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BORN SECRET

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At the heart of the 1979 case *United States v. Progressive, Inc.*[1] is the "born secret" doctrine of the Atomic Energy Act of 1946, a permanent gag order affecting all public discussion of an entire subject matter. There is nothing like it anywhere else in American law.

Before the Manhattan Project, government secrets were temporary. The hypothetical "sailing dates of transports or the number and location of troops," from *Near v. Minnesota*,[2] was a reference to temporary secrets, during wartime. Even radar, which had a greater impact on the course and outcome of World War II than did atomic bombs, was never envisioned as a permanent secret.

Then again, nobody had reason to be ashamed of radar. The Hiroshima bombing was so destructive, so troubling, and so unexpected—at least by the general public—that an instant consensus emerged: such matters are better not discussed, even in a free country.

The truth is, there was never really an A-bomb secret, aside from the scale and timing of the wartime Manhattan Project, and the precise results of certain critical mass experiments. Uranium fission had been announced by German scientists in 1939, and quickly confirmed around the world.

Since neutrons cause fission and fission produces more neutrons, a nuclear fission reaction could obviously be self-sustaining, if enough of the proper material, sufficiently pure, could be assembled in one place. Fortunately, the requisite fissile material, uranium-235 or plutonium-239, turned out to be extremely expensive. Only the United States had enough money and protected real estate to construct the necessary industrial infrastructure during the war.

Scientists of the arms control movement, which began inside the Chicago branch of the Manhattan Project, agreed there was no A-bomb secret. In the (secret) June 1945 Franck Report, they stated, "Nuclear bombs cannot possibly remain a 'secret weapon' at the exclusive disposal of this country for more than a few years. The scientific facts

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[1] 467 F. Supp. 990 (W.D. Wis. 1979).
[2] 283 U.S. 697 (1931).

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on which construction is based are well known to scientists of other countries."

The McMahon Bill, submitted to Congress on December 20, 1945 and slated to become the Atomic Energy Act of 1946, was a victory for arms control scientists. Their intention was to wrest control of nuclear energy away from the Pentagon and give it to a new civilian agency. The bill, as submitted, also reflected their desire to remove the wartime secrecy apparatus and restore nuclear science to the realm of open scientific inquiry.

Under the heading "Purpose of Act" the first item was "(1) A program . . . to encourage maximum scientific progress." The second item was "(2) A program for the free dissemination of basic scientific information and for maximum liberality in dissemination of related technical information."

Section 9 of the bill was titled "Dissemination of Information." It tacitly acknowledged that the government had accumulated secret information on nuclear technology during the war, and it called for release of that information "with the utmost liberality as freely as may be consistent with the foreign and domestic policies established by the President." For national security and public safety purposes, the bill emphasized control of nuclear *materials*, not information. The Espionage Act was cited as sufficient to deal with misuse of information.

However, by August 1, 1946, when the Atomic Energy Act reached President Truman for signature, the new second purpose was "(2) A program for the *control* of scientific and technical information . . .,"[3] and Section 9 was gone, replaced by a new Section 10, "Control of Information." This new section contained the novel doctrine later described as "born secret." Slightly modified in 1954, it is still in force today.

When the Atomic Energy Act became law, it defined a new legal term "restricted data" as "all data concerning the manufacture or utilization of atomic weapons, the production of fissionable material, or the use of fissionable material in the production of power," unless the information has been declassified. The phrase "all data" included every suggestion, speculation, scenario, or rumor—past, present, or future, regardless of its source, or even of its accuracy—unless it was declassified. All such data were born secret and belonged to the government. If you related a dream about nuclear weapons, you were breaking the law.

[3] Emphasis added

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Declaring something secret doesn't make it so. Five months later, in January 1947, Albert Einstein, as chairman of the Emergency Committee of Atomic Scientists, defiantly stated in a fund-raising letter, "There is no secret." He was right.

But four years later, in 1951, there *was* a secret, the first and only true nuclear weapon secret: the Teller-Ulam H-bomb secret. It remained secret almost three decades, although it could have been revealed by a single two-word phrase: radiation implosion.

The following explanation of radiation implosion may seem overly technical for a legal journal, but the physics and chemistry involved are not above the college freshman level. Students of the prior restraint case will recall that the first time I told this story, in the *Progressive* magazine in 1979, I got some of the details wrong. The court case facilitated correction of those errors.

My point here is not that anyone could have figured out radiation implosion and got everything right on the first try, but rather that there is a short list of nuclear bomb materials, with known properties, and only one really good way to put them together. It's not the kind of secret that can be kept forever, and once it's out, there are no others. Also, the full story gives insight into a major event in American political history: the Oppenheimer security hearing of 1954.

In January of 1950, President Truman had publicly assigned to Los Alamos the task of inventing a hydrogen fusion bomb which would have a thousand times more power than the uranium fission bomb that destroyed Hiroshima—megatons instead of kilotons. But fusion cannot sustain itself the way fission does. Hydrogen fusion is produced by extreme heat and pressure, like that found at the center of the sun, or, momentarily, inside an exploding fission bomb (A-bomb). A fission bomb could easily ignite fusion, but fusion does not produce the heat and pressure necessary to sustain itself. What it does produce is high-energy neutrons that run off with eighty percent of the energy.

