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Letters/Interviews

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(3)

DETECTION OF THE FIRST SOVIET NUCLEAR TEST  
ON AUGUST 29, 1949

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Energy History Collector

Alert 112, (JOE 1 - ~~deleted~~) began just like many of the previous alerts of the AFOAT-1 Long Range Detection System. A field unit reported ~~deleted~~ from Alaska on 3 September 1949 that a filter paper exposed for three hours at 18,000 feet on an Air Weather Service weather reconnaissance flight (WB-29) from Japan to Alaska, under the command of 1st Lt. Robert C. Johnson, ~~deleted~~ had a radioactivity measurement of 85 counts per minute. The AFOAT-1 headquarters in Washington, D. C. had established 50 counts per minute as a threshold of significance. This information triggered a massive effort by the USAF Air Weather Service involving 92 special missions from Guam to the North Pole and from Japan to the British Isles. At an appropriate time British authorities were alerted

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Rain water stations of the Naval Research Laboratory (NRL) in Washington, D. C. and Kodiak, Alaska and ground sampling stations of AFOAT-1 added to the samples of radioactive debris from what was to be evaluated as the first Soviet nuclear test. Analyses of samples by Tracerlab Western Division, an AFOAT-1 contractor supported by special analyses of critical elements at the Los Alamos Scientific Laboratory (LASL).

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provided unambiguous evidence that the Soviets had succeeded in detonating a plutonium bomb. Rain water samples collected by the NRL and analyzed by the NRL, LASL and the University of California Radiation Laboratory provided valuable confirmation of JOE 1. Finally, the overall results were doubly confirmed by deleted air sampling operations and subsequent radiochemical analysis.

How did it happen that this special organization was in existence two years before the earliest estimated time of a first Soviet nuclear test?

The story goes back almost two and one-half years. Then, shortly after 1 January 1947 when the Atomic Energy Commission (AEC) took over the functions which had been under the Manhattan District, one of the commissioners, Admiral L. L. Strauss deleted who had been in Naval Intelligence during World War II, raised the question whether intelligence arrangements had been made for monitoring the radioactivity of the upper atmosphere with the intent of discovering whether any other nation was testing an atomic weapon. In fact to this, in October 1946 General Hoyt Vandenberg, Director of CIG, had queried General Groves of the Manhattan District deleted but since the Manhattan District affairs were in the process of being transferred to the newly constituted AEC, General Groves was not in a position to comment for the new organization. After conferring with General Vandenberg and noting that no monitoring system was in effect or planned, Admiral Strauss urged the appointment of an inter-service committee to study the situation and recommend a course of action.

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In early March 1947 General Vandenberg invited the Secretaries of War and Navy, the Chairman of the AEC and the Chairman of the Joint Research and Development Board (JRDB) to furnish representatives to sit on a Long Range Detection Committee which would formulate a general plan. The committee met 21 May 1947 and consisted of: Captain H. Rivero (Navy); Dr. A. K. Brewer (Navy); Colonel William M. Creasy (WDGSR&D); Dr. A. V. Peterson (AEC); Mr. W. T. Golden (AEC); Colonel L. E. Seeman (CIG); Brigadier General Karl S. Haog (WDGSR&D); Colonel D. J. Keirn (AEC); Lt Colonel David Parker (War); Colonel B. G. Holzman (Army Air Forces); Lt Colonel F. A. Valente (CIG); Dr. E. S. Gilfillan (Navy); and Dr. C. S. Piggott (JRDB)  Their recommendations were accepted at a meeting on 6 June and forwarded on 30 June to the Secretary of War, Secretary of Navy, Chairman of the AEC, and Chairman of Joint Research and Development Board, with the recommendation that the Army Air Forces be assigned titular responsibility for the project. Subsequent conversations between the principals resulted in concurrence in early September and on 16 September the Chief of Staff of the Army, General Dwight D. Eisenhower  directed General C. A. Spartz, Commanding General of the Army Air Forces, to assume responsibility for detecting atomic explosions anywhere in the world.

Major General LeMay, Deputy Chief of Staff, R&D, following extensive study by his scientific staff officer, Colonel B. G. Holzman,

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assigned the responsibility for Long Range Detection, in mid-November 1947, to Major General W. E. Kepner [REDACTED] Chief of the Special Weapons Group, US Air Force (DCS/M). General Kepner immediately convened representatives of more than 25 agencies and in the succeeding month assigned certain major sectors of a plan for participation in SANDSTONE to units of the Army, Navy and Air Force.

