



# How Long Until Armageddon?

## Michael Gordin

Scientists, generals, and politicians all failed to accurately predict when the Soviets would get the bomb. Could they have done any better?

Seventy-eight years ago, give or take a few months, American policymakers, military officers, and scientists were obsessed with a single technological prediction: How long until another country develops an atomic weapon? A few years earlier, a different technological prediction centered around the fission of heavy nuclei — Is it possible to build such a bomb? — but that question was incontrovertibly answered in the affirmative in August of 1945, when the U.S. Army Air Forces dropped a uranium bomb on Hiroshima and a plutonium bomb on Nagasaki. Now is a good time to revisit that historical moment for what it can illuminate about the challenges of technological forecasting. During the brief period of the American atomic monopoly — which existed from the Trinity Test on July 16, 1945, to the Soviet Union’s demonstration of their own weaponization of nuclear fission on August 29, 1949 — the question of predicting how soon other countries might breach the atom was a crucial driver of policy choices for Americans across government, the military, and science. Tremendous resources were invested in providing reasonable predictions of this question, and yet the eventual Soviet detonation of what the Americans called Joe-1 came as a surprise to everyone — even those who had basically gotten the question right.

Although historians are not trained for the business of tomorrow, the debates surrounding the estimates of Soviet proliferation have the potential to illuminate the serious business of technological forecasting in our present moment, whether it be of carbon capture, fusion energy, or artificial general intelligence. It’s not a question of it being *nice* to know these things — we simply cannot make policy choices in the present without at least an implicit guess about these future developments. In this, anyone with concerns for the coming century is in the position of those American policymakers in the shadow of the first mushroom clouds.

\*\*\*

The Manhattan Project that produced the first nuclear bombs was a joint international effort of the United States, United Kingdom, and Canada, populated by scores of émigré specialists from across Europe, but by the time nuclear fission was thrust into the Pacific

War these weapons were controlled from Washington, D.C. American war planners and pundits began to project recent history onto the future, imagining American cities smoldering under mushroom clouds and asking: “How much time do we have?” Pressing policy choices about diplomacy, military deployments, demobilization, and more were contingent on the duration of the American atomic monopoly. Given the economic and geopolitical realities of the postwar moment, the only state that could conceivably marshal

the motivation and the resources for such an effort was the Soviet Union. That is where the forecasters turned their attention.

How many years after 1945 — when Joseph Stalin, as well as everyone else, could not deny that nuclear weapons were a real threat — would it take for the Soviet Union to get the bomb? Framed this way, it was a much easier question than forecasting the advent of AGI: The Americans were concerned with only one adversary and the development of a single technology *which they already knew all the details of*. American predictions of Soviet proliferation offer a highly constrained case study for those who would undertake technological forecasting today.

It is not an encouraging precedent. In the aftermath of the Japanese surrender on August 15, 1945, predictions about a Soviet bomb percolated through both the popular press and the classified channels of the American elite. Estimates ranged from two years to 20 years to never. It came as a shock to basically everyone when on September 23, 1949 — less than a month after the event — U.S. president Harry S. Truman announced: “We have evidence that within recent weeks an atomic explosion occurred in the U.S.S.R.”<sup>1</sup> Truman had been given a plethora of predictions, and just about all of them had been wrong. Could they have done any better?

\*\*\*

Any prediction of Soviet proliferation was a judgment about two things: How hard is it to make an atomic bomb? And how capable were the Soviets? One found broad disagreement on both points even among the well-informed, who based their judgments on the information they had access to, and how they defined what was essential to “making an atomic bomb.”

Consider the case of General Leslie Groves, the head of the wartime Manhattan Project, and the only individual with access to information about all operational, scientific, engineering, and logistical aspects of proliferation. In the span of three months of 1945, he offered three different ranges, and hedged each one. Addressing the War Department in September, Groves opted for a 10-year estimate: “With regard to Russia, he estimated it would take her three years to develop the scientific knowledge (assuming efficient administration and access to German scientists) and five years by major effort to solve the industrial problems, or seven to ten years under a program of normal peacetime emphasis.”<sup>2</sup> The following month, as an expert witness before the House of Representatives, he “believe[d] that for another country to do this work, if it had the power of the greatest countries left in the world, but had no particular ideas, that it would take them from 5 to 20 years, and the difference in time would depend entirely on how ‘all-out’ they made their efforts and how much they threw security to the winds.”<sup>3</sup> Before the Senate the month after that, he tilted once more to the longer end, stating that if the Soviets “did it in complete secrecy, probably within 15 to 20 years — more likely the latter.”<sup>4</sup> Groves justified these assessments, at least publicly, by citing the backward technical capacities of the war-ravaged Soviet economy and his poor opinion of Soviet engineers and scientists.

