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THE IMPACT OF THE LIMITED TEST BAN
TREATY ON NATIONAL SECURITY

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THE IMPACT OF THE LIMITED TEST BAN TREATY
ON NATIONAL SECURITY .

A MONOGRAPH

by

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The monograph examines: the events leading to the signing of the nuclear test ban treaty; the status or validity of the treaty benefits as claimed by the Kennedy administration; and the status of the four safeguards that were to be maintained in order to make the treaty acceptable.

TABLE OF CONTENTS

	Page
ABSTRACT	ii
INTRODUCTION	1
EVENTS LEADING TO THE NUCLEAR TEST BAN TREATY	2
RATIFICATION OF THE TREATY	6
AN APPRAISAL	12
CONCLUSION	30
FOOTNOTES	33
BIBLIOGRAPHY	36

INTRODUCTION

On 5 August 1963, the United States, the United Kingdom, and the Soviet Union, the three major nuclear powers at that time, signed a treaty banning nuclear tests in the atmosphere, outer space, and underwater. The Nuclear Test Ban Treaty marked the first breakthrough in reaching some satisfactory agreement with the Soviet Union on the control of nuclear weapons.

On 24 September 1963, the United States Senate voted, by a large majority (80 votes for and 19 against) for ratification of the Nuclear Test Ban Treaty. President Kennedy signed the documents of ratification on 7 October 1963 and the treaty entered into force on 10 October 1963.¹

Although the Senate ratified the treaty by a comfortable margin, there was considerable opposition to the treaty in the Congress and in the scientific community, on the grounds that it would be detrimental to the national security of the United States. Furthermore, the Congress had strong doubts that the Soviet Union could be trusted to adhere to provisions of the treaty in view of its record of past treaty violations. The Kennedy administration acknowledged certain risks were involved in entering into the treaty but believed the political and military benefits to be gained far outweighed the risks involved.²

This monograph will examine the impact of the Nuclear Test Ban Treaty on national security. It will address those events leading to the signing of the treaty, the status or validity of

the treaty benefits as claimed by the Kennedy administration, and the status of the four safeguards that were to be maintained in order to make the treaty acceptable.

EVENTS LEADING TO THE NUCLEAR TEST BAN TREATY

By late 1958, world opinion on the polluting of the world's atmosphere by the continuance of atmospheric nuclear testing brought immense pressure on the nuclear powers to seek a nuclear test ban agreement. The United States, Great Britain, and the Soviet Union began negotiations with the convening, in 1958, of the Geneva Conference on the Discontinuance of Nuclear Weapons Tests.³ Pending agreement on a treaty, the three nations unilaterally announced a moratorium on all testing. The negotiations continued until early 1959, when the United States discovered that its methods for detecting small underground nuclear detonations below 19 kilotons were in doubt. As a result, the United States made a new proposal in February 1960, which called for a ban on all atmospheric tests, all underwater tests, and all underground tests above a 19 KT yield.⁴ While the three countries agreed in principle to the US proposal, the talks were suspended on September 27, 1960, as a result of the U-2 affair.

Negotiations resumed in Geneva on 21 March 1961, and continued until 30 August 1961, when the Soviet Union announced that it would resume testing of nuclear weapons. The Tass news agency said the USSR was "compelled" to resume nuclear testing "for the sole aim" of averting a world war.⁵ Twenty-four hours following this announcement an atmospheric test was conducted.

The United States was surprised by this development and President Kennedy stated on 30 August 1961, that the Soviet's decision to resume atmospheric testing "would be met with deepest concern and resentment throughout the world by increasing the dangers of nuclear fallout;" further, "it leaves the United States under the necessity of deciding what its own national interests require."⁶ Subsequently, on 15 September 1961 the United States initiated an underground test program at the Nevada Test Site. The technology at that time did not permit certain types of tests to be conducted underground and as a result, preliminary plans were made to conduct a series of atmospheric tests.

Although the United States had resumed underground testing, this country continued to press for a nuclear test ban treaty. On 25 September 1961, President Kennedy addressed the United Nations and presented a plan that would bring general and complete disarmament under effective international control. This plan included the following:

1. A nuclear test ban treaty to be signed by all nations.
2. A halt in the production of fissionable materials for use in weapons and a prohibition on their transfer to any nation lacking nuclear weapons.
3. A prohibition on the transfer of control over nuclear weapons to states that do not have them.
4. A declaration to prevent the employment of existing nuclear weapons in outer space.
5. The gradual destruction of existing nuclear weapons and the conversion of their nuclear materials to peaceful uses.
6. A halt in the unlimited testing and production of strategic nuclear delivery vehicles and the gradual destruction of such vehicles.⁷

The Soviet Union did not respond favorably to this plan and continued testing until 4 November 1961, when their test series ended. The Soviet test program was highlighted by a detonation on 31 October 1961 of a reduced version (58 megaton) of their much-publicized 100 megaton bomb.⁸ During the period of Soviet testing, the United States refrained from testing in the atmosphere. The President was urged by many members of Congress, the Joint Committee on Atomic Energy, the Joint Chiefs of Staff, the military departments, and various nuclear scientists to resume atmospheric testing at the earliest possible time; however, President Kennedy wanted to examine every alternative, review the justification, and consider all the consequences before the resumption of atmospheric testing. British Prime Minister Harold Macmillan urged the President to find some way to avoid more testing. Nevertheless, the Prime Minister also agreed that the West must test if no agreement could be reached.

From early November 1961 to early March 1962, the President made several important statements which indicated that the United States was making preparations to resume atmospheric testing. At the same time, the President assured the Soviets that he was ready to negotiate a test ban treaty. Finally, after mounting Congressional pressure and after all avenues of negotiation had been exhausted, the President, on 2 March 1962 went on nationwide television and announced that he had ordered resumption of atmospheric testing in April unless the Soviet Union agreed before that time to an ironclad treaty banning all such tests.⁹

The Soviet Union agreed to attend the Geneva Disarmament Conference on 14 March 1962 to discuss a test ban treaty. However, they held steadfast to their position that they would not accept the United States treaty proposal banning all tests in the atmosphere, outer space, underground, and in the oceans.

