Finding the Site of the First Soviet Nuclear Test in 1949

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Abstract

Efforts by the U.S. government to detect the first Soviet atomic test began at least as early as 1946. Interception of radioactive debris from the first test was made by the Air Weather Service B-29 weather reconnaissance aircraft, which was equipped to filter particles from the air, on 3 September 1949 at 500 mb east of Kamchatka. The U.S. Weather Bureau was charged with trying to find the likely testing grounds from this first interception and a few later ones. The test site was found using backward air trajectories from the radioactivity detection line and a time of detonation to determine where to stop the backward trajectories. The explosion time, with large error bars, was obtained from radiochemical analysis of the particulate debris. In 1949, best time was estimated to be about 1500 UTC on 27 August. This was then combined with 500-mb backward trajectories to place the likely test site, incorrectly, near the northern part of the Caspian Sea. The uncertainties in the test time and in the calculated trajectories allowed the test site to be possible over a much larger region.

Subsequently, the real explosion time was found to be about 0100 UTC 29 August, placing the most likely test site, from the 1949 Weather Bureau trajectories, just south of Lake Balkash. The true test site has also been revealed to be the Khazakh Test Site, and is 250 to 275 miles north of this latter calculated position. The percentage error between the calculated and correct source position relative to the trajectory distance is about 5%. This value, 5%, is much smaller than the more typical 20% errors found by other studies.

1. Introduction

Today's reader may not appreciate the impact of the announcement of the first nuclear test by the Soviet Union in September 1949. The end of the U.S. nuclear monopoly by a country weakened by World War II came as a shock to many, including administration officials who initially found it hard to believe. President Truman sought to ease that shock in his public statement about the test on 23 September 1949 (Truman 1949):

> Nearly 4 years ago I pointed out that "scientific opinion appears to be practically unanimous that the essential theoretical knowledge upon which the discovery is based is already widely known. There is also substantial agreement that foreign research can come abreast of our present theoretical knowledge in time."

But this hardly assuaged the dismay to most people in the western world. Among other consequences, it led to an acceleration of U.S. efforts to produce more plutonium and enriched uranium, as well as the development of the fusion "superbomb" (Hewlett and Duncan 1969). The competition of the Soviet nuclear weapon capability intensified the Cold War. We shall briefly recount how the United States came to detect this first Soviet nuclear test. The new aspect of this history, which will be described more fully, relates to the role of the U.S. Weather Bureau in locating the test site. While the detection of the nuclear test and identification of its plutonium fuel was a major achievement, the Weather Bureau's contribution was hampered by an inaccurate estimate of the time of the explosion. But new information after 1949 shows that the Weather Bureau's work would have been even more useful had the right time of the detonation been known.

2. Establishment of a U.S. nuclear test monitoring program

When the U.S. Army's Manhattan Project was being replaced in early 1946 by the civilian Atomic Energy Commission (AEC), one of the commissioners, Admiral L. Strauss, led an effort to establish a nuclear weapon detection program (Northrop 1962).[1] His concerns were shared by other senior government and military officials. After many meetings and discussions, the program was assigned primarily to an organization that subsequently was identified as AFOAT-1 (Northrop 1962). The unit is still functioning as the Air Force Technical Applications Center (AFTAC), which continues to manage the U.S. Atomic Energy Detection System (AEDS) with emphasis on nuclear treaty monitoring.

Concurrently there were many scientific discussions. Doubts about detection capability were raised,

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[1] This is the most authoritative statement of activities leading up to and during the early days of the detection of the first Soviet nuclear explosion, Joe-1. It has been used extensively throughout this report even when not referenced.

even against the more obvious techniques, such as the collection of airborne radioactive debris (Blair et al. 1945).[2]

Were the radioactive particles small enough to survive travel outside the Soviet borders? Might not a nuclear test be conducted during a rainstorm, which would scavenge the radioactivity? Or could a stagnant weather regime prevent radioactivity from crossing the border in detectable amounts?

Seismic and acoustic detection techniques had their own problems in 1946 as well. In the spring of 1948, the United States conducted a series of three atmospheric nuclear tests in the equatorial Pacific at Eniwetok (11° N, 162° E), Project Sandstone. Various detection methods were tested against these U.S. nuclear explosions (Northrop 1962). The transport and subsequent collection of particulate radioactivity at great distances—many thousands of miles—were easily demonstrated. It is this detection method that subsequently involved the U.S. Weather Bureau. Predictions of where the clouds of radioactivity would be found proved to be very successful. In fact, measurable amounts of particulate radioactivity from these U.S. tests were detected over large areas of the Northern Hemisphere, a finding that is now less surprising than it was prior to 1948. Although most of the radioactivity was collected aboard military aircraft, the U.S. Navy also obtained large amounts of radioactivity in rainwater samples. On the other hand, seismic and acoustic methods in 1948 were less successful; signals from the Sandstone tests "were a disappointment" (Ziegler 1988).

The success of aircraft collection of atmospheric particulate radioactivity led to the establishment of the program that ultimately succeeded in detecting the first Soviet nuclear explosion, called Joe-1. Filtration devices, called "bug catchers," were mounted on USAF B-29 Air Weather Service weather reconnaissance aircraft. Two side-by-side filter papers were changed every 3 h in flight; each change necessitated depressurizing the aircraft. Radioactivity scanning was performed at the landing base of the aircraft by means of a simple wraparound Geiger counter. Based on Sandstone experience, a counting rate of 100 counts per minute (cpm) or more for a filter exposed for 2 h triggered an alert requiring a more detailed analysis. This minimum count rate was subsequently lowered to 50 cpm. The reason for a 50-cpm or other alert level is due to the presence of natural particulate radioactivity, radon and thoron daughters attached to natural particles in the air. Most flights were conducted on the 500-mb pressure surface or at about 18 500 ft mean sea level (MSL) (almost 6 km). A study of airflow from hypothesized test sites in the Soviet Union indicated that the most likely Air Weather Service track to pick up Soviet test radioactivity would lie between Alaska and Japan, a track called Loon Charlie (Fuller 1990). These flights were scheduled for every other day. A large number of false alerts preceded the first real detection. These were the result of communication errors, unusual natural radioactivity, false acoustic or seismic signals, and incorrect press reports.