Many of the scientists who worked under Groves during the war, however, had encountered quite a few of the leading Soviet nuclear physicists during the cosmopolitan interwar quest for the secrets of quantum physics, and deemed them able to solve the riddle of fission as competently as the scientists at Los Alamos had. In October 1945, atomic gadfly Leo Szilard, Groves’s *bête noire*, testified to Congress that it might be six years.<sup>5</sup> His colleagues Hans Bethe and Frederick Seitz published an article in 1946 entitled “How Close Is the Danger?,” outlining in clear prose what it would take for Russia, France, China, Argentina (or a South American coalition), Sweden, or Switzerland to make atomic weapons. One had to assess the nations’ incentives, scientific talent, technological ability, starting point, and (of course) access to uranium. Their conclusion: five years. That is, five years from 1946, which meant around 1951.<sup>6</sup>

Not all scientists drifted to a “low” or “medium” estimate, which it bears repeating, still

1. Harry S. Truman, public statement of September 23, 1949, PSF, Subject File, 1940–1953, Box 59, Folder: “September, 1949.” The Soviets were likewise astonished that the Americans found out and made the announcement, but that’s a different story. Full details on the debates about prediction, the process of detection, and the aftermath, can be found in Michael D. Gordin, *Red Cloud at Dawn: Truman, Stalin, and the End of the Atomic Monopoly* (New York: Farrar, Straus & Giroux, 2009).
2. “Notes of a Meeting in the Office of Secretary of War Concerning Atomic Energy Legislation, 9:30 A.M.–11:00A.M., 28 September 1945,” Harrison-Bundy Files Relating to the Development of the Atomic Bomb, Records of the Office of the Chief of Engineers (RG 77), National Archives and Record Administration (NARA), College Park, MD, Microfilm Publication M1109, Roll 5, Target 4, File 68: “Interim Committee — Legislation,” 5.
3. Leslie Groves testimony, October 9, 1945, United States House of Representatives, Committee on Military Affairs, *Atomic Energy: Hearings on H.R. 4280, 70th Congress, 1st*

not an physicist erred to so low an estimate — which, it bears repeating, was significantly overestimated the time to Soviet proliferation. Arthur Holly Compton, a 1927 physics Nobel co-recipient who had directed the Metallurgical Laboratory at the University of Chicago<sup>7</sup> and was as well informed as anyone, told a reporter in 1948 that he felt it would be at least four years — that is, 1952 — before the Soviets obtained a bomb, but that “I won’t be surprised if they don’t get it before 1970.”<sup>8</sup> Less cocky but no less dismissive, J. Robert Oppenheimer, the lord of Los Alamos, asserted in a letter that same year: “With all recognition of the need for caution in such predictions, I tend to believe that for a long time to come the Soviet Union will not have achieved this objective, nor even the more minor, but also dangerous possibility of conducting radiological warfare.” Confronted with this assessment at his security-clearance hearings in 1954, five years after the first Soviet nuclear test, Oppenheimer hung his head: “This was a bad guess.”<sup>9</sup>

Compton and Oppenheimer had access to different parts of the secret information available to Groves, and this might explain their tendency toward higher estimates. Those with less access to classified information tended to have similar low estimates, or sometimes even lower. William Leonard Laurence, the journalist who accompanied the Nagasaki mission and won a Pulitzer Prize for his inside reporting on the Manhattan Project, stated in 1948, “We still have about four years, as of today,” in line with Compton’s guess of 1952.<sup>10</sup> On the other hand, senior Republican senator Arthur Vandenberg — the backbone of Truman’s bipartisan foreign policy — on December 10, 1945, at first wrote: “We agree that Russia can work out this atom science in perhaps two years.”<sup>11</sup> Less than six months later he had revised his view more in line with that taken by conservative journalists: “Our ‘secret’ in respect to atomic bombs probably will not be a ‘secret’ for more than five years.”<sup>12</sup>