The increasing tempo of the work resulted in the formation within the USAF Special Weapons Group, under Major General Kepner, of a Long Range Detection Division in December 1947, which became known as AFMSW-1 (Air Force Materiel Special Weapons-One) under Major General Hegenberger (USAF) [REDACTED] One of his first steps was to secure the services of Dr. Ellis Johnson as the Technical Director who over the next few months recruited a technical staff and prepared a research plan for long range detection of the SANDSTONE tests. Later, in August 1948 the unit was redesignated AFOAT-1.

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Early in the planning stages, it was recognized that in addition to detecting an atomic explosion by sound waves in the atmosphere or by other geophysical means, primary importance was to be attached to the collection and analyses of nuclear debris. With responsibility for aerial sample collection assigned to the Air Weather Service, using its weather reconnaissance aircraft WB-29's there remained the problem of providing laboratory analytical services. To this end the Air Force

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engaged the service of Tracerlab, Inc., of Boston, Massachusetts to perform the necessary radiochemical analyses during the SANDSTONE tests.

Within the short span of time available prior to the tests, a plan was adopted and arrangements made to test almost all of the detection techniques suggested. Major responsibilities were assigned the Army Signal Corps, the NRL, the Air Weather Service, the Air Materiel Command, the Naval Ordnance Laboratory (NOL), the Navy Electronics Laboratory, the US Coast and Geodetic Survey (USC&GS), and Tracerlab, Inc. At the conclusion of the SANDSTONE tests, evaluation of the long range detection techniques provided qualitative confirmation of their utility. However, the evaluation also revealed major areas which required additional research and development or redesign of detection equipment.

All in all, the results were so encouraging that in the summer of 1948

AFOAT-1 established an Interim Surveillance Research Net ~~deleted~~

~~deleted~~ It consisted of nuclear debris collection by aircraft and ground-level air filtering equipment operated by the Air Weather Service and a network of acoustic stations operated by the Army Signal Corps.

Arrangements were made with the USC&GS to provide seismic data recorded on significant events to a Data Analysis and Research Center which was established in AFOAT-1 headquarters, Washington, D. C.

In the last half of 1948 further evaluation of the results obtained on the SANDSTONE tests led to formulation of an intensive research and

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development program which was deemed essential before the surveillance net could be considered to be fully effective. For example, a report from the NRL in the fall of 1948 recounted their success in recovering nuclear debris, long after the US spring tests, from reservoir waters in the Virgin Islands and elsewhere. As a result of this AFOAT-1 arranged in January 1949 to provide financial support for a program at NRL to develop radiochemical techniques for analyzing large amounts of rain water and to build several precipitation stations, one immediately at Kodiak Island and others later in the year [REDACTED] These stations were to be equipped with a large aluminum roof for collection of rain water which, during non-precipitation periods, could be flushed down to collect any dust particles on the roof. While the station at Kodiak was primarily functioning as part of a Naval research program, it was also considered a part of the Interim Research Net which could be called on in case the need arose.

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Extensive research work was initiated with university, industrial and government laboratories in perfecting radiochemical techniques, developing geophysical techniques and apparatus for detection and arranging for calibration experiments on US nuclear tests. Meanwhile within AFOAT-1 operational experience was accumulating in the running of the Interim Net. There were problems in communications to overcome, specialized logistical support for the technical teams in the field, operating manuals to be written, criteria of significance to be

refined, and a host of similar problems to be solved. Following the SANDSTONE tests, the level of significance for radioactivity was set at 100 counts per minute for aerial filters and 300 counts per minute for ground level filters. deleted When a new operating procedure was put into effect on 1 August 1949, the level of significance for aerial filters was dropped to 50 counts per minute based on the experience gained in the interim period. During this time the Long Range Detection System experienced 111 Alerts. Each of those alerts was treated as evidence of a possible Soviet nuclear test, but each was proved beyond reasonable doubt to have been due to such natural causes as volcanic explosions, earthquakes, or normal variations in natural background radioactivity.