In fact, a sustained fusion reaction has not been achieved, to this day, in either bombs or reactors. Using a fission bomb to ignite fusion in a tank of hydrogen is like igniting a water-soaked log with a blowtorch. The wet log will not keep burning after the blowtorch is turned off.

This was the context for the great H-bomb debate of 1949, held mostly behind closed doors. What the public learned about it, from press accounts at the time and later, was that H-bombs could be extremely powerful and that scientists of questionably loyalty, Robert Oppenheimer in particular, might be dragging their feet, allowing the Russians to get the H-bomb first. A second nuclear lab was needed to

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keep a scientists' strike from being effective, and Oppenheimer needed to be fired, or worse.

The truth was a bit more complicated.

In 1949, there were two types of hydrogen bomb on the design table: the booster and the super. Neither type had been tested, but everyone expected the booster to work. Oppenheimer championed the booster, but initially opposed the super.

For the booster, a gaseous mixture of deuterium (heavy hydrogen) and tritium (double heavy hydrogen) would be pumped into a hollowed-out grapefruit of plutonium, just before detonation. Trapped inside the heart of an exploding atomic bomb, the hydrogen mixture would fuse into helium and release free neutrons.

The energy output from this deuterium-tritium ("D-T") fusion would be negligible, but each neutron would start a new chain reaction in the plutonium, speeding up the fission and reducing the amount of plutonium that is normally wasted when the bomb blows itself apart. Theoretically, boosting could increase the fission yield of a typical bomb from twenty kilotons to, say, fifty or a hundred, or, conversely, reduce the plutonium requirement by half, doubling the number of twenty-kiloton bombs to be made from a given amount of plutonium.

The problem was the cost of tritium.

Deuterium is cheap, but tritium, like plutonium, must be produced in nuclear reactors, where it competes with plutonium production. Every atom of tritium represents an atom of plutonium not produced, and the potential fusion energy from tritium is ten times *less* than the fission energy from the sacrificed plutonium. Oppenheimer was well aware of this arithmetic, and he knew tritium production could be justified only if tritium more than made up for the plutonium it displaced. Such would clearly be the case with the booster, which improved plutonium burn-up in the bomb, but probably not with the super. In 1949, he recommended proceeding with boosters, to maximize the explosive power of the arsenal, given the available reactor capacity.

However, the booster was not the multi-megaton H-bomb that Truman ordered in 1950 as America's response to the first Soviet fission bomb. That would be the super.

For Edward Teller's "classical" super, an arbitrarily large amount of hydrogen, far too bulky to fit inside a grapefruit, would need be located off to the side of the fission bomb, in a canister called the secondary. A fission bomb, called the primary, would serve as a blasting cap; the secondary would be the stick of dynamite. As with dynamite, a self-sustaining shock wave would detonate the secondary as

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it passed through it. To be cost effective, the hydrogen would need to be almost pure deuterium (no tritium), but the "D-D" reaction is four times less energetic than D-T and a hundred times slower.

Calculations showed that the shock wave could not sustain ignition. The stick of dynamite would, in fact, be a wet log. The deuterium might need to be sweetened with tritium, in which case the super program would severely constrain plutonium production. And the design still might fail anyway.

In this context, Oppenheimer had recommended against the super. A super program might actually reduce the total power of the arsenal. Oppenheimer was not the friend of arms control that many people suppose.

Ironically, his moral argument against the super, that a single bomb could be unlimited in power, was the opposite of the practical argument, that it might not work at all, and, if it did, it might require too much tritium. Anyway, that moral argument was based on an incorrect assumption; it turns out there was also no practical limit, other than expense, to the size of a pure fission bomb.

In January of 1951, all design problems were solved by the single unexpected innovation of radiation implosion. Rarely in the history of technology has such a seemingly daunting problem turned out to have such a nifty solution. Stanislav Ulam's idea of imploding the entire secondary, plus Teller's idea to do the job with radiation, changed everything. Fusion didn't need to propagate; it could be forced. To use x-rays from an exploding nuclear bomb to envelop and highly compress another more powerful nuclear bomb was immensely clever, and for nearly three decades completely unknown to the general public. It was not, however unknown to bomb designers in Russia, Britain, France, and China, who built H-bombs during this period.

The notion that x-rays could move solid objects with the force of thousands of tons of dynamite was beyond the grasp of the science fiction writers of the time. It was quite satisfying to the privileged few who knew about it, especially to "cleared" politicians who were members of this new nuclear priesthood. Radiation implosion became the cornerstone of the Cold War temple of secrecy, and the secret password to its inner sanctum.

In engineering terms, this weird and wonderful secret allowed for the exploitation of several known features of nuclear bomb materials which heretofore had eluded practical application.