A year before the Soviets actually proliferated, in September 1948, the CIA converged, like almost everyone not in the inner circles of the Manhattan Project, to a five-year estimate: “The earliest date by which the Russians may have exploded their first bomb is mid-1950; the probable date by which they will have exploded their first test bomb is mid-1953.”<sup>13</sup> Notice how this splits the difference of “five years”: 1950 is five years from the first nuclear explosions of 1945, and 1953 is five years from the present — either way you sliced it, the relevant number was five.

Mushroom cloud from the detonation of the Joe-2 (RDS-2) Soviet nuclear bomb on 24 September 1951 at the Semipalatinsk Test Site in what is now Kazakhstan. This test had a yield of 38 kilotons of TNT. A total of 456 Soviet nuclear tests were conducted at the Semipalatinsk site between 1949 and 1989.



75th Congress, 1st session, 1945 (Washington, D.C.: Government Printing Office, 1945), 18.

4. Leslie Groves testimony, November 29, 1945, United States Senate, Special Committee on Atomic Energy, *Atomic Energy: Hearings on S. Res. 179*, 79th Congress, 1st session, 1945–1946 (Washington, D.C.: Government Printing Office, 1945–1946), 62.
5. Leo Szilard testimony to House Committee on Military Affairs, October 18, 1945, *Atomic Energy*, H.R. 4280, 88.
6. Frederick Seitz and Hans Bethe, “How Close Is the Danger?,” in Dexter Masters and Katharine Way, eds., *One World or None* (New York: Whittlesey House, 1946): 47.
7. The “Met Lab” was where the world’s first nuclear reactor went critical on December 2, 1942, proving that a fission chain reaction in uranium was possible.
8. “Compton Sure Russia Doesn’t Have A-Bomb,” *Los Angeles Times*, May 1, 1948, 14.
9. Letter, April 14, 1948, read during Oppenheimer testimony of April 12, 1954, in U.S. Atomic Energy Commission, *In the Matter of J. Robert Oppenheimer: Transcript of Hearing before Personnel Security Board and Texts of Principal Documents and Letters* (Cambridge, MA: MIT Press, 1971), 47.
10. William L. Laurence, “How Soon Will Russia Have the A-Bomb?,” *Saturday Evening Post*, November 6, 1948, 181.
11. Reproduced in Arthur H. Vandenberg Jr. with Joe Alex Morris, eds., *The Private Papers of Senator Vandenberg* (Boston: Houghton Mifflin Company, 1952), 228.
12. Arthur H. Vandenberg to L.G. Carnick, April 18, 1946, in Vandenberg with



Morris, *The Private Papers of Senator Vandenberg*, 252–253.

13. Intelligence Memorandum No. 59 for Secretary of Defense, September 20, 1948, CIA Records (RG 263), NARA, Box 110, Folder: “26519,” 9.

\*\*\*

Two general points emerge from the above, each of which requires explanation: First, individuals with greater access to secret information tended to have higher estimates than those with less; and second, the lower, less-informed guesses ended up being more accurate (though still overestimates). The explanation for the first point has to do with secrecy and is multidimensional; the explanation for the second has to do with assumptions and is more straightforward.

To begin with secrecy: Nobody really knew how hard it was to develop a nuclear weapon, even (or especially) those who had just done so. There was not just one thing that was “to build a bomb.” There were, in 1945, exactly two historical data points: the Americans, who had done it in 3.5 years; and the Germans, who had failed. Where on that continuum would the Soviets fall? (As it happens, almost 80 years later, no proliferating nation has ever managed to build a bomb in less time than the Manhattan Project.) Making a bomb required, at minimum, prospecting uranium, building an industry to isolate the fissionable isotope that constituted less than 1% of the natural ore (or synthesizing plutonium from the remainder), and designing a deliverable bomb. The physicists thought the secret to the bomb was the physics itself, which honestly wasn’t too hard. Engineers like Groves believed the industrial infrastructure and complex logistics — their specialty — was the real “secret” of the bomb.

