Sandia Balloons, 1959

In spite of the very strong opinion that only detonations underground or at very high altitude would be allowed in any future tests, assuming a complete test ban was not agreed to, some work continued along other lines. Sandia, who had designed and operated the tethered balloons used in earlier operations in Nevada for lifting nuclear devices for detonation, now began the design and development of a balloon capability for Eniwetok. The concept was developed by Don Shuster, as Commander of 7.1, and others in the Task Group and at Sandia. The AEC, through NVOO and Sandia, supported the development. By June of 1959, Sandia had had test flights at the Nevada Test Site of balloons carrying up to 20,000 pounds of payload, indicating that it would be feasible to lift such weights to altitudes of some 5,000 feet at the Eniwetok Proving Grounds. Coaxial cable for balloon use at NTS was being procured in July of 1959, and further prototype testing of a 20,000-pound lift balloon with a 15,000-pound payload was planned for September and October. Shuster reported in December that aerodynamic balloon operations could proceed about 10-12 months after authorization (5 months for test balloon delivery + 2 months for test flights + 3 to 5 months for production unit delivery).

Reduction of EPG Capability, 1959

During the earlier Pacific Operations, the Army Task Group had been responsible for "housekeeping" at the Eniwetok Proving Grounds. They furnished the Island Commander and his staff, many of the military vehicles required, airfield operation and maintenance at Eniwetok Island, and many other such functions. During the early operations, the Army had been most willing to perform this function as one of the ways of getting into and staying in the nuclear weapons business. However, the Army portion of the nuclear weapon pie gradually reduced in the later part of the 1950s and the manpower drain to continue this function was appreciable (the Army had 1,000 personnel at Eniwetok at the end of 1958). At the end of Hardtack Phase I, the TG 7.2 (Army) Commander, Colonel Stanley Sawacki, recommended to CJTF7 that the Air Force assume responsibility for all the military functions at Eniwetok presently assigned to TG 7.2, that the AEC contractor (H&N) take over the other TG 7.2 functions, and that TG 7.2 be inactivated. Initially, this proposal received no particular attention in the light of the uncertain future of JTF-7 itself, as mentioned earlier. However, later, against the background of the general set of studies and moves going on in mid-1959 (i.e., the Department of Defense reorganization, the agreement to put JTF-7 under AFSWP, and the reorganization of AFSWP into DASA), the suggestion was looked upon with favor. The requirement that the Army support the Nike-Zeus test program on Johnston Island made the relief from maintaining Eniwetok even more welcome. As a result, Task Group TG 7.2 was reduced to less than 400 people at Eniwetok by the end of July 1959.

The "Report of the Study Group on Organization for Future Test Operations" was endorsed by CJTF-7 (Anderson); Chief, DASA (Parker); and Director, DMA (Starbird), on August 20, 1959, and sent to Secretary of Defense, the AEC, and the JCS Chairman. The report recommended, among other things, that at the Eniwetok Proving Ground there be a general move to standby status by such actions as consolidating all base camp activities to Eniwetok Island with mothballing of the facilities on Parry, which had been the headquarters of the technical organizations, reductions in the size of the boat pool, elimination of locally based aircraft, and no further construction. Total personnel were reduced to 495. Anticipating the study completion was the official notification of a standby status phase-down to TG 7.2 and others on August 8. By

September 1959, Operation Switch was taking place with TG 7.2 handing over its responsibilities and equipment to Holmes & Narver. By December of 1959, TG 7.2 was down to 20 people on Eniwetok. This study group report, which came out just two days less than a year after the President had announced the test ban moratorium, and the concomitant actions resulted in the conversion of an active and useful proving ground to an almost useless piece of real estate in a period of about a year and a half, mainly on the assumption that testing in the atmosphere would not be allowed in the future, even if we were to return to testing.

It appears that not a single person in the whole chain of decision makers at that time, all the way to the President through PSAC, the Commission, the Department of Defense, and the Laboratory Directors, actually believed that there was any serious hazard associated with worldwide fallout that might be produced by any future nuclear testing in the atmosphere. Rather, there was judgment that if negotiations were to break down because of the inability to solve the underground detection and identification problem, reaction to public fear of fallout would result in at least an atmospheric test ban. The reduction of total test funding, both because of the need to reduce the total national budget and the conviction that we would not have to go back to testing at all, contributed strongly to the degradation of the Eniwetok Proving Ground. In retrospect, however, the author believes that had the Eniwetok Proving Ground been maintained it would have been used in 1961 and 1962. Most of the development shots would probably have been balloon lifted rather than airdrops. Also in retrospect, however, it's not a bit clear that any more weapons development information would have been gained that way than actually was obtained at Christmas Island, nor is it clear that the operation would have actually been conducted any sooner.

Plowshare, Early 1959

Livermore had long been promoting the peaceful uses of nuclear explosions (Plowshare). Clearly, the pursuit of this effort in a period of no weapons testing could be helpful in maintaining a weapons testing capability. The device designs were similar, but Plowshare devices did not have to meet the rigid strength and size criteria required of weapons. In addition, the criteria on cleanliness might be different. The testing of a device to be used for Plowshare purposes used essentially the same observational techniques as those for a weapon test. Many of the experiments could be performed with devices designed to be used as weapons. Edward Teller and Gerry Johnson of Livermore pressed to separate the peaceful uses program from the weapons test problem, urging that any test ban allow the continued use of nuclear explosions for peaceful purposes. They urged that arrangements be made for Plowshare experimental detonations in the then extant circumstances of a weapons test moratorium. The Russians were not enthused about the Plowshare concept, and pointed out that it would be very difficult to differentiate a Plowshare explosion from a weapons test explosion. It was clear in the AEC family that such a differentiation would be most difficult; and, in fact, it was clear that unless there was extremely detailed monitoring, it would be very simple to conduct weapons tests under the guise of Plowshare. This latter politically difficult point led to a sort of schizophrenia in the community, in which it was simply not proper to admit the possibility of using Plowshare for evasion purposes. Hence, the Plowshare discussions were usually kept separate from the weapons discussions. This same feeling led a little later to the Plowshare program being separated within the AEC Headquarters from the weapons development program, resulting in a separately labeled budget for planning Plowshare detonations.

During January of 1959, preparations continued. EG&G was constructing alpha

measuring equipment and a portable timing and firing system. Livermore was making detailed plans, while Los Alamos re-examined the value of participating in the Plowshare program. Previously LASL had not been particularly interested in Plowshare as such, feeling they were already overloaded with weapons problems. However, under project SANE (Scientific Applications of Nuclear Explosions) work had been done on the possibility of producing and recovering large amounts of transplutonic elements by means of underground nuclear explosions. (A number of the transplutonic elements had been produced in several previous shots, including Mike, but the devices had not been designed to maximize such production.) Production of electrical energy by underground nuclear explosions was also considered.

Attempts were being made early in the year to formulate proposed international rules by which Plowshare shots might be conducted. Early announcement to other nations giving the date, the place, the purpose, the yield, measures to minimize fallout, etc., was suggested.

By mid-1959, physical preparations were being made for two Plowshare demonstrations. One was Project Chariot, to produce a harbor at Cape Thompson in Alaska, to assist in the development of the region.* Chariot consisted of a cratering shot of 100 kt yield at about 700 foot depth, to produce the harbor, and an additional four 20 kt shots to produce a channel connecting the harbor to the ocean. Environmental studies of the region, including engineering considerations, were being conducted at this time. Project Gnome, a 10-kt shot to be fired in a salt dome in southern New Mexico, was planned to study energy and isotope production. In mid-May, the Commission approved expanded effort on these projects. The Plowshare group at Livermore was, by this time, of appreciable size. A number of the group members also were part of the weapons test organization.

An example of the feedback of Plowshare considerations to weapons test capabilities is shown in a message about this time from Ed Fleming of Livermore to Colonel Thompson of AFSWC concerning future air sampling capability. He offered his opinion that for a long time to come, only cratering-type Plowshare shots would produce radioactive clouds, that these could probably be sampled by the drone aircraft sampling system then being developed by Sandia and that, therefore, the efforts of the 4926th Sampling Squadron would not be required after the end of 1959.

NTS 90-Day Readiness, Late 1959

By mid-June 1959, the testing system had developed reactions to the guidance offered from the May 7 meeting of DMA, Lab Directors, DASA, etc., previously mentioned. LASL, after due consideration, went back to its old stand that it preferred vertical holes to tunnels and formally requested that ALOO design and construct four 1,100-foot holes of 36-inch diameter in Area 3, and cancelled their request for tunnel work at Rainier Mesa. Discussions at the June 4, 1959, Nevada Planning Board meeting centered around the "requirement" to meet a 90-day readiness for underground testing. It was concluded that such readiness could be achieved by November 1, 1959, if prompt approval were given for the LASL 1,100-foot holes and for the desired LASL mobile alpha station. At that time the laboratories would be ready to do approximately one shot each per month, assuming continued drilling and tunneling were

*Envisaged at that time was, strangely enough, the use of the harbor as the end point of an oil pipeline from what has since become known as the Prudhoe oil field, allowing shipping most of the year out of that harbor to the lower 48. The pipeline would be almost continuously over hardrock and would therefore not face most of the environmental difficulties that the present pipeline faced.

approved. A 550 $W^{1/3}$(ft)* rule for detonation depth was accepted in spite of the containment difficulties with tunnels during Hardtack. LASL indicated that they would be happy to have some release of activity to improve the possibilities of sampling for radioactive debris, whereas Livermore intended complete containment. (Livermore had started an attack on the concept of prompt sampling through small pipes from the shot point during Hardtack.) Sandia was also preparing their balloon lift capability to be ready on a 90-day notice for shots in two or three areas at NTS. LASL initiated effort on the design and field check of a method for cleaning the contamination from all the reusable vertical holes used in Plumbbob and Hardtack. It was estimated that this action might make four 330-foot, 36-inch diameter holes available for one-point detonations. The 1,100-foot vertical holes requested by LASL would cost some 1.9 million dollars, which had not yet been approved. Construction had been authorized and was under way for three safety shot sites in Tunnels I, J, and K for Livermore. However, authorization to prepare the full-yield shot sites was still required. Preparation was estimated to cost some 3.6 million dollars in FY 1959, 5.5 in FY 1960, and an additional 9 million once the go ahead for actual testing had been received. In mid-June, Gerry Johnson of Livermore requested authorization from DMA (Starbird) to begin the new construction necessary if readiness were to be achieved by November 1. On June 22, Starbird withheld such authorization pending further review. At the midyear review on June 25, 1959, Norris Bradbury (LASL) emphasized that LASL intended to make its decisions and conduct its programs such that they could be abruptly modified as the future course of testing became apparent. He felt it unlikely that the U.S. would again test in the lower atmosphere to any extent and commented that the probability of resuming nuclear testing under any circumstances was about 50%. He commented that LASL did not plan to devote any appreciable effort to the problem of elaborate physical diagnostics underground until it was clear that there actually would be a test series. He further commented that LASL intended to make extensive use of the capabilities of Sandia to assist in diagnostic measurements of exoatmospheric detonations should testing of this type be undertaken. He also commented on his intent to shift about 10 percent of the current LASL testing personnel to other programs in the next year, assuming there were no extraordinary changes in the testing scene.

