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## FEASIBILITY AND LIKELIHOOD OF SOVIET EVASION OF A NUCLEAR TEST MORATORIUM

Submitted by the  
DIRECTOR OF CENTRAL INTELLIGENCE

The following intelligence organizations participated in the preparation of this estimate: The Central Intelligence Agency and the intelligence organizations of the Departments of State, the Army, the Navy, the Air Force, The Joint Staff, and the Atomic Energy Commission.

Concurred in by the  
INTELLIGENCE ADVISORY COMMITTEE

on 10 December 1957. Concurring were The Director of Intelligence and Research, Department of State; the Assistant Chief of Staff, Intelligence, Department of the Army; the Director of Naval Intelligence; the Assistant Chief of Staff, Intelligence, USAF; the Deputy Director for Intelligence, The Joint Staff; and the Atomic Energy Commission Representative to the IAC. The Assistant Director, Federal Bureau of Investigation, abstained, the subject being outside of his jurisdiction.

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## FEASIBILITY AND LIKELIHOOD OF SOVIET EVASION OF A NUCLEAR TEST MORATORIUM<sup>1</sup>

### THE PROBLEM

To estimate whether the USSR would attempt to evade a two-year nuclear test moratorium beginning 1 January 1959, and to assess the capability of present and future detection systems to identify and provide evidence of an evasion.

### CONCLUSIONS

1. We believe that, if the USSR agrees to a moratorium on nuclear tests, its initial policy will be to abide by the terms of the moratorium. We believe this because the Soviet leaders not only would not wish to receive the opprobrium which would follow a violation but because they probably would hope that the effect of the moratorium would give them political and strategic advantages. During the early days of the moratorium they probably would not be seriously tempted to deviate from this intention, in the light of our judgment that, between now and 1 January 1959, they have sufficient time to complete the tests they probably feel essential and feasible.
2. The Soviet scientists probably have a fairly accurate estimate of present US detection capabilities. They would recognize that some types of tests would almost certainly be detected. They would probably also realize that some tests could not be detected and that in some cases it could not be demonstrated that detected explosions were nuclear in origin. Nevertheless, there would be some uncertainty in Soviet calculations of their ability to escape detection and proof of their responsibility.
3. If, contrary to our present estimate, the Soviets had not completed their minimum testing program prior to the entry into effect of the moratorium or if, as the period of the moratorium advanced, they developed designs for much more effective and economical nuclear warheads, we still believe it unlikely that the USSR

<sup>1</sup> The Joint Atomic Energy Intelligence Committee is publishing separately a report (Restricted Data) which discusses in detail the importance to the USSR of continued testing and evaluates detection systems.

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would evade the prohibition except by ways they considered unlikely to be detected. We cannot, however, wholly exclude the possibility that they would take some risks.

4. We conclude that the Soviet leaders would almost certainly regard the political consequences of getting caught red-handed as unacceptable, except in extraordinary circumstances. Such circumstances might be either a clear opportunity to gain a great advantage over the US in nuclear weapons capabilities through some now unforeseen develop-

ment, or a situation in which the West had gained a clear advantage over the USSR. If such cases did arise, we believe the Soviet leaders would quite possibly not observe the moratorium since they would probably feel that the military advantages to be gained by testing would outweigh any adverse political effects. They would probably attempt to minimize the political disadvantages of evasion by false accusations prior to open denunciation of the agreement — in the hope of inducing the West to take the initiative itself in denunciation.

## DISCUSSION

### SOVIET OBJECTIVES IN AGREEING TO A TEST MORATORIUM

5. Active exploitation of the disarmament issue is one of the key aspects of present Soviet external policy. The USSR clearly regards this issue not only as an essential part of its pose of "peaceful co-existence" but, even more important, as a possible means of neutralizing Western nuclear striking power and inducing its withdrawal from around the periphery of the Bloc. It is probably also concerned over the potential threat to its position in the satellites from US and NATO military power in Europe. For these reasons the USSR has tended to concentrate on such disarmament proposals as nuclear test suspension, a ban on use of nuclear weapons, liquidation of foreign bases, and troop withdrawals from Europe.

