CHAPTER II

TEST MORATORIUM, 1958-1961

Test Organization Situation, Late 1958

But the indefatigable Starbird did not rest. On the 12th of November, 13 days after the moratorium went into effect, Starbird presented a coordinated weapons test readiness program to the Commission*. Luedecke, as Task Force Commander, had already presented his recommendations to the Chief, AFSWP, the Joint Chiefs of Staff, and the Atomic Energy Commission**. At this time there was a strong dichotomy between the two weapons development laboratories. Livermore, inspired by Teller, was enthused about underground testing, was pushing Plowshare, and was beginning to push experiments that might have to do with establishing the characteristics of seismic signals from underground detonations. The Livermore staff were fighting desperately for future nuclear device testing, either underground under the auspices of Plowshare, in deep space, or any other way that could be found. Los Alamos, on the other hand, was not anxious to test. Norris Bradbury and a fair fraction of his staff genuinely believed a moratorium, or a later test ban, might be to the benefit of the United States and, perhaps even more broadly, to the benefit of the world. Bradbury did not believe that a capability for an immediate testing response was important. As he put it, "It takes four years to get from test to stockpile. What do a few months matter?" His advisors felt strongly that underground testing was a difficult method of testing devices. The diagnostics would be uncertain, the costs would be high, and high-yield device tests would be too expensive. This difference in attitude is reflected in the correspondence of the period; Livermore offering the possibility of great advances in yield-to-weight ratio, clean devices, etc., if testing were allowed; Los Alamos, largely in the persons of Bradbury and Carson Mark, trying gently to refute some of the claims, but leaning more, always, in the direction of some sort of international limitations.

It is pertinent to point out here that there were genuine weapons problems immediately after the moratorium went into effect. [redacted] Furthermore, as Libby had commented, there was a tremendous amount of data to be analyzed. Unfortunately, in 1958, the computer capability in each laboratory was not really sufficient to take proper advantage of the data presented. The data analysis from Hardtack Phase II in Nevada did not take long, but there were difficult problems in understanding the results from secondaries tested in Hardtack Phase I. The effects data from Teak and Orange were fragmentary

*Essentially the same as his October 31 plan, but including the aborted "Adams" event of Hardtack Phase II.

**See the section "Physical Test Readiness" near the end of Chapter I.

and incomplete, so that analysis was extremely difficult. The point of this chapter is to explain how the testing organization kept, or did not keep, a capability to test in the future. Let us examine the question: Where is the nuclear weapon testing capability? At any time. Either in 1958, 1959, 1961, or 1975? It is in three places. Livermore, for Livermore devices and Livermore-sponsored Department of Defense tests; Los Alamos, in the same way; or DASA, through its contractors. The rest of the systems do not furnish testing capability but furnish the surroundings by which the testers may do their work (with certain exceptions having to do with systems tests or NUTEXs). The capability to make the measurements that are the results of development tests and are the only proof of a successful test lies, in 1958, 1961, and today, in the weapons laboratories, Sandia, DNA, and their subcontractors, where the major technical subcontractor is EG&G. The AEC has had nontechnical contractors in the past, as has the DOD. These contractors have contributed tremendously to the success of our previous weapons tests, but they have not been essential in the sense that the two weapons laboratories, LASL and Livermore, and then Sandia and EG&G, have been. At this point, it seems pertinent to digress to these five prime organizations--Los Alamos Scientific Laboratory; Lawrence Livermore Laboratory (then UCRL, Livermore); Edgerton, Germeshausen & Grier; Sandia Laboratories; and Defense Atomic Support Agency. One can regard these as the five primary organizations for nuclear weapons testing, and put as secondary such organizations as Holmes & Narver, ALOO, the Task Force, and various DOD contractors. In the question of weapons development and the diagnostics thereof, before 1958, Los Alamos was clearly the senior organization and almost the controlling organization. However, UCRL made important contributions from the very beginning, became very strong in the subjects as early as 1952, and became a serious faction in 1955. Sandia, originally an offshoot of Los Alamos, contributed continually and strongly to the methods of carrying out an operation; but the basic AEC objectives, with very few exceptions through 1958, came from the weapons design laboratories rather than any other organization. EG&G, a profit making concern, had been formed at the request of the AEC in the late 40s to furnish technical support to Los Alamos (later expanded to include other weapons laboratories). In the period before 1958, EG&G was essentially an equal partner in testing with the weapons laboratories (perhaps a little more equal with Los Alamos). Other organizations were of secondary importance. NVOO was still a field office in ALOO and while its guiding light, Jim Reeves, under the auspices of Kenner Hertford, was terribly important, his efforts were still subsidiary to what the laboratories were trying to accomplish. In the DOD, the situation was a little different because the basic technical competence was not in AFSWP (DASA) but in its contractors.

So the problem at the beginning of the moratorium was simple from the point of view of the laboratories: How is competence kept alive? They assumed there would be another operation of some sort, and the problem was simply to battle the AEC, the Department of Defense, the OMB, and, ultimately, the President to arrange for that funding necessary to support the efforts of maintaining the competence. Any framework that would accomplish this funding and at the same time engender in the personnel involved a sense of mission would be satisfactory. Obviously, such a framework would be better if it were clearly meaningful.

The three basic AEC weapons laboratories had differing problems. At Los Alamos, contrary to the author's feelings and to a certain extent to those of Al Graves, Norris Bradbury had no interest in Plowshare. So Los Alamos had practically no input or effort involved with that subject. The Test Division did have some effort, but it was very small, perhaps 5% of the Division effort, involved with surface-based detection of high-altitude explosions, and that kept a few people busy. But the main objective was to prepare for further nuclear tests. The directives from Washington

were continually changing, never very consistent, but always supportive of whatever the laboratories could put forth to maintain some capability. The engineering support was maintained at Los Alamos, at least for the first half of the moratorium, because of the decision by Bradbury to make the Test Division responsible for nuclear propulsion reactor testing. Thus, the operational people and the civil and electrical engineers could be given a good profitable job to do that would exercise their talents but still make them available if weapons testing were to occur again. More critical problems were in the test design groups. Let me take those roughly one at a time.