As of mid-1959, Starbird had requested that the initial January AEC testing budget of 17.5 million dollars for full-scale tests be upped to 27.5 million for FY 1960. This upward revision included the cost of doing preparatory work for possible underground testing in Nevada. It was his assumption that of the 27.5 million, some 8 or 9 million would go into minimum maintenance effort at the Eniwetok Proving Ground. A little would be reserved in case some method of testing other than underground should become possible, and about four million dollars would be used for continued tunneling in preparation for possible full-scale weapons tests (approximately one million dollars of that was for the Jericho shot). This money would support some 150 miners engaged in tunneling, but he suggested that the number be dropped to perhaps 100 by July 1, 1959. Approximately two million dollars would be spent on construction for shots connected with the underground seismic program and about one and a half million on various efforts concerned with the problem of water contamination at the Nevada Proving Ground. To allow flexibility as the situation became clearer in the latter half of 1959, 4.8 million would be left uncommitted.

By July 1959, LASL, in conjunction with Reynolds Electrical and Engineering Company and NVOO, was well into the design of the operational and mechanical

*The product of the number 550 and the cube root of the yield--for yield expressed in kilotons--is to be the depth of burial in feet; i.e., for 1 kt, the depth would be 550 ft; for 1,000 kt, depth would be 5,500 ft.

procedures for firing in their proposed 1,100-foot holes, and the AEC had given approval to procure some 20,000 feet of coaxial cable for use with possible balloon shots at NTS. Design was under way for a downhole catcher to collect radiochemical samples which could then be pulled up through the sand of the backfill.

As a result of the uncertainty concerning groundwater contamination in Nevada, Reeves contracted with the USGS (Bill Twenhofel) to begin an investigation of this problem at NTS. A 1,200-foot hole was drilled in the north-central part of the Tippipah Springs Quadrangle during July and August 1959 as a beginning of a ground water monitoring program.

In mid-July, LASL changed its request for deep holes from 1,100 feet to 1,200 feet in order to make the hole depth good for 10 kt. ALOO had prepared the advance notice for bids for these four deep holes, but was holding them pending DMA authorization of construction. LASL was having difficulty completing their experimental design for these holes because of the problem of getting the boost region alpha signal up the size cable they felt was reasonable to put down 36-inch diameter holes. By August 6, some five different downhole canister geometries with various diagnostic capabilities had been proposed.

All three weapons laboratories were working hard on the problem of containing radioactive debris underground. LASL was, for a change, taking the subject seriously, and in late August, J-15 published a set of computations predicting the proper depth of burial. However, there was no change in the officially approved $550W^{1/3}$ criterion chosen by the planning board in early June.

While work was continued on the tunnel complexes for LRL and the Department of Defense, approval from Washington did not come for the LASL 1,200-foot holes. Thus, toward the end of September, LASL returned most of its equipment to New Mexico. An internal LASL report of the period includes the comment "the enormous quantity of work that Holmes & Narver has had to do for LRL weapons, Vortex and Plowshare, has made H&N progress on LASL designs very slow. There is small indication that they will divert more effort to our projects any time in the near future."

On August 26, 1959, President Eisenhower announced that the United States would extend its unilateral testing suspension to the end of 1959. On the 27th, the United Kingdom stated that it would not resume tests as long as the negotiations showed prospect of success, and on August 28th, the U.S.S.R. pledged not to resume testing unless the western powers did so. This obviously did away with the concept of beginning an underground operation on November 1, 1959, but for a little while, the planning went ahead with the same concepts as those expressed in May, but delaying the time at which testing might resume.

Livermore continued to refine their plans. On October 19, 1959, Myron Knapp outlined in an internal document a plan (Succotash) for reaching a readiness-to-test capability for LRL [redacted]

Ex.(b)(3)

[redacted]

Ex.(b)(1)

Ex.(b)(3)

[redacted]

In the fall of 1959, LASL, in a further attempt to learn about methods of radiochemical sampling for underground testing, core-drilled one of its one-point shots fired in 1957. The results were the refinement of the yield of that shot and the conclusion that such sampling, even long after a test, had great diagnostic value.

By the end of the year, LASL's deep holes had been designed, but ALOO had decided not to go ahead with the construction unless the moratorium situation changed to indicate that the holes would be used. At this point, Bradbury requested that Starbird direct that the 1200-foot holes be drilled, stating that at the moment, LASL probably had the capability of doing a few one-point shots on three months notice, but could not make any statements about larger shots until the holes were drilled or approval was given for their construction.

Livermore was so busy by this time on Plowshare, seismic detection readiness, etc., that they felt forced to back out of the planning of the Jericho shot. They proposed that they be phased out of the management starting Jan.1, so that DASA would have it completely under their control by March 1, 1960.

Radioactive Cloud Sampling, 1959

By mid-1959, although the attention of the testing community had turned largely to the problems associated with underground testing, there were those who felt that atmospheric testing was still a possibility. If the capability to test in the atmosphere was to be maintained, one of the most crucial items was the aircraft sampling capability that had been built up over the long period from 1946 through 1958. The major capability for United States weapons test sampling was in the 4926th Sampling Squadron of the 4950th Test Group in Albuquerque Ex.(b)(1) Ex.(b)(1) This capability was used to sample not only United States nuclear weapons tests at both Nevada and in the Pacific, but also the Rover nuclear propulsion tests. Aircraft sampling required a high level of proficiency on the part of the crews, both in order to prevent radiation overexposures, and in order to assure proper sampling. The sampling tanks used were long lead-time items requiring extensive aircraft modifications which could not be made on short notice. With appropriately equipped aircraft, planning and training for an operation normally began six months to a year before the planned operation.

In mid-1958, AFSWC, the owners of the 4926th Test squadron (sampling), had begun the argument that the 4926th strength could not be significantly reduced if a nuclear sampling capability was to be maintained. By December of 1958, Headquarters Air Force had notified the field of its philosophy for continuation of a vigorous program to maintain and improve its atomic capability. Specifically, their guidance was that no actions were to be consummated which could jeopardize or reduce the continued development of their atomic capability, including test resumption immediately following the termination of the test moratorium. This guidance was apparently intended only to instruct all Air Force units to continue pressing for Air Force nuclear weapons. But, it was also used by AFSWC as one of the many crutches to maintain the sampling program. The very fact of the continued existence of JTF-7 during this period of time, and the decision to maintain the Eniwetok Proving Ground at some level, also supplied strong support for the continued existence of the 4926th sampling capability.

Soon after the moratorium began, in spite of the original recommendations, Major General William M. (Monte) Canterbury of the Air Research and Development Command (ARDC), with the agreement of Maj. General C. M. McCorkle, Commander of the AFSWC, somewhat reduced the strength of the sampling group. Both commanders faced the

common problem of maintaining an adequate readiness posture while usefully employing the people involved. In this vein they expanded the AFSWC research and development tasks, such as Javelin and Journeyman development and testing, while continuing test support to the AEC on nonweapons tests, such as the Rover program. As another move to strengthen the 4950th the Joint Chiefs of Staff gave approval in December for the formation of a permanent Air Force Task Group, 7.4. That function would be carried out by the 4950th, and would result in increased responsibility for them and for the Commander of Joint Task Force 7. However, this move was never consummated.

In April 1959, the 4950th had eight B57-Bs and two B57-Cs, out of a readiness requirement for twelve B57-Bs and four B57-Ds. The intent now was to convert the Cs to sampler configuration (a useable substitute for the Bs) and to obtain the Ds from Strategic Air Command if they were ever needed. While no particular efforts were made during 1959 to reduce this sampling capability below that established immediately after the moratorium began, it was clear that the organization itself was worried about further reductions if additional jobs were not found. In June of 1959, Colonel Byrne of the 4950th queried both George Cowan of LASL and Ed Fleming of Livermore on the plans and requirements for samplers which could be used from Indian Springs, beyond projects already named. Fleming didn't help the situation when he replied that, in his opinion, other than Rover and Plowshare, there would be no nuclear tests requiring sampling for a long time to come. Furthermore, since Sandia would have completed a Drone Aircraft Sampling System by the end of the year, he did not see that Livermore would need the 4926th sampling capability after that time.

Perhaps 4950th spirits rose a bit when they were told by Merrill Smith of ALOO in September that the AEC was surveying possible canal and harbor sites in Alaska, with a view toward using atomic weapons for excavation purposes in 1961. Participation with AFTAC in exercises in Australia in early October 1959 must also have helped a bit. In October 1959, the ARDC reaffirmed their statement that it was important to retain the 4950th as it presently existed. The possibility of the 4950th continuing to assist AFTAC was strengthened by a rumor in early October that U-2 aircraft might be assigned to the 4950th to support the AFTAC requirements for extremely high-altitude sampling. However, in November, the new commander of the 4950th, Colonel Wignall, was faced with the suggested reorganization of AFSWC, which would do away with the 4950th by absorbing its function into AFSWC Headquarters. Wignall clearly felt that such a move would impair the proper support to nuclear test planning and jeopardize the sampling capability. In December 1959, Headquarters Air Force requested details of aircraft, manpower and schedule requirements to build up the capabilities needed if testing were resumed, the information to be supplied by Feb. 1960.

Thus, at the end of 1959, the capability for sampling atmospheric detonations in Nevada had not been seriously compromised, but the pressure was fairly high to reduce it.

Pacific Test Capability/Willow Planning, 1959

During the Hardtack series in the Pacific in 1958, the Marshallese natives asked the United Nations to take those moves necessary to prevent further testing of nuclear weapons at the Eniwetok Proving Ground. In November of 1958, both John Foster Dulles and Phil Farley* expressed their feelings to the Commission that

*Philip J. Farley was Recording Secretary of the AEC, 1947-1954; member of the State Department Office of the Special Asst. for Atomic Energy, 1954-1957; and then Special Asst. to State Department Secretaries Dulles and Herter.

further testing in the Marshalls would be most impolitic. However, the testing organization was reluctant to give up the large and familiar plant that had been built up over the years. In November of 1958, Starbird (DMA) requested that the testing system maintain a capability of firing a few large-yield shots at the EPG on three months notice. Ex.(b)(3) As backup, he also requested that the testing organization look at other possible test sites such as Palmyra, Midway, Canton, or Howland/Baker, and consider open sea operations, using either airdrops and/or Liberty ships as platforms for the devices. The testing organization had to add to Starbird's suggestions the Department of Defense planning for the 1960 Operation Willow.