On 10 April 1962 a joint United States-United Kingdom statement was released appealing to the Soviet Union to agree to a nuclear test ban treaty with adequate safeguards, including the principle of international verification.¹⁰ The statement also indicated that if an agreement were not reached, the United States would begin atmospheric testing in late April 1962. No agreement was reached. Out of concern over the military advantages that the Soviets might have obtained from atmospheric testing and their apparent unwillingness to sign a test ban treaty, ~~President~~ Kennedy authorized, on 24 April 1962, a series of atmospheric tests in the Pacific Ocean. This series of atmospheric tests began on 25 April 1962, and was completed on 4 November 1962. Following the President's announcement to resume atmospheric testing, the USSR announced on 22 July 1962 that they were forced to resume testing. The Russian's second series of tests ended on 24 December 1962.

The nuclear test ban and disarmament talks continued at Geneva during the period of United States and Soviet Union testing. There was little progress. With these negotiations at a virtual standstill, the United States, Great Britain, and the Soviet Union began separate talks in early 1963 on a test ban treaty.

These talks finally led to the nuclear test ban treaty which prohibited nuclear explosions in the atmosphere, in outer space, and underwater. Although the treaty does not expressly permit underground tests, by implication it does not ban underground tests as long as the radioactive debris associated with the tests remains within the territorial limits of the nation conducting these tests.

RATIFICATION OF THE TREATY

Secretary of State, Dean Rusk, and William C. Foster, Director of the US Arms Control and Disarmament Agency on 11 March 1963, appearing before the Senate Foreign Relations Committee and the Joint Committee on Atomic Energy, respectively, enumerated the treaty benefits as follows:

1. The Nuclear Test Ban Treaty would constitute a significant step in bringing the arms race under control.
2. The treaty would significantly reduce radioactive fallout.
3. The treaty would constitute a significant first step in achieving control over the further spread of nuclear weapons.
4. The treaty would preserve for a longer period, our present nuclear advantages, that is, in the areas of intermediate and lower yield weapons, and in the higher yield to weight ratio.¹¹

They contended the treaty benefits were so great as to make it advantageous for the US to sign.

In addition to the statements by Rusk and Foster and subsequent to additional Senate Foreign Relations Committee hearings on the treaty, President Kennedy went before a nationwide television audience on 26 July 1963 in order to gain further support for

the ratification of the treaty. He called the treaty, "a victory for mankind--but not the millennium. It will not resolve all conflicts or cause the Communists to forget their ambitions, or eliminate the dangers of war. It will not reduce our need for arms, or allies, or programs of assistance to others. But it is an important first step--a step toward peace--a step toward reason--a step away from war." Further, President Kennedy said that the treaty would not endanger the national security and that the United States would continue underground testing and remain prepared to resume other testing.¹² Despite these assurances by the President, criticism was leveled at the treaty because the United States had not tested weapons in the 50 megaton yield range nor had they tested the antiballistic missile nuclear weapon system as the Soviets had done. During a press conference on 1 August 1963, President Kennedy replied to this criticism and indicated that the United States had no use for a 50 or 100 megaton bomb and that an antimissile defense "is beyond us and beyond the Soviets technically."¹³

Two Committees of the Senate, the Foreign Relations Committee and the Preparedness Investigating Subcommittee, held hearings on the treaty. During these hearings, the Joint Chiefs of Staff (JCS) recommended four safeguards and specific criteria to implement the safeguards that would make the treaty acceptable and which would be in the national interest. The safeguards and criteria recommended by the JCS were:

1. The conduct of comprehensive, aggressive, and continuing underground nuclear test programs designed to add to our knowledge and improve our weapons in all areas of significance to our military posture for the future.

Criteria.

a. The underground test program should be comprehensive. Therefore, it should be revised to include as many as feasible of the objectives of the tests which we would otherwise do under conditions of unrestricted testing.

b. The underground test program should be vigorous. It should proceed at a pace that will exploit to the fullest the capabilities of existing AEC and DOD weapons laboratories. If these capabilities are proved to be inadequate to meet established requirements, they should be expanded.

c. The underground test program should be a continuing program designed to insure the highest practicable rate of progress in nuclear technology.

d. The standards established governing the type and magnitude of tests to be conducted should not be more restrictive than the spirit of the treaty limitations.

2. The maintenance of modern nuclear laboratory facilities and programs in theoretical and exploratory nuclear technology which will attract, retain, and insure the continued application of our human scientific resources to these programs on which continued progress in nuclear technology depends.

Criteria.

a. Adequate AEC and DOD budgets, modern facilities, and positive personnel policies should be maintained and augmented as necessary in order to attract and retain competent scientists in nuclear and related fields.

b. Broad and forward-looking research programs should be carried on which will attract and retain able and imaginative personnel capable of insuring the highest practicable rate of progress that can be attained in all avenues of potential value to our offensive and defensive posture.

3. The maintenance of the facilities and resources necessary to institute promptly nuclear tests in the atmosphere should they be deemed essential to our national security or should the treaty or any of its terms be abrogated by the Soviet Union.

Criteria.

a. The readiness-to-test program should be established on a governmentwide basis in support of a plan common to all participating agencies. The required resources and facilities should be maintained in a state of readiness, or earmarked, so that plans can be implemented within the reaction times established.

b. Reaction times for resumption of testing in the prohibited environments must be established and maintained within the constraints of military requirements and reasonable costs. Reaction times will vary for the broad categories of testing. As an immediate objective, we should be able to conduct proof tests of weapons in stockpile in about 2 months; operational systems tests in about 2 to 3 months; weapon developments tests in about 3 months; and weapon effects tests in about 6 months.

c. There must be provision for periodic updating of our test program plan and for checking our readiness to test.

4. The improvement of our capability, within feasible and practical limits, to monitor the terms of the treaty, to detect violations, and to maintain our knowledge of Sino-Soviet nuclear activity, capabilities, and achievements.