Groves, however, also knew something else, one of the most closely guarded secrets of the era: He had all the world’s known uranium. Before World War II, this heavy metal had only very limited industrial uses — principally to form a bright yellow pigment — and so was poorly prospected. Most people believed it was rare; it was only in the rush to control this resource after the war that revealed that it is in fact reasonably plentiful. Groves’s Combined Development Trust monopolized 97% of the world’s known uranium, mostly from the Belgian Congo. His success was highly classified, so most pundits were unaware of the stranglehold the Americans held on resources, and which we now know significantly hampered the Soviet project.

Secrecy was a problem for forecasting in general. Different people knew separate things about the Manhattan Project, about the Soviet Union, about the laws of nature, about the U.S. government. American intelligence was (and remains) partitioned across multiple agencies, forbidden from compiling what they knew by the arcana of classification and the instincts of mistrust. Biases became ingrained. The newly created Air Force opted for a short time frame since they were the premier military branch for nuclear delivery; the Navy, perhaps fearing obsolescence in this brave new world, opted for a longer timeline so their relevance would be assured for many years to come. Both could marshal data that confirmed their priors.

Knowledge about what was going on in the Soviet Union was harder for Americans to obtain than details about their own weapons. Decades of spy movies have conditioned us to expect that this problem could be ameliorated with human intelligence in the form of American agents on the ground. But the workers' paradise was "denied territory" in intelligence parlance: There were *zero* ground agents in the Soviet Union. In 1949 the CIA began a five-year program to recruit and train former Soviet citizens who would be air-dropped back on Soviet territory. Almost all of them were arrested at once and shot. Those few who produced information were not trusted by the Americans, who feared that the informants had been "turned" to double agents. The inverse was not true, of course: The Soviets had several highly placed agents within the Manhattan Project and obtained significant information about the details of the American program. This penetration, too, was secret, and therefore was not explicitly factored into any of the estimates above. (Groves, who knew the most about it, seems not to have considered it at all.)

You certainly couldn't trust what the Soviets said about the "atomic secret." On November 6, 1947 — long before any of the credible American estimates had matured — Soviet foreign minister Vyacheslav Molotov hinted at Soviet success. During a rousing speech in honor of the 30th anniversary of the Bolshevik Revolution, he cryptically added: "As we know, a sort of new religion has become widespread among expansionist circles in the U.S.A.: having no faith in their own internal forces, they put their faith in the secret of the atomic bomb, although this secret has long ceased to be a secret."<sup>14</sup> Two weeks earlier,

Andrey Zhdanov, Stalin's second-in-command, had announced in Warsaw that while the Americans had a monopoly on nuclear weapons, that monopoly was "temporary." Andrey Vyshinsky, who would replace Molotov as foreign minister in 1949, later declared that the monopoly was an "illusion."<sup>15</sup> It suited the Soviets both to claim they had already proliferated in order to deter a preemptive American strike, and also to keep mum about it once they had tested their first device in August 1949, lest this trigger the same aggressive response before they had time to amass a stockpile.

\*\*\*

What about the puzzling fact that the working physicists in general seemed to have lower estimates than Groves and others with access to the largest amount of classified information — and that those lower estimates were correct? It was surely the case that Groves overestimated the time to Soviet proliferation because he thought that the devastated Soviet economy could not possibly handle the tremendous technical and logistical effort involved in building an entire nuclear industry. Such large-scale construction projects were his specialty — he built the Pentagon, still the world's largest office building, ahead of schedule and under budget in the wake of the Depression — so he likely overweighted this factor. Groves knew that the physics involved in building a nuclear weapon was not especially difficult, and that Soviet scientists could figure it out within a few years, especially if they got their hands on German specialists (which they did). He just did not think that was sufficient to build a bomb. Why were the lower-estimating physicists closer to being right?

