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MEMORANDUM OF CONVERSATION

September 30, 1958

Subject: October 31 US-UK-USSR Negotiations on the Suspension of Nuclear Tests

Participants: State

Ambassador James J. Wadsworth  
Mr. Ronald I. Spiers, S/AE  
Mr. Vincent Baker, S/AE  
Mr. George Spiegel, S/AE  
Mr. Donald R. Morris, S/AE

AEC

Commissioner Willard F. Libby  
Dr. Edward Teller  
Brig. General Alfred D. Starbird  
Captain John H. Morse  
Dr. Harold Brown  
Dr. George Kavanaugh

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Mr. Spurgeon Keeny

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*Mr. Smith*  
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DFI - *Mrs. Bulick*

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Dr. Libby said he had asked for this opportunity to meet with Ambassador Wadsworth as Chairman of the United States delegation to the October 31 negotiations to discuss with him the importance of Operation Flowshare for the development of peaceful uses of nuclear explosions and some of the aspects of the control system which had been agreed upon at the Geneva Conference of Experts on nuclear test detection.

Dr. Teller said he had noted three things of importance in the Geneva conclusions:

1. The detection of nuclear explosions of less than one kiloton yield had not been discussed.

2. While in its initial evaluation of a detection system for detecting underground nuclear explosions down to one kiloton yield the U.S. delegation had decided 650 detection stations

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would be required, it subsequently, under Soviet delegation pressure, increased the minimum detectable yield to five kilotons and agreed on a control system with 160-170 stations.

3. No concrete system was proposed for the detection of any nuclear explosion above 30 to 50 kilometers, and for explosions at thousands of miles from the surface of the earth.

These points indicate loopholes in the proposed system. Firstly, it may be impossible with such a system to detect underground explosions of less than five kilotons. Secondly, it may be practically impossible to detect explosions at great altitudes, especially in interplanetary space. Dr. Teller said he felt thought should be given to the wisdom of prohibiting events which cannot be detected by a control system. He therefore would like to speak in terms of whether clandestine tests of small devices or tests in interplanetary states are worth worrying about.

With regard to the first item, Livermore for the past year has devoted about one-third of its efforts on the development of nuclear weapons with yields less than five kilotons. They deem these developments so important for defensive purposes and for tactical weapons that they have telescoped several projects in order to test them during the forthcoming series prior to October 31. For instance, in this series Livermore is testing six weapons of less than five kilotons of which three or four are in the one kiloton range. Dr. Teller suggested that the present evaluation of the relative positions of the US and USSR in nuclear weapons development does not have much validity in the small yield range because, since we cannot detect such explosions at long distances with our present detection system, we do not know what the Soviet Union has done in this yield range.

With regard to high altitude tests, he wished to stress that the United States had performed such experiments for the first time this summer. We observed some very important phenomena from these explosions, notably severe interruption of radio transmissions and electromagnetic disturbances with important implications to our ballistic missile defense efforts. These effects are just now beginning to be analyzed and their full importance will not be known for some time. Tests of nuclear weapons carried out in interplanetary space thousands and thousands of miles from the surface of the earth would be relatively easy to execute and would probably be undetectable. For instance, a payload could be launched into outer space containing a bomb in one-half and measuring instruments in another half. After this payload had travelled for several days or even weeks and reached a considerable distance from the earth, the two halves could be separated by remote control. After they had been separated by about fifteen miles, the bomb could be detonated by remote control and the phenomena of the

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SECRET

explosion measured by the detection instrumentation would be telemetered back to the earth in appropriate coded form. Such tests would be quite easy for the Soviet Union to perform at the present time given their missile payload capacity. In a year's time the US could probably perform them also. It should be noted that the launching of such a projectile would not involve the complicated problems of re-entry nor of the guidance required for orbiting a satellite or reaching a specific area, such as the moon, and thus would be relatively simple.

Dr. Teller then described what he feels to be a further loophole in the technical considerations discussed at Geneva. He noted that the only information which exists concerning the coupling of the energy of an underground nuclear explosion to the earth to cause earth motion is that provided by the single underground explosion set off by the United States in 1957, known as Rainier. On the basis of theoretical considerations he and his associates believe it is possible to reduce the coupling of the energy of nuclear explosion by one-third or even one-tenth. This possibility should be explored either by individual nations or by some international organization by conducting experiments to test theoretical techniques. Unless this is done it might be possible to test a weapon of 5 kiloton yield or greater under decoupling conditions underground and evade detection.

Dr. Teller said he felt there were two suggestions as to how the United States might proceed in the October 31 negotiations to meet these points which he had raised. The first would be to support a provision in the treaty that nuclear tests which could not be detected by the system would not be prohibited. For instance, underground tests of less than 5 kiloton yield might be allowed. He wished however to point out two weaknesses to this suggestion. The first is that it would be very difficult to determine whether an explosion had been indeed less than 5 kilotons. While the site of the explosion could be inspected for yield determination with some degree of accuracy this would require advance notice so that the international inspectors could be on hand. A second weakness would be that if decoupling techniques are developed, larger explosions could be made to look like yields of less than 5 kilotons.

A second suggestion would be to limit not the size of nuclear test explosions which would be allowed by the agreement, but rather the size of the effect of these explosions. For instance, it might be agreed that earthquakes with magnitudes less than 4.5 on the Richter scale would not be investigated. This would then mean that underground nuclear explosions giving seismic indications of 4.5 magnitude would be allowable under the agreement.

Dr. Libby

SECRET

Dr. Libby noted that the AEC felt quite strongly that the term "nuclear explosion" in any agreement must be defined to allow safety tests of nuclear weapons which hopefully involve no yield of nuclear energy and developmental explosions at the Laboratories involving yields of nuclear energy of only a few hundred pounds of TNT equivalent.

Turning to the subject of the use of nuclear explosions for peaceful purposes, Dr. Libby noted that for two years the AEC has been working on Operation Plowshare. Recently all information, with the exception of the design of the nuclear devices which would be used, about this project has been declassified. This program envisaged the use of nuclear explosions for such projects as: earth moving, which could be accomplished at one-tenth to one-fiftieth of the present cost with conventional techniques; the crushing of rock over-burdens to permit access to mineral deposits; the creation of energy stores in the earth; the creation of useful radioactive isotopes; and similar civil projects. The AEC believes that such a program can be carried out within the context of an agreement to suspend nuclear weapons tests with international inspection of these projects. Dr. Libby said it was their estimate that international inspection would prevent the instrumentation of such explosions that would be necessary in order to gain any information useful in weapons development. He said the AEC presently would not be willing to grant reciprocal access to the device which would be used but would insist on the concept of concealment in a "black box". He added the final thought that these projects hold untold possibilities for the future benefit of mankind and that he personally felt quite strongly that it was wrong to limit or stop any scientific development which might contribute to the benefit of mankind by legislation, treaty or any other means.

Mr. Spiers said that the "black box" concept could create a great psychological barrier to acceptance of the continuation of peaceful uses explosions. He suggested that a comprehensive analysis be made of the loopholes that such an approach would create for the USSR as opposed to the disadvantages from our point of view of managing such a program on the basis of full exchange of information, i.e., opening up the "black box". If the latter approach were found possible, the program would involve substantially fewer political difficulties vis a vis both the USSR and world opinion. Dr. Libby agreed this should be explored.

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