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This then was the state of affairs in early September 1949 -- an intensive research and surveillance net was still in the process of installation and shakedown and an extensive research program was being carried out with high priority to learn more about detection. Shortly after dinner on Saturday evening, 3 September 1949, the report was received at the AFOAT-1 Data Analysis Center in Washington, D. C. that a filter paper, exposed for three hours at 18,000 feet over the North Pacific, had 85 counts per minute of radioactivity on it when measured in Alaska after the WB-29 landed. But now the companion paper had also been counted, showing 153 counts per minute, and was immediately sent on its way to the laboratory for radiochemical analysis.

Meanwhile, as successive measurements made in Alaska by  
Sgt Eugene W. Tews [redacted] were plotted by Dr. W. D.  
Urry and Dr. D. H. Reck at the AFOAT-1 Data Analysis Center as the  
individual reports were received in Washington, the conclusion became  
firmer that this activity was the result of fresh fission products in the  
atmosphere. But was it bomb debris? Monday, Labor Day, found the  
AFOAT-1 staff anxiously following the decay measurements on the first  
filter paper of Alert No. 112. Sgt Tews, working at Eielson Air Force  
Base in Alaska under Captain Carroll L. Hasseltine [redacted]  
of Air Weather Service, continued his measurements every two hours  
over a 48-hour period. With only these measurements available, the  
AFOAT-1 staff had little information to guide it in stating requirements  
for additional airborne sampling. Was the pickup in the North Pacific  
on the 3d of September from the leading edge of the contaminated air  
mass or was it at the tail end? To answer this, in addition to a mid-  
Pacific flight from Alaska to Hawaii, two WB-29's were dispatched from  
Fairfield-Suisun Air Base in California on Monday to filter the air en  
the way to Alaska, one plane traversed the Pacific Ocean some distance  
west of the US and Canada, the other inland. Later a special mission  
was sent from Alaska to search the area to the north and east over the  
Beaufort Sea.

Monday evening an unexpected report arrived from Japan. A routine  
weather flight from Guam to Japan reported that a paper exposed at



10,000 feet just east of Japa measured over 1,000 counts per minute of radioactivity! This was 20 times the significance level. An urgent request went back to Japan to send the filter papers immediately to Tracerlab in California by special aircraft

Meanwhile, decay measurements were being received in Washington, indicating the collection of long-lived activity by the USAF surface air filtering units at Fort Randall and Shemya in the Aleutian chain early on the 5th and later by a station in Northern Japan on the 6th. The initial filter paper dispatched from Alaska arrived at Tracerlab in California in the early afternoon of the 6th. Reports of the positive interception by the flights from California to Alaska were received that day, and late on Tuesday the papers from the Alaska to Hawaii flight showing positive pickups, arrived at Tracerlab ~~deleted~~ DOE ARCHIVES

At three-thirty in the morning of 7 September, Dr. William Urry of AFOAT-1 received a call from Dr. Lloyd Zornwald ~~deleted~~ at the Tracerlab laboratory in California with the information that the fission isotopes of Barium and Cerium had been identified, and five hours later the fission isotope of Molybdenum was reported present on the first filter paper.

Major General Morris R. Nelson, who had succeeded Major General Hegenberger as Chief of AFOAT-1, and Mr. Doyle Northrup, who had succeeded Mr. Ellis Johnson as Technical Director, AFOAT-1 upon receipt of this electrifying news, decided upon an all-out effort to

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collect as many samples as feasible. With the guidance furnished by the intercepts on the special vector filtering flights and a detailed study of the air mass movements, orders immediately went out to vector the two Fairfield aircraft from Eielson, Alaska to Westover AFB, Massachusetts, to search as wide an area over Canada as possible and to get as large a sample of the nuclear debris as possible. In succeeding days, all told between 3 and 16 September at the direction of AFOAT-1, the Air Weather Service vectored 92 special filtering flights which sampled a general area from Guam to the North Pole and from California to the British Isles. Over 500 samples were taken deleted.

The flight crews had not been briefed on the mission of detection. The only thing they knew was that at approximately three-hour intervals the airplanes would be depressurized and a new piece of paper inserted into the "bug catcher" mounted on top the WR-29. What the purpose was, they obviously did not know for the mission was highly classified.

When the JOE 1 operations got underway, the exposure pattern was modified and papers were changed at more frequent intervals. With the equipment then utilized, a filter paper change required depressurization and loss of cabin heating. It then took about 30 minutes to regain pressure and cabin heat. Then, within a few minutes, the pressures and heat would again be spilled for the next filter change. Since some of the missions were 16 to 18 hours long, this became a real operational hardship. Further, due to the limited crews and large number of special

flights, crew rest periods were short or virtually non-existent.