Criteria.

a. The current capability of the United States to detect and identify nuclear tests conducted by the Sino-Soviet bloc must be improved to the extent it is both feasible and remunerative.

b. A vigorous research and development program must be pursued in order to improve equipments and techniques for nuclear test detection and identification.

c. Conventional intelligence sources must continue to complement the scientific intelligence techniques.¹⁴

Defense Secretary McNamara, appearing before the Foreign Relations Hearings on 13 August 1968, gave his support for the treaty and stated:

1. The US nuclear forces were superior to those of the Russians.
2. The US had more experience in underground testing and that would at least retard Soviet progress and prolong the duration of our technological superiority.
3. The Russians had the advantage in the 60-100 megaton range.
4. The US strategic forces posture was not impaired because the US strove for higher efficiency, i.e., higher yield to weight ratios than did the Russians.
5. The US would pursue an active underground nuclear test and would be prepared to resume atmospheric testing which would negate any advantages the USSR would gain should they abrogate the treaty.¹⁵

To gain further support for the treaty, President Kennedy sent a letter to Senate leaders Mansfield and Dirksen on 11 December 1963, containing the following assurances:

1. Underground testing of weapons and nuclear devices, permitted by the treaty, will be vigorously and diligently carried forward.
2. The United States will maintain a posture of readiness to resume testing in the atmosphere, outer space and underwater and will take all the necessary steps to safeguard our national security should Russia abrogate or violate the treaty.
3. Our facilities for the detection of possible violation of this treaty will be expanded and improved.
4. The treaty in no way limits the authority of the Commander in Chief to use nuclear weapons for the defense of the United States and its allies if necessary.
5. If Cuba should be used either directly or indirectly to circumvent or nullify this treaty, the United States will take all necessary action in response.
6. The fact that both the United States and East Germany had signed the treaty did not in any way imply or grant United States recognition of the East German regime.

7 This Government will maintain strong weapons laboratories in a vigorous program of weapons development, and will maintain strategic forces fully insuring that this nation will continue to be in a position to destroy any aggressor, even after absorbing a first strike by surprise attack.

8. Through underground tests the United States would "diligently pursue" development of peaceful nuclear devices; if atmospheric tests for peaceful purposes were required, the United States would seek an international agreement under the treaty to permit them.¹⁶

Opponents to the treaty argued that the treaty would delay development of anti-ballistic missile defenses; stop development and testing of high-yield bombs; retard experiments in detecting the effect on US missile defense communications and radar "black-out," inhibit the ability of the United States to verify the hardness of its Minuteman missile sites; stimulate rather than retard the arms race because the United States would be compelled to deploy more ICBM's around the world to make up for uncertainties in the nation's defenses; and have little effect on the proliferation of nuclear arms in other nations because the additional cost involved in underground testing compared with atmospheric testing is minimal when contrasted with the huge initial cost of research and construction of nuclear reactors.¹⁷

The Preparedness Investigating Subcommittee, in their report on the treaty, stated the United States would:

. . . be unable to match Soviet achievements in very-high-yield weapon technology; be unable to obtain information on the effects of high yield atmospheric tests and of high altitude explosions; be unable to determine "with confidence the reliability of an anti-ballistic missile (ABM) system; be unable to verify the "hardness" of its second-strike missile system; be unable to

verify the survivability and penetrability of re-entry vehicles with nuclear warheads; give the Soviets the opportunity to equal US low yield weapons development; and be denied a valuable source (radioactive debris from atmospheric tests) of information on Soviet nuclear capabilities.¹⁸

In spite of the objections to the treaty, it was ratified on 24 September 1963, and President Kennedy called the Senate's action a welcome culmination of this effort to lead the world once again on the path of peace. In addition, the President gave his assurance that the provisions of the nuclear test ban treaty safeguards, as recommended by the Joint Chiefs of Staff, would be implemented.

AN APPRAISAL

It is the purpose of this section to analyze: (1) the validity of the treaty benefits as claimed by the Kennedy administration; (2) the treaty articles and how they affect the national security; and (3) the status of the safeguards which were to be implemented and maintained in order to make the treaty acceptable and in the national interest.

Each of these will be discussed in turn.

The political and military benefits outlined in the preceding sections promised to strengthen our security and that of other nations. However, with the passage of time, those treaty benefits as claimed by the Kennedy administration appear less and less valid.

The treaty has not been a significant step in bringing the arms race under control. The arms race has not been halted or even hindered to any great extent by the treaty. This is evidenced in a recent statement made by Defense Secretary Laird before Congress when he said, "The Soviet Union is continuing rapid deployment of major strategic weapons systems at a rate that, could by the mid-1970's, place us in a second rate strategic position with regard to the future security of the free world."¹⁹ The inadequacy of this benefit is even more evident when one examines the Fiscal Year 1972-76 Defense Program and the 1972 Defense Budget. The administration considers it both prudent and necessary in the budget to preserve the options to augment or modify both the offensive and defensive capabilities.²⁰ This includes, for example, development of new systems, such as: the Undersea Long Range Missile System (ULMS); the new strategic Bomber, B-1; and Hard-Site Defense System, to mention only a few.

The one positive treaty benefit is the reduction of radioactive atmospheric contamination. It should be noted that the treaty does not completely halt the contamination of the atmosphere since both France and the Chinese Peoples Republic continue to test nuclear weapons in this environment. The number of tests and future tests that have been, or will be conducted by these two countries, is not likely to approach the level of effort by the United States and the Soviet Union for the foreseeable future. Therefore, the levels of contamination will not approach those levels that existed prior to the treaty.

The proliferation of nuclear weapons has not been stopped by the treaty. Since the signing of the treaty, two countries, France and Communist China (nonsignatories), have joined the nuclear club. There are others, notably, West Germany, Japan, India, and Israel, that have the scientific knowledge to develop nuclear weapons. There are four motives which these nations may have for going nuclear: fear of a large power, a desire to be independent of the major blocs, rivalry with other countries, and national prestige. Regardless of the treaty, a country will go nuclear if it is in their national interest to do so. It is interesting to note that this treaty benefit; i.e., the prevention of the spread of nuclear weapons, is based on the assumption that other nuclear countries might be somewhat more reckless in their strategy than either the United States or the Soviet Union and, hence, lead us into an unwanted nuclear war. How ironical this is when many nations, as they review the two major nuclear powers' involvement in the Cuban Crises, the Vietnam War, the Berlin Blockade, and the Hungarian and Czechoslovakian uprisings, consider the United States and the Soviet Union unpredictable. Based on the political realities of today, it is difficult to rationalize how the treaty has prevented or will prevent the proliferation of nuclear weapons.

