2,300-feet-deep payload, Long Shot did not intend to test the explosive capacity of the warhead but rather generate seismic data for comparison to the signatures of naturally occurring earthquakes. For comparative purposes, the test was scheduled immediately following a 8.7-magnitude earthquake near the island. Producing no spectacular fireball and little visible atmospheric effect, the explosion instead rendered the solid geologic milieu of Amchitka into a momentarily fluidic medium for producing, processing, and conveying data. Seismographs registered a 3.9-magnitude surface wave, and a 6.1-magnitude "body" wave. Cannikin, detonated in 1971, generated a 7.0-magnitude wave, causing rapid subsidence at surface zero resulting in a 2-kilometre-square, 12-metre-deep lake. A massive spherical cavity of molten and subsequently vitrified rock—in effect, nuclear glass—remains as a geologic artifact of the island's liquefaction. Utterly inaccessible for mapping or remediation but threatened with fracturing during future seismic events, the island's toxic glass heart has in turn been computationally modeled and figured using the data gathered from the detonation.[10] As the surface of Amchitka once again became a living laboratory, the scale of the seismic waves rippling around the earth and through seismic instruments around the world reverberated into a unified laboratory planet.[11]

The laboratorial coupling of explosion and earth was designed to operate as much geopolitically as geophysically. The data from the Amchitka Program were used not only for producing new geophysical knowledge, but for surveilling Soviet nuclear tests by proxy seismic signature—a strikingly materialist technique to make geophysical sense of the geopolitical, and vice versa. In this sense, the geopolitical and geophysical valences of the laboratory planet are superseded by their "geotechnical" figuration as an indeterminate and open relation.[12] This sense of geotechnics invokes its multiple and unaligned genealogies: as a technical discipline concerned with engineering the earth; as metadesign ethos and "applied science of making the world more habitable"[13] running from Geddes and MacKaye through Boulding and Fuller;[14] and, following Bernard Stiegler, "technics as the pursuit of life by means other than life"[15] that, as "process of exteriorization," concretizes into a "techno-geographical milieu."[16] In Stiegler's formulation, the techno-geographical or (as I propose) geotechnic milieu describes a condition where "the technical object of which it is the environment structurally and functionally 'associates' with the energies and elements of which this natural milieu is composed, in such a way that nature becomes functional for the technical system."[17] This is, of course, just the kind of structural coupling and computational immanence enacted by Operation Long Shot, entraining the earth as seismic field into its geopolitical calculus of risk. And, as Stiegler warns, to be enfolded into the operations of such a milieu threatens to be computed as a

10 D.D. Gonzalez, L. E. Wollitz, and G. E. Brethauer, "Bathymetry of Cannikin Lake, Amchitka Island, Alaska, with an Evaluation of Computer Mapping Techniques," USGS-474-203 (Lakewood, CO: United States Geological Survey, 1974).

11 I borrow this term from the journal created by Ewen Chardronnet and Bureau d'etudes: "Since the Second World War, the world has been progressively transformed into a full scale laboratory. The model of a 'laboratory world' has been added to the model of a 'factory world'… We do not work in, nor for, this laboratory. Nor are we its objects. What can be done with the immense, autonomous machine that has now taken on a momentum of its own? Can we redirect the fate and the orientation of a laboratory whose creation none of us, or so few, has agreed to? Can we take leave of a future traced by others? In other words, can we still act freely?" Ewen Chardronnet and Bureau d'etudes, "Why Are We Working for Our Own Obsolescence?" *Laboratory Planet* 1, no. 1 (2007).

12 Here I want to acknowledge the history of thinking "geo-technics" belonging Patrick Geddes (1898; 1902), Lewis Mumford (1934; 1967), and Benton MacKaye (1968). A reformulation of geotechnics via theorists of technicity (like Stiegler and Sloterdijk), technoscience (Haraway) and technopolitics (Mitchell) offers a compelling line to rethink what MacKaye elsewhere rephrased as the "how" of habitability (MacKaye 1950). This critical splicing would pose a deep critique of the organicism of Geddes, Mumford, and MacKaye—an organicism that despite its alliance (Geddes 1905) with the r/evolutionary "universal geography" of Reclús (2004) and Kropotkin (1995), retains troubling vectors of political activation in racialized, imperial geopolitics.

13 Patrick Geddes, quoted in Benton MacKaye, *From Geography to Geotechnics* (Urbana: University of Illinois Press, 1968).

14 The influence of geographical conditions on social development. See Patrick Geddes, *The Geographical Journal* 12, no. 6 (1898): 580–586; Kenneth Boulding, *Earth as a Spaceship* (Committee on Space Sciences, Washington State University, 1965); and Buckminster Fuller, *Operating Manual for Spaceship Earth* (Carbondale: Southern Illinois University Press, 1969).

15 Bernard Stiegler, *Technics and Time, Volume I: The Fault of Epimetheus*, trans. Daniel Ross (Palo Alto, CA: Stanford University Press, 1998), 137.

16 Stiegler adopts this concept from Gilbert Simondon. Simondon, *On the Mode of Existence of Technical Objects*, trans. Cécile Malaspina (Minneapolis: Univocal Publishing, University of Minnesota Press, 2017).