6. By its maneuvers on such issues the USSR clearly hopes to encourage the relaxation of Western defense efforts, help undermine NATO and create divisions among its partners, and above all create a climate inhibiting Western use of nuclear weapons. In addition the USSR is probably concerned about the enormous cost of its military establishment and would welcome a measure of disarmament which would permit some diversion of re-

sources to meet other pressing needs. It may also have some concern over the possible development of nuclear capabilities by "fourth countries," particularly in Europe. However, we do not believe that either of the latter two concerns would be compelling in Soviet thinking.<sup>2</sup>

7. In agreeing to a nuclear test moratorium the USSR would be motivated by the belief that such an agreement would be an important first step toward these Soviet objectives in the field of disarmament. Through its consistent and unambiguous advocacy of a test ban the USSR has already gained considerable propaganda advantage. It would gain much further credit if tests were actually suspended, especially in the eyes of the considerable number of persons in all countries who favor such a ban out of concern with atmospheric pollution or as a first step toward curbing the danger of nuclear war. The Soviet pose as the strongest exponent of disarmament would thus be strengthened. Above all, a nuclear test ban would create immediately a greater psychological barrier to the use of nuclear weapons, and over the longer

<sup>2</sup> Soviet policy toward disarmament is discussed more comprehensively in paragraphs 213-216 of NIE 11-4-57, "Main Trends in Soviet Capabilities and Policies 1957-1962."

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term offer the prospect of increasing pressures for legally circumscribing the use of nuclear weapons. At the same time, the USSR would recognize that a test moratorium would not prevent it from continuing to manufacture fissionable materials, to apply tested principles to new weapons production, to improve its delivery capabilities, and to continue weapons research and development for testing at the end of the two-year period.

#### FACTORS AFFECTING THE FEASIBILITY AND LIKELIHOOD OF EVASION

8. Whether the Soviet leaders would attempt to evade a test moratorium agreement would depend largely upon the relative weights they attached to the following factors: (a) the political disadvantages of getting caught, (b) the military advantages to be gained from further testing, and (c) the effectiveness of the monitoring system in identifying and producing evidence of an evasion.

#### The Political Disadvantages

9. If a violation by the USSR were demonstrated to the satisfaction of the bulk of the free world nations, the Soviet propaganda position and peaceful pose would suffer substantially, and the USSR would jeopardize the gains it sought in agreeing to a two-year moratorium. The Soviet leaders would probably recognize that, under such circumstances, they would alienate much of the support and acceptance they have won in uncommitted countries, that defense preparations in Western countries would probably be intensified, and that the US in particular would resume its test program. More significantly, if the USSR were clearly shown to have acted in bad faith, the chances would be greatly reduced that other countries would accept a more comprehensive agreement which would gain for the USSR the more important objectives of forcing a retraction of US military power and legally circumscribing the uses of nuclear weapons.

#### The Military Advantages

10. Study of the results of the Soviet nuclear tests which have been detected shows clearly

that the USSR has tested a wide range of fundamental weapons concepts, that it has achieved a high level of sophistication in both weapons theory and technology, and that it now possesses an extensive capability to produce a family of weapons capable of satisfying to a reasonable extent most of its major military needs. The USSR almost certainly still has a great need for further testing in order to improve current weapons and to develop certain additional types of weapons and weapons designs. However, before the end of 1958, the USSR, by continuing an intensive program on the 1956-57 scale, can probably complete the tests which we estimate are necessary in order to produce workable, though perhaps not optimum, solutions to most of these additional requirements. Specifically, the Soviets would probably be able to improve their current weapons to remove shortcomings, to develop efficient air defense warheads, and to develop weapons making more economical use of fissionable material. On the other hand, they probably would not be able to complete the tests necessary either to refine these warheads or to assure the most economical use of fissionable material.<sup>3</sup>

11. We believe the Soviets would regard the above results as the minimum necessary prior to a test moratorium, and that they would probably carry through the required intensive program, if they were now prepared to accept a moratorium effective on 1 January 1959 or now foresaw such a moratorium as likely. If, contrary to our estimate, they should fail to carry through this minimum program, they would probably attempt to postpone the entry into effect of the moratorium until the necessary tests were completed.