Ex.(b)(1)

The Laboratories took Starbird's directive seriously and sent to ALOO the plant construction and maintenance requirements necessary to continue the EPG test capability. The most important item of maintenance was the signal cable plant, but other repairs, including strengthening a number of the buildings and towers on Parry and Eniwetok, were needed. Money promptly became a problem. In mid-November 1958, Hertford asked for an extra two million dollars to do the necessary construction. Starbird approved some of the work in mid-December 1958, but delayed the rest for further consideration.

In early 1959, discussions between the Laboratory people, Joint Task Force 7, ALOO, and others began to solidify some of these concepts. At a January 28 meeting held at ALOO it was estimated that to achieve an open seas readiness stature would take about five months, but that the Eniwetok Proving Ground could respond in three months. Furthermore an eight-shot operation could be completed at the EPG before any alternate location could be ready. However, later discussions led to the decision to go ahead with the open sea operation concept. The open sea operation would be planned for approximately 600 miles south of Hawaii, using airdrops lifted from Hawaii, or, when the device could not be prepared for an airdrop, Liberty ships as platforms. The operation would be controlled from an AGC command ship. Fireball cameras could be pointed by slaving to the ship's radar tracking system. Sampling would be done by aircraft based at Hickam or Barbers Point. An LSD would be used by the AEC laboratories as an instrumentation ship.

However, in the longer range future, the full Operation Willow, about mid-1960, would use both Johnston and Eniwetok.

In line with these concepts, EG&G began design and construction of the tracking platforms, while the Navy investigated techniques for mooring barges or ships in deep water. ALOO authorized H&N, Sandia, and EG&G to proceed with design and engineering for some of the open sea facilities and timing and firing systems. They began exploration of the use of Pearl Harbor and Hilo as a Hawaiian Test Center. Since the LSD was critical to the open sea concept, ALOO requested that JTF-7 forward the designation and "as built" drawings of an LSD approved for use in the operation in order that the Laboratories could make specific ship modification plans. For their part, AFSWP continued design and construction of the equipment needed for Project Willow, using part of the 17 million dollars in their 1959 budget for that project. The estimate of the total Willow cost was 60 million dollars. No additional funds were yet approved for 1960.

Starbird emphasized that all of these investigations and activities should be conducted in a low-publicity manner to avoid the misinterpretation that we were proceeding toward nuclear testing (in retrospect, it's hard to see how that could have been a misinterpretation). LASL transmitted a number of unclassified messages on this subject in mid-February, and were promptly told by Washington that it was an

extremely sensitive subject and that it should all be classified.

At the end of January 1959, Parker (AFSWP), noting that magnetic conjugate, communications, and radar effects from high-altitude shots warranted further investigation, Ex.(b)(1) Ex.(b)(3) [redacted]

In March, the Eniwetok Proving Ground population was 1,800, of which 564 were Army and 407 Air Force. Design and construction work was still continuing, but on a rather leisurely schedule.

In mid-March, representatives of all of the pertinent agencies again met in Washington at Arlington Hall and agreed on the specific planning for conducting an overseas test operation some 300 nautical miles southeast of the island of Hawaii. Ex.(b)(1) Ex.(b)(3) [redacted]

Scripps Institute was brought in to help calculate the tsunami hazard of open sea detonation, and, by July, had come up with guidelines; one of them was, "For example, if a wave height of six feet onshore at Hawaii is considered the safe limit, a ten-megaton open sea barge shot should be located at least 800 miles away, while a one-megaton shot need be removed only 250 miles."

Thus, during the early part of 1959, the Eniwetok Proving Ground itself was not only maintained, but some repairs were made under the restricted funding. But in early May 1959, at a meeting in Washington attended by high level AEC and DOD personnel, including AEC Laboratory representatives, the conclusion was reached that early resumption of atmospheric tests at the EPG had an extremely small probability, and that, as a consequence, the EPG should be placed on a maintenance standby status and expenditures should be limited to those necessary to prevent deterioration of essential facilities to the point where replacement or repair could cause a long-term delay in test resumption. It was assumed that no tests would commence at the Eniwetok Proving Ground sooner than nine to twelve months after receiving authority to resume testing. At the same meeting, it was concluded that there was a slightly higher probability that open sea testing would be allowed and, therefore, investigation of techniques and planning for such tests were warranted, but that no substantial funds or talent should be expended on the problem.

Just slightly later, during the previously mentioned discussions of the test planning ad hoc group of Starbird, Parker, and Anderson and their subcommittees, several actions were recommended to phase down the resources at the Eniwetok Proving Ground to a maintenance standby status. Some of them were: consolidation of the base camp facilities on Eniwetok Island with concomitant mothballing of the facilities and equipment on Parry Island, which had been the AEC and 7.1 Headquarters; reduction of the boat pool; removal of all locally based aircraft; reassignment of all communications to the AEC contractor (H&N); cessation of any further construction, except for minor modifications needed to consolidate the base camp facilities; and reduction of the total strength to 495 people, of which 69 would be Department of Defense. However, it took a little time to carry out these actions in the field, so in June of 1959 H&N still had under design for the Eniwetok Proving Ground the following interesting items: a new barge slip for Parry Island, permanent reinforcement of the base island buildings, soundproofing and air conditioning of the Livermore and LASL offices on Parry Island, redesign of the IBM computer building, replacement of the triangular photo towers on Parry and Enyu by stronger rectangular towers, and design of a new photo tower to replace the Mack tower. They were also working hard, however, on the open sea concept and had under design an LCU shot vehicle and a more appropriate LSD mast for timing and firing communication.

The Department of Defense continued vigorous planning for Willow through May,

June, July, and August of 1959, including support to its contractors for preparation of the mid-1960 operation. However, in early August, the Secretary of Defense, McElroy, changed his guidance, stating, amongst other things, that expenditures for construction equipment and instrumentation for specific tests would be limited to the funds available to the military departments and to DASA for weapons testing purposes. The new guidance stated that no weapons effects series involving overseas operations and environments other than underground would be conducted prior to the spring of 1961. This action resulted almost immediately in a reduction of the funding for DASA projects by approximately a factor of three.

By the 28th of July 1959, the Department of Defense and the AEC had agreed, in principal, that the EPG should be reduced to the minimum required for a 12-month response capability, and the associated DOD organizations were to proceed with corresponding functional and manning changes. (But on the 3rd of August, the Chief of DASA (Parker) added an EPG land surface weapons effects test to the Willow Planning.)

On August 7, 1959, Eniwetok was officially notified by JTF-7 (less than one year after the beginning of the moratorium) that the EPG would be phased down immediately to maintenance standby, with a capability to resume testing within 12 months. Only facilities and equipment which could not be replaced within 12 months would be kept at the EPG and there would be a maximum consolidation of the AEC/DOD functions. Task Group 7.2 was to start immediately to transfer its functions to the AEC contractor (H&N), and was to complete the transfer by January 1960. At the same time, Jim Reeves, wearing the hat of the Commander of Task Group 7.5, ordered the AEC contractor side of the house to proceed in the same fashion,

Ex.(b)(1)

Instructions to the Navy Task Group were to return all ships to the Navy with the exception of 16 LCMs and four LCUs which were to be retained at EPG for use by the AEC maintenance and security force.

So began Operation Switch at Eniwetok. The Laboratories removed all of their equipment from the upper islands and either stored it on Parry or Eniwetok or brought it home. Military-owned equipment, except for that needed to keep the airfield open, was either transferred to the AEC or returned to CONUS. Coaxial cable was returned to the Nevada Test Site. The Air Force redeployed all helicopter personnel to home station. By mid-December 1959, the Task Force strength on Eniwetok was down to about 20 from a level of 1,000 at the beginning of the year, and Holmes & Narver had taken over virtually all functions. By late January of 1960, Operation Switch had been completed.

In parallel with these actions at Eniwetok, the Task Force support organization, consistent with the recommendations made through June and July, was also phased down. As mentioned elsewhere, the Technical Task Group, 7.1, was deactivated as of August 31, 1959. JTG 7.2, the Army housekeeping organization at Eniwetok, as previously mentioned, was continually reduced in size and finally moved from Eniwetok to Arlington Hall Station on January 17, 1960. Task Group 7.5, the AEC Task Group was deactivated, but retained a fair fraction of their personnel within AEC Field Offices, at ALOO, or in Nevada.

The previously mentioned study by Chief AFSWP, JTF-7 Commander, and Starbird recommended that JTF-7 become a subordinate command of DASA. That action became effective November 27, 1959, with the previous JTF-7 Chief of Staff, Brigadier General George T. Duncan, taking over command from General Anderson. On August 20, 1959, Duncan had indicated to the Department of the Army that there would be no requirement for a general officer in the Task Force after FY 1960. Rear Admiral Parker, Chief DASA, on November 9, directed that a plan be developed to transfer the Nevada Test Site support functions of DASA to JTF-7, and that JTF-7 establish an Albuquerque office to carry out that work.

By the end of 1959 a major portion of the organizations for conducting overseas tests had disappeared. Eniwetok Proving Ground had been put in a caretaker status, the plans for an open sea operation had come and gone, and virtually the only active planning for a real operation was the DASA planning for Operation Willow, to be conducted in 1961.

High-Altitude Test Detection, Mid-1959 Through Early 1960

As previously related,* the Conference of Experts had recognized their lack of knowledge concerning the detection of high-altitude detonations and the need for a later conference on the subject. Efforts ** were made in early 1959 to prepare for such a meeting, including the appointment by PSAC of an Ad Hoc group on High Altitude Detection, chaired by Dr. Wolfgang Panofsky.

The Commission began considering the high-altitude detection question in earnest at a May 29, 1959, meeting, at which they were briefed by Dr. Richard Latter of Rand.