17 Bernard Stiegler, *The Automatic Society, Volume I: The Future of Work*, trans. Daniel Ross (Malden, MA: Polity, 2016), 79.

technical function evolved within the system. This does not only pose problems of "life as a system to be managed,"[18] nor biopolitics, but the design and delimitation between geopolitics and geophysics, body and blast, fluidity and form, life and non-life.[19] Or, from another vantage, geotechnics describes the techno-geographical design and delimitation of relations between the living and its milieu.

It is in this more robust sense that the Amchitka Program comprises a geotechnical project. Power reorganizes the earth in its laboratorial image by experimentally differentiating domains of habitability through gradations of force, and delimiting relations between life and non-life through uneven distributions



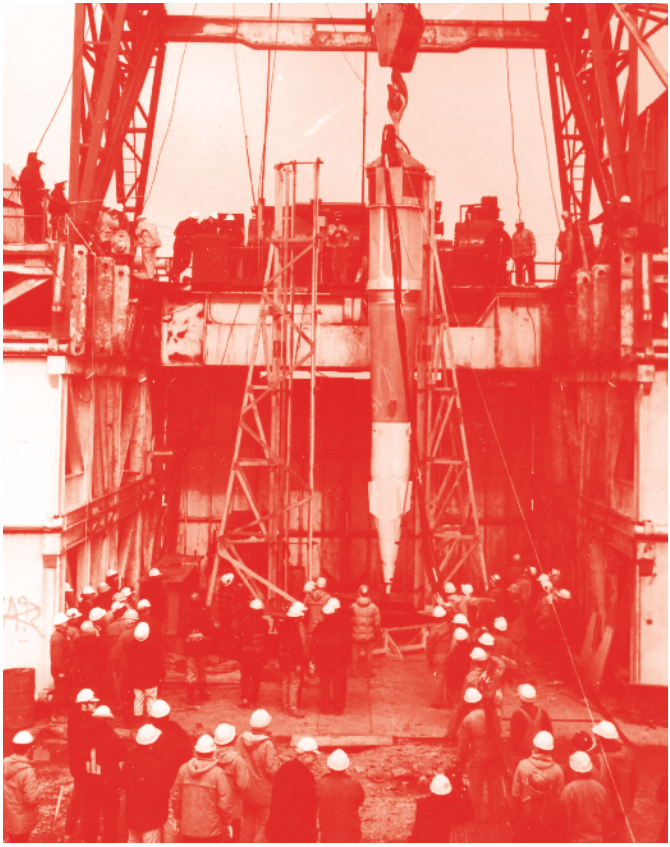

Figure 5: LLNL Explosives Emplacement

of entropy. This naturalization comes as a sleight of hand rather than as spectacle. The AEC film itself presents the Amchitka Program as such—a mere recording of the natural order of things. The narrator, in an absurd black-boxing of Long Shot as "unusual seismic activity," thus intervenes: "Although the island is located in an active seismic area, the best scientific evidence available to seismologists and other scientists indicating the possibility of any connection between

underground nuclear testing and unusual seismic activity … appears quite small." Of course, it is precisely this connection—the manufactured immanence of a planetary geophysical and geopolitical experiment—that the film evidences and describes. Here catastrophe no longer presents itself as a refrain of the real by assuring that "this is not a test." On the contrary, the speculative parameterization for (human) life insists that, indeed, it is—we are—this is—a test. In this "situation of living in the laboratory," writes Canguilhem, "the relations between the living and the milieu as they are studied experimentally and objectively are of all possible relations [the most] pathological."[20] Where the laboratory planet proliferates a generalized condition of geotrauma as experimental precondition and effect,[21] the living becomes opposed to its own milieu, dissolving "centers of organization, adaptation, and invention that are living things into the anonymity of the mechanical, physical, and chemical environment … [to] include the living."[22] This final stage of geotechnical nihilism is the naturalization of the laboratory planet as a total world interior[23] where everything is made to count, but only through the material computation of violence.[24]

18 Donna Haraway, *Modest–Witness@ Second–Millennium. FemaleMan–Meets–OncoMouse: Feminism and Technoscience* (New York: Routledge, 1997), 152.

19 Elizabeth Povinelli makes a similar point in describing "geontopower" as the administration of differences between life and non-life; this is, I think, already the central question of technics. See Elizabeth Povinelli, *Geontologies: A Requiem to Late Liberalism* (Durham, NC: Duke University, 2016).

20 Georges Canguilhem, "The Living and Its Milieu," trans. John Savage, *Grey Room* 3 (2001): 21.

21 See Robin Mackay, "A Brief History of Geotrauma," in *Leper Creativity: Cyclonopedia Symposium*, ed. Eugene Thacker and Nicola Masciandro (Brooklyn: Punctum, 2012), 1–37.

22 Canguilhem, "The Living," 27.

23 Peter Sloterdijk, *In the World Interior of Capital: Towards a Philosophical Theory of Globalization*, trans. Wieland Hoban (Malden, MA: Polity, 2013).

24 Canguilhem, "The Living," 21.

FIGURE CITATIONS

Figure 1: Kirkwood J. 1971. Summary of Ecological Effects of Milrow

Figure 2: Stephan & Mercier. 1972. Amchitka Bioenvironmental Program

Figure 3: AEC, TetraTech. 1970. Ocean surface effects generated by a nearby underground explosion at the Amchitka test

Figure 4: Stephan & Mercier. 1972. Amchitka Bioenvironmental Program

Figure 5: Lawrence Livermore National Laboratory, Explosives Emplacement.