12. On the assumption that their minimum testing program was successful, Soviet sci-

<sup>3</sup>Specific Soviet nuclear weapons requirements and the tests associated with them are discussed in detail in the JAEIC paper noted on page 1. The capability of the USSR to produce warheads suitable for ICBMs is discussed in NIE 11-10-57, "The Soviet ICBM Program," and general nuclear weapons capabilities are discussed in NIE 11-2-57, "The Soviet Atomic Energy Program," and will be further considered in the forthcoming NIE 11-2-58, "The Soviet Atomic Energy Program."

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entists and technicians would probably be fairly well occupied during the early part of the moratorium in evaluating their data and applying these data to weapons design. As the period continued, the Soviets might have a military need for testing in at least two possible respects:

a. Although the Soviets would have developed an efficient air defense warhead for use against aircraft, they would not have conducted the tests necessary to develop the most effective warhead for an anti-missile missile. If the Soviets had the other elements necessary for an effective anti-missile missile system in an advanced stage of development, we believe they would regard such a warhead as a major military requirement.<sup>4</sup> The testing required would involve at least medium-yield explosions.

b. The Soviets have given no indication of an attempt to develop "clean" weapons, i.e., weapons involving entirely or almost entirely thermonuclear reactions. They might regard such weapons as desirable to reduce the dangers of world-wide contamination, or to reduce local contamination in operations where a surface burst is desired or where fallout might affect Soviet-controlled territory or future operations. However, they would probably not conclude that such weapons were crucial to an effective nuclear posture in the short run, especially since the existence of a test moratorium would appear to reduce the chances of general war. Thus, the Soviet leaders probably do not have an urgent requirement to develop "clean" weapons during a test moratorium period.

In addition, other motivations might arise as a result of new requirements, new theories, or other unforeseen developments.

<sup>4</sup> In NIE 11-5-57, "Soviet Capabilities and Probable Programs in the Guided Missiles Field," (12 March 1957), we estimated that the USSR could probably develop a missile system of some capability against the ICBM for operational use during the period 1963-1966. We believe the USSR might be able to advance this date somewhat and that it might make great efforts to do so if the US deployed substantial numbers of IRBMs and/or ICBMs.

### Effectiveness of the Monitoring System<sup>5</sup>

13. The Soviet view of the effectiveness of the monitoring system would play an important role in any Soviet decision regarding evasion of a test moratorium since it will establish the degree of risk which the Soviet leaders would have to accept in carrying out various kinds of tests. The monitoring problem has two aspects: (a) detecting the fact of an explosion (and estimating time, location, and yield); (b) demonstrating that an explosion was nuclear. In both respects, the ultimate test is the production of usable evidence convincing to other nations.

14. At the present time, the various parts of the existing US Atomic Energy Detection System, working together, are able, within certain limits, to detect the fact of an explosion and to determine its approximate time, location, and yield. Other intelligence collection methods may contribute to this determination. The existing system has an excellent capability (90-100 percent) for detecting air bursts of 10 KT or above, a good capability (60-90 percent) for detecting air bursts of 5-10 KT, a fair capability (30-60 percent) for detecting air bursts of 3-5 KT, and a poor capability (0-30 percent) for detecting air bursts of less than 3 KT. The present detection system, in addition to its unreliability for detecting low-yield air bursts, might be unable to detect tests occurring at altitudes in excess of about 100,000 feet. In the case of tests conducted in some other unique environments, such as deep underground or underwater, the fact of an explosion might be detected, primarily by seismic means, but there would be difficulty in separating such phenomena from natural disturbances.