The radiochemical group had a great deal of work to do analysing samples left from previous operations, including foreign tests, and they had many problems on the basic physics of fission to keep them busy. The Rover nuclear reactor tests contributed strongly to the maintenance of their capability. They could exercise their cloud phenomena theories, their sampling theories, and most important of all, their continued data analysis capabilities. The group that previously had been concerned with the neutron outputs of nuclear weapons now became involved with neutron outputs of nuclear propulsion reactors, and with the design of future experiments that would allow more detailed observations of a thermonuclear burning region. The group concerned with the measurement of reaction history completely changed its character during the period of 1958 to 1961. It was split up into two sections, one concerned with some of the detailed characteristics of nuclear propulsion reactor observations, and the other very senior technical capability that was left over remained in an essentially advisory capacity to the Division Office. The capability to measure the reaction history was in serious jeopardy for some time at Los Alamos.

The Los Alamos group concerned with the measurement of fireball characteristics had many problems to work on during the moratorium, in fact, so many problems that mundane testing problems got in their way. Basically an astrophysics group, they could and did spend time refining the fireball expansion theories so as to explain the past discrepancies between fireball and radiochemical yield results. Time was now available to attempt theoretical confirmation of previously measured radiation opacity values.

The group that had been concerned strongly with very detailed esoteric measurements of the internal workings of thermonuclear devices found this period terribly traumatic. Their measurements in previous operations had been regarded with great interest by the theoreticians but had not been particularly useful because the calculational techniques available did not allow the experimental results to be put into the theories of the weapons of those days, and thus, support to the group during the moratorium was not overly enthusiastic, and its morale by the end of the moratorium was very poor. However, they did study the characteristics from past records of electromagnetic effects and similar phenomena.

The group at Los Alamos that had been concerned with blast and optical phenomena took on the principal responsibility at Los Alamos for Vela Sierra, the name used to identify work on surface-based detection of atmospheric and high-altitude explosions. They designed and assisted in the construction and operation of the AFTAC systems for observing atmospheric detonations.

Los Alamos had always depended for its testing capability not only on internal competence, but on that of external contractors such as the Naval Research Laboratory, Naval Ordnance Laboratory, EG&G, the National Bureau of Standards, and others. Their difficulties will be mentioned later. However, the Test Division in Los Alamos also depended very strongly on the support of the other divisions within Los Alamos, mainly the Physics Division, from which both the Division Leader and the Alternate Division Leader had come. That Division, which had furnished people such as Louis Rosen, Austin McGuire, and Keith Boyer, could, for at least a while, maintain its

strength within its normal charter of carrying out the physical research for the Laboratory. In addition, P Division, with some help from the Test Division, took on the job of satellite-borne high-altitude and deep space test detection. Other assisting Divisions, such as CMB, also had normal charters which would support their people.

At Livermore, the situation was somewhat different. The background of test information to be analyzed was not so extensive because Livermore had been formed comparatively recently. They were tremendously affected by Edward Teller, who was determined now as Laboratory Director to maintain his Laboratory's capability to resume testing under any circumstances. Livermore had gotten strongly involved in a number of real time issues that became very helpful to them. Not only was the Pluto air-breathing nuclear propulsion reactor in full flower, but they were the main exponents of the use of nuclear explosions for peaceful purposes (Plowshare), and very quickly picked up the major effort within the AEC on the subject of seismic detection.

Thus, Livermore had a large advantage, in principle, over Los Alamos. They had started underground tests and had tunnel designs and configurations. They had an ongoing funded program in Plowshare, were pushing seismic detection shots, and had a Director who was convinced of the value to the country of future nuclear weapons tests. However, Los Alamos had a different kind of advantage. It had a test organization that had been continuously in existence for 10 years, was well organized in its separate aims, and had many years of past data behind it to continue to study. Furthermore, many of the mundane aspects of nuclear weapons testing had been in the hands of Los Alamos up to this time. In 1958, Task Group 7.1, with its some 60 military types to help in test planning, was still based in Los Alamos. EG&G, who could take care of timing and firing and fireball photography, had not learned to work with Livermore and depended upon Los Alamos almost completely for their guidance. While Jim Reeves, the ALOO Test Manager for the NTS, was clearly most respectful of Livermore opinions expressed by Duane Sewell and Gerry Johnson and the Laboratory Director, he was in very close rapport with Al Graves, the LASL Test Division Leader.

Sandia had plenty to do. They could now work on a number of new devices that had been developed for stockpile in the last year and a half. There were new fusing problems which could be solved without nuclear testing. The question of weapons system vulnerability to hostile action needed attention. The development of aerodynamic balloons as possible future test platforms was required.

The Department of Defense Laboratories were, however, in a very bad way, at least until mid-1961, because there was no serious effort to keep their competence alive and because of the reorganization of the Department of Defense mentioned earlier. Air Force Special Weapon Center, for example, went from something like 1000 personnel in 1958 to 14 in 1961. In late 1959 the Secretary of Defense, Thomas Gates, ordered all preparations for nuclear weapon testing stopped as of Jan. 1, 1960.