For example, the best way to store deuterium in a reasonably dense state is to chemically bond it with lithium, as lithium deuteride. But the lithium-6 isotope is also the raw material for tritium production, and an

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exploding bomb is a nuclear reactor. Radiation implosion will hold everything together long enough to permit the complete conversion of lithium-6 into tritium, while the bomb explodes. So the bonding agent for deuterium permits use of the more efficient D-T fusion reaction without any pre-manufactured tritium being stored in the secondary. The tritium production constraint disappears.

Another example: radiation implosion operates on temperature difference. For the secondary to be imploded by the hot, radiation-induced plasma surrounding it, it must remain cool for the first microsecond, i.e., it must be encased in a massive radiation (heat) shield. The shield's massiveness allows it to double as a tamper, adding momentum and duration to the implosion. No material is better suited for both of these jobs than ordinary, cheap uranium-238, which happens, also, to undergo fission when struck by the neutrons produced by D-T fusion. This casing, called the pusher, thus has three jobs: to keep the secondary cool, to hold it, inertially, in a highly compressed state, and, finally, to serve as the chief energy source for the entire bomb. The consumable pusher makes the bomb more a uranium fission bomb than a hydrogen fusion bomb. It is noteworthy that insiders never used the term hydrogen bomb.

Finally, the heat for fusion ignition comes not from the primary but from a second fission bomb called the spark plug, imbedded in the heart of the secondary. The implosion of the secondary implodes this spark plug, detonating it and igniting fusion in the material around it, but the spark plug then continues to fission in the neutron-rich environment until it is fully consumed, adding significantly to the yield.

The two-stage, radiation-implosion, Teller-Ulam superbomb is like an ecosystem in which nothing is wasted. The pieces fit like a jigsaw puzzle. Every component contributes to overall yield, often in more than one way. Oppenheimer declared it "technically so sweet" and embraced it, but too late to prevent his public defrocking as the chief nuclear priest in 1954.

It was not, strictly speaking, the hydrogen bomb Truman had ordered, but it *could* make a multi-megaton explosion. Everything else about it was secret, including the fallout problem. It was a radioactively dirty fission bomb, not a relatively clean fusion bomb.

It turned out to be the cheapest and most compact way to build small nuclear bombs as well as large ones, erasing any meaningful distinction between A-bombs and H-bombs, and between boosters and supers. (Both the primary and the secondary are essentially boosters, using fusion to enhance fission.) All the best techniques for fission and fusion explosions are incorporated into one all-encompassing, fully-

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scalable design principle. Even six-inch diameter nuclear artillery shells can be H-bombs.

Both design labs, Los Alamos and Livermore, as well as all the factories of the widely scattered nuclear weapon production complex, were immediately tooled to make separate primaries and secondaries to be mated in a final assembly plant.

In the ensuing fifty years, nobody has come up with a better way to build a nuclear bomb. Conventional wisdom holds that the bomb labs have been busy inventing better ways to kill millions of people and destroy nations, but it's not true. In the first year or so, all the technical possibilities of radiation implosion were brainstormed out at Los Alamos. By the mid-1950s, all these ideas were being tested in prototype devices, and by 1963, there was nothing left to invent or refine. Since then, the work at the Los Alamos and Livermore Labs has been smoke and mirrors, makework behind a wall of secrecy. According to one insider, much of the work at Los Alamos involves translating decades-old computer codes to run on the latest computers. As long as it generates classified documents, it passes as work.

In the quarter century it took for the one and only nuclear secret to leak out, the institutions of secrecy became well entrenched. Powerful myths took hold, perhaps none more important than the idea that America would never strike first with nuclear weapons. Since the born secret doctrine prohibits discussion of the utilization as well as the manufacture of nuclear weapons, the only public policy that has ever risked the survival of the nation has been exempted from the First Amendment.

In fact, United States policy has always been to strike first, from Hiroshima to the present day. In the Cold War, U.S. nuclear weapons were deployed to deter conventional war. They would be launched preemptively if Soviet infantry forces moved toward West Germany or Iran. In the early days, the Soviets would have been able to retaliate only against Europe, but by 1964, they had enough long-range, nuclear-armed missiles to devastate the U.S. The U.S. plan then became a snowball's-chance-in-Hell effort to simultaneously destroy all Soviet missiles in their silos and submarines, along with all Soviet leaders and their means of communication. This lunatic pre-emptive mission, which has inexplicably survived the collapse of the Soviet Union, still determines the size and shape of the U.S. nuclear arsenal and the accuracy requirements and quick-launch characteristics of U.S. missiles.

Informed public discussion may never change any of this, as long as people would rather not think about it. Were interest to arise, all the relevant information has been in the public domain for decades, even

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though much of it has not yet been declassified. Journalists and activists openly defy the born secret doctrine with apparent impunity, but decision makers are still able to hide behind their security clearances when setting policy. Reporting is distorted by constraints on quotable people with official credentials and a lack of credentials on the part of people who know the facts, unofficially, and are willing to tell the other side of the story.

Although the *Progressive* magazine demonstrated its absurdity in 1979, the born secret doctrine remains a potent suppressor of free speech on a subject of immense importance.