<sup>5</sup> The "monitoring system" discussed in this section is one which would operate only in the Northern Hemisphere in areas not remote from the USSR. Conceivably tests could be staged in remote areas such as Antarctica or southern waters, but such possibilities would probably be excluded by the Soviets, since various intelligence collection efforts would be almost certain to spot the activities which would be associated with test preparations, if not the test itself.

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15. In order to establish conclusively that a given explosion was nuclear in origin, it is necessary to obtain radioactive debris. This is generally possible for tests conducted between the surface and the tropopause (35,000-45,000 feet) involving substantial fission reactions. However, tests in unique environments and tests involving entirely or almost entirely thermonuclear reactions might not produce radioactive debris that could be collected in quantities sufficient to establish the fact of a nuclear explosion, under any known or foreseeable monitoring system.

16. In order to estimate the likelihood of a Soviet evasion it is necessary to measure Soviet testing requirements against the present and expanded monitoring systems. The following paragraphs describing the effectiveness of various assumed monitoring systems provide some guide to the likelihood of detection in the event the USSR does not complete its pre-moratorium testing program or decides to test designs relevant to warheads for anti-missile missiles, the development of a "clean" weapon, or other designs.

17. *Present monitoring capabilities.* It is possible that a moratorium agreement might go into effect without providing sufficient time to put into place any additional detection equipment in or adjacent to the USSR, and therefore that it might be necessary in an initial period to rely upon substantially the existing system. Considering the limitations of this system as defined above, the USSR might be able to avoid detection and verification of the low-yield fission tests we estimate that it requires in order to develop certain air defense warheads and to achieve more efficient use of fissionable materials. If the Soviet leaders should decide to conduct tests in the medium or high kiloton ranges, these tests would have to be conducted in unique environments in order to avoid detection. If conducted at extremely high altitudes, they might be particularly difficult to detect.

18. *Effect of peripheral expansion of monitoring capabilities.* If additional facilities were established around the periphery of the USSR, the range of Soviet maneuverability would be

slightly less, but these facilities would still not provide consistent detection of the kinds of tests noted in the preceding paragraph.

19. *Effect of limited inspection within the USSR.* The Soviet leaders have announced their willingness to accept international control posts within the USSR on a reciprocal basis. The effectiveness of inspection within the USSR would largely depend upon the extent to which these control posts could gain access to areas of suspected activity and upon the extent to which they were alerted by other detection methods. It would be possible for the USSR, by denying mobility or access to particular areas, to reserve for itself an area in which it could carry out, with no greater risk of detection, the tests which we have noted in paragraph 17.

20. *Effect of a comprehensive system of inspection within the USSR.* If it is assumed that the USSR accepted a substantial number of installations properly placed within the USSR and that these installations could be equipped and staffed in time,<sup>\*</sup> it would be possible to get at least 50 percent reliability on fission tests in conventional environments as low as one kiloton, in the detection system as a whole. However, not even this expanded system could consistently detect and identify low-yield explosions occurring deep underground or underwater, or possibly sizeable yields at altitudes in excess of 100,000 feet. Thus the USSR could, even in this maximum situation, carry out some tests with a good chance of escaping detection.

21. *International manning of the monitoring system.* In assessing the effectiveness of any form of monitoring system for the purpose of producing evidence convincing to other nations, it is important to note that international manning of the system would, as a practical matter, greatly assist in meeting this need. For example, if the existing collection system, unimproved, were in operation, international participation in the pro-

<sup>\*</sup>Since such a comprehensive system would take from 18 to 24 months following its approval to reach maximum effectiveness, it is questionable whether it could play a role in a two-year moratorium.

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curement and analysis of radioactive debris would add substantially to the chances of convincing a UN monitoring commission and a majority of UN members. Moreover, in attempting to prove the nuclear origin of those types of tests not likely to produce debris, international manning of detection facilities would assist in putting pressure on the USSR to produce an explanation of detected explosions (for example, underground explosions detected by seismic means).