The reasons for conducting high altitude nuclear tests, Latter said, are as follows: (1) to obtain further information on the scientific and military applications of nuclear weapons; (2) to carry out tests, other than underground, which would not result in radioactive fallout; (3) to continue testing in the event there is agreement to limit testing at altitudes below 100,000 km, thereby avoiding radioactive fallout; and (4) to determine the capability to carry out and detect clandestine nuclear tests above 100,000 km altitude in the event of agreement to cease all nuclear weapons tests. He summarized the Panofsky Panel's conclusions as being that nuclear testing is feasible at altitudes up to 300 million kilometers, that it is feasible to establish a system of satellites for detection Ex.(b)(1) Ex.(b)(1) In response to expression of doubt about a fully guaranteed high-altitude detection capability, Latter said that he could not detail such a system at the time, but felt that an adequate system could be established by 1963. Through this briefing, and one a few days later which included some new information from the Panofsky Panel, the commissioners concluded that high-altitude test detection was more feasible than underground test detection and also reached a consensus that the results of the panel's studies and reports should be made public.

Khrushchev expressed a willingness to join in technical discussions on the high-altitude detection problems as proposed by the U.S. and U.K. Thus, a meeting of experts from the three countries convened on June 22 in Geneva, concluding their talks with a final report on July 10, 1959. This group, known as Technical Working Group I, made the following general recommendations: that five to six earth satellites be emplaced at altitudes greater than 30,000 kilometers for detection of neutrons, prompt gamma rays, delayed gamma rays, and soft x-rays, or, if technical or economic reasons required, this system be deployed at low altitudes; that a satellite be placed in the appropriate elliptical earth orbit to cover the magnetic field regions of electron trapping; that, if thought necessary, a system of four solar satellites be emplaced to increase coverage of the regions behind the moon and the

*In a May 14, 1959, letter (*Department of State Bulletin*).

**An early example was an April 19, 1959, report written at LASL by Don Westervelt, in draft form, on an atmospheric fluorescence system. Major Robert Fisher of AFTAC had requested that this report be submitted immediately, even though it was only partially complete, based on an urgent request from Hans Bethe that it is needed in Geneva. Thus, three copies of the hurriedly finalized draft were sent to Geneva to Spurgeon Keeny, Bethe, and Panofsky.

sun; and last, "that ground control posts be equipped with instruments for observing direct visible light, for observing fluorescence in the upper atmosphere, for measuring the absorption of cosmic radio noise in the ionosphere, and for measuring radio signals."

During the summer of 1959, the DOD had agreed to accept overall responsibility for high-altitude detection, but there was uncertainty as to who would oversee the work until the primary role was given to ARPA on September 2. Until this decision was final, between about April and September, the lack of definite responsiblity caused some problem, although it is clear that AFTAC was playing the major DOD technical role at this time.

On July 22 Starbird requested that the LASL and Sandia directors produce a concrete statement of the work that had to begin without delay, for forwarding to AFTAC. AFTAC needed the details to formulate the final program in order to ask for approval and funding from the DOD. Since AFTAC felt that this funding might be a long time in coming, DMA asked for emergency funding for its portion.

The U.S. satellite borne detection efforts, which were based on the work already being overseen by the Buzzer Committee, were to become known as Vela Hotel. The techniques of surface-based detection of high-altitude explosions, such as the observation of nuclear explosion-induced atmospheric fluorescence being worked on at LASL, became part of Vela Sierra.

During the summer, some of the detectors and logic systems being developed at LASL and Sandia for satellite packages were tested. A neutron detector, an electron magnetic spectrometer, and a proton counter telescope were flown on small rockets as the beginning of experimental work on such systems. Doyle Northrup (AFTAC), on September 3, 1959, forwarded to Bradbury a background program document entitled "Proposed Program of Research on Detection of Nuclear Explosions at High Altitude in the Atmosphere and in Space." The document discussed Technical Working Group I recommendations of July 10, 1959, to the Geneva Conference, and addressed the feasibility of various methods of detecting high-altitude explosions using ground stations and satellites. Northrup stated that AFTAC had the overall technical project management whereas ARPA would be responsible for overall supervision and funding. AFTAC intended to request the assistance of consultants in various disciplinary fields, and proposed the establishment of an advisory panel to DDR&E. The proposed panel would have Panofsky as the chairman and Dick Latter as the acting chairman, with Bethe, Bing, Donovan, Goldberger, Longmire, Molnar, Peterson (SRI), Pickering (JPL), Taschek, and Watson (LRL) as members. Part of the program was to be a set of nuclear tests to check the detection system's capability. The tests would include a repeat of the last Argus test and a number of other tests, with and without x-ray shields, between 100 thousand and 300 million kilometers altitude.

The AEC laboratories were asked late in the summer to provide information on their theoretical work to the DOD, who also had the Army Ballistic Missile Agency (ABMA) and the Space Technology Laboratory (STL) on contract to ARPA to provide information to the Department of State for the Geneva negotiators. The Geneva negotiators requested that ARPA study and evaluate detection systems for explosions of one kiloton or larger yield, at altitudes above 30-50 kilometers, using either surface or satellite means. ARPA was to provide a report to Geneva by October 7, 1959, and to update the report within 6 months.

In early fall 1959, after being assigned overall responsibility, ARPA issued Order No. 102-60 directing Air Force Ballistic Missile Division (AFBMD) to investigate a system of ground stations and satellites for detecting nuclear detonations at altitudes above 50 kilometers. By Amendment 1 to the same order ARPA directed BMD to produce a development plan for the R&D program leading to a detailed definition of such a satellite system. This plan was to be developed by a joint working group

including AEC, NASA, and ARDC. The group's report was published in rough draft in March of 1960 by the Vela Joint Working Group, chaired by Colonel Harry Evans of AFBMD. The report, entitled "Project Vela Hotel, ARPA Order No. 102-60" discussed all aspects of the proposed satellite systems (using a large part of the Buzzer Committee's October 1959 report, entitled "Capability Report for a Satellite System for Nuclear Burst Surveillance"), as well as associated communications, launch vehicle development, possible use of various rocket probes for instrumentation development, and extensive estimates of cost. Sixty-three million dollars would be required between FY 1961 and 1964, 36 million for launch vehicles and 20 million for satellite payloads.

In October, at Starbird's request, both LASL and Sandia estimated the FY 1960 funding and manpower required to support Vela Hotel. LASL required additional funding of something less than $1 million, and Sandia estimated $2.7 million, more than half of which was for hardware procurement. On October 29, Glen Fowler of Sandia updated the Sandia cost estimate to a significantly lower number for FY 1960. Livermore, seldom mentioned in high-altitude detection, responded with an estimate for a small effort of $200,000.

On October 29 Taschek gave Don Shuster LASL's rocket support requirements. LASL required, between January and July of 1960, about 10 small rockets having a 100-mile altitude capability, and about 10 carriers with a 300 mile altitude capability as soon as Sandia could make them available. For higher-altitude applications, LASL and Sandia would jointly request carriers from AFTAC.

On November 23 Starbird gave LASL a go-ahead for their program, but authorized Sandia to proceed only with general research, not to include any hardware purchases.

On February 19, 1960, Hertford summarized the LASL and Sandia requirements for Vela Hotel for the next several fiscal years. Sandia intended to utilize 10 Nike-Cajun rockets for instrumentation flights thnrough the rest of FY 1960. Journeyman B rockets for instrumentation flights needed by LASL and Sandia were to be provided by AFSWC. Other instrumentation packages were planned to be carried piggyback on NASA satellite flights. Finally, emplacement of four Vela Hotel satellites was planned, with the first pre-prototype package of a nine-satellite build to be launched in 18 to 24 months.

Deep Space and High-Altitude Nuclear Testing, Spring 1959 Through Early 1960

April 1959 hearings on the Argus explosions by the House Committee on Science and Astronautics and the subsequent publication of the unclassified part of these discussions in June served to increase awareness of the possible future use of space for nuclear test detonations. Public reaction to the problem of atmospheric fallout from low altitude testing was one of the factors that had led to the test moratorium, so there was need to consider the possibility of deep space nuclear weapon testing as an alternative or supplement to underground testing. There was need to consider the methods by which the enemy might cheat on a CTB by testing in outer space. There was need for the DOD to understand the effects on communications, radar operation, etc. of nuclear detonations at high altitudes. These needs led to growing attention to this testing environment in the spring of 1959. As mentioned elsewhere, planning for the DOD high-altitude effects series Willow had been going on for many months, but only in early May did the Commission (AEC) begin addressing the possibility of satisfying some of their own requirements by testing in the upper atmosphere or in deep space.

In May, Starbird requested that the Laboratories send him information on possible high-altitude testing, detection, and evasion methods, in preparation for the

upcoming Technical Working Group I meeting. He especially desired a Livermore report on possible shielding of high-altitude nuclear detonations. Molnar (Sandia) responded in late May with details of how nuclear devices and rocketborne experimentation could be utilized to test in outer space, with particular attention being given to those details that Molnar felt should not be discussed with the Russians at the upcoming High-Altitude Detection Technical Working Group. He forwarded two studies on high-altitude testing possibilities, addressing methods of positioning and instrumenting such tests, the basic measurements that would be sought, and how they would be obtained, and discussing safety problems, both with the missile and the warhead, and how these problems might be solved.

The Commission was briefed July 17 by General Starbird on the various preliminary high-altitude test summaries and proposals. Their reaction was to regard the information as extremely sensitive, and to suggest that the reports ought to be closely held.

The DOD, through Loper, suggested to the AEC that Willow be made a joint AEC-DOD program, but in the summer of 1959 there was neither a strong desire by DASA to have the Laboratories' programs fully included in Willow, nor an eagerness by the AEC technical people to include their requirements in this DOD series of tests.

DASA planning for the high-altitude portion of Willow, as updated to the DDR&E on August 3, was to carry the appropriate warhead aloft on a Jupiter missile launched from Johnston Island. The missile would also carry two to four "pods" to be deployed for close-in measurements. Companion rockets would be utilized for additional measurements. A review of the Willow plan by DDR&E resulted in a decision in August to conduct Willow no earlier than March 1961, and the JCS was given the figure of two million dollars to fund the FY 1960 effort rather than six million as originally recommended by AFSWC. AFSWC was to be in charge of the rocket launch and pod programs, as well as small rocket programs for other DOD Laboratories.

The Airforce Ballistic Missile Division, on their own initiative, published, on September 1, a proposed program for Outer Space Weapons Testing. Their report began by noting the Air Force "realization that the U.S.S.R. has such a capability and may well be in a position to exploit it." A carrier system was proposed to lift a 1,000-pound payload containing the device, measurement sensors, and equipment to transmit the data back to earth. The time to have a new test capability was estimated to be greater than 24 months. The Eastern Test Range and Johnston Island were considered possible launch sites for the program, estimated to cost around $30 million.