Within other organizations central to testing, similar efforts were made to extend the life of the capability, although to the participants it may have seemed different. In retrospect, it appears that the lives of the 4950th Air Base Group and the 4926th Squadron in Albuquerque were almost charmed because they had two real-time jobs to do. One, for Sandia they could continue the investigation of drop ballistics of bomb shapes and, hence, had an excuse to continue their bomber capability, now shifting from the B-47 to the B-52. Even more important from the testing point of view, the question of the effluent characteristics from propulsion nuclear reactors being tested in Nevada allowed them to continue a radioactive sampling capability and to exercise that capability occasionally. As is so often the case in this story, the persistence of a radsafe capability through the moratorium was the result of a very

few individuals' persistent efforts. The Army Radiological Safety Support Unit (RSSU) had been a mainstay of the rad-safe effort from 1955 to 1958. Task Group 7.1 and the Task Force helped to argue for their continued existence during 1959 and 1960 so they were still available to help in 1961. Much of the JTF-7 rad-safe equipment was transferred to REECo, and was thereby saved. Gordon Jacks was strongly instrumental in preserving this capability, and was again saddled with the job of putting it back together and using it in 1962.

Joint Task Force 7, under Luedecke initially, continued to exist and make plans to conduct future operations. Later under Anderson, as one might expect of any organization that did not have a real-time job to do, JTF-7 began to go downhill. The Navy Task Group, as it had ever since Crossroads, managed in some way to continue its existence, studying the kinds of systems tests which would be of value to the Navy and maintaining, as long as it existed, their coordination with Task Force 7.

Probably the single biggest loss to testing capability in this period was the disappearance of the TG 7.1 J-3 in the summer of 1959. In the previous Pacific operations since Sandstone, this organization had taken the responsibility, between operations, to determine from all the experimenters (AEC, DOD, and otherwise) what their objectives were, what they were trying to accomplish, and what logistic needs they had. All of this was then organized, put on paper, and the appropriate requests for facilities and transportation sent out. Once those facilities were obtained, 7.1 J-3 went into the field and in real time administered that logistic system. The organization for years had consisted of about 60 military people under the guidance of civilian personnel at Los Alamos (with assistance from the other laboratories and AFSWP) and had been headed by such individuals as Colonel Phil Hooper and Colonel Dutch Kerwin (later Vice Chief of Staff, Army). Loss of this organization meant the disappearance of any driving force at a detailed working level to make a continuing coherent operational picture of whatever it was we were planning at the time, and it specifically meant that the technical organizations that would eventually cooperate in performing the future operation no longer had any single point of focus to bring their plans together. This function had not, in general, in the past been carried out by the Task Force headquarters because the Task Force was responsible for carrying out the operation on a large scale and coordinating the efforts of a Navy branch, an Army branch, an Air Force branch, a technical branch, and the AEC branch. JTG 7.1 J-3 was the coordinating spark of the technical branch of the operations.

Clearly, loss of the rest of the JTF-7 organization during the moratorium was also serious, and will be discussed in more detail throughout the rest of this chapter.

The period of the moratorium had many interacting aspects. The rest of this chapter will detail a number of those aspects in approximately chronological order, with the intent of giving the reader a feeling for the number of balls that the jugglers had to keep in the air at one time.

AEC/DOD Actions, Late 1958

As early as October 21, 1958, Starbird had presented to the Commission a proposed weapons test program. Starbird was apparently not convinced that the moratorium would even last the year promised by the President, and in correspondence with the Laboratories was investigating what needed to be done. Eisenhower had stated in his August 1958 messages to the AEC and the Department of Defense that they should maintain their capability to test. It was obvious he was concerned with being caught flat-footed if the Russians were simply playing a game.

There were three main thrusts to the AEC and Laboratory efforts that might

maintain a capability to test. One was a readiness program consisting of a continuing series of questions and plans and some minor action over the next three years that kept the subject alive in everyone's mind. The second was the Plowshare program which would clearly use both design and test capabilities. The third had to do with determining the reliability of methods of seismic detection and identification of underground nuclear detonations.

Livermore was, with the cooperation of the Commission, pushing hard on Plowshare. They were studying, among other things, the following items: a channel through the reef at Kapingamarangi; a harbor at Cape Thompson, Alaska; a harbor at Katalla, Alaska; a sea-level canal across the Alaska peninsula at Port Moller; oil recovery from tar sands; an isotope production shot; the creation of artificial aquifers; mining by leaching; and recovery of oil from oil shale. Chairman McCone felt the importance of Plowshare very strongly and had suggested slightly earlier that an AEC committee for Project Plowshare should be established. On November 20, 1958, the Commission authorized the creation of a Plowshare advisory committee. The committee was formed with Spofford English as Chairman and such members as General Doolittle, Bob Wilson, and others. There was clearly hope at that time that the continuing Geneva negotiations could be maneuvered in such a manner as to allow Plowshare shots in the case of a treaty and during the moratorium. At that time, our government was convinced of the value of nuclear explosions for peaceful uses and wanted strongly to continue that effort, and the Russians were not particularly interested, whereas later the situation was reversed.

By December 1958, the question of the validity of the Rainier data, as interpreted for the Conference of Experts, was being reviewed in the light of the Hardtack Phase II data. On December 4 AEC Commission discussion on this subject, specifically between Commissioner Floberg and Paul Foster, noted that the seismic signal was smaller than assumed in the Conference of Experts' report and that the threshold limit for detection for nuclear (underground) tests might be as high as from 5 to 20 kt. An ad hoc panel of seismologists under the auspices of AFTAC met from November 16 to 19, 1958, to consider this question. Carl Romney was chairman and among the members were Frank Press and Perry Byerly with consultants Hans Bethe, Dave Griggs, Ken Street, and Carson Mark. They concluded that it was more difficult to distinguish earthquakes from explosions than had been previously estimated, that the number of earthquakes per year of magnitude equivalent to or greater than a given nuclear yield was about twice that previously estimated, and that, therefore, underground explosions should be carried out to study the effects of explosions in varying geological environments and to evaluate the methods of concealing underground nuclear explosions. Teller felt very strongly that he should announce that underground tests could not be detected under certain conditions, but agreed with McCone not to make any public announcement until the Geneva conference had recessed.