In regard to the fourth benefit, the prolongation of the US nuclear advantages in the areas of intermediate and low yield weapons and in higher yield to weight ratios, the argument was made that unlimited testing would tend, over a relatively short

period of time, to produce equality; hence, our advantages in these areas would disappear. The question now is whether the eight intervening years since the signing of the test ban treaty have permitted the Russians to achieve equality in these areas? On the basis of the announced number and yields of the US and Soviets' tests since 1963, it would appear that the US has maintained an advantageous 5 to 1 ratio over the Russians in these areas. However, the advantages accrued to the US in these areas are not so large when the philosophies of both countries are examined. The US generally strives for miniaturization while the Russians normally go for brute strength; i.e., large yields and systems. The Russians considered large yields and large delivery systems necessary because of their limited guidance technology. However, their guidance technology has improved and is now equal to ours. Therefore, we have a situation wherein large Russian yields can be placed on targets with greater accuracy. This compounds the problem of survival of our strategic offensive and defensive systems. Furthermore, many political and military analysts and strategists consider the US and the Russians to be at nuclear parity at this time. If this is true, it seems superfluous to argue that we are more efficient in nuclear design than are the Soviets if they can match us missile for missile, and kiloton for kiloton.

The preamble and Article I of the treaty directly affect our national security, while the remaining articles of the treaty are administrative in nature.

In the preamble to the treaty each of the nuclear signatories proclaimed, as their principal aim, to "achieve agreement on general and complete disarmament under international control," and to "eliminate the incentive to the production and testing of all kinds of weapons, including nuclear weapons."²¹ What would it mean to the US in terms of nuclear options or strategies if we were to adhere both to the intent and the legal aspects of the treaty preamble? For example, could the following options be initiated by the US without violating the treaty?

1. Could the US support a European nuclear force fostered by the British and French nuclear programs? This would alleviate European fears concerning the control of nuclear weapons. As a result, both countries would increase their testing of nuclear weapons and would increase their armaments.

2. Could the US withdraw its European nuclear umbrella? This would probably force certain European countries, (West Germany, Italy, etc.), to go nuclear or to reach some detente with the Soviet Union. (This may not be a plausible option at this time; however, it is conceivable that Congress could force the withdrawal of the nuclear umbrella.)

3. The US would transfer nuclear weapons to the NATO countries, thereby, providing a European deterrent under the control of Europeans. Obviously, certain of our legal statutes which prohibit foreign control of US nuclear warheads would have to be changed before this could become a possibility.

4. The US could withdraw its nuclear umbrella from Japan if our political relations with Japan deteriorated or if the US desired no further involvement in Asia. This action would probably force the Japanese to go nuclear or reach some detente with China or Russia or both.

Under the conditions of the preamble to the treaty, the point to be made is that pursuit of certain options, which may be in our national interest, may not be legally or morally possible.

Under Article I, each signatory undertakes to prohibit, to prevent, and not to carry out any nuclear explosions, at any place under its jurisdiction or control in any of the three environments. Also, each signatory refrains from causing, encouraging, or participating in the carrying out of any nuclear weapon test explosion, or any other nuclear explosion, anywhere which would take place in the prohibited environments.²² Therefore, can a signatory use nuclear weapons in a limited war, such as Vietnam, without violating the treaty? Secretary of State, Rusk, appearing before the Senate Foreign Relations Committee on 12 August 1963 stated, "This treaty does not affect the use of nuclear weapons in war."²³ Nevertheless, the interpretation of the words, "other nuclear explosions" appears to prohibit the use of nuclear weapons in war. Any use of nuclear weapons in a limited war would apparently constitute a violation of the treaty. Therefore, it is contended that the option to use nuclear weapons in a limited war is not available to the signatories of the treaty.

In approving the Nuclear Test Ban Treaty, the Congress authorized the establishment of four specific safeguards as a joint responsibility of the Department of Defense and the Atomic Energy Commission. In short:

1. A vigorous and comprehensive underground test program.
2. An effective laboratory research program in nuclear technology.
3. A readiness posture to resume atmospheric testing.
4. Improve the US capability to monitor foreign nuclear detonations of all types.

In support of the first safeguard, over 230 announced US nuclear underground tests have been conducted since the signing of the Nuclear Test Ban Treaty. This has been accomplished in a safe manner with little adverse effects of any real consequence on the ecology, manmade structures, or the populace. The underground nuclear tests have yielded programmatic and effects on data on nuclear weapons not visualized as obtainable when the test ban treaty was signed. Tests in the underground nuclear test program are placed in four general categories:

1. AEC weapons development tests.
2. AEC tests related to peaceful uses of nuclear explosives (Plowshare Program).
3. DOD weapons effects tests.
4. DOD sponsored experiments on detection of nuclear tests (Vela Program).

The AEC weapons development test category is further subdivided as follows:

1. Weaponization.

The testing of nuclear weapons which are in the development engineering phase.

2. Weapon Feasibility.

Testing required to determine the feasibility of particular concepts.

3. Advanced Technology.

Tests with the objective of advancing the "state-of-the-art" and providing an advanced scientific technological basis for possible future weapon systems.

4. Warhead Vulnerability.

Tests necessary to verify the required hardening of strategic nuclear warheads to the effects of nuclear detonations.

The Plowshare Program is designed to investigate and develop peaceful applications of nuclear explosives. To accomplish this purpose, nuclear explosives suited to the various Plowshare applications were developed. However, budget and other constraints have curtailed this program.

The DOD-sponsored tests are conducted in coordination with the AEC. They are designed to obtain weapons effects information. One of the main areas in which this effects information is needed, concerns the vulnerability and hardening of strategic missile systems and related weapon systems components. There is a division of responsibility between the AEC and DOD on these programs.

The AEC is concerned with the vulnerability and hardening of the nuclear package while DOD is concerned with the weapon system as a whole. However, separation of the responsibilities is often difficult since what affects the delivery vehicle may ultimately affect the nuclear package.

The DOD-sponsored tests on detection (Vela program) are designed to improve the United States capability to detect, identify, and locate underground nuclear explosions.

Requirements for underground testing to support these programs can be divided into a number of categories:

1. Maintenance of the present nuclear stockpile.

Nuclear weapons, along with other technological devices, are affected by aging. Chemical, nuclear, metallurgical, or electronic deterioration can occur. Inspection, maintenance, and repair go a long way toward preventing this deterioration. However, some nuclear testing may also be required for adequate assurance that specific weapons will continue to function properly.

2. Provision of weapons for new systems.

The passage of time makes weapons systems obsolete. Over the years, a number of new weapon systems have come into being (e.g., Polaris, Poseidon, Minuteman, and Safeguard). Each of these developments requires a nuclear weapon specifically tailored for the system. Specific features such as yield, size, weight, etc., must be designed into the nuclear weapon to match the specific system requirements. The characteristics of the nuclear weapon profoundly affect the characteristics of the weapon system and how it will function. The design of the nuclear

weapon, the determination of its characteristics, its integration into the weapon system, and proof of its reliability require many underground tests.