22. *Soviet estimate of the risk of detection.* The Soviet scientists probably have a fairly accurate estimate of the present capabilities of the US detection system, and they would therefore be able to project the effect of expanding US capabilities in the ways indicated above. They are probably aware that our detection capabilities even under maximum conditions could not detect all sorts of nuclear explosions or adduce proof that all detected explosions were nuclear. They would also recognize that certain types of tests would be virtually certain of detection. They could probably estimate the test-site locations, yields, and environmental conditions within which there would be a reasonable chance of escaping detection under varying types of monitoring arrangements. Yet, they could never be certain of the capabilities of the US detection system. They would realize that new techniques for detection or improvements in existing methods, about which they were unaware, were always possible. Thus, there would be some uncertainty in Soviet calculations of their ability to escape detection and proof of their responsibility.

#### PROBABLE SOVIET POLICY

23. We believe that, if the USSR agrees to a moratorium on nuclear tests, its policy initially will be to abide by the terms of the moratorium. We believe this because the Soviet leaders not only would not wish to receive the opprobrium which would follow a violation but because they probably would hope that the effect of the moratorium would give them political and strategic advantages. During the early days of the moratorium they probably would not be seriously tempted to deviate from this intention, in the light of our

judgment that, between now and 1 January 1959, they have sufficient time to complete the tests they probably feel essential and feasible. Moreover, they would recognize at the outset that there was a substantial category of tests which they could not conduct without a high risk of detection.

24. If, contrary to our estimate, the Soviets had failed to complete their essential pre-1959 test program, and had also failed to obtain postponement of the agreed moratorium, then the Soviets would confront a grave choice between urgent military needs and the political disadvantages of getting caught in evasion. We conclude that the Soviet decision would probably be substantially influenced by the likelihood of getting caught, and that the Soviets would not conduct tests in the categories where there would be a substantial chance that the world at large would conclude that they had broken the moratorium. Some of the tests required to complete the program could probably be conducted in the low-yield category or in unique environments — where the chances of detection and evidence were small — and the Soviets might conceivably decide to evade the moratorium to the extent of a very small number of tests of these types. However, our present judgment is that the possibility is slight that the USSR will not complete its essential testing program prior to 1 January 1959. If, nevertheless, the beginning of the moratorium should antedate the completion of the program, we believe it unlikely that the USSR would evade the prohibition, except by ways they considered unlikely to be detected. We cannot, however, wholly exclude the possibility that they would take some risks.

25. As the period of the moratorium advanced, the military motivations for violations might increase, particularly if the Soviet scientists had developed designs and theories which, if satisfactorily tested, would provide much more effective and economical warheads, such as those for an anti-missile missile. This and other foreseeable testing needs might be considered by the Soviets so substantial as to argue against Soviet acceptance of an uninterrupted continuation of the moratorium. However, we believe that the Soviets would

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not estimate these needs as so urgent as to compel testing involving any substantial degree of risk within the two-year period.

26. We conclude that the Soviet leaders would almost certainly regard the political consequences of getting caught red-handed as unacceptable, except in extraordinary circumstances. Apart from failure to complete their pre-1959 test program, discussed above, circumstances in which the Soviet leaders would consider risking detection are: (a) if, through some now unforeseen development, there were a clear opportunity to gain a great advantage over the US in nuclear weapons capabilities,

or (b) if the West had an enormous military advantage over the USSR as a consequence of advances in Western military technology and deployment. If such cases did arise, we believe the Soviet leaders would quite possibly not observe the moratorium since they would probably feel that the military advantages to be gained by testing would outweigh any adverse political effects. They would probably attempt to minimize the political disadvantages of evasion by false accusations prior to open denunciation of the agreement — in the hope of inducing the West to take the initiative itself in denunciation.

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