These problems had resulted in appreciable expenditure of effort in the AEC Laboratories. Unfortunately, at that same time, Eisenhower was strongly concerned with the gold outflow and the stability of the dollar in world markets and felt strongly that the federal budget had to be reduced. McCone supported the President in this and imposed the responsibility on the Commission and staff to achieve major AEC budget reductions for FY 1960. As a result, the Plowshare budget was cut by some 25%, and weapons operating funds by approximately 10 million dollars.

Initial Readiness Directions

Several separate but related discussions and studies went into the establishment by DMA of the initial readiness directives at the beginning of the moratorium. The

first specific guidelines to Jim Reeves came verbally from General Starbird in late September. Reeves communicated these to Al Graves on September 29 as the following:

Ex.(b)(1)

[redacted]

There had been a meeting in Los Angeles on September 19, of various contractor and AEC test organization personnel, following which H&N had presented cost and task estimates through Calendar Year 1960 to maintain a nine-month response capability to resume full-scale testing of the magnitude of Hardtack Phase I at the EPG.

After some discussion with their Headquarters (Air Research and Development Command), AFSWC, in early October planned to maintain a capability within the 4950th to support a full-scale nuclear test series within six months after cancellation of the moratorium. Further, they planned to maintain development programs to make the best use of data gathered on past tests and continue a vigorous, theoretical laboratory and simulation test program.

On October 12, General Alvin Luedecke, Commander of JTF-7, forwarded for comment to Bill Ogle (JTF-7 Scientific Deputy) a draft report on "Capability for Resumption of Nuclear Testing," which he had sent to the Air Force Chief of Staff for possible forwarding to the JCS and to the Chairman of the AEC. [redacted] Ogle replied to Luedecke on October 17 and, in relation to the readiness response, said:

> It would seem to me that the country can and should maintain the capability to begin testing within three or four months after notification, but I believe no further comment on the number of shots or rate of testing after that time is necessary since it will depend strongly on the information desired from the shots.

Elsewhere, Ogle remarked that both proving grounds should be maintained in a status to accept a moderately rapid buildup.

Ex.(b)(1)

[redacted]

The Chief of AFSWP forwarded the Secretary of Defense Moratorium Guidance (dated September 19) to Field Command and AFSWP on October 26. The Secretary of Defense had stated that the assumption should be that limited test operations might be initiated by February, 1960, but extensive test operations would be started no earlier than mid-1960.

Further discussions on the initial readiness guidelines were significantly affected by the Soviets continuing testing for several days after the 30th of October. Starbird asked both Laboratories to plan the most necessary and fastest response tests that they could do, both overseas and in Nevada. As the pattern typically went, Livermore came up with a number of ideas and pushed for physical preparations to be authorized in Nevada immediately, whereas LASL didn't wish to resume testing for a fair amount of time in order both to reduce the past data and to

prepare for the next tests properly. There were several interesting points in Starbird's hypothetical questions to the Laboratories and within DMA as to alternate readiness positions based on the additional Soviet tests. The discussion began before the beginning of the moratorium (October 28 was the date of the queries to the Laboratories) and included mention of Christmas Island as a possible alternative to EPG overseas and, additionally, the use of Johnston Island. The Commission considered specific nuclear test resumption possibilities in their meetings on November 12 and for the next few days. The possibilities included a specific DMA test readiness paper and a memo from General Starbird to the Chairman of the Commission recommending immediate test resumption if there were additional tests by the Soviets. The Chairman said he was reluctant to seek Presidential approval for additional tests until after the Russians had conducted further tests. However, these discussions did result in swift approval for certain physical readiness preparations at the NTS, including provision to conduct the Adams test. There was discussion of John Foster Dulles's serious concern over further use of Eniwetok because of its status as a U.N. Trust Territory. Hertford informed Starbird on November 13 that reductions at the NTS had put the site in danger of losing its 90-day response capability. He also specified immediate actions in the way of balloon and barge procurement, tunnel construction, and other items to assure the appropriate response.

Thus, out of these initial moratorium readiness guidelines, discussions, and hypothetical propositions, came authorization for a number of physical preparations, as well as specific consideration of alternatives such as Christmas Island and an open sea test capability.

As mentioned before, the AFSWP was in an odd position in December 1958. Personnel of AFSWP knew the DASA charter would be implemented in the spring of 1959. At that time, all military services' nuclear testing budgets would be consolidated into a single DASA budget for FY 1960. That budget would obviously be appreciably larger than the previously planned FY 1960 AFSWP budget. However, there was no certainty that this money would actually be forthcoming because of the uncertain duration of the moratorium and the uncertain need to prepare to resume testing. AFSWP had managed to test (on the Logan event of October 16, 1958) a short section of a vacuum pipe system that was the forerunner of underground effects tests. The results of that small experiment were being studied in order to design a possible follow-on for the circumstance that we would return only to underground testing. Similarly, the Teak and Orange results led to preliminary plans for possible later high altitude detonations.

By January of 1959, most of the test personnel had recovered from Hardtack and the holidays and were back to work to consider again the problems of testing. However, for many months, their efforts were largely devoted to analyzing the results of Hardtack. The operational and construction administrative branches continued the "what if" game for new tests. In January, the TG 7.1 operational staff produced studies on the possibilities of using Johnston, Christmas, Midway, or Eniwetok Islands as bases for a future open seas operation. They also considered the question of quick and dirty balloon shots at Johnston and Christmas Islands.