3. Vulnerability.

A nuclear weapon could be subjected to severe environments of heat, acceleration, shock, and nuclear and electromagnetic radiation. Therefore, assurance is required that weapons will function in these environments. This is an essential element of a credible deterrent. Fortunately, underground tests are able to duplicate some of those environments.

4. Safety.

A testing program is required in order to assure that weapons can be stored and handled in safety and that there will be no inadvertent nuclear explosion.

5. Advanced developments.

As in any other modern technology, new ideas and developments in nuclear weapons occur rapidly. Such developments add to the effectiveness of the Nation's nuclear arsenal. Hopefully, this effort keeps the US aware of possible new developments, by other nations, which would affect the balance of deterrence.

Undoubtedly, the US has conducted a vigorous underground test program in support of the first safeguard. However, there is no assurance that it has been comprehensive. A comparison of announced US and USSR underground nuclear tests since 1963 is contained in Figure 1.

FIGURE 1

COMPARISON OF US AND USSR TESTS^{24,25}

<u>Yield</u>		<u>1964</u>	<u>1965</u>	<u>1966</u>	<u>1967</u>	<u>1968</u>	<u>1969</u>	<u>1970</u>	<u>1971</u>
Low (<20KT)	US	19	20	24	14	14	10	14	6
	USSR	2*	0*	1*	1*	3*	3*	0	0
Low-intermediate (>20KT < 200KT)	US	5	4	9	8	11	15	12	2
	USSR	0	2	4	3	2	6	7	6
Intermediate (>200KT < 1MT)	US	0	1	2	3	0	1	1	0
	USSR	0	1	2	1	0	2	2	0
High (>1MT)	US	0	0	0	0	2	1	1	1
	USSR	0	0	0	0	0	0	1	1

NOTE: *Soviets conducted one additional test in 1964, three in 1965, one in 1966, one in 1967, one in 1968, and one in 1969. Yields are unknown.

The data in Figure 1 suggests that the US has maintained a lead in low yield and low to intermediate yield technology over the USSR. However, the high US numbers in these categories may be misleading since they include a large number of safety tests. The Soviets may conduct these types of tests also, but the US does it almost unnecessarily often. In addition, the US probably test more often in these categories because they have a more diversified nuclear arsenal to test than does the USSR. It is also quite possible that the Soviets saw no need to conduct a large number of small yield underground tests to verify their designs. Design verification could have been accomplished by the number of small yield tests that were conducted just prior to the signing of the treaty. Further, it is quite possible that the Soviets conducted a large number of low yield underground tests that went undetected

before the US improved its low yield detection capability. Consequently, it is difficult to conclude that the US has maintained its lead in low yield technology.

Certainly, in the intermediate to high yield technology, the US has not conducted a vigorous and comprehensive test program. The US has not made a concentrated effort to match the Soviet's achievements in the very-high-yield weapon technology. The data in Figure 1 on the intermediate yield category indicates that both the US and the USSR conducted an equal number of tests. And in the high yield category indications are that the US is slightly ahead. However, the Soviets conducted more tests in both the intermediate and high yield categories in 1961 and in 1962 than the US had ever made in its entire history.²⁶ Therefore, the gap that existed in 1961 to 1962 era, in these categories, between the US and the USSR still exists. In addition, the Soviets demonstrated, when they detonated a 6MT device in late 1970--one year ahead of the US 5MT test, Canniken, that their underground technology for large yield tests is at least equal to or greater than that of the United States.²⁷

Further, the US underground test program has yielded little information on the capability of radars to detect or track enemy missile re-entry vehicles or the degrading of radio communications in a high altitude high yield environment. Information on these problems is obtained through theoretical calculations, which include improved analysis of data recorded during pretreaty tests, and by nonnuclear means of simulating some of the effects.²⁸

What is important here, is that the US is still constrained by the test ban treaty in obtaining communication and radar blackout information vital to the deployment of the ABM system while the Russians apparently obtained or understood the blackout effects sufficiently after their 1962 tests to commence deployment of their first-generation ABM system.

It is worthy to note, that since 1963, the annual reports of the Secretary of Defense, to the President, do not contain any statements on complete operational systems tests. Such statements were contained in previous reports. Does the absence of these statements mean that both tactical and strategic systems entering the stockpile after 1963 have not had complete systems tests, that is, launch to nuclear detonation? Obviously this is true for strategic systems, but is it true for tactical systems? A comprehensive and cleverly designed tactical test program might demonstrate operational systems tests. A sobering thought on this subject is that with the retirement of obsolete weapons systems, one can conceive of a US nuclear arsenal that would contain systems which have never demonstrated their reliabilities by successfully flying the launch to target sequence.

In satisfying the criteria of the second test ban treaty safeguard, both the AEC and DOD nuclear R&D program have maintained a multitude of activities:

The AEC R&D Program includes the origination of new weapon concepts, evaluation of their feasibility, detailed design of weapons, testing of components, development of new and advanced

materials and processes, certification of weaponized designs for production in stockpile quantities, and continuous technical surveillance of stockpile weapons to assure that the designs will perform as indicated.

The DOD R&D Program encompasses: the development of information on effects of blast induced and direct ground shock on the survivability of silos, launch control facilities, command centers and hardened communication facilities; blackout effects of single and multiple detonations on radar performance and communications systems; transient radiation effects on electronics in missile guidance and electronics systems, arming and fuzing systems, and satellite electronic systems; effects of electromagnetic pulse on missile components, electronic systems in hardened missile structures, and missiles in flight; effects of nuclear radiation on missile boosters, reentry vehicles, penetration aids, and satellites; and monitoring foreign nuclear tests.

The only apparent deterioration, of an otherwise well planned and well executed R&D program, was the reduction of laboratory personnel which was caused by budget constraints. For example, the AEC research laboratories had to absorb a seven percent cost of living increase within the past several years. This adjustment caused a reduction of about five hundred laboratory personnel between 1970 and 1971 and a further reduction of about six hundred people between 1971 and 1972.²⁹ How serious an impact this constraint will have on the second safeguard is difficult to assess. Similar actions relative to DOD laboratory personnel are anticipated.