3. First detection

So it was that on 3 September 1949, a Loon Charlie flight reported to Washington, D.C., headquarters of AFOAT-1, a filter paper with 85 cpm on Saturday of Labor Day weekend. This finding was reinforced by a later report from the companion paper of 153 cpm. Both counts were above the alert level (Northrop 1962). The position of the flight track and the leg with the positive signal off Kamchatka appear in Fig. 1 (U.S. Weather Bureau 1950).[3] These early alerts triggered 92 special flights searching for the radioactivity over the Pacific Ocean, Canada, and into the North Atlantic (Northrop 1962). The United Kingdom was notified and their aircraft joined in the search for the nuclear cloud. The search for subsequent downwind radioactivity was guided by Air Weather Service meteorologists. The dotted legs on either side of the positive segment of the flight on Fig. 1 contained no unusual radioactivity, nor did the Loon Charlie flight two days earlier (Northrop 1962). The six back trajectories on Fig. 1 starting at several points along the positive leg were prepared in early September 1949. It is evident that those that originated in the northern part of the leg initially approached the Kamchatka leg from the north, those in the southern part from a southerly region. The trajectories starting from the end points of the leg were less likely to be pertinent, since radioactivity at either edge would probably also have been present on filter papers of the adjacent legs.

In 1949, all of the air-parcel trajectories were pre-

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[2] This report contains a suggestion by J. Magee and A. Turkevich that "radioactive fission products from the 16 July nuclear explosion at Trinity near Alamogordo, NM, might be detectable after having been blown around the world by prevailing west-to-east high altitude winds." The Los Alamos group outfitted a B-29 aircraft to crudely filter the air. Between 10 and 15 August 1945 they sampled air in western North America and found long-lived radioactivity mainly on 10 and 11 August. This radioactivity was attributed by a meteorologist, J. Hubbard, to fission products from the Hiroshima nuclear explosion, which took place on 5 August, about five or six days earlier.

[3] These trajectories were, however, prepared in early September 1949.

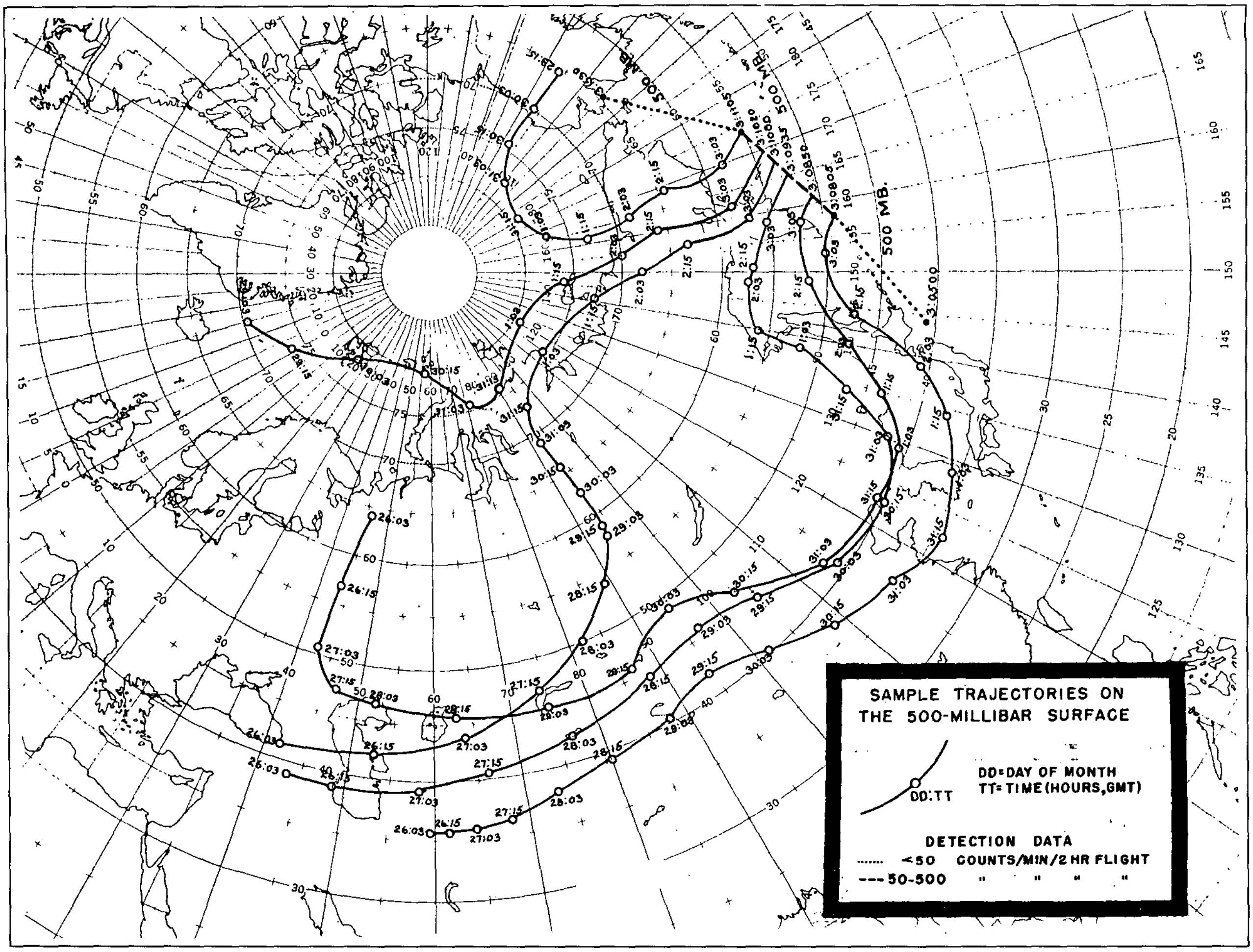

FIG. 1. The location of the first detection of debris from Joe-1 near Kamchatka, with backward trajectories from six parts of the flight leg on 3 September 1949 at 500 mb. The figure is reproduced unchanged from 1949.