Evolution of High-Level Attitude Towards Testing, 1958-59

During the first year of the moratorium, just as anticipated by the 1958 Geneva Conference of Experts, the inability to resolve the question of the detectability of nuclear explosions underground and at very high altitude became an obstacle to negotiating a comprehensive test ban treaty. Indeed, the underground detection and identification problem became more and more difficult because of additional data from

the Hardtack II tests. The data, as interpreted by an AFTAC Panel and the "Berkner" Panel, indicated poorer sensitivity than earlier indicated by the Conference of Experts. The Latter big-hole theory (potential of decoupling in a large cavity) and the lack of experimental data on decoupling in various media under various conditions were indicative of the need for more research on underground explosion detection and identification. In the first half of 1959, the Panofsky Panel on High-Altitude Detection made very clear that outer space test evasion methods were feasible, and methods of detection of such tests should be studied. Those who were most earnest in their desire to have adequate verification of a full test ban were more pessimistic about adequate detection in underground and outer space environments in the spring of 1959 than they had been after the Conference of Experts.

The AEC shifted their emphasis in treaty negotiation discussions (which affected test readiness activities) to consideration of the concept that the test ban should be reached in phases, with any initial formal agreement excluding the underground and outer space environments for the time being. Through 1959, this consideration was increasingly coupled with the fear that an ongoing, unpoliced, complete moratorium allowed other nations to conduct clandestine tests in the underground and outer space environments without detection by the currently installed systems.

President Eisenhower was surprised at the adoption of specific, agreed, control guidelines at the Geneva Conference of Experts, where he had expected the Soviets to take more of a political stand. However, he found the Soviets far less willing to adopt the Conference of Experts' system when the political negotiations began after October 30, 1958. Noting the veto that they seemed to require on the Control Commission and their demand that each nation's control posts be staffed by government nationals, he felt this "made it obvious they had no intention of agreeing to a practicable control system."* This sort of feeling, coupled with the new underground test data which further confused the issue of adequate control measures, led Eisenhower to propose to Khrushchev on April 20, 1959, that a limited nuclear test ban only for the atmosphere be addressed at the conference.

The community attitude towards testing and test readiness in this time period was exemplified by the guidelines given to, and reports of, a committee addressing future test methods and testing organizations, chartered jointly by DASA, JTF-7, and DMA. Their report reflected the guidance that testing in the atmosphere, as opposed to underground and in outer space, was highly unlikely.

Thus, by April of 1959, without explicitly coordinating their positions ahead of time, the AEC, DOD, Department of State, and the White House all came to focus on underground and outer space testing as the likely future techniques. Perhaps more importantly, they tended to treat the old style of testing in all environments as so improbable as to receive little attention and less funding. These philosophies were solidified in discussions between the President's Scientific Advisor (Killian), the Deputy Secretary of Defense (Quarles), and Chairman McCone in late April 1959. This reasoning significantly warped test readiness considerations for the rest of the moratorium period.

In light of these positions being fairly well defined in the minds of many people by the summer of 1959, and not forgetting Dulles's position that the EPG was not a desirable area, owing to its trust territory status, the decisions to downgrade the status of that proving ground, from August of 1959 on, are not a surprise. The so-called "minimum maintenance" status to be retained at that location, following the inactivation of the Army support unit there (Joint Task Group 7.2), was to keep the

*Dwight D. Eisenhower, *Waging Peace, 1956-1961; The White House Years*, Doubleday, New York, 1965, page 478.

U.S. ready to resume full-scale testing as in the past or within a year of authorization. This was felt to be more than adequate based on the improbability of resuming that method of testing.

The experts' conference at Geneva on high-altitude detection, known as Technical Working Group I, concluded several weeks of joint discussions on July 10, 1959, with an agreement proposing the establishment of a system of both earth satellites and ground control posts to detect high-altitude detonations. Perhaps this encouraged many of the decision makers, particularly the nontechnical personnel, to suppose that the technical details of adequate enforcement in all environments was possible, and rekindled a hope that with a similar conference on the underground environment, the negotiations might again be on a track leading to a comprehensive agreement.

The Russians, with reluctance, did agree to a look at the new U.S. theories and experimental data as part of a technical experts' conference on the detection and identification of underground nuclear detonations. This became Technical Working Group II (TWG II), which met at Geneva in November and December of 1959. Various observers felt that this technical conference, in contrast to previous joint conferences, was not totally objective but had strong political overtones. It did not result in agreement on needed research, development, or treaty requirements. In fact, each of the three delegations submitted separate reports with the U.S. and U.K. agreeing in substance, and the Soviets disagreeing on almost every technical conclusion and recommendation of the U.S. experts. By the time TWG II met the Soviets had taken an ambiguous stand on the issue that the U.S. felt was the key to enforcing a comprehensive test ban in the underground environment, that of on-site inspections. On July 9 the Soviets agreed to the principle of an annual quota of inspections, but would not agree to a definite number. Thus, the U.S. remained optimistic, through the last half of 1959, that the Soviets might agree eventually to safeguards that the U.S. felt were sufficient technically. On the other hand, anxiety grew that the Soviets were "stalling" while they cheated or prepared to cheat. The lack of agreement at TWG II made the U.S. even more pessimistic about a comprehensive treaty.

In August of 1959 Eisenhower extended the one-year moratorium to the end of the year to permit more time for negotiations and technical discussions. Later, noting the Soviets' unwillingness to consider all of the technical data in reaching a satisfactory agreement, he allowed the moratorium to expire on December 31. He considered the U.S. free to resume testing, but pledged that we would not do so without announcing our intentions in advance. He also stated that during this period of voluntary suspension, the U.S. would continue an active program of weapons research, development, and laboratory experimentation.

The Commission position, and the personal position of Chairman McCone, was clarified by a number of public statements and Commission discussions through 1959. Perhaps to lay the groundwork for policy decisions on test readiness authorization, Chairman McCone stated, at a meeting of the principals (Secretary of State, Secretary of Defense, etc.) on October 6, that the Commission felt the Geneva negotiations toward an agreement should continue, but he proposed that if the negotiations did not reach an agreement, the U.S. announce a unilateral moratorium on atmospheric tests. With respect to underground tests, he proposed to reserve the right to take action as deemed necessary, perhaps after the first of 1960.