The first detailed proposal from the AEC Laboratories on a deep space test capability came from Edward Teller to Starbird on September 30, 1959. Teller encouraged development of that capability and proposed use of a three-stage Atlas booster launched from either Eniwetok-Bikini or Christmas Island. Johnston Island, he felt, should not be considered because it was already overcrowded. Livermore estimated that this development would take about 18 months (through the first calibration shot) and cost about $50 million. Later shots would cost $10-15 million each. Teller stated that either LASL or Livermore should be assigned responsibility for the experiment, but that Livermore could not undertake the job without an increase in staff and, thus, he preferred that LASL undertake the job. McCone notified Starbird on October 18 that he was impressed with Teller's proposal.

The earliest mention of the Thor as a device carrier is in an October 27 AFSWC proposal for inclusion of Argus type experiments in Operation Willow. AFSWC recommended that three tests be carried to altitudes of 100 to 400 kilometers (from Johnston Island) by the Thor (which would carry instrumentation pods), with additional diagnostic equipment to be carried by Javelin rockets.

Discussion of these various proposals had progressed sufficiently by late 1959 that the Chief of DASA, Admiral Parker, sought General Starbird's concurrence that

DASA fund preliminary planning for development of an outer space testing capability. Starbird forwarded the DASA proposal for joint consideration of outer space testing to ALOO and the weapons laboratories on January 19, 1960. Noting the similarity between the AFBMD and the Teller proposals, Starbird asked for opinions about a reciprocal program with the DOD whereby the AEC would provide the warhead and some diagnostic packages for the two highest-altitude Willow tests, while at the same time encouraging the DOD to proceed with planning and engineering studies outlined in the AFBMD proposal. Starbird noted that "except for organizational concept and assignment of responsibilities," the DOD outer space program would accomplish the purpose of the Livermore proposal. That particular exception was one that was extremely important to the addressees. Gerry Johnson of Livermore replied, on January 26, that there was a clear difference between the objectives of Willow (high-altitude effects) and outer space testing (to develop an AEC lab capability in that regime). Furthermore, Livermore specifically disagreed with Starbird's proposed division of responsibility, feeling that the development of any testing capability was the responsibility of the AEC, and military participation would appropriately be only supportive. Bradbury, although somewhat milder, was also pessimistic about the organizational format and responsibilities. He also felt that the AEC must retain control. The Sandia reply, on January 27 was even stronger in guarding the AEC's rightful responsibilities on Willow and outer space testing. Sandia felt that DASA should be notified that the AEC would provide a package containing warheads and associated arming, firing, and diagnostics systems for joint AEC-DOD Willow tests for both weapons effects and diagnostic purposes. Furthermore, for the outer space test capability, DOD might provide and control the launch vehicle and perform certain other functions such as site selection and preparation, but the AEC should have overall test direction to ensure that the scientific objectives of these tests were met.

After receiving these replies, Starbird informed Hertford, with information copies to the Laboratories, on February 3, 1960, of his response to DASA. He indicated that the AEC agreed to provide the warheads and diagnostic packages for the Willow shots. Starbird felt the organizational responsibilities could be worked out later, following approval of the tests. As for the outer space testing proposal, Starbird recommended that DOD proceed along the line of the AFBMD study. The Laboratories were to proceed with engineering and developmental planning for an AEC package which would contain the warhead, arming, fusing, firing, safing, diagnostic equipment, and related telemetry for a full-scale nuclear test.

Based on Starbird's agreement DASA released funds to ARDC for further study of their outer space testing proposal, in coordination with the AEC. The technical working group that was formed to study this was chaired by Air Force Ballistic Missile Division (AFBMD, under ARDC) and had representatives from AFSWC, Livermore, LASL, and Sandia. At their first meeting on February 19, 1960, at AFBMD the group agreed to develop a detailed plan on a testing capability for some appropriate distance outside the earth's influence. Following approval by both AEC and the Air Force, the plan would be delivered to DASA by July 28, 1960. This system was given the acronym ASWT, for Advanced System for Weapons Test. Early discussions indicated that while it would cost an additional $30,000,000 to launch from Johnston Island instead of the present facilities at Cape Canaveral, it would also solve a number of operational and safety problems.

In January 1960, DASA canceled Redstone flights planned for later that year to test the missile with the instrumentation pods, indicating that such tests were an unwise investment in the Willow low-altitude program. Virtually all of the Willow activity and active planning and preparation were discontinued by DASA February 26, although Task Group 7.3 (Navy Task Group) supported a series of tests off the Florida coast in February and March of 1960 to evaluate various methods of locating and

recovering pods ejected from missiles on high-altitude tests.

Thus, after all the studying and coordinating of proposals, a couple of months into 1960 the only firm high-altitude program (Willow) was completely inactive, but the AEC and DOD had started to coordinate planning and development of an outer space test capability.

Underground Detection, 1959

On April 23, 1959, Chairman McCone met with Killian, Quarles, and Starbird and agreed that the AEC would be primarily responsible for following the Berkner Panel recommendation to undertake an experimental test program to determine the parameters of detection and concealment of underground nuclear detonations, and to determine the feasibility, practicability, costs, and timing of underground tests necessary to investigate these parameters. The AEC and the DOD would try to establish the test requirements jointly.

Livermore and Rand, working with AFTAC and Sandia, promptly set about to carry out these aims under the guidance of such people as Carl Romney of AFTAC, Glen Werth and Harold Brown of Livermore, and Al Latter of Rand. In May of 1959, there was pressure on Livermore to produce results quickly, especially on the Latter-hole concept. But Harold Brown, in an exchange with Starbird, made the strong point that it would be better to take a year and get the correct results than to produce erroneous results in a short time, even though results were needed for the upcoming meeting of Technical Working Group II at Geneva.

In late June, an interagency "Scientific Panel to Evaluate the Overall Adequacy of Test Detection Systems" was set up, and as part of that, the Ad Hoc Group on Seismology, with Dr. Frank Press as Chairman, was formed by the Director of Defense Research and Engineering. The Commission, at Starbird's suggestion, made Harold Brown the AEC representative, with Spofford English and Starbird as observers.

The feeling that data had to be produced to assist in the test ban negotiations grew stronger and stronger in mid-1959. This desire for data grew out of two opposing viewpoints. Those who felt very strongly that continued testing was to the benefit of the United States wanted such measurements and calculations in order to show that detection and identification systems would really not be effective against a determined cheater. Those who felt a treaty, a cessation of all testing, would be to the benefit of the United States also felt that such measurements and calculations helped develop confidence that the U.S. would not be trapped by allowing the Soviets to gain information from clandestine testing, which they could do, whereas we, on the other hand, would not advance any further because, in our open society, it was clear that we could not, and would not, conduct tests clandestinely.

There was, of course, a third set of people who wanted the cessation of testing, believed the Russians would not cheat, and thought that the whole business of requiring on-site inspections and detection stations within the Soviet Union was a lot of folderol. However, their voice was not loud in Washington. Obviously, persons of this third category did not believe that either further experimental or theoretical investigations were necessary. However, since that happened to be the Russian line at the moment, it was not popular in American circles.

The general line of attack seemed to be to produce data and theory to convince the Soviets that the problem of detection was difficult and that cheating was possible. This line was apparently supposed to convince them that they should accept our proposals for on-site inspection and international detection systems, or at least that they should join us in designing satisfactory systems of that type. In essence, we seemed to be saying that "We know we won't cheat, but we know you will if given

the chance, so why don't you woo us into a complete test ban treaty by allowing us to design and install methods to prevent any cheating that we can imagine. And furthermore, we would like you to help us pay for this."

As had been remarked by the Berkner Panel, the overall problem of underground detection involved an understanding of the response of the earth to nuclear detonations and earthquakes; improved seismological techniques for investigating these phenomena; and an understanding of the effects of geology, depth of burial, etc., on coupling of nuclear detonation energy to the earth, as manifested by the appearance of that energy at teleseismic distances. It was of great importance to distinguish somehow the signal of a nuclear explosion from that of an earthquake. To offer significant improvements in the detection and identification system, it was necessary to learn, by theory and experience, a great deal more about the signals from nuclear detonations.

The Latter "big hole" theory prediction of decoupling factors as high as 300 was addressed by means of two programs, one high-explosive and one nuclear. The high-explosive program, Project Cowboy, consisted of several shots fired in hollow cavities in salt. In particular, 1,000 pounds of high explosive was fired in the center of a 30-foot diameter spherical cavity and the seismic signal from that compared with the signal from the detonation of a 1,000-pound high explosive closely tamped in salt. The seismic signal (at several frequencies) was observed at distances as great as 44,000 feet. Between December 1959 and mid-March 1960 these experiments showed that the decoupling theory was approximately correct for high explosive. Amongst our own experts there was not agreement that high-explosive experiments could prove that the Latter decoupling theory applied to nuclear detonations.

The second part of the cavity decoupling program, nuclear decoupling, was the subject of Commission discussion in late July. As a result Starbird notified the Laboratories and AFTAC on July 24, 1959,* that Chairman McCone wanted to accelerate studies and actions to stage those underground nuclear shots necessary to confirm or refute the Latter decoupling theory. On August 3, 1959, at a Washington meeting called by Starbird, attended by Northrup and Romney of AFTAC, Al Latter of Rand, Carson Mark of LASL, and others, an attempt was made to further planning for the decoupled and associated closely tamped nuclear events. After arguments in which Livermore suggested 200 tons yield, and AFTAC 5 kilotons, agreement was reached to attempt a 1.7 kiloton detonation in salt. If it turned out to be impractical to build a cavity for that yield the 200 ton yield would be the fallback position. The decoupled shot could presumably be conducted by March of 1960.

Early on, it was recognized that the coupling of the energy of an underground nuclear detonation to the earth would be dependent upon the medium in which the shot was fired (alluvium, tuff, granite, salt, etc.).** In order to investigate this phenomenon and the question of nuclear vs. high explosive coupling, Project Concerto was initiated. By early August 1959, the engineering was well along for that project, to be conducted at the Nevada Test Site. Project Concerto involved some seven closely tamped shots, of which six were to be nuclear. Specifically there were to be three 5-kt nuclear shots (Orchid at 2- to 3,000-foot depth in tuff, Porpoise at 10,000-foot depth in tuff, and Dinosaur at an unspecified depth, but off site); two shots to compare nuclear vs. high explosive at 1 kt (Cottontail, high explosive in

*A handwritten comment on the LASL copy of this message is "How come the Chairman will let this test be planned, but Starbird says 'nothing doing on one-points'?" Surely getting ready for a decoupling shot will be "obvious" and arouse comment.