The third nuclear test ban treaty safeguard required the maintenance of the facilities and resources necessary, to promptly institute nuclear tests in the now prohibited environments should they be deemed essential to our national security or should the treaty, or any of its terms, be abrogated by the signatories to the treaty. The capability to implement the provision of this safeguard was attained on 1 January 1965, approximately 15 months after the signing of the treaty.

Since the program was conceived in 1963, the AEC and the DOD have accomplished the following major projects: a substantial increase in the available land area and an upgrading of facilities at Johnston Atoll which would be the overseas test site for the majority of the planned tests; construction of scientific and support facilities throughout the Hawaiian area and at Johnston Atoll; modification and instrumentation of three NC-135 aircraft to permit basic measurements of device diagnostic data and nuclear explosion phenomena for the AEC; modification and instrumentation of RB-57F aircraft for debris sampling purposes; adaption of B-57C aircraft for launching airborne rocket samplers; modification of B-52 aircraft for use as device drop aircraft; development, fabrication, and stockpiling of special ballistic cases for both airdrop and rocketborne nuclear devices; development of the capability to carry out a high altitude program using rockets as carriers for both the nuclear device and diagnostic instrumentation; comprehensive instrumentation development to establish advanced ground, aircraft, and rocket equipment designs which can obtain reliable and accurate

measurements of device outputs and weapons effects; identification of operational system tests as well as nuclear tactical exercises of prime interest to the military services and the development of plans and safety studies required to place them in the desired state of readiness; and maintenance of a cadre of experienced and capable people to carry out this program should it become necessary.³⁰

Recently, the readiness-to-test-program has been revised by both the AEC and the DOD. This revision was largely the result of budgetary constraints and will increase the response time required for resumption of atmospheric testing once authorization is received. Senator Henry M. Jackson, who heads a special subcommittee which oversees the treaty safeguards, feels that the proposed budget cuts will once again preclude a prompt and meaningful response to any surprise Russian tests like those that occurred in 1961 when the Soviets abrogated an informal moratorium on testing.

Senator Jackson disclosed that the readiness-to-test-program was being reduced by two-thirds. He stated,

This action marks the first significant erosion in the test ban treaty safeguard program.

My concern stems from the fact that the basic reasons for establishing this safeguard to nuclear test-ban treaty in the first place, including the reaction times associated with it, appear to be still clear and valid.

Our readiness to resume testing on short notice minimizes the risk that the Soviets might achieve a technical breakthrough that would give them an advantage which they could exploit before we could restore the strategic balance.

In addition, our readiness posture is an active deterrent to abrogation of the treaty by the other side, since it minimizes the advantage to be gained.³¹

Dr. Glenn T. Seaborg, Chairman of the AEC, in hearings on the AEC authorization bill for fiscal year 1972, disclosed that it had been suggested to the executive branch that this might be the year to reduce the readiness program. However, the executive branch thought it would be more prudent to continue this program.³² Nevertheless, "the readiness-to-test-program," in the words of General Edward B. Giller, Assistant General Manager for Military Application, AEC, "is down to a bare minimum activity on the technical side" despite the executive desire to continue the program. This technical activity deals only with certain very important long leadtime experiments. Further, he disclosed that the operational exercises associated with the readiness program were eliminated a year ago and that all personnel assigned to this aspect of the program have been taken off the rolls.³³

Thus, the third safeguard has been reduced to the point where it could invite a future abrogation of the treaty by the Russians.

The fourth safeguard, which was established as essential to our national security, was concerned with the improvement of US capability to: monitor the terms of the limited test ban treaty, to detect violations, and to maintain US knowledge of other countries' nuclear activities, capabilities, and achievements. This test detection program, which is concerned with the implementation of the fourth safeguard, is called the Vela Program and is the prime responsibility of the Defense Advanced Research Projects Agency (ARPA). Because of their technical competence

and capabilities, the AEC and Defense Nuclear Agency (formerly the Defense Atomic Support Agency) play major roles in assisting ARPA in this program.

The Vela Program has three subprograms: Vela Uniform-- detection of underground nuclear explosions; Vela Satellite-- detection by means of satellite-based instrumentation systems of nuclear explosions in space and in the atmosphere; and Vela Surface-- detection by means of sound-based systems of nuclear explosions in space and at high altitude in the atmosphere.

In support of the Vela Uniform and Vela Satellite Programs, respectively, seven underground nuclear experiments have been detonated and twelve satellites have been launched in six successful launches. Scientific investigations in optical and detection techniques, as well as other techniques, have been performed in support of the Vela Surface Program. The Vela Program has been so successful that there is a high degree of confidence that long-range detection of nuclear tests as small as two or three kilotons is now possible. This is quite an achievement when one remembers that US detection methods in 1963 could only detect tests greater than 19 kilotons. Dr. Eberhardt Rechtin, Director, Advanced Research Projects Agency, recently stated that, "The technical problems associated with monitoring the compliance with the treaty and of detecting large underground nuclear explosions are largely solved. The problem that remains as the magnitude of the explosion decreases is the identification of a detected seismic event as either an explosion or as an

earthquake."³⁴ Nevertheless, it can be stated without further qualification that the US has fully implemented and maintained the provisions of the fourth safeguard.

CONCLUSION

The treaty has been partially successful in accomplishing one of its advantages as stated by the Kennedy administration. Events since the signing of the treaty show that:

The arms race has not been dampened by the Nuclear Test Ban Treaty. Nuclear warhead production has not stopped, nor have nuclear stockpiles been reduced, nor have arms reductions commenced as a result of the treaty. In fact, the rate of nuclear testing has increased rather than decreased since the signing of the treaty. From 1945 until the treaty in 1963, 440 nuclear explosions have occurred--an average of 24 tests a year. Since the treaty, approximately 328 nuclear tests have occurred--an average of 41 tests a year.³⁵

The radioactive contamination of the atmosphere and the earth's surface has been reduced significantly below those levels of the pretreaty testing era. However, radioactive fallout continues today, primarily because France and the Chinese Peoples Republic conduct atmospheric tests.