pared by hand, a procedure in marked contrast to today's method of constructing trajectories by computer. Then, as now, the basic wind information was derived from radiosonde balloon observations taken twice a day (at a few places, four times a day). Meteorologists routinely prepared twice-daily maps of the heights of standard pressure surfaces such as the 500-mb surface—the reason that Loon Charlie and other weather reconnaissance aircraft usually flew on the 500-mb surface. The isolines of heights of a given pressure level represent, to a good approximation, the horizontal airflow; the isolines are almost streamlines. This approximate air motion, the geostrophic wind, depicts the wind velocity that would exist if the pressure-gradient force were exactly balanced by the Coriolis force due to the rotation of the earth. Friction, and all other forces, are thus neglected. The shortcomings of using these geostrophic winds were well known in 1949. However, their use was justified because the 500-mb level at about 18 500 ft MSL is well above the influences of ground friction. And, unfortunately, there was little choice, since the weather reports received in the United States in 1949 from some foreign weather services rarely contained observed winds. The very few winds received were used in the trajectory calculations.

Thus, the trajectories appearing on Fig. 1 were based on geostrophic winds extracted from twice-daily 500-mb weather charts. Spatial interpolation between radiosonde sites was simple because the maps contain continuous isolines. Interpolation in time used a technique in which the isoline pattern on each map was considered frozen during a 12-h interval 6 h before to 6 h after map time. During the period of the frozen pattern, the isolines, considered to be streamlines, were coincident with trajectories.

How accurate were the after-the-fact 500-mb trajectories derived from geostrophic winds? In 1949, although the errors from the use of the geostrophic winds were quantitatively known, a satisfactory alternative answer about the trajectories was unavailable. We knew in the late 1940s that trajectories should be constructed on isentropic, not constant pressure, surfaces but, again, the consequence of using the 500-mb rather than isentropic paths was not systematically studied. However, this assumption was tested during the Joe-1 calculations (U.S. Weather Bureau 1950) and was found to be reasonably correct. The vertical extent of the Joe-1 radioactive cloud was unknown but could be estimated by extrapolation from the radioactive clouds observed during U.S. atomic tests. The cloud might have risen to over 30 000 ft (10 km), the depth of the troposphere, but the settling of particles from higher elevations down to 18 500 ft was believed to be relatively insignificant as the radioactive particles found on the filter papers were reported to be small (U.S. Weather Bureau 1950). Thus, for purposes of the trajectory calculations, a reasonable assumption was made that there was radioactivity in the initial nuclear cloud at 500 mb and that its transport on the 500-mb surface brought the radioactivity to the point of detection near Kamchatka.

4. Locating the test site in 1949

The main charge to the Weather Bureau was to find the location of the Joe-1 test site. At the time, neither seismic nor acoustic signals were of any help (Northrop 1962). The determination of the site location was secondary to other kinds of information, such as whether the detected radioactivity was from a nuclear bomb explosion or from a reactor accident, and what kind of bomb was detonated. Both of these questions were answered by radiochemical analysis of debris. But some assurance that the radioactivity originated within the Soviet Union was desired.

Inspection of the backward trajectories from the various starting points along the Kamchatka leg in Fig. 1 will indicate two problems in locating the test site. First and foremost: Where or at what time along a back trajectory must one stop? Second, since the trajectories starting on the northern portion of the flight leg differ markedly from those starting in the southern part, which part of the flight leg contained the radioactivity?

The time of the explosion could, in principle, be derived from radiochemistry. The ratio of two radionuclides on the filter paper with different half-lives together with the fission yield curve for either uranium or plutonium fission allows one to determine the time of origin. Tracerlab Inc., under contract to AFOAT-1, examined several pairs of isotopes from among ^{140}Ba, ^{99}Mo, ^{95}Zr, and ^{144}Pr. They estimated the uncertainties in each aspect of the radiochemistry and the calculations to determine a best explosion time of 1500 UTC on 27 August 1949 (Zumwalt et al. 1949).[4] But the uncertainty in these data was large enough to allow the possibility of an explosion any time between 0300 UTC 26 August and 0300 UTC 29 August.

After the first Kamchatka detection, many aircraft succeeded in finding radioactive debris. These later flights changed their filter papers every hour instead of every 3 h. Of particular interest was a flight southeast of Japan two days later on 5 September. One leg of this flight at 700 mb (about 10 000 ft or 3 km) sampled a much more concentrated piece of the nuclear cloud; the filter paper contained over 1000 cpm. The back trajectory of this strong positive interception is shown on Fig. 2 (U.S. Weather Bureau 1950).[5] In all likelihood it was a back trajectory of the main part of the cloud stem as compared to the Kamchatka detection, which probably intercepted only the advance nose of the cloud. The back trajectory of the 5 September interception in Fig. 2 puts the test site somewhere along the southern edge of the Soviet Union in a region similar to the region traversed by trajectories starting from the southern part of the Kamchatka flight leg in Fig. 1.