Ex.(b)(1)

tuff, and Crystal, nuclear in tuff); and two other shots to look at the effects of yield (Coffee Pot, 1/4 kt nuclear in tuff, and Stingray, 50 kt nuclear in tuff). In mid-September, Harold Brown (Livermore) requested authority to proceed with construction for the high-explosive Cottontail event to achieve a February 15, 1960, ready date for the shot. Of the whole Concerto program, this was the only shot he felt could be conducted without serious political restrictions. Starbird again stressed the need to avoid any leak or speculation that the large hole experimentation was indicative of AEC planning for any nuclear tests, even though discussions had been going on with the Russians for some time aimed at getting them to join these experimental efforts to improve the definition of the required worldwide seismic net. In early October, Gerry Johnson of Livermore again requested from Starbird authorization to proceed with the engineering and construction for Cottontail. However, Livermore had chosen a new site in a separate tunnel and now proposed a new readiness date of May 1, 1960, which would be consistent with the AFTAC readiness to observe teleseismic signals from Lollipop,* intended for April 1, 1960. On October 22 Starbird stated that, following ALOO review, the new Cottontail emplacement plan would be discussed with AFTAC. In November 1959, the Commission reviewed the Lollipop plans, wishing to be sure that any instrumentation proposed could be revealed to Soviet representatives if the test should be conducted under international sponsorship. There was worry that some of the proposed projects associated with this shot could not be defended solely on the basis of seismic detection studies of underground nuclear shots, but appeared to aim more toward the development of weapons testing techniques and nonmilitary uses of nuclear explosions, Ex.(b)(1) Ex.(b)(1)

On September 2, 1959, Project Vela came into existence officially with the assignment of the seismic, high-altitude, and surface detection programs to ARPA. The underground detection study program became known as Vela Uniform (Uniform for underground). However, the AEC continued to carry the responsibility for the nuclear underground detonations and for Cottontail.

By the end of 1959, a great deal of the effort at Livermore, Sandia, and the test section of ALOO had been transferred from weapons testing to the design and preparation of underground shots for seismic detection purposes. An appreciable part of the FY 1960 weapons funding had also been transferred to that purpose.

Plowshare, Late 1959

Livermore and the Commission, in particular Libby, continued to press hard for some arrangement that would make the Plowshare program feasible, either during the moratorium or under the framework of any treaty to be negotiated. There was a bit of schizophrenia at Livermore. On the one hand they were pressing hard for a provision that would allow underground testing, even though atmospheric testing was banned (a variation of this had been proposed at Geneva in April), and on the other hand they were also pointing out (Brown to Starbird, April 22) that being allowed to do the most obvious cratering shots was in conflict with the proposed requirement to test only underground - it's hard to make a crater and yet completely contain. Another problem that received serious attention was that of making an unclassified Plowshare test area, that is, an area available for inspection, so as to prove that it had nothing to do with weapons development.

*Separately planned by Livermore and AFTAC (in response to the Berkner Panel recommendations) as a 5-kt tamped nuclear shot in granite at the NTS.

During the summer of 1959, Livermore settled on a number of Plowshare proposals, of which the most significant were:

a. Gnome - planned as a 10-kt detonation in the Salado Salt Basin about 25 miles southeast of Carlsbad, New Mexico. The detonation would be some 1,200 feet below the surface. The primary purpose of the experiment was to investigate the use of such an explosion as a source of heat or energy to run an electric power plant (although no plant was to be associated with the detonation). Side issues were the investigation of the production of transplutonic radioisotopes and additional data on seismic coupling in salt.

b. Chariot - an excavation project to produce a harbor close to Cape Thompson, Alaska.

c. Oxcart - which was to be a couple of detonations at NTS to investigate excavation efficiency as a function of yield and depth to assist in the planning for Chariot.

d. Ditchdigger - was to be the test of a Ex.(b)(3) clean explosive device which would enhance the feasibility of such projects as the proposed sea level Panama Canal.

e. Oilsands - an experiment to study the feasibility of oil recovery by means of a nuclear explosion in the Athabascan tar sands of Canada.

f. Oil Shale - which would use a nuclear explosion to shatter an oil shale formation, followed by an attempt to retort in place.

By September of 1959 Livermore had presented the first four of these to DMA as specific project proposals; however, Plowshare could clearly not proceed without some clarification on the test moratorium question. There was strong fear that the budget would be reduced by Congress unless the promise could be made that some projects could really be carried out. The Commission and General Manager were faced with funding limitations and the requirements of the readiness and underground detection programs, so that they, too, were questioning the proposed Plowshare funding. In early September, Starbird requested that his staff (Kelly and Keto) proceed with those steps necessary to activate "the Plowshare Advisory Committee," with the aim of a first meeting in October. It was his feeling, later concurred in by Teller, that the recommendations of a properly formed high-level committee on the subject would bear more weight with those judging the program than the recommendations of specific concerned individuals. Starbird considered (September 1959) the Gnome shot to be somewhat questionable technically and wrote "Three million dollars may not appear much money in a weapons program, but in a congressional investigation, particularly in an election year, it could loom mighty big as an agency waste." He felt that the joint AEC and Bureau of Mines Oil Shale shot might be the white hope to keep the program going. He was somewhat unhappy about Oxcart because it had no public appeal in demonstrating, visibly, new uses, since it was at NTS and would be regarded with suspicion as a weapons test. He felt that Ditchdigger was important to the long range future of Plowshare, but also felt that some treaty would have to be agreed to before an approved effort could be achieved. He specifically felt that Chariot had the greatest long range potential. All of this he intended laying before the to-be-formed Plowshare Advisory Committee.

In January of 1959, Wadsworth, in Geneva, in an attempt to get a "Plowshare Exception" to the proposed CTB Treaty, had tabled a "Black Box" proposal suggesting that devices to be used for peaceful purposes should be placed in a repository on or before the date the treaty was signed and kept under continual surveillance until used. These devices would not be subject to internal inspection, but if any other devices were to be used for peaceful purposes, they would be subject to internal inspection. The Soviet Union initially rejected the concept of a "Plowshare Exception," but later agreed that some explosions could be conducted if the other side were given the right to inspect the internal structure of the devices used. They also demanded parity between the two sides on the number of nuclear explosions. At home there was a great deal of discussion on what devices might be placed in such a stockpile. By mid-September of 1959, "what if" detailed discussions were going on on the possibility of using versions of the Mark VII for this purpose. LASL expressed confidence that various yield versions would be quite reliable, even in the low-yield range, without further test. However, at the same time, Starbird and Luedecke, recognizing "it was difficult to make a budget recommendation on this matter because of the status of the Geneva Conference and its effect on the expenditure of FY 1960 funds available," nevertheless recommended eight million dollars for the FY 1961 Plowshare budget to permit flexibility in the event the program should go ahead.

Laboratory Weapons Programs, 1959

During this time, the Laboratories were reconsidering in more detail their weapons test requirements and the question of how much device design work could be done under the moratorium. At the previously mentioned meeting on May 7, 1959, between members of the Department of Defense, representatives of the weapons laboratories, and DMA, there was discussion of programs for which testing was desirable. Specific development programs listed were a 600 pound maximum yield warhead for Minuteman and Polaris; a 3,000 pound maximum yield warhead for Atlas and Titan; a 300 pound, Ex.(b)(3) warhead for Pershing; and a 1,600 pound warhead of maximum yield for possible future ICBM use.

Of perhaps more interest than the specific programs were the concepts presented at that meeting which might be developed or investigated through further testing. Ex.(b)(3) [redacted] Further improvements in the safety against nuclear contribution to the yield of accidental detonations seemed both possible and essential. Most controversial, however, was the introduction by Livermore of the concept of enhanced radiation warheads for specific kill effects, of which the most immediate possible development seemed to be enhanced neutron output devices. The conversation here on enhanced neutron output was to lead later to the newspaper concepts of the neutron bomb, which would kill people or other animals by neutron exposure, but would produce no heat or blast and, hence, would destroy no material. Ex.(b)(3) [redacted]

The proposed NTS underground program agreed upon at that same meeting followed some of these concepts. Ex.(b)(3) [redacted]

Ex.(b)(3)

[redacted]

By the fall of 1959, the realities of the situation began to impress themselves on the system. Washington did not agree to all of the construction requested by the Laboratories, and readiness for any large underground program was beginning to slide off into the more distant future. Furthermore, there had been time to look more carefully at what the problems really were. [redacted]

Ex.(b)(3)

[redacted]

Summary of 1959

Thus, by the end of 1959, the testing system had pretty well convinced itself that any future testing would either be underground or in deep space (above 50 kilometers). Both proving grounds had been degraded to some extent; Nevada in the sense that funding for desired readiness construction was not being made available, and Eniwetok as a conscious move to reduce to a 12 months readiness condition. Money for readiness had become very tight because of the possible need to carry out programs that might be allowed during the moratorium or by treaty terms; that is, Plowshare, investigations into the detection and identification of clandestine shots, and methods of evading detection systems. The testing organizations had been degraded, some not seriously but others very seriously. Eisenhower had concluded that it was a good gamble to continue the test ban discussions and the moratorium beyond the one year initially stated.

Geneva and Other International Developments, Early 1960

As discussed above, President Eisenhower had changed the U.S. test moratorium policy at the end of 1959, leaving us free to resume testing if we decided that to be the proper course and obligating us only to make a prior announcement if we resumed testing. Following Eisenhower's December 29 statement, Khrushchev declared, in a December 30 interview, that the Soviets, having already suspended all nuclear weapons tests, would not conduct any more unless the West did so. As a result of the U.S. position on the lack of enforceability of a comprehensive treaty, the U.S. brought to the conference table on February 11 a treaty proposal to ban all controllable and detectable nuclear tests. Specifically, it called for a ban on atmospheric, underwater, and high-altitude tests at altitudes for which effective controls could be agreed to, but limiting the underground test ban to a seismic magnitude of 4.75 or higher. The proposal also called for a joint program of seismic research and experimentation and proposed to systematically extend the underground test ban until adequate control measures could be agreed upon. Having rejected the U.S. treaty proposal in February 1960, the Russians made public a counterproposal on March 19. The essential changes proposed were that all sides agree to a moratorium on underground tests below 4.75 seismic magnitude beginning on the date of treaty signing, and that the joint research program not specifically allow for nuclear tests underground. The

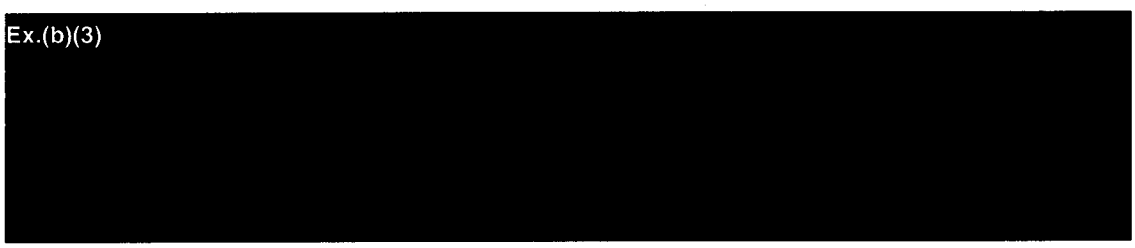
Western reply to this Soviet proposal resulted from a meeting of British Prime Minister Macmillan and President Eisenhower in late March. Their joint statement of March 29 offered to accept the Soviet proposal if the test moratorium were to have a fixed duration and if the joint research program were agreed to before signing, provided that the remaining treaty issues, including inspection, were resolved. Eisenhower also stated that such a moratorium on low-level tests would be a personal agreement and that he could not obligate his successor. The Geneva negotiators agreed that technical talks on the seismic research program would be held in May in parallel with the political negotiations. The Soviets made a further concession on May 3 that the program could include a "strictly limited number" of nuclear experiments, formerly not allowed by the Soviet proposals. Eisenhower took this opportunity to publicly announce the Vela program.