The proliferation of nuclear weapons has not been impeded by the Nuclear Test Ban Treaty. France and the Chinese Peoples Republic have joined the nuclear club in spite of the treaty. Further, there are twenty-three countries listed by the US Atomic

Energy Commission as possessing the resources to develop and deliver nuclear weapons.³⁶ Any one of these countries could go nuclear if they deem it necessary to do so for their own national interest. As Earl Voss, author of Nuclear Ambush stated on the nonproliferation of nuclear weapons, "We attempted to defy one of the fundamental laws of human nature, by attempting to stop the spread of knowledge and to abolish an idea, to uninvent nuclear weapons, to arrest technological advance."³⁷

The US's technological advantage over that of the Russians, in the areas of intermediate and lower yield weapons, and in the higher yield to weight ratios, is in question. Since the treaty went into effect, the Russians have developed a large spectrum of small nuclear warheads and they probably see no need to execute a large number of low yield underground tests to verify their designs.

In relation to implementing and maintaining the safeguards associated with the Nuclear Test Ban Treaty, the US has fallen short of its goals.

Safeguard 1. The US has conducted a vigorous, but not comprehensive, underground test program. The program has not solved serious problems such as the radar and communications blackout, response of missile silos and missiles to nuclear effects, full scale operational systems tests; development of yield warheads comparable to those detonated by the Russians in 1961 and 1962, transient radiation effects on electronics, and electromagnetic pulse effects on electronic missile systems.

Safeguard 2. The US has maintained modern nuclear laboratory facilities and programs in theoretical and exploratory nuclear technology. But some deterioration in this safeguard is occurring as evidenced by the reduction of approximately 1100 laboratory personnel in two years.

Safeguard 3. The readiness-to-test program has been reduced to a bare minimum. This has resulted in increased reaction times to resume testing in the now prohibited environments.

Safeguard 4. The detection and monitoring capabilities of the US have increased remarkably since the signing of the treaty.

It is concluded that the risks associated with the Nuclear Test Ban Treaty now outweigh its advantages.


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FOOTNOTES

1. US Department of State, Treaties and Other International Acts, Series 5433, Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space, and Under Water (1963), p. 1 (hereafter referred to as US Dept of State, The Test Ban Treaty).
2. US Arms Control and Disarmament Agency, ACDA Report 15, Why a Nuclear Test Ban Treaty? (1963), p. 9 (hereafter referred to as ACDA, Why a Nuclear Test Ban Treaty?).
3. Charlmers M. Roberts, The Nuclear Years (1970), p. 46.
4. "Interim History," Disarmament and Nuclear Tests, 1960-1963, (1964), p. 21 (hereafter referred to as Interim History, 1960-1963).
5. Ibid., p. 47.
6. Ibid.
7. John F. Kennedy, President's United Nations Disarmament Address, Speech (25 September 1961).
8. Interim History, 1960-1963, p. 54.
9. John F. Kennedy, Nuclear Testing and Disarmament, Speech (TV) (2 March 1962).
10. Interim History, 1960-1963, p. 72.
11. ACDA, Why a Nuclear Test Ban Treaty?, pp. 3-12.
12. John F. Kennedy, Remarks on Test Ban Treaty, Speech (TV) (26 July 1963).
13. John F. Kennedy, News Conference on Foreign and Domestic Matters, Press Conference (1 August 1963).
14. James H. McBride, The Test Ban Treaty (1967), pp. 115-117.
15. Robert S. McNamara, Statement of the Secretary of Defense before the Senate Foreign Relations Committee on Nuclear Test Ban Treaty (13 August 1963), pp. 97-203.
16. Congressional Quarterly Service, Congressional Quarterly Almanac 88th Congress 1st Session 1963, Vol. XIX (1963), pp. 253-254 (hereafter referred to as Congressional Quarterly Almanac Vol. XIX).

17. Ibid., p. 252.
18. Ibid., p. 253.
19. Melvin R. Laird, Statement of the Secretary of Defense Before the Senate Armed Services Committee on Fiscal 1972-1976 Defense Program and the 1972 Defense Budget (15 March 1971), p. 63.
20. Ibid., p. 63.
21. US Dept of State, The Test Ban Treaty, p. 4.
22. Ibid.
23. Dean Rusk, Statement of Secretary of State Before the Senate Foreign Relations Committee on Nuclear Test Ban Treaty (12 August 1963), pp. 10-14; 18-20.
24. Commander Wayne C. Beech, Atomic Energy Commission, letter to author, 28 December 1971. (Note: Numbers also include those figures from footnote number 25.)
25. "Interim History," Disarmament and Nuclear Tests, 1963-1969 (1970), pp. 46-47; 89-90; 124-125; 156; 190-191; 237.
26. McBride, p. 27.
27. "Soviet Nuclear Blast, 2nd Biggest Detected," The New York Times (28 September 1971), p. 33.
28. John A. Northrop, Statement of Deputy Director, Science and Technology, Defense Atomic Support Agency before the Appropriations Subcommittee of the House Committee on Department of Defense Appropriation for 1972 (8 June 1971), p. 459.
29. Edward B. Giller, Major General, Statement of Assistant General Manager for Military Application, Atomic Energy Commission before the Appropriations Subcommittee of the House Committee on Public Works for Water and Power Development and Atomic Energy Commission Appropriation Bill 1972 (29 April 1971), p. 189.
30. US Atomic Energy Commission, Annual Report to Congress of the Atomic Energy Commission for 1963 (1964), pp. 55-72. (Note: Information for the footnote is taken from the annual reports 1963 through 1970.)
31. Robert S. Allen and John A. Goldsmith, "Is US Being Short-Changed on the Test Ban Safeguards?" Carlisle Evening Sentinel (12 March 1970), p. 4.

32. Glenn T. Seabory, Statement of the Chairman of the Atomic Energy Commission before the Joint Committee on Atomic Energy on AEC Authorizing Legislation, Fiscal Year 1972 (3 February 1971), p. B.

33. Giller, p. 201.

34. Eberhardt Rechtin, Statement of Director, Advanced Research Projects Agency before the Appropriation Subcommittee of the House Committee on Department of Defense Appropriations for 1970 (1 July 1969), p. 813.

35. "Nuclear Bombs for Everyone - A New Worry at Helsinki," US News and World Report Inc. (14 December 1970), p. 61.