Using the explosion time and date of 1500 UTC 27 August and the trajectories in Fig. 1 and 2 allows one to estimate likely locations of the point of detonation, as in Fig. 3 (U.S. Weather Bureau 1949). The 50% area denotes the 50% likelihood that the test took place there. The next outer 40% area indicates that there is a 90% likelihood that the test site lies within the 40% plus 50% enclosed area and so forth for the other areas. Similar maps were prepared for other times at which the nuclear test might have occurred. In these maps, such as Fig. 3, the Weather Bureau tried to include not only the uncertainty in the analysis of the airflow, but also the uncertainty arising from whether the aircraft intercepted the cloud center or its edge. The several maps of probable locations of origin of radioactivity, such as Fig. 3, for different explosion times given from the radiochemistry indicated the possibility of the test site being almost anywhere in the Soviet Union. One could even rationalize, with very

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[4] The time of the explosion using all data was 1500 UTC 27 August 1949, but using only the more reliable data altered the time by 4 h to 1900 UTC.

[5] The figures in this early report also show the areas of location probabilities for three possible origin times, 0300 UTC on the 27, 28, and 29 August. It is this report that was available to the Vannevar Bush Panel (discussed later), which produced on 19 September 1949 its statement of the Soviet nuclear test. The areas of the likely test site for each time were generally similar to the areas depicted in the final report in 1950.

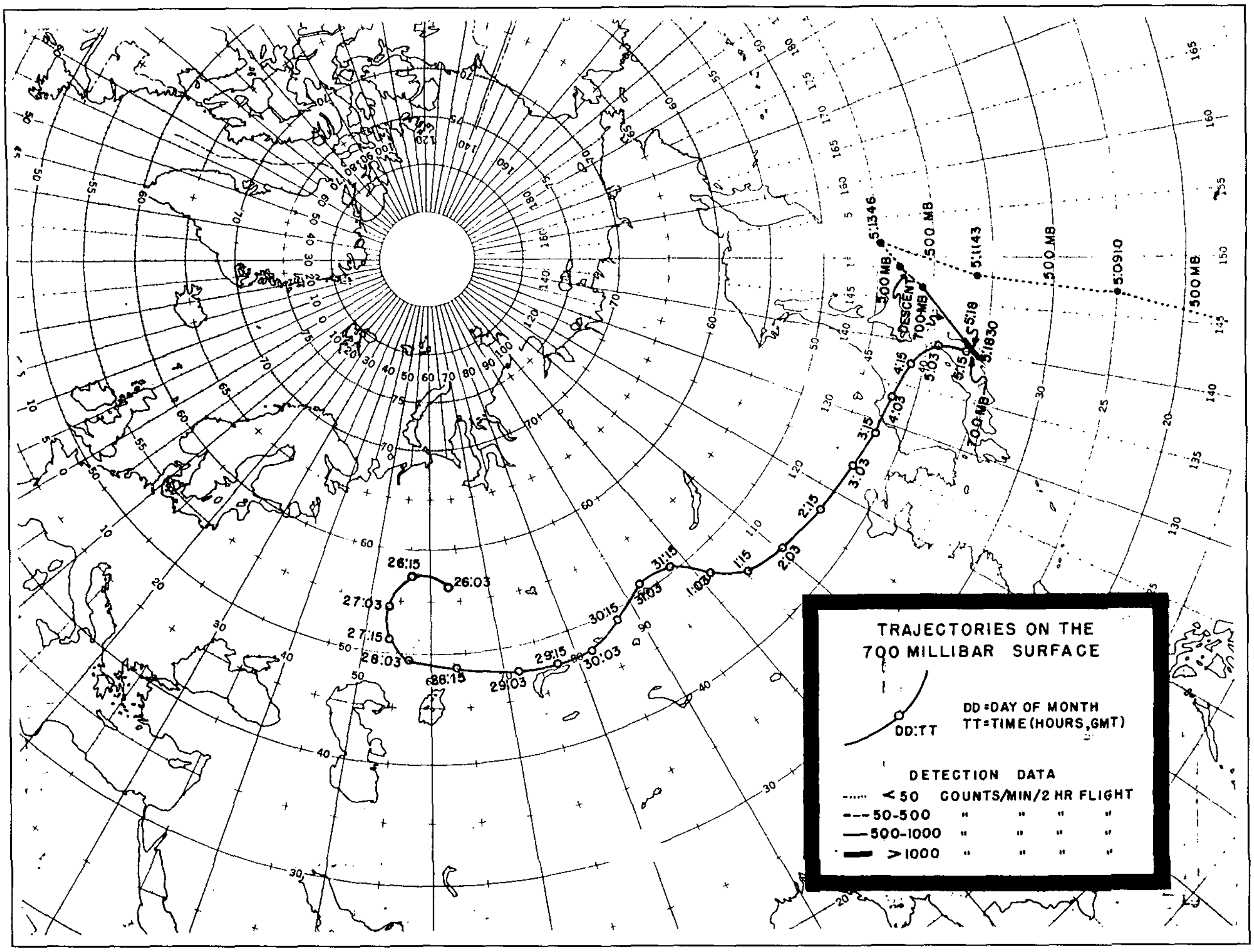

Fig. 2. The flight track on 5 September 1949 and a backward trajectory from the leg at 700 mb, which contained over 1000 cpm of particulate radioactivity. This figure is reproduced unchanged from 1949.

low probability, an origin in non-Soviet Europe (U.S. Weather Bureau 1950).

During the first half of September 1949, all information related to this nuclear event was being conveyed to military and civilian authorities by AFOAT-1 and the AEC. In keeping with the earlier skepticism concerning Soviet nuclear capabilities, many of these people were dubious that a nuclear bomb test had taken place. Accordingly, a panel of distinguished, mainly nongovernment scientists, under Dr. Vannevar Bush, was asked to review all of the evidence and pass judgment on the matter. On 19 September 1949, the panel concluded that the observed phenomena "are consistent with the view that the origin of the fission products was the explosion of an atomic bomb whose nuclear composition was similar to the Alamogordo bomb and that the explosion occurred between the 26th and 29th of August at some point between east 35th meridian and 170th meridian over the Asiatic land mass" (Northrop 1962). The impact, if any, of the Weather Bureau's efforts, described above, was to locate the test site "over the Asiatic land mass," not a profound contribution. Had the story ended here, there would be little reason to boast of the accomplishments of meteorological air trajectories. But in the course of time, new information was uncovered and the story continues.