Thus, by May 1960, from the setback felt by some at the lack of progress made in Technical Working Group II, the events following the U.S. phased treaty proposal had increased the hope of the optimists that a real signed test ban treaty was in the offing. In Eisenhower's own words,*

> From the autumn of 1959 to the spring of 1960 most people of the Western world felt that a slight but discernible thaw was developing in the icy tensions which had become normal between the West and the Soviet Union. This impression resulted partially from Mr. Khrushchev's agreement at Camp David to remove his threat to end the presence of Allied forces in West Berlin. His action made it possible for the Western nations in December to agree to attend a summit meeting without sacrifice of self-respect and under no hint of blackmail. Plans for a spring meeting began with a place and date: Paris, in mid-May of 1960.

Curiously, many of the technical experts were convinced that an underground detection system might never be effective below the thresholds already discussed, even following extensive seismic research testing. Certainly, many felt that the seismic detection system would not be cost-effective based on the estimated enormous cost of installing and operating such a system. In addition, many doubted that an effective agreement on inspections could ever be reached. At any rate, public hopes that a test ban treaty might be signed were somewhat higher in May 1960 than they were at any other point during the moratorium.

Out of the mainstream of these negotiations, but of interest, were the initial discussions within the Commission on a threshold treaty on January 11, 1960. At this meeting, Spofford English, who had attended a meeting of the Principals on December 28, 1959, reported that the threshold treaty was being discussed and that George Kistiakowsky (who had replaced Killian as the President's Science Advisor) and James Fisk were assembling a group of seismologists to study the question of a threshold limitation and to define a workable yield figure based on seismic signal magnitude. The Commission discussed the meaning of seismic magnitude threshold in terms of yield and impact on AEC weapon development progress. DMA informed the Commission that seismic magnitude 4.75 was equivalent to a 19-kiloton coupled detonation and magnitude 5 was equivalent to about 43 kilotons.



*Eisenhower, *Waging Peace*, page 546.

It is of interest that later in the spring, at the Geneva discussions on the threshold treaty proposals, the Russians were equating a 4.75 seismic magnitude to about 5-kilotons, as stated by the 1958 Conference of Experts, rather than 20 kilotons as the U.S. was now estimating.

Reflecting the Administration's thinking while the threshold treaty was being tabled and discussed, Kistiakowsky wrote to Chairman McCone on February 24 that the President wished McCone and Secretary of Defense Gates to be informed that he considered a "vigorous and continuing research and development program on the detection of underground and high-altitude explosions to be a matter of high priority and that he hopes the DOD and AEC will find it possible to finance this program for FY 1961 within their existing budgets." (Perhaps this has a direct tie to the fact that Starbird was trying to get all of the increased readiness activities paid for out of FY 1960 funds, since he expected a problem with procuring FY 1961 funds because of the high priority to be given to Vela.)

Ex.(b)(1)

[redacted]

NTS Weapons Test Readiness, Early 1960

During early 1960 the discussion between Livermore and Starbird (DMA) on a Livermore readiness program continued, mainly concentrating on Polaris warhead problems and on a small two-stage, partly fusion device. An early plan is listed in Table VI.

On January 9, 1960, Starbird authorized the expenditure of $3.3 million for the construction necessary to meet the readiness dates shown in Table VI, all to be costed in FY 1960. Harold Brown estimated the scientific construction in the tunnels to meet this readiness as costing $625,000 and the long lead-time procurement, cables, etc., as $380,000, for a total of roughly $1,000,000 to come out of FY 1960 funds. The total FY 1960 test funds available were $4,500,000, of which, by this time, $2,600,000 had been committed for Cowboy and Lollipop. In mid-January, ALOO estimated that the scientific construction would be $2,600,000 as opposed to Brown's $625,000, and an extra 20% over this to meet the proposed readiness schedule. Thus, apparently, additional funds would have to be found to meet these readiness dates.

Teller had earlier recommended a change in the containment scaling law from $D=550W^{1/3}$ ft to $D=450W^{1/3}$ ft (where W is the yield in kilotons) which would obviously save money. Starbird agreed with this change on the basis of an assurance that there would be no significant escape of radioactivity. He emphasized that it was not sufficient to simply keep the radioactivity on site.

As noted before, LASL had had into ALOO a request for 1,200-foot holes for some time. However, the pressure on the AEC was not particularly high to accede to this

Ex.(b)(1)

TABLE VI
LIVERMORE READINESS PROGRAM, EARLY 1960

Ex.(b)(1)
Ex.(b)(3)

request since ALOO commented that the holes could be drilled within three months after word to go back to testing was received. It was LASL's opinion (Bradbury, December 1959) that it would take of the order of three months to get back to testing anyway after the word was given. LASL did have four 500-foot holes that could be used for safety shots or nuclear detonations up to a kiloton. At the end of December 1959 Bradbury had written to Starbird:

> We also propose to request that the AEC now accede to an early request of this laboratory, namely that of digging the 1,200-foot holes to contain shots up to 10 kt, (that you) proceed at such priority as you deem appropriate, and that we be informed of the date when two to four such holes will be available. ..
> Ex.(b)(3)
> .. Naturally, we would be more interested in experiments of full yield and perhaps you can assure us that the containment of such shots would not be unduly expensive or delayed in time. Furthermore, if we are correct in our assumption that testing in the atmosphere or in the gravitational field of the earth is too unlikely at this point to warrant any procurement or preparational effort, we would appreciate being so informed. Finally, for the purposes of this year's programmatic statement, we are ignoring the practical possibilities of testing in outer space.

Obviously, LASL was somewhat irritated at the continuing effort to establish some sort of readiness for Livermore without some such corresponding effort for LASL. Thus, in early February 1960, having authorized $3.3 million for the Livermore Succotash readiness program, Starbird authorized $700,000 for possible use by LASL. It was intended that this money be used to advance the LASL readiness to fire in the 500-foot holes already excavated at NTS. In his letter of transmittal to Kenner Hertford, Starbird said:

I wish to have you emphasize that this readiness preparation does not constitute any indication, real or implied, that a series will be carried out. It is rather an extension of our efforts aimed at a more advanced readiness state and (it) is desired that no, repeat no, publicity be given to this authorization for added work at NTS. If questions should arise necessitating an answer, it should be explained as merely a continuation of the work to retain site readiness.

So LASL began another internal go-around in early February, 1960. In general, while Bradbury usually acceded to Starbird's request for some specific list of what should be tested, the internal philosophy was more that "the world was a continually changing thing, our problems were different every week, and, therefore, our path should be to prepare within the funding allowed the most flexible response or capability." Using Bradbury's guideline that testing could not start sooner than three or four months after notification, LASL tried to develop a plan on the assumption that May 1, 1960, would be the earliest possible date of notification, making August 1, 1960 the first date at which testing might actually begin. An additional assumption was that all tests would have to be confined underground.

LASL considerations were in three main classes: future stockpile devices, experiments, and nonstockpile applications.

Future stockpile considerations at LASL included:

Ex.(b)(3)

Ex.(b)(3)

[redacted]

Ex.(b)(3)

[redacted]

Nonstockpile applications included:

- o Transuranic element production.

- o Project Orion - General Atomics had been funded for studies of a space nuclear propulsion system that involved throwing nuclear devices out the back end of a ship and detonating them. The resultant particles then hit an ablation plate at the back of the ship to establish propulsion. The characteristics of that ablation plate could be studied in underground tests and General Atomics (Ted Taylor) had sought cooperation from LASL on the subject. It also sought cooperation in building the appropriate devices. LASL was willing to talk, but in general took the attitude "bring money and then we will play."

This was quite a program to tackle with $700,000. H&N estimated that four 1,200-foot holes would take 148 days to construct at a cost of about $170,000 each. In addition, surface facilities and hoist installation would cost on the order of $3,000,000 and would take on the order of nine months procurement and construction. In an attempt to solve the problem, LASL compromised. A plan, transmitted from

Hertford to Starbird on February 25, included a proposal to deepen one of the existing 500 foot holes to 800 feet, and to start drilling two holes to 1,200 feet, with the actual depths to be determined by the constraints of funding. The holes would be drilled within the fiscal year. The plan included ordering two hoists suitable for 1,800-foot depths, and other long lead time items necessary for the surface facilities. On March 9, Starbird approved a variation of this plan as follows: deepen one existing 500 foot hole to 800 feet; knock out the plug at the bottom of a second 500 foot hole and deepen it to 525 feet; start drilling two new holes toward 800 and 1200 feet respectively, and continue as far as time and money permit before the end of the fiscal year; purchase a 35-ton-capacity winch and provide some other long lead time items, all at costs not more than $700,000. By March 10, ALOO, H&N, and REECo were moving rapidly on this plan with orders going out for cabling, racks, hoists, etc. Invitations for drilling bids were to go out on April 6 with the bids due during April and notice to proceed to come on the 29th of April. Projected completion times were then June 3 for the 525-foot hole, June 3 for the first 800-foot hole, June 6 for the second 800-foot hole, and June 30 for the 1,200-foot hole. The job was expected to require three drill rigs of the proper size and capacity.

The system moved with appropriate speed so that the bids for drilling new holes were opened on April 26, 1960.