A critical element in the vectoring of aircraft was forecasting the movement of the suspect air mass. The success or failure of a flight to pick up debris wasn't known until after it had landed and the filter paper measurements received in the Data Analysis and Research Center in Washington D. C. An Air Weather Service unit operated as an integral part of the operation. Captain Jerry Glover of Air Weather Service, one of the senior members of this group, was especially adept in the trajectory problem, and with the assistance of Captain William Malloy, of AWCAT-1, contributed significantly to the success of the operation.

The filtering results during 8 September indicated that the air mass with the bomb debris was departing the North American continent and was headed for the British Isles. General Nelson and Mr. Northrup called

upon Mr. Carrol Wilson, General Manager of the AEC and obtained approval to notify the authorities in the UK.

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Great Britain

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The debris collections by the surface air filters in Japan and the Aleutians suggested an attempt to get a large sample by rain collection at the Kodiak Island station operated by the Naval Research Laboratory. This was discussed with the Office of Naval Research on the 8th and 9th of September [redacted] and the NRL sent out a request to have the roof scrubbed preparatory to rain collection. At about this time the gamma ray detectors at Kodiak started to show a rise in activity. Subsequently, two rain collections - the first from 6-12 September and the second from 13-16 September [redacted] were found to contain large samples of the nuclear debris.

AFOAT-1 believed it imperative to obtain confirmatory radiochemical analyses. Therefore, an aerial filter paper was sent to Dr. Roderick Spence at LASL for analysis and on the 12th another was passed to NRL. On the 14th, NRL reported the presence of fresh fission products in this sample but further analysis was not carried out because of the large precipitation collection at NRL in Washington and at Kodiak appeared to promise much larger samples of debris. The Kodiak sample arrived at NRL by special plane on the 19th of September and preliminary results received at AFOAT-1 about 26 September [redacted]

By 10 September Tracerlab, Inc. had completed and reported partial analyses on 5 aerial filter papers. These analyses permitted preliminary estimates of the origin time and the type of fissionable material used. In addition, it was indicated that normal uranium had been used to surround

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the fissionable material. Since the end of the SA-1 STONE tests in the spring of 1948, Tracerlab had been engaged in perfecting radiochemical techniques and performing calibration measurements on material irradiated at LASL. One calibration, not yet made, concerned neptunium-237. On Saturday, 10 September, a hurry-up call was made to Dr. Frederick Spence at LASL who arranged for the irradiation that weekend and delivery of the sample to Tracerlab in California on Monday (see Reference 11). This permitted the firm conclusion that large amounts of normal uranium were employed in the Soviet device.

Early in the week of 11 September General Morris R. Nelson and Mr. Doyle L. Northrup visited Dr. Vannevar Bush, who had been the wartime head of the Office of Scientific Research and Development, and requested him to convene a panel consisting of Dr. Robert E. Serber, a former commissioner of the AEC; Dr. J. Robert Oppenheimer, who had been the Director at LASL when the first US atomic bomb was developed; and Admiral W. S. Parsons, who had been in the Manhattan District; and Dr. Karl T. Compton, Chairman of JRDB, to review and evaluate all the available information on this significant event for the Chief of Staff of the Air Force, General Hoyt S. Vandenberg. DOE ARCHIVES

The conference was held at AFOAT-1 headquarters, 1712 G Street, Washington, D. C., 1000 hours on 19 September with the following participants:

United Kingdom

Lt. William G. Penney ✓

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*British*

United States

General Hoyt S. Vandenberg, US Air Force Chief of Staff

Lt General L. Norstad, US Air Force

Major General D. M. Schlatter, US Air Force (Chief, AFOAT)

Maj General K. D. Nichols, US Army

Mr. Sumner Pike, AEC Commissioner

Mr. William Webster, Department of Defense (Chairman, Military Liaison Committee)

Mr. Carroll Wilson, AEC General Manager

Dr. Spofford English, AEC, Chief, Chemical Branch

Dr. George Weil, AEC, Chief, Production Division

Dr. R. W. Spence, Los Alamos Scientific Laboratory

Colonel B. G. Holzman, US Air Force

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Dr. Frederick G. Henriques, Tracerlab, Inc.

Dr. Lloyd R. Zumwalt, Tracerlab, Inc.

Dr. A. F. Stevens, Tracerlab, Inc.