5. New information

Sometime after 1949, it was revealed that the correct date of Joe-1 was 29 August, rather than 27 August as was provided by radiochemistry and used in the 19 September 1949 evaluation. According to Sykes and Ruggi (1990), the date of Joe-1 was believed by U.S. authorities to be 27 August 1949 until at least 1954. Many documents, including a 1978 AEC list of foreign tests (U.S. Department of Energy 1979), have confirmed the new date, but none gives the time on 29

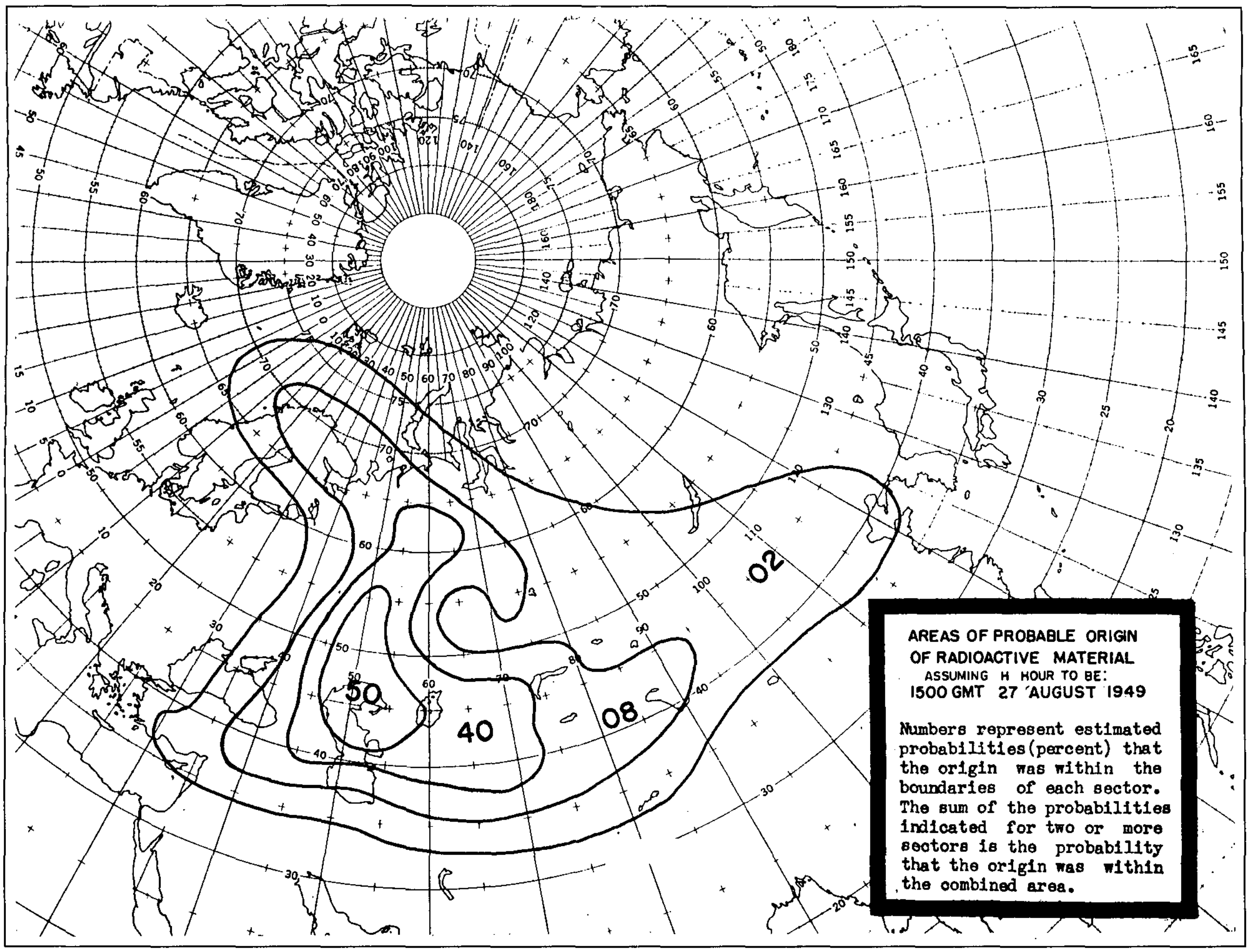

FIG. 3. The probability of the nuclear test taking place somewhere in the indicated areas if the time of the explosion was 1500 UTC 29 August 1949. This figure is reproduced unchanged from 1949.

August. However, a recent Soviet publication (Golovin 1990)[6] describes the time as 0600 on 29 August, presumably local time. This corresponds to 0100 UTC.

Figure 4 shows the probable areas of the test site for time 0100 UTC 29 August in a way similar to that for Fig. 3 (U.S. Weather Bureau 1950). In 1949, the Weather Bureau prepared a chart for 0300 UTC 29 August rather than for 0100 UTC. The isolines in Fig. 4 were adjusted slightly (less than 100 miles westward) from those in the 0300 UTC chart to be more appropriate for the 0100 UTC time. Thus, if the correct time, 0100 UTC 29 August, had been known in early September 1949, Fig. 4 would have been shown to the Vannevar Bush Panel for their evaluation. The explosion location is the present Khazak Test Site (Sykes and Ruggi 1990; Golovin 1990), which appears as a solid rectangle added to Fig. 4. The rectangle lies at the edge of the 70% area and 250 to 275 miles north of the dot at the center of the 70% ellipse. Would the relatively correct location of the test site of Fig. 4 have made any difference to the Vannevar Bush Panel on 19 September if it, rather than the one in Fig. 3, had been available to the panel? Maybe, but only marginally. It would have made the most likely test region more remote from a nuclear reactor and possibly in a more plausible location for a nuclear proving ground than a location derived from Fig. 3. For the meteorologist, subsequent confirmation of the location of the Khazak Test Site, near Semipalatinsk, now gives credence to trajectory analyses prepared in 1949.

