THE PRESIDENT'S SCIENCE ADVISORY COMMITTEE
Executive Office Building
Washington, D. C.

~~TOP SECRET~~ UNCLASSIFIED

407374

March 28, 1958

MEMORANDUM FOR THE SPECIAL ASSISTANT TO THE PRESIDENT FOR NATIONAL SECURITY AFFAIRS

SUBJECT: Transmittal of Report

In accordance with Action No. 1840 of the National Security Council, as approved by the President on January 9, 1958, I submit herewith a report of the Ad Hoc Working Group devoted to the following three studies in the area of nuclear testing:

"(a) A study of the losses to the United States consequent on a total suspension of nuclear tests at specific future dates.

"(b) A symmetrical study of the losses to the USSR that would accrue from cessation of nuclear testing, using the same hypothetical dates.

"(c) A study of the technical feasibility of monitoring a test suspension, including the outlines of a surveillance and inspection system."

The Ad Hoc Working Gropp submitting this report is made up of representatives nominated by the President's Science Advisory Committee, the Department of Defense, the Atomic Energy Commission and the Central Intelligence Agency.

The Ad Hoc Working Group, in preparing this report, limited itself to the technical feasibility of monitoring nuclear tests and to the technical losses that would result to the U. S. and the U. S. S. R. from a cessation of tests. Although the Group considered some of the military implications of these technical losses to the U. S. and the U. S. S. R., a complete evaluation of these military implications would have required extensive studies by the Department of Defense and these are not yet available. It excluded from its consideration any question of policy with respect to whether there should be a suspension of nuclear tests.

J. R. Killian, Jr.
Chairman

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Attach.

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March 27, 1958

Dr. James R. Killian, Jr.
Special Assistant to the President for
Science and Technology
The White House
Washington 25, D. C.

Dear Dr. Killian:

We submit herewith for transmittal to the National Security Council the report of the Ad Hoc Working Group on the Technical Feasibility of a Cessation of Nuclear Testing established in accordance with NSC Action 1840 c. The report is concurred in by all members of the Working Group which included representation from the President's Science Advisory Committee, Department of Defense, Atomic Energy Commission, and Central Intelligence Agency.

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REPORT OF THE NSC AD HOC WORKING GROUP ON THE TECHNICAL FEASIBILITY OF A CESSATION OF NUCLEAR TESTING

SUMMARY

1. [redacted]

2. A practical detection system can be designed which can detect and identify nuclear explosions in the USSR and China except for some underground tests of small size [redacted] Such a system, adequate for safeguarding a nuclear test limitation agreement, would require 1/:

a. the installation of about 70 observation stations in the territories of the USSR and China;

b. the right of immediate access of mobile teams to any areas suspected of having been the location of a clandestine underground test; and

c. rights to overfly parts of the Soviet Union and China on certain occasions.

An additional system of about [redacted] stations and extensive air sampling coverage of the entire world would greatly improve the detection capability of the existing Long Range Detection System for test explosions in the remote areas of the world. Such a system is described in Appendix A and its capabilities are discussed in Section B of the Conclusions. With such a system agreed to and implemented, the Working Group feels that the USSR could not utilize testing to improve significantly its nuclear weapon capability, except for small yields without running a great risk of being detected.

1/ The separate views of the CIA member appears in Section B 6 of the Conclusions.

3. The Working Group considers a cessation of tests before the end of the HARDTACK series as undesirable and practically not feasible.

4. [redacted]

5. [redacted]

6. The rapidity of deterioration of U. S. weapons laboratories will depend on the duration of a test suspension and the belief of the laboratory staffs as to the permanency of the suspension. [redacted]

7. The Working Group has discussed the military effects of the deficiencies in nuclear weapons due to a test cessation but has not been able in the time available to assess these defects in detail. Thus it has not come to an agreement as to whether a suspension or cessation of tests would be a net military advantage or disadvantage to the U. S.

CONCLUSIONS OF THE AD HOC WORKING GROUP ON THE TECHNICAL FEASIBILITY OF A CESSATION OF NUCLEAR TESTING

In response to the action taken by the National Security Council meeting on January 6, 1958, a technical panel of the President's Science Advisory Committee, the Department of Defense, the Atomic Energy Commission, and the Central Intelligence Agency has made a study of the technical factors affecting an international agreement for the cessation of nuclear tests.[1] The following conclusions have been reached:

A. Capabilities of the Present U. S. Long Range Detection System

[redacted]

Since the present system was designed to detect tests conducted in the USSR, its capabilities for tests outside the USSR are limited. Nuclear tests as large as a few hundred kilotons and possibly even one megaton might be missed if conducted in areas remote from the present detection network.

1/ A complete transcript of the proceedings of the Working Group has been deposited with the Office of the Special Assistant to the President for Science and Technology

B. The Technical Feasibility of Monitoring a Test Suspension, Including the Outlines of a Surveillance and Inspection System

This involves detection and identification of nuclear explosions carried out in the following physical environments.

1. At the Earth's Surface and at Low Altitudes within the USSR and China. It would be feasible to detect and identify explosions at the earth's surface and at low altitudes, having yields down to about [redacted] with the net of seismic, acoustic and electromagnetic stations located within the USSR and China, described in Appendix A. Positive identification requires the collection of nuclear debris which may in some cases involve overflight of the USSR or China.

2. At Very High Altitudes Over the USSR and China. Electromagnetic detection techniques, based on theoretical predictions, show great promise of detecting and identifying nuclear explosions created at very high altitudes. This is discussed in detail in Appendix B. A close net of some [redacted] electromagnetic detection stations would suffice, subject to confirmation of actual capabilities. Earth satellites could carry instrumentation for detecting and identifying the nature and location of nuclear detonations both within and outside the earth's atmosphere.