They really weren't, in the sense that all the logistical hang-ups predicted by Groves — the uranium shortage, the dilapidated heavy industry, the competing demands of the civilian economy — were indeed the factors that most slowed down the Soviet bomb builders, who had in fact started working out the physics in the middle of the war. What Groves and

14. Vyacheslav Molotov, "Thirtieth Anniversary of the Great October Socialist Revolution," speech at celebration meeting of the Moscow Soviet, November 6, 1947, in V.M. Molotov, *Problems of Foreign Policy: Speeches and Statements, April 1945–November 1948* (Moscow: Foreign Languages Publishing House, 1949), 488.
15. "Reds 'Possibly' Have A-Bomb — Vishinsky," *Los Angeles Times*, November 7, 1947, 1; "U.S. Monopoly on Atom Bomb 'Illusion,' Vishinsky Tells UN," *The Christian Science Monitor*, October 1, 1948, 6; "Reds' A-Bomb Hint Called 'Dishonest,'" *The Washington Post*, October 3, 1948, M3; Andrey Zhdanov quoted in Sydney Gruson, "U.S. Monopoly of Bomb Cited," *The New York Times*, October 23, 1947, 3.

everyone else hadn't counted on was Joseph Stalin. It was extremely hard to force-march your entire economy toward the building of an atomic bomb while sacrificing the needs of an impoverished civilian population while at the same time prospecting across the vast reaches of Central Asia for uranium, running an international intelligence operation, and keeping your entire army mobilized. Stalin could do that without civilian unrest, and he could also steal heavy industry from Central and Eastern Europe for the chemical industry required for the project. Groves looked at the raw data of the Soviet economy and figured it could never, under normal circumstances, compete. Stalin meant the circumstances were not normal. In the end, the "physicists' estimate" ended up being more right because that was the only one of the many factors that could not be accelerated by state terror.

This speaks to a lesson that one can draw from the failed American predictions of Soviet proliferation: what one could call the problem of *specification*. In almost all of the predictions above, what it means to "have a bomb" is different, much as it is today in forecasting Iranian proliferation. When you evaluate an estimate, it is essential to know what it is an estimate *of*. Did one mean five years until the Soviets uncovered the basic information of how to make an atomic bomb? Five years until a working reactor? Until the establishment of the production process for nuclear fuel? Until the first atomic test? Until a sizable stockpile? Until the assembly of a delivery system capable of striking the American heartland? Most estimators were vague about what they meant, and so it was possible, in good conscience, to keep reiterating "five years," because the five years may have referred to something different each time.





Because of the conditions of secrecy, in this case non-specification drove the convergence of estimates. Everyone predicting "five to 10 years" gave a comforting feeling of certainty to both the forecasters and their audience. If a good many smart people offer the same conclusion, they must be on to something, right? Unfortunately, the uniformity masks an underlying heterogeneity of reasoning. By focusing on the number, one misses that the justifications for the predictions are quite different, and at times contradictory. The number easily becomes unmoored from reality: People who said "five years" in 1945 would say the same in 1947, and in 1949. "Five years" slowly came to mean "five years from now," not "five years from when they started" or "five years from my first prediction."

The Americans were not always so hapless at nuclear prediction, famously announcing the Chinese test at Lop Nur in 1964 a few weeks *early*; nonetheless, the debates of the late 1940s do give one pause when confronting the present. Even though today there are many well-informed, thoughtful people making predictions, they face similar challenges to those facing postwar Americans: many competing entities with private information — this time the secrecy is corporate instead of military — alongside a lack of specificity (in the case of AGI, unspecified in large part because the characteristics aren't known) about the precise nature of the prediction. The challenges of one single technological forecast about a known entity, the object of focused attention for years by the most well-informed people around, illustrates some of the difficulties of today's necessary predictions.

---

**Michael D. Gordin** is the Rosengarten Professor of Modern and Contemporary History at Princeton University. His books include *A Well-Ordered Thing: Dmitrii Mendeleev and the Shadow of the Periodic Table* and *Five Days in August: How World War II Became a Nuclear War*. He lives in Princeton, New Jersey. Twitter @GordinMichael

---

Published June 2023    

Have something to say? Email us at [letters@asteriskmag.com](mailto:letters@asteriskmag.com).

**Previous**  
Through a Glass Darkly

**Next**  
Are We Smart Enough to Know How Smart AIs Are?

**Further Reading**

More: **history, forecasting**

---

AI Isn't Coming for Tech Jobs—Yet Jonathan Mann

---

The Puzzle of Non-Proliferation Carl Robichaud

---

**Through a Glass Darkly** Scott Alexander

---

?