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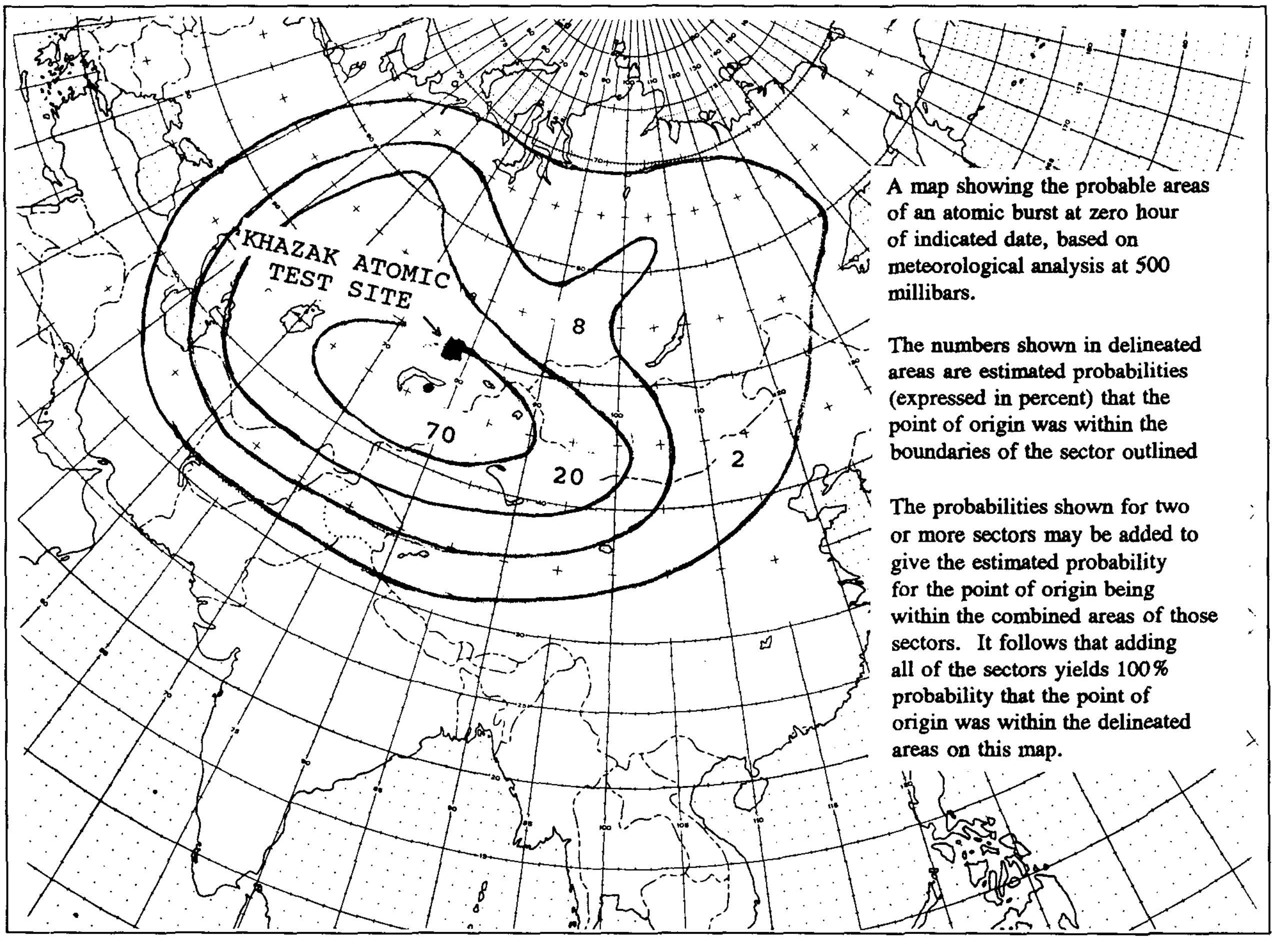
[6] There still remains some confusion on the time of the detonation. Golovin (1990) states only that Kurchatov declared the H-hour: 29 August 1949, 0600 LST "after a discussion with Stalin" but before the explosion. In the subsequent text, Golovin never corrects the time if it was different. Sunrise is about 0500 LST and Golovin writes that "the sun had risen. . . " when the test took place. But M. Pervoukhin in "Recollections of I.V Kurchatov" gives the time as 0400 to 0500 LST. Each hour earlier than 0600 local time—0100 UTC—would shift the patterns of isolines westward in Fig. 4 by about 35 miles.

6. Comparison with other trajectory constructions

Was the skill in locating the test site using 1949 weather data and techniques surprising? The answer is yes, because compared to the typical errors quoted in the 1950s, the skill was quite good. For example, in 1954, Homer Mantis of the University of Minnesota (Moore et al. 1954) reconstructed trajectories of horizontally floating balloons at an altitude of 30 000 ft (300 mb) over the United States using conventional meteorological information, including real radiosonde winds over the United States. Twenty flights, each about 1000 miles in length, that adhered closely to the 300-mb surface were used in a comparison between meteorologically constructed and observed trajectory endpoint positions. This analog to the trajectories constructed for Joe-1 is not inappropriate, even though the altitudes and the geographical areas were different. The usual statistic for describing the error in a trajectory calculation is given by the ratio of the distance error between the calculated and observed positions to the travel distance. Mantis' results indicated that the average distance error between observed and calculated position was about 200 miles or 20% of the balloon trajectory length. The error in locating the test site, 250 to 275 miles, is only about 5% of the travel distance, almost 5200 miles, or a quarter of the average percentage error found by Mantis. The success of the Joe-1 constructed trajectories is in large part due to the relatively simple and persistent airflow pattern at the time, in part due to chance, and in part due to the major effort by the Weather Bureau team in evaluating the data, the meteorological analyses, and the many possible trajectories. Such an intense and time-consuming effort requiring so much manpower can be justified only for unusual events.