Air Force guidance*, circa April 1959, was "No actions are to be consummated which would jeopardize or reduce the Air Force capability for continuous development and subsequent testing immediately following the termination of any test moratorium.

*Hdqts. 4950th Test Group, Readiness Report, 1 April 1959.

Special care must be applied to prevent any degradation of capability in areas of planning, programming, personnel and other supporting activities."

On July 9, 1959, at a meeting of the Executive Council of the French Community, France announced their intentions to conduct nuclear tests in the Sahara Desert. The first explosion was not conducted until February of 1960. The entry of France into the nuclear weapon community exacerbated the problems of obtaining international agreement to a CTB.

At a Commission meeting on December 11 Chairman McCone noted that the Joint Committee on Atomic Energy "fully supports the Commission's position on the importance of adequate safeguard positions in any test ban agreement with the Soviet Union." Senator Anderson urged that the Commission be in the position to test a number of devices immediately after the first of the year or as soon as the test moratorium ended.

Seismic Detection/Latter Hole, Early 1959

In early January, the Commission turned its attention to the question of providing guidance for U.S. negotiators at Geneva concerning seismic detection. The United States officially released its new data suggesting that the Geneva experts' system would have a threshold closer to 20-kt than to 5-kt. The Commission expressed its concern that it would take six to eight months to conduct further underground tests to determine the seismic detection threshold. Another complication came in January when Dr. Albert Latter of Rand Corporation, apparently at the suggestion of Edward Teller, announced a decoupling theory by which a shot could be fired and produce only about 1/300 of the seismic signal that had been previously assumed. This decoupling phenomenon was effected by firing the shot in a very large spherical cavity, the required diameter of which could be calculated in accordance with the theory. However, there was appreciable concern about the validity of this theory at the time and for many years afterwards. Nevertheless, it was accepted by the PSAC, including Hans Bethe and Edward Teller, in late January. Since now it appeared that a large shot could be fired without detection if the evading country were willing to build such a cavity, the introduction of this theory, as probably intended, led to confusion as to the guidance to be given to our Geneva negotiators.

Laboratory Attitudes, Early 1959

During early 1959, the Laboratories and DMA continued to plan nuclear weapons tests, at first considering times only a few months away, but later settling onto November 1959 as a possible date, since that was when the one-year moratorium would run out. Livermore tended to concentrate its thinking on renewed underground testing and pressed for more tunnel construction in Nevada. Los Alamos was more concerned with overseas atmospheric testing, including high-altitude shots, while Sandia prepared for any of these concepts. The pressure from the Commission was toward the conduct of underground tests for seismic detection research, with a concomitant drop in interest in nuclear weapons tests. Los Alamos was strenuously against underground and outer space testing. In March, Al Graves took the opportunity to make these feelings known to the General Advisory Committee's Weapons Subcommittee during their meeting at Los Alamos, intending to counteract some of the Livermore enthusiasm for underground testing given to the JCAE the previous July at Livermore.

Weakening of JTF-7, Early 1959

In March 1959, less than five months after the beginning of the moratorium, questions arose concerning the function of Task Force 7, its organizational structure, and even its continued existence. This question was apparently first raised by the Deputy Secretary of Defense, Don Quarles, in a March 7 letter to Mr. McCone. The question arose because of the ongoing reorganization of the Department of Defense, specifically the planning for greater consolidation of atomic weapons activity in AFSWP. The new thought was to effect greater economy by transferring the functions of the Task Force to DASA. In April, a study group consisting of General Starbird (DMA), Admiral Parker (AFSWP), and General Anderson (JTF-7) was set up to study this question. In addition to the question of money and the reorganization of the Department of Defense, it was recognized that future tests, especially effects tests, might require more coordination between the AEC and the Department of Defense than in the past. Loper asked General Anderson to consider this point. Somewhat optimistically, it was suggested that future AEC shots could be prepared and held until the effects community was ready, rather than being tied to previously specified operational dates.

It is interesting to note the judgment of this study group on the likelihood of different methods of future testing. They felt that contained underground testing was most likely to be permitted and that a limited amount of preparation should be conducted so that such testing could proceed with minimum delay. Tests at altitudes greater than 50 kilometers, which was the presumed limit of detectability of the Geneva experts' system, were considered somewhat less probable, so that no preparation should be made for such tests, but investigations and plans for this type of testing should be kept under continuous review. Atmospheric tests at the NTS were considered of such small probability that no detailed planning or preparation was warranted. Atmospheric tests in the Pacific at sites other than Eniwetok or Bikini should be studied, but no appreciable expenditure of funds should be allowed. The likelihood of atmospheric tests at Eniwetok Proving Ground was considered so small that the Proving Ground should be put on standby status and only those expenditures should be made that would prevent significant deterioration of essential facilities. It was assumed that test preparation could begin nine to twelve months before extensive firing was required. Johnston Island had already been returned to Air Force command, and plans were being made to transfer it to the Army on or about January 1, 1960, for launching missiles for the Nike-Zeus program. The group noted that Johnston Island would be in an operational status within 18 months, which was also the stated readiness time to do Operation Willow, and suggested that the Army could support nuclear tests launched from Johnston Island using the same people who would already be there for support of the Nike-Zeus program. Thus, a few people, mainly a test director and staff, could go to Johnston for a short period of time to conduct any high-altitude tests. They therefore recommended that future agreements between the services should be made with this concept in mind.

The study group recommended that JTF-7 become a subordinate command to DASA, with liaison with the AEC maintained through DMA. The AEC would, of course, acquire joint control after the decision had been made to resume testing. Specifically, it was recommended that Task Group 7.1 (the scientific group) be disestablished because it would obviously not be required during the interim period. That disestablishment was to be completed by August 31, 1959.