Mr. James R. Smith, Office of Naval Research

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United States Conference (cont'd)

Major General Morris R. Nelson, US Air Force (Chief, AFOAT-1)

Mr. Doyle L. Northrup, US Air Force (Technical Director, AFOAT-1)

Dr. William D. Urry, US Air Force (Director of Research, AFOAT-1)

Mr. J. Allen Crocker, US Air Force (Assistant Technical Director,  
AFOAT-1)

Mr. George B. Olmsted, US Air Force (Assistant Technical Director  
AFOAT-1)

Dr. Donald H. Rock, US Air Force (Assistant Technical Director, AFC)

The evidence left no doubt that fresh fission products had been detected nor that the activity came from a large source, as was evident from the large dispersion of the debris. The key point which the panel had to consider was whether the debris originated from an atomic bomb explosion or from some other source such as a reactor accident. It was the large number of comprehensive analyses providing internally consistent data presented by Tracerlab personnel, Dr. Frederick Hemingway, Dr. A. J. Stevens and Dr. Lloyd Zumwalt, which provided the deciding factor. Dr. Spence, from LASL, confirmed the presence of fresh fission products in the aerial filters analyzed at LASL. Mr. James W. Smith, Office of Naval Research, presented the work done at the NRL by Drs. Peter King and Herbert Friedman which showed fresh fission products in the aerial filter sample collected by the Air Weather Service aircraft and in the surface air filters collected in Washington at NRL.

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The panel concluded that the observed phenomena were 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 Nagasaki bomb and that the explosion occurred between the 26th and 29th of August at some point between the east 35th meridian and 170th meridian over the Asiatic land mass."

The conclusions of the panel deleted on 19 September 1949 were reported to President Truman on 20 September. The public announcement that an atomic bomb had been exploded by the USSR was made by President Truman on 23 September 1949.

Subsequent to review by Dr. Bush's panel, Drs. Peter King and Herbert Friedman of the Naval Research Laboratory reported the presence of fresh fission products in two rain water samples collected by the US Navy at Kodiak Island during 9-12 and 12-16 September deleted. Plutonium was later obtained by NRL from the rain water samples. Part of this plutonium was sent to LASL where it was purified and verified by more detailed radiochemical analysis. It was then analyzed by Dr. Ghiorso of the University of California and in June 1950 reported by Dr. Spence, LASL deleted to possess an isotopic composition which demonstrated that the plutonium had been used in a nuclear explosion.

Although acoustic records were carefully examined at the time of JOE-1, no signals relating to the event were discovered. However,



subsequent review these records revealed weak signals at two stations. These acoustic signals were very useful because they helped after the fact to establish the location, time and size of JOE 1 with greater precision than was possible otherwise.

On 17 October 1949, in the following letter to General Vandenberg, Dr. Vannevar Bush stated that the panel had authorized him to commend the excellent work done by the agencies involved:

"Dear General Vandenberg:

"On September 20 I reported to you the results of examination of scientific data in connection with the atomic explosion recently announced. This review was made by a Panel appointed by you consisting of Dr. Oppenheimer, Dr. Bacher, Admiral Parsons, and myself. This Panel before it adjourned authorized me to write you to commend the excellent work done by the agencies involved, particularly by the group under your command.

"I do this with great enthusiasm. I was much impressed not only with the foresight exhibited by AFOAT-1 in recognizing the need for confirmation of its conclusions and for initiating in the short time available the very valuable confirmatory studies by the Los Alamos Scientific Laboratory and the Naval Research Laboratory, ~~deleted~~ but I was impressed also with the thoroughness and skill exemplified in the entire study, and the effectiveness with which it was presented. It was also evident that AFOAT-1 by its excellent performance has secured excellent collaboration from such agencies as the Los Alamos Scientific Laboratory, Tracerlab Inc., Air Weather Service, Naval Research, and the Naval Research Laboratory. I hence take great pleasure on behalf of the Panel in commending those involved for remarkable and effective performance.

"It is fortunate that the Air Force instituted this work early, and that it was pushed with thoroughness and skill. This is one undertaking which has most certainly paid out. Its

(cont'd letter dated 17 October 1949 from Dr. Bush to General Vandenberg)

opportunities are by no means over, it now has tasks which are altered, but in my opinion not lessened in importance, and I trust its performance in the future will conform to the high standards which it has already set.

"Sincerely yours,

V. Bush"

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