A map showing the probable areas of an atomic burst at zero hour of indicated date, based on meteorological analysis at 500 millibars.

The numbers shown in delineated areas are estimated probabilities (expressed in percent) that the point of origin was within the boundaries of the sector outlined

The probabilities shown for two or more sectors may be added to give the estimated probability for the point of origin being within the combined areas of those sectors. It follows that adding all of the sectors yields 100% probability that the point of origin was within the delineated areas on this map.

Fig. 4. The probability of the nuclear test taking place somewhere in the indicated areas if the time of the explosion was 0100 UTC 29 August 1949. This figure is based on an identical map prepared in September 1949 for 0300 UTC by the Weather Bureau, but the isolines have been shifted by 2 h using 500-mb winds. The solid rectangle, added later, locates the Khazak Test Site where Joe-1 took place. The dot to its south, the center of the 70% ellipse area, is the most likely calculated position of the test site.

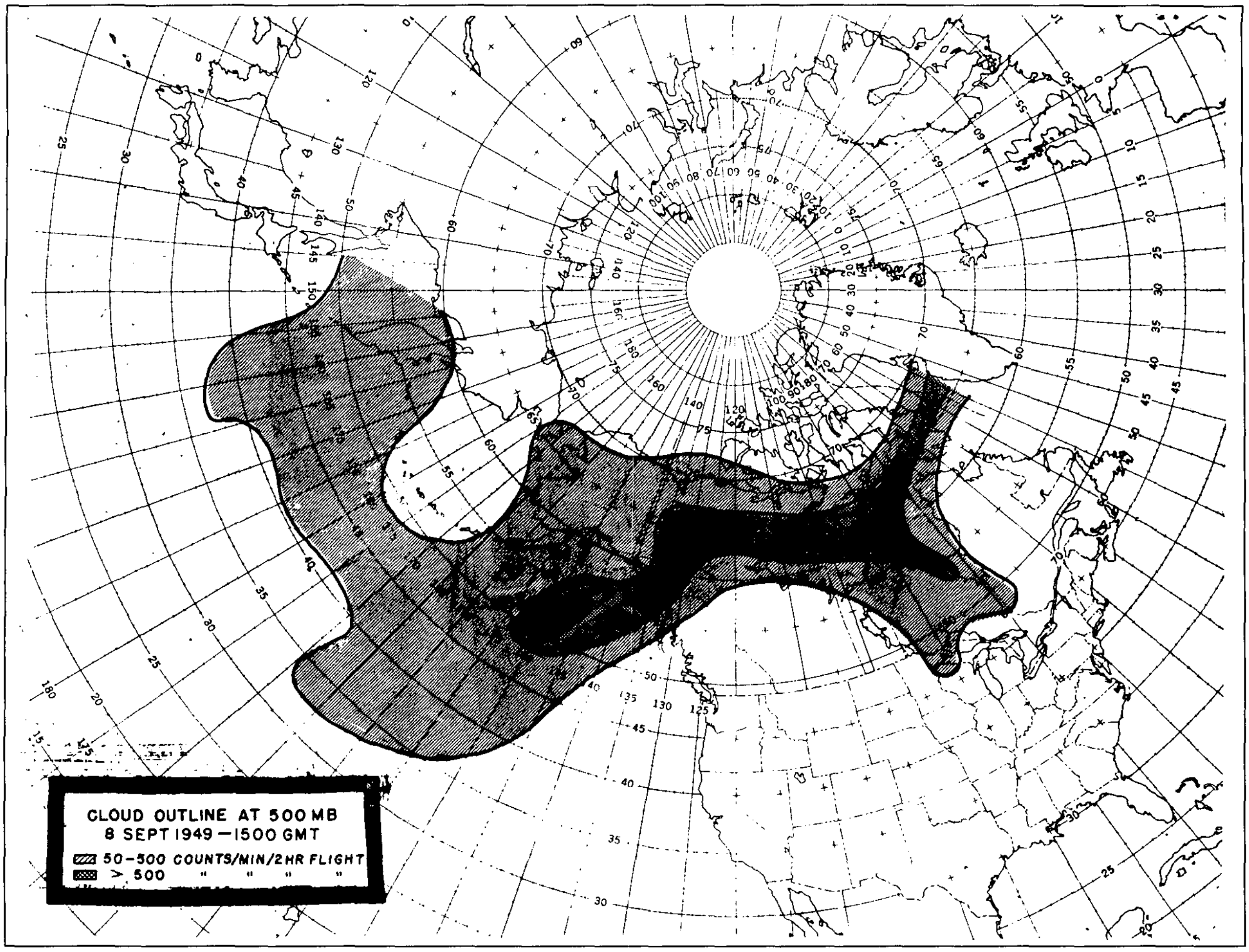


FIG. 5. The geographical distribution of particulate radioactivity on the 500-mb surface at 1500 UTC 8 September 1949.