It is interesting to speculate why this particular recommendation was made. None of the three gentlemen making the decision had had task force experience, although Starbird had had a great amount of contact with Luedecke during the 1958 series. Al Graves had offered some resistance to the decision to discontinue Task

Group 7.1, but he was in Geneva at the time and couldn't argue very effectively. There was very little support for its continuation from the AEC laboratories (other than LASL) or from the DASA testing organization. On June 5, 1959, Don Shuster resigned as Task Group Commander, and on June 25, 1959, General Order No. 5 ordered the discontinuance of Task Group 7.1 effective August 31, 1959. Thus, the organization that had conducted the technical, operational, and logistics work for overseas tests for over 10 years was disbanded.* In retrospect, this move appears as possibly the most serious single move made during the moratorium toward winding down our capability to test in the atmosphere. In overseas operations prior to 1959, the senior laboratory representatives in the field, commonly heading Task Units of 7.1, thought their major responsibility was to their home laboratories, or, in the case of DOD, to Field Command. The JTG 7.1 staff was the next layer up in the field and planning organization and, therefore, was still extremely sensitive to the needs of the basic experimenters in accomplishing their work. The Task Force staff, however, and to a certain extent the other task groups, were isolated by the very nature of operations from detailed knowledge of what those requirements were, and hence tended to look upon the experimenters as an unreasonable group of people simply trying to feather their own nests and make life hard for everyone else. In the author's opinion, the result was that after August of 1959, the Task Force lost touch with reality, at least as far as the AEC requirements were concerned, because it no longer had any channel at all to accept the thinking of the AEC laboratories.

Overall, the Loper study group recommended an 80% reduction in currently authorized spaces, with Task Force Headquarters going to 77 people, the Army to 32, the Navy to 90, the Air Force to 7, and of course, the scientific task group to 0.

In retrospect, it is difficult to see what these gentlemen were up to: by the time the report was finished, the concept of future operations had been reduced by others to that of underground tests in Nevada (for which a Task Force wasn't needed), and deep space tests launched from Johnston Island, with a remote possibility of large-yield atmospheric shots fired in some not-quite-clear way, perhaps by a floating task force in the Pacific. [redacted]

Ex.(b)(1)

[redacted] So it's clear that Task Force Headquarters, left at 77 people, was barely needed.

JTG-7.2, the Army, reduced to 32, at least had a job of maintaining housekeeping at Eniwetok, although that could easily be done by the AEC alone since Eniwetok reverted to them, in principle, in non-operational phases.

The Navy task group, left at 90, was needed mainly for planning Navy systems tests, whereas the Air Force, which was essential to almost any concept of operations in the atmosphere, either AEC or DOD tests, was reduced to seven. And the technical task group, 7.1, required for any technical planning at all, was reduced to zero.

Amazing!

Treaty Progress, Early 1959

At Geneva the arguments continued, largely about the number of inspection stations which had now been confused by the seismic detection uncertainties mentioned

*The going-away party used up all but $200 of a fairly large sum collected for the recreational fund (7.1 rec. fund) over those 10 years.

before. In fact, Eisenhower in April proposed to Khrushchev an alternative by which the test ban should be put into effect in phases, starting with the prohibition of nuclear weapon tests in the atmosphere up to 50 kilometers, while the negotiators went on to seek methods of extending an effective test ban to underground and outer space. Khrushchev rejected that proposal and went back to the argument about on-site inspections.

At Livermore, Teller apparently felt there was a high possibility of testing being allowed in the very near future underground or in deep space, simply because there was no way to come to a satisfactory treaty agreement on those subjects. However, Los Alamos seemed to feel it was being driven to underground tests against its will. George Cowan commented in March 1959 that all the experience in underground radiochemistry was at Livermore (LASL's two previous underground shots had come out of the ground so nicely that samples were obtained above ground). He also commented that if we had to test that way, then he supposed we would learn how. To paraphrase LASL views: "Either weapons testing is worthwhile or it isn't. If it is, let's do it properly; and if it isn't, then let's have a treaty." Livermore, sparked by Teller and Harold Brown, was doing everything it could to move toward a treaty that would still allow testing. It's interesting that at this point, Harold Brown, after returning from Geneva, proposed a treaty, apparently based upon observation of nuclear testing by the use of satellites, that would not involve either a threshold limit or inspection teams.

Test Planning, First Half, 1959

Starbird continually requested that the Laboratories update test plans, but he also did his best to accomplish, in this hard time, all of the real work necessary to maintain our nuclear weapons capability. Thus he went as far as he could to cooperate with the Laboratories' Directors in a manner to best benefit their internal programs.

At the Nevada Test Site, as a result of LASL's insistence upon firing in vertical holes in Area 3, the ugly problem of groundwater contamination was raised. Some shots had to be fired below the water table, and hence, assurance was necessary that the contamination would not be tranported by underground water to some embarrassing spot off-site or to producing water wells. Further studies were initiated to investigate the ground-water problem.

The Laboratories and AFSWP, in the light of the new testing philosophies, were seeking facilities for NTS underground tests. LASL, in the person of Bob Newman, requested in April that ALOO (Reeves) develop a plan for the construction of four tunnel sites on Rainier Mesa (estimated to cost 7 million dollars) and four 1100-feet holes in Area 3 (estimated to cost 3 million dollars). At the same time, Ken Street of Livermore suggested to DMA that maintaining a 90-day readiness would result in extensive wasted effort and funds, and suggested instead preparation for continual underground nuclear weapon testing to be started 12 to 18 months later.