36. Ibid.

37. Earl H. Voss, Nuclear Ambush (1963), p. 505.

BIBLIOGRAPHY

1. Allen, Robert S. and Goldsmith, John A. "Is US Being Short-Changed on the Test Ban Safeguards?" Carlisle Evening Sentinel, 12 March 1970, p. 4.
2. Bader, William B. The United States and the Spread of Nuclear Weapons. New York: Pegasus, 1968. (JX1974.7 B28)
3. Beech, Wayne C. Atomic Energy Commission. Letter to author, 28 December 1971.
4. Congressional Quarterly Service. Congressional Quarterly Almanac, 88th Congress, 1st Session, 1963, Vol. XIX. Washington: Congressional Quarterly Inc., 1963. (JK1 C6 1963)
5. Giller, Edward B. Statement of Assistant General Manager for Military Application, Atomic Energy Commission before the Appropriations Subcommittee of the House Committee on Public Works for Water and Power Development and Atomic Energy Commission Appropriation Bill, 1972. Washington: US Atomic Energy Commission, 29 April 1971. (KF-71 H181-47 PT.4)
6. Interim History. Disarmament and Nuclear Tests, 1960-1963. New York: Facts of File Inc., 1964. (JX1974.7 F3 c.2)
7. Interim History. Disarmament and Nuclear Tests, 1964-1969. New York: Facts on File Inc., 1970. (JX1974.7 M328 c.3)
8. Kennedy, John F. "Nuclear Testing and Disarmament." The New York Times, 3 March 1962, p. A6.
9. Kennedy, John F. "President's United Nations Disarmament Address." Speech. United Nations. The New York Times, 26 September 1961, p. 16.
10. Kennedy, John F. "President's News Conference on Foreign and Domestic Matters." New York Times, 2 August 1963, p. 10.
11. Kennedy, John F. "Remarks on Test Ban Treaty." The New York Times, 27 July 1963, pp. 1-2.
12. Kertesz, Stephen I. Nuclear Non-Proliferation in a World of Nuclear Powers. Notre Dame: University of Notre Dame Press, 1967. (JX1974.7 N6 1967)
13. Laird, Melvin R. Statement of the Secretary of Defense before the Senate Armed Services Committee on Fiscal Year 1972-1976 Defense Program and the 1972 Defense Budget. Washington: US Government Printing Office, 1 March 1971. (JA23 A51 1971 L3 c.15)

14. McBride, James H. The Test Ban Treaty; Military, Technological and Political Implications. Chicago: Henry Regnery Company, 1967. (JC1974.7 M27)
15. McKnight, Allan. Atomic Safeguards; A Study in International Verification. New York: United Nations Institute for Training and Research, 1971. (JX1974.7 M291)
16. McNamara, Robert S. Statement of the Secretary of Defense before the Senate Foreign Relations Committee on the Nuclear Test Ban Treaty. Washington: US Department of Defense, 13 August 1963. (JX1974.7 U52 1963a)
17. Mustin, Lloyd M., Vice Admiral. Statement of Director, Defense Atomic Support Agency before the Department of Defense Subcommittee of the House Committee on Appropriations. Washington: Defense Atomic Support Agency, 25 March 1970. (UA23 A5 1971a)
18. Northrop, John A. Statement of Deputy Director, Science and Technology, Defense Atomic Support Agency before the Appropriations Subcommittee of the House Committee on Department of Defense Appropriations for 1972. Washington: US Government Printing Office, 1971. (UA23 A5 1972a PT.7 c.4)
19. "Nuclear Bombs for Everyone - A New Worry at Helsinki." US News and World Report Inc., 14 December 1970, pp. 61-63.
20. Roberts, Chalmers W. The Nuclear Years; The Arms Race and Arms Control, 1945-1970. New York: Praeger, 1970. (JX1974.7 R58)
21. Rehtin, Eberhardt. Statement of Director Advanced Research Projects Agency before the Appropriations Subcommittee on the Housing Committee on Department of Defense Appropriations for 1970. Washington: Advanced Research Projects Agency, 1 July 1969. (UA23 A5 1970a PT.5 c.2)
22. Rosencrance, Richard N. The Dispersion of Nuclear Weapons; Strategy and Politics. New York: Columbia University Press, 1964. (UF767 R56)
23. Rusk, Dean. Statement of the Secretary of State before the Senate Foreign Relations Committee on the Nuclear Test Ban Treaty. Washington: Department of State, 12 August 1963. (JX1974.7 U52 1963a)
24. Seaborg, Glenn T. Statement of the Chairman of the Atomic Energy Commission before the Joint Committee on Atomic Energy on AEC Authorizing Legislation, Fiscal Year 1972. Washington: Atomic Energy Commission, 3 February 1971. (KF-71 J801-3 PT.1)

25. "Soviet Nuclear Blast, 2d Biggest Detected." New York Times, 25 September 1971, p. 33.
26. US Arms Control and Disarmament Agency. Documents on Disarmament 1963. "Treaty Banning Nuclear Weapon Tests in the Atmosphere, Outer Space, and Under Water, August 5, 1963." Washington: US Government Printing Office, 1963.
27. US Arms Control and Disarmament Agency. Why A Nuclear Test Ban Treaty? ACDA Report 15. Washington: US Government Printing Office, 1963. (JX1974.7 U482)
28. US Atomic Energy Commission. Annual Report to Congress of the Atomic Energy Commission for 1963, 1964, 1965, 1966, 1967, 1968, 1969, and 1970. Washington: US Government Printing Office. (UF767 U44)
29. US Congress. Joint Committee on Atomic Energy. Technical Aspects of Detection and Inspection Controls of a Nuclear Weapons Test Ban. JCAE Rept. 55625 86th Cong., 2d sess., 1960. Washington: US Government Printing Office, 1960. (JX1974.7 U43 1960a)
30. US Congress. Senate. Committee on Foreign Relations. Nuclear Test Ban Treaty. 88th Cong., 1st sess., 1963. Washington: US Government Printing Office, 1963. (JX1974.7 U52 1963a)
31. US Department of State. Geneva Conference on the Discontinuance of Nuclear Weapons Tests; History and Analysis of Negotiations. Department of State Publication 7258, 1961. (JX1974.7 C56 U5)
32. US Department of State. Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space, and Under Water; Treaties and Other International Acts Series 5433. Washington: US Government Printing Office, 1963. (JX1405 A5 5433)
33. Voss, Earl H. Nuclear Ambush; The Test Ban Trap. Chicago: Henry Regnery Company, 1963. (JX1974.7 V6)
34. York, Herbert. Race to Oblivion; A Participant's View of the Arms Race. New York: Simon and Schuster, 1970. (JX1974.7 Y55)