3. Below the Earth's Surface. Nuclear explosions conducted well below the earth's surface are most difficult to detect. (See Appendix C)

[redacted]

[redacted]

4. Tests Conducted Outside the USSR and China. Detection of nuclear tests conducted in the Southern Hemisphere will require a net of about 30 detection stations with components similar to those in the Northern Hemisphere and air sampling coverage extended to both hemispheres. This system will be limited in detection and identification

[redacted]

5. Detection Net. A net of about 70 detection stations located within the USSR and China, as described in detail in Attachment A, backed up by inspection teams and aerial reconnaissance, would be essential for monitoring possible Soviet tests conducted in all feasible environments within those countries. Full operational status would require approximately two years after an international agreement is reached although a few stations could be installed earlier. Without such a detection system located inside the USSR and China, the detection coverage would be inadequate for safeguarding a nuclear test limitation agreement. Should there be an international agreement to pursue technical studies and design of the detection system of the type described in Appendix A, a substantial amount of information could be disclosed by the U. S. without revealing Atomic Energy Restricted Data although it would be necessary to disclose presently classified detection techniques and capabilities.

6. Risk of Detection. The detection system described above has been designed to achieve a high probability of detection and identification of all nuclear shots in the USSR and China which give signals equivalent to [redacted] For the actual enforcement of a moratorium, such a high probability may not be required since it may only be necessary to achieve a situation where the Soviets cannot afford to take the risk of being caught in a clandestine nuclear test. This risk would increase rapidly if several tests were required.

The U. S. has estimated (SNIE 11-7-57) that if the Soviets have an over-riding need for the conduct of nuclear tests and if the risk of detection is reasonably high, then they would probably prefer to denounce openly the moratorium and minimize the political disadvantages of such action by false accusations against the West.

C. The Losses to the U. S. and to the USSR That would Accrue From Cessation of Nuclear Testing

1. U. S. and USSR Nuclear Warhead Capabilities. Table 1 compares the present and expected position of the U. S. and the USSR nuclear weapons developments according to warhead weight class; it is based on Appendices D and E. The yields of present U. S. warhead developments are measured yields unless otherwise noted. Throughout this report, dates given for U. S. nuclear warhead developments correspond to technical capabilities rather than dates they enter the U. S.

stockpile. Present yield capabilities attributed to the Soviets are based on acoustic observations from the tests conducted prior to January 1, 1958. The estimates of weights of Soviet nuclear devices are uncertain even if deduced from tests, and in addition in several cases the warhead capabilities are extrapolations from test experience. Such a tabulation of Soviet nuclear warhead developments is necessarily speculative and its surety cannot be comparable to the tabulation of U. S. capabilities.

U. S. capabilities indicated as of the end of 1958 reflect the best estimates of the weapons laboratories concerned (see Appendix D). In those weight classes where there is major doubt of results in the forthcoming HARDTACK tests, models of different degrees of conservatism will be tested. The estimates given in Table 1 of the USSR position at the end of 1958 are mere extrapolations from the rate at which they have been improving their weapons technology (Appendix E). It is not at all clear that such tests will in fact be made.

[redacted]

6. Summary of Relative Position.

[redacted]

7. Clean Weapons. Clean nuclear weapons are being developed for special military purposes, primarily to reduce the hazard of

radioactive fallout to troops and friendly populations when it is necessary to detonate the weapon near the ground.

As far as reduction of fallout is concerned, clean bombs exploded near the surface may be replaced by standard weapons exploded in the air in such a way that the fireball will not touch the ground. However, certain hard targets require ground bursts, such as airfield runways if it is desired to make a crater, railroad yards if severe destruction of tracks is to be accomplished, or heavily entrenched troops. Where ground bursts are required, clean weapons are needed if reduction of fallout is necessary because of future military operations or other cogent reasons such as protection of non-belligerants.

The use of clean weapons in strategic situations may be indicated in order to protect the local population, especially to protect our European allies from the consequences of attacks on the Western USSR or the satellite countries. In tactical situations, some hard targets may exist close to our own troops or friendly populations which would then call for the use of clean weapons.

Possession of a clean tactical weapons capability may also contribute to a political climate favorable to the introduction of nuclear weapons in a limited engagement. If both the USSR and the U. S. possessed clean weapons, a convention to use them rather than standard megaton weapons is conceivable.

8. Military Effects of a Test Cessation. The foregoing conclusions have been concerned with current and prospective warhead performance characteristics. The Working Group has not attempted to assess the military effects that would flow from stoppage of further weapons tests. In other words, it has not examined the effects on performance and availability of weapons systems and alternate systems and strategies that might be devised to compensate for warhead performance limitations. It believes that detailed systems evaluation studies should be undertaken by the Department of Defense on a priority basis with the necessary allocation of a number of experienced scientific and military personnel to this task.

9. Effects of a Cessation on Weapons Laboratories. The effects of a test suspension on the weapons research laboratories will depend on the terms of the moratorium, its duration and the general political climate and, in particular, on the belief of the laboratory personnel on the permanency of the test suspension. If laboratory personnel believe that the suspension is temporary, which might be the case if the agreement called for the automatic resumption of testing if progress were not achieved on the general problem of disarmament, considerable work might be possible, leading to a backlog of ideas and untested developments to be tested upon resumption of tests. If the laboratory personnel believed that the test cessation would be made permanent, the weapons groups in the laboratories would certainly deteriorate rapidly.

10. Soviet Gains Through Espionage.

Table 1 (4 pages) denied in full by NSC 11/3/86.