Ex.(b)(3)

[redacted] Also included were some holes in granite and

marble for the seismic detection program. One of the Livermore tunnel sites was for the DOD shot, Jericho, later renamed Marshmallow. The tentative construction budget to finish this work was 52 million dollars, of which about half was available. Several of the Livermore tunnel sites had already been constructed or were funded, whereas only the LASL safety shot holes were in that situation (four 500-foot, 36-inch diameter holes). Diagnostics in the proposed underground series would be minimal. [redacted]

Ex.(b)(3)

Deep Space Testing, May 1959

By now (May 1959), the system seems to have convinced itself that the only "atmospheric" testing that would be allowed and, hence, was worth planning for, would be conducted at altitudes above the Geneva system detection limit of 50 kilometers. The Berkner Panel (who met in early 1959 and published their results on March 31, 1959) had suggested looking at the problems of testing at altitudes above the limit of detection by the Geneva system. McCone had met on April 23, 1959, with Killian, Quarles, and Starbird and agreed the AEC would look into this question. Livermore felt that such shots could probably be performed in about 12 months, obtaining only very rough diagnostic data, and that in about 18 months fairly acceptable measurement techniques could be developed. At the previously mentioned meeting in early May (which included Starbird, Bradbury, Jane Hall, Ogle, Mark, Teller, Johnson, Foster, Herbst, Fowler, Shuster, Hertford, Reeves, Loper, Parker, and others), the high altitude program was discussed. [redacted]

Ex.(b)(3)

[redacted] Each device would be lifted on a modified Redstone from Johnston Island to 500-1,000 km altitude. The earliest launch date would be August 1960. The DOD was already planning on the Willow program of six tests, four utilizing the Redstone missile, one the Jupiter missile, and one a balloon. It was also agreed that the possibility of performing the AEC tests at altitudes of 100,000 kilometers or more would be investigated, as suggested by the Panofsky Committee of the President's Science Advisory Committee. Such tests would require four different boosters (Centaur, Atlas, Vega, and Saturn), with readiness dates ranging from late 1960 to 1965 (see Table V). The estimated costs for the lower-altitude AEC program were 185 million dollars, whereas the system to test above 100,000 kilometers would cost some 320 million dollars. Sandia was already looking into the problems of missile failure, destruct systems, and associated safety devices. Problems of retinal burn, electromagnetic interference, and atmospheric fallout were recognized.

[redacted]

Ex.(b)(3)

TABLE V
A. PROPOSED AEC HIGH-ALTITUDE PROGRAM
May 7, 1959

Ex.(b)(3)

[redacted]

[a]Diagnostic package weight for all devices would be 600-700 lb.
[b]For altitudes of 500-1,000 km the carrier would be the modified Redstone; ready date, August 1960.

NOTE: Use of the improved Atlas would allow testing the 3000 lb warhead at 25,000 km and all of the others shown at 50,000 km commencing in mid-1961.

B. DOD WILLOW HIGH-ALTITUDE EFFECTS PROGRAM

Ex.(b)(3)

[redacted]

Clandestine Test Detection, Mid-1959

The forerunner of what was eventually to become the Vela Program was now beginning to solidify. At the previously mentioned meeting of McCone, Killian, Quarles, and Starbird in April 1959, the AEC agreed to cooperate in following the Berkner Panel recommendations relative to undertaking an experimental test program to determine the parameters of detection and concealment. Within the AEC, Livermore, in conjunction with Rand, had considered the underground detection question more than others so that that work fairly naturally fell to them. During discussions of the possibility of combining proposed weapons tests underground with proposed seismic detection shots, LASL did express an interest in the seismic detection program, but

pointed out in late April that it was inconsistent to combine these two aims since a test shot by definition might not give the predicted yield. LASL, because of its experience and interest in atmospheric testing, somewhat naturally took on the problems of high-altitude detonation detection. Using ground stations, they would observe the fluorescent light and electromagnetic signals resulting from the detonation. In conjunction with Sandia, Los Alamos began to look seriously at the question of detecting deep space shots using instruments in satellites. This work was, of course, in conjunction and in cooperation with ARPA and AFTAC, who had the basic responsibility. To further this work a joint Los Alamos-Sandia working group (called the Buzzer Committee) was set up with Dick Taschek of Los Alamos as the Chairman. Membership was drawn from the physics, test, and theoretical divisions at LASL, and from Sandia. It was expected that it would take this committee four to six months to come up with anything significant beyond the recommendation of the Panofsky Panel Report. Consequently, the Laboratories suggested that the Panofsky report was adequate to provide any interim need of the Geneva Panel of Experts or others.

In mid-May, Starbird, worrying about information for the upcoming working group meetings in Geneva, asked Livermore to consider the necessary programs and time scale to obtain acoustic data from extremely small detonations in blocks of salt or other material. Later on, high-explosive detonations in the appropriate media would be conducted in a further effort to try to understand the observation during Hardtack of very different seismic signals from two tests at essentially the same yield (Tamalpais and Evans).

Ex.(b)(3)

[redacted]

Starbird also requested that Livermore and the operations offices investigate the feasibility of testing the Latter hole theory using high-explosive detonations in the salt mines of Louisiana and Texas. He informed the Commission that two such salt mines had been identified. These tests could be conducted in something like 60 to 90 days.

Effects of Moratorium

In early 1959, the system began to realize the penalties of not testing. At the early May meeting previously mentioned, the representatives of DMA, DASA, ALOO, Laboratory Directors, and the Military Liaison Committee concluded that: (a) Foregoing all testing in the future would limit the warheads that the AEC could offer to the DOD to meet existing or near-future system requirements (certain warheads offered by AEC would fall short of DOD desires in regard to assurance of performance, amount and predictability of yield, or other characteristics); (b) the exploitation of certain fields of longer-range DOD interest which could lead to significant changes in weapons systems and doctrine could not be accomplished without further testing; (c) foregoing further testing would preclude obtaining effects information required by the DOD, of which high-altitude effects were the highest priority.