7. Subsequent cloud pattern

As noted earlier, the first positive detections of the Soviet radioactivity along the east coast of Asia triggered a massive effort to collect additional samples of radioactivity, primarily for radiochemical analysis. As the radioactive cloud moved eastward, it passed over the North Pacific Ocean, over Canada, and into the northern Atlantic Ocean. The abundance of sampling results permitted a delineation of the cloud shape at least on the 500-mb surface (U.S. Weather Bureau 1950), the altitude at which most interception flights were conducted. In order to reconstruct the geographical distribution of particulate radioactivity concentration, all flights within plus or minus 2 days of the time of the map were used. For off-time flights, meteorological trajectories were used to carry the air masses forward or backward to the time of the map along the 500-mb surface using the appropriate geostrophic winds. Figure 5 displays one of the maps of the radioactivity distribution for 1500 UTC 8 September 1949. It is evident that the cloud has stretched out and extends from Asia to Greenland and beyond. The leading and trailing edges cannot be closed because of the lack of U.S. aircraft sampling east of Greenland and over Asia. This stretching, largely in the direction of the wind, is typical of a tracer whose initial distribution is in a vertical column, such as a volcanic eruption. Upward vertical mixing from levels of lower wind speeds, and downward mixing from higher altitudes, where the wind speeds are stronger, combine to elongate the cloud at the 500-mb level. In general, the wind shear in the vicinity of 500 mb is that of increasing speed with height rather than a change in direction. The large area over which the cloud extends after 10 days of travel illustrates why finding radioactivity by aircraft many days after a nuclear test is a much easier problem than locating the source of the radioactivity from one or two places where the radioactivity is found.

8. Radiochemical dating

Since this story revolves about an incorrect most-probable time of fissioning, an obvious question arises as to why the radiochemical dating was wrong. The most reliable dates (Zumwalt et al. 1949) of fissioning were derived from the ratio of ^{140}Ba (half-life, 12.8 days) and ^{99}Mo (67 hours). The correct fission yields and half-lives of these radioisotopes were known in 1949. But what was not adequately appreciated were the consequences of the production of most of the ^{140}Ba through the short-lived (16-s) Xenon (^{140}Xe) parent (Turkevich, private communication, 1991).[7] To calculate the time of fissioning, the assumption must be made, of course, that the ^{140}Ba/^{99}Mo ratio in the aircraft sample is the same as that in an air parcel at the time of fission except for radioactive decay. Because of the ^{140}Xe parent, it is likely that much of the ^{140}Ba has a different condensation history than ^{99}Mo and thus negates this assumption. Indeed, later U.S. experience with nuclear tests has led to the abandonment of ^{140}Ba as one of the radioisotopes used for yield-determination purposes.

9. Summary

The first known western information that the Soviet Union had tested a nuclear bomb came from the interception of the radioactive cloud by a U.S. Air Force weather reconnaissance aircraft off Kamchatka on 3 September 1949. The U.S. Weather Bureau, using backward air trajectories and the time of the explosion, tried to determine the location of the test. The most probable region for the test based on 1949 information using 1500 UTC 27 August 1949 as the test time was in southeastern European Russia or western Khazakstan. However, the uncertainties in the time of the explosion derived from the early radiochemistry, together with those of the meteorological trajectories, allowed the test to have taken place over a very wide region of the Soviet Union.

Years later, the time and location of the test became publicly known. Using this new time and the 1949 calculated trajectories now correctly locates the most probable place of the test site in Semipalatinsk province, near Lake Balkash. The center of the most probable area lies about 250–275 miles south of the now known Khazak Test Site. This relatively small distance discrepancy is rather good, considering that the backward trajectory was almost 5200 miles in length and 5 days of travel. The error is about 5% of the travel distance. Experience with similar constructions of air trajectories suggests that the errors are, on the average, closer to 20%. The failure to provide a correct time of fission in 1949 is attributed to the use of the ^{140}Ba/^{99}Mo ratio without adequately appreciating the differing condensation histories of the two radioisotopes.

Acknowledgments. The U.S. Weather Bureau team, the Special Projects Section, involved in the Joe-1 operation included the author, who was then the chief of the section, Kenneth Nagler, Lester Hubert, Miles Harris, Harry L. Hamilton, and Robert List. All were working under Harry Wexler, director of research of the Weather Bureau. Both Harry Wexler and Ben Holzman of the Army Air Force offered criticism from time to time. Special mention should be given to Ken Nagler, who more than others insisted on the utmost care in every step of the work.

Thanks also go to the present Air Force Technical Applications Center for its help and constructive suggestions.

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Editor's note: After preparing a draft of his article, "Finding the Site of the First Soviet Nuclear Test in 1949," Lester Machta sought the other five Weather Bureau meteorologists who worked on the

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[7] Turkevich nicknamed the first Soviet nuclear test "Joe."

project. All were located and came to a dinner gathering at the Machtas' home. Wives were there, too. The Machtas, Naglers, and Lists still live in the Washington, D.C., suburbs. Lester Hubert lives in western Virginia, Miles Harris in Massachusetts, and Harry Hamilton in North Carolina.

We had a chance to go over the paper and to reminisce. Now we can talk about what was very secret in 1949. Starting in the summer of 1948, our Special Projects Section, headed by Machta, studied the techniques and accuracies of long-range trajectories. We worked with observations of the radioactivity from the U.S. tests, and with high-level balloon data. The impetus for our project was the possibility that the USSR might develop an atomic bomb, perhaps in a few years.

In early September 1949, "Alert 112" proved to be the real thing. Of course, we could discuss our work only with those few in the Weather Bureau, the AEC, and the military who had the proper security clearances. Much of our work that week was done in a very secure but small room in the Air Weather Service building at Andrews Air Force Base. There we had prompt access to the radioactivity intercept data as well as to weather data and analyses. In that crowded room I recall using a drawer in a map-filing cabinet as a table for the analysis and trajectory work.

In our reunion we recalled the surprise, the excitement, the feeling of working at something important, and the camaraderie of that event more than 42 years earlier. In our reunion, the camaraderie was still there. *—Kenneth M. Nagler*