In preparation for a visit by Chairman McCone to the Laboratories in early May of 1960, both Laboratories prepared statements on their opinions of the situation if testing were to stop permanently, if only underground testing were permitted, or simply if the present situation should go on for some time. In the course of this, Bradbury commented in early March:

> It is my opinion that the probability of nuclear testing in 1960 is so low that the course of the Laboratory should be along the lines "We aren't going to test in 1960; therefore we will start acting as if we weren't and planning for the long range as if we weren't, and keep testing and devices for test very much on the back burner." Then if this assumption turns out at any moment to be wrong, and we are told we can resume testing--well, we fall out and fall in again pointing (and going) in the new direction as fast as possible. Admittedly, on this basis we would not test as soon as we might otherwise after a Presidential directive to resume testing, but we would have a lot more sensible program in the meantime, a lot of people would be driven less rapidly to schizophrenia, and the actual difference in time might not be more than 30 days!

He also commented that it would be difficult to go back to weapons testing because most of the LASL test people had been committed to Rover.

Teller, just slightly earlier (February 2) on the same subject, had commented for Livermore:

> Some very important types of weapons involving really new ideas cannot be developed at all if no nuclear tests are allowed. However, the Lab considers its function to be the most rapid development of nuclear weapons under whatever circumstances may be dictated by national policy.

He reasserted his belief that testing in the near future could only be underground and that the diagnostics would be adequate. He added:

> During the next few years, if such testing resumes, underground sites for testing in the 100 to 200 kiloton range can be constructed and used.

On February 25, 1960, he commented to Starbird that he had five devices just about ready for entry into the stockpile without testing and six more devices being developed. Of these 11, 10 could be ready for testing by September if the go-ahead was

given for development and preparation of a tunnel.

LASL continued to attempt to catch up with Livermore on underground sampling. Over the early months of 1960, LASL conducted several small high-explosive shots to investigate some of the problems of sampling through pipes into the zero point.

EPG Status, 1960

Joint Task Force

While NTS continued in a state of moderate health because of the funding available for test readiness and the increasing funding for seismic detection experiments and Plowshare, the system concerned with testing at the Eniwetok Proving Ground continued to go downhill. JTF-7 had become a subordinate command of DASA on November 27, 1959, and in order to retain some communication with the rest of the testing community established an Albuquerque office on January 15, 1960, at Sandia Base. Some of the problems associated with putting the Joint Task Force under DASA show up in a memo from Parker, Chief of DASA, to Duncan, Commander, JTF-7:

> All matters concerning proposed changes to program expenditures and all matters which may detract from your ability to accomplish the JTF-7 mission will be coordinated with this Headquarters.

However, he added:

> You and your staff are authorized the freedom of action necessary in conducting routine day-to-day work in coordination with elements of the military departments and other governmental agencies to accomplish your mission and assure a smooth transition of JTF-7 from a nontesting to a testing period.

And:

> The fact is well recognized in Headquarters, DASA, that JTF-7 may or may not remain under my operational control during the buildup and operational phases of a test period.

With a headquarters complement of 37 officers and 35 enlisted men, JTF-7, during January and February 1960, prepared operations and administrative plans for three types of possible atmospheric operations as follows: high-altitude tests at J.I., open seas tests south of Hawaii, and full-scale tests at Eniwetok Proving Ground.

Operation Switch (the mothballing of EPG to achieve a 12 months readiness status) was essentially complete in late January. JTF-7 rad-safe equipment to the tune of $88,757.42 was transferred to AEC Albuquerque with an understanding that the AEC would be responsible for future procurement of rad-safe equipment as required by JTF-7 in the event of another operation.

In late January James Douglas, Deputy Secretary of Defense, requested that the Chairman of the JCS, DDR&E, and the Military Liaison Committee review their current studies and experimental programs on nuclear weapons effects in light of the guidance:

> If realization of useful results depends fully on actual tests, underwater or in the atmosphere, these tests should be suspended. If realization of useful results depends on outer space or underground testing, they should be continued for the present in the planning or preparatory stages with attention given to design and testing of instrumentation. If useful data can be obtained by theoretical computational or simulation methods or by low-order detonations, as defined by the AEC, increased emphasis should be placed on these approaches.

On February 12, 1960, General Duncan recommended to Loper:

> In view of the extremely high cost of maintaining the Eniwetok Proving Ground on a 12-month maintenance standby status, the uncertain future of nuclear testing within the atmosphere and increasing interest in this area shown by other agencies, it is recommended that the requirement for maintaining the EPG at a 12-month basis standby status for nuclear testing be reevaluated at this time.

As a result of these reconsiderations, Admiral Parker (DASA), General Starbird (DMA), and General Duncan (Commander, JTF-7) requested by joint memorandum in mid-March 1960 that Colonel William J. Penley, DASA Army Representative and Chairman of the group; Captain Charles E. Houston, DMA Representative; and Colonel Lawrence M. Watson, JTF Representative, reappraise the requirements for the Eniwetok Proving Ground as well as the readiness status and functions of JTF-7. The Study Group's Report was sent out 12 days later (obviously not reflecting complete coordination with all concerned). It stated that:

a. Pacific Range, Air Material Command, Tactical Air Command, and Strategic Air Command have all indicated an interest in using all or part of the Eniwetok Proving Ground facilities on a continuing basis for an indefinite period of time.

b. It is politically necessary that there not be complete U.S. withdrawal from the Eniwetok Proving Ground or complete dissolution of the U.S. Nuclear Test Organization.

c. Douglas's memorandum is interpreted as guidance that will continue at least through FY 1961 and states that the 12-month capability to test at Eniwetok Proving Ground no longer needs to be maintained.

d. If testing is resumed, it will probably be underground or in outer space.

e. The Atomic Energy Commission plans to reduce the contractor personnel at the Eniwetok Proving Ground to 300 people from 450 by July 1, 1960, and operate at a total annual cost of about $5,000,000 (as opposed to $8.6 million) without significant change to the state of readiness through FY 1961.

f. There are increasing DOD requirements for effects information which can best be obtained by high-yield shots in the atmosphere or underwater. Testing of high-yield production weapons before stockpile was a requirement which can best be fulfilled by testing in the atmosphere at the EPG.

g. The best place to launch vehicles for outer space nuclear testing . . . would be Johnston Island or EPG.

The group concluded that the Eniwetok Proving Grounds should be reduced to a caretaker status and that JTF-7 Headquarters should be phased down to a planning staff of approximately 36 simultaneously with the phasedown of the EPG. This alternative was judged to have the least effect on present disarmament negotiations and on international, domestic, and psychological factors.

On March 17, 1960, General Duncan, in what was apparently his parting advice to Admiral Parker of DASA, again urged that the 12-month readiness of the EPG be abandoned and went on to suggest that the Eniwetok Proving Ground should be released from even the caretaker status for future testing, which would relieve JTF-7 of any support responsibilities for those facilities. He recommended the continuing phasing down over the next 15 months of the Task Force to the status of a planning staff of DASA, in which circumstance they should be located at Sandia. Strangely, he also suggested that JTF-7 be given the responsibility for providing support for the Nevada Test Site, which was somewhat inconsistent with JTF-7 being nothing but a planning staff. The JTF-7 staff at about the same time made a number of fascinating

suggestions with respect to future operations. Among them were: DASA and the Atomic Energy Commission "must" be required to keep JTF-7 fully informed as to what projects and events are being considered as they develop; the Eniwetok Proving Ground Planning Board should be chaired by the Commander of JTF-7; the use of Bikini should be discontinued and any very large shots should be done using the open sea concept; vehicular requirements should be cut drastically; reduce shipments of needless or plush personnel or equipment to the Eniwetok Proving Ground; do not rotate personnel at Eniwetok Proving Ground during an operation. (The author would have disagreed with every one of these recommendations.)

General Duncan, U.S. Army, who had assumed command on November 27, 1959, was replaced by Colonel William S. Hutchinson* on March 23, 1960. JTF-7 now concerned itself with the orderly transition of its assets to other organizations and the problem of leaving some advice for some later Joint Task Force.

On March 30, 1960, the Commission discussed the Air Force (SAC) request to use Eniwetok as a target site for Atlas-Titan (Tick Tock) exercises from Vandenberg and approved the use of the Eniwetok Proving Ground for this exercise on the basis that AEC personnel would be evacuated by the Air Force or provided adequate shelter and the exercise would be announced as an Air Force project clearly not involving the Atomic Energy Commission. In late April and early May, the Chairman of the AEC (McCone) and the Secretary of Defense (Gates) agreed that the Eniwetok Proving Ground should not be retained as a nuclear test facility except on a caretaker basis and that it should be transferred to the Pacific Missile Range by July 1, 1960.

On May 24, 1960, the Task Force initiated a project for turning over the EPG and the liaison offices to PMR. It seemed wise to consider the use of H&N employees to provide certain services there after the transfer in order to maintain an AEC presence in the area. SAC conducted their first exercise in June. H&N support for the exercise suffered because of their expectation of significant reduction in staff by July 1, when the atoll would be transferred to PMR. By June 10, 1960, Charles Kelley, Vice-President of H&N, and Ray Emens, the Honolulu representative of the AEC, were far along in their discussions of the Pacific Missile Range takeover. As of July 1, 1960, the LCMs and LCUs assigned to the AEC at the Eniwetok Proving Ground were transferred to PMR; the Air Force transferred one L20 aircraft and spare parts to PMR; enforcement of plant and animal quarantine laws was assumed by PMR; and PMR took on the job of submitting requirements to MATS for transportation. In essence, the transfer of the Eniwetok Proving Ground from the AEC to PMR became complete. The responsibility for the continuation of leases on the outlying islands around the Eniwetok Proving Ground (used for weather stations and radiation monitoring) was transferred from the AEC to DASA on this date. Coincident with the above actions, Task Force Headquarters personnel were reduced to 28 officers and 41 enlisted men. The JTF-7 meteorological effort was transferred to the University of Hawaii. The effort during this period of time was known to the Task Force Headquarters as Operation Phasedown.

On June 15, 1960, the JCS recommended to the Secretary of Defense that JTF-7 be reduced to a planning group of 10 personnel within the DASA organization.

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*Colonel Hutchinson wrote to Colonel Thomas L. Mann on May 19, 1960: "General Harrison has notified you of your selection for assignment as Commander of JTF-7. I'm sure that you will find this somewhat puzzling; however, be assured that this is a highly desirable assignment upon which you are to be congratulated." The reply came from Colonel Mann (in Iran at the time): "I am quite puzzled and am looking forward to the assignment with anticipation mixed with quite a bit of reservation."