

PART IV

SOME CONCLUDING OBSERVATIONS

Chapter XIV

The Test Ban Negotiations and Treaty in Retrospect

I

Introduction

Did the signature of the Moscow Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and Under Water mark a turning point in the nuclear era? Obviously it is too early to answer this question. Only in the future will it be possible accurately to assess the significance of the Moscow Treaty. Unfortunately though, except for the purposes of historical analysis, it is impossible to wait to make judgments. To act rationally in formulating policy the outcome of each step must be scrutinized with care and analyzed before a choice is made among the possible courses for the next move. An assessment must be made, however tentative it may be and subject to reevaluation. Similarly, although a single case study is hardly an adequate basis for formulating answers to the questions raised in the introductory chapter concerning the processes by which United States security policy was formulated and executed, the nature of these policies, and the characteristics and modalities of the contemporary international system, these too demand immediate answers.

Fortunately, the nuclear test ban negotiations probably provide as good a basis for generalizations as any single set of diplomatic talks that have occurred since the end of the Second World War. The nuclear test ban talks involved, in one way or another, most of the actors in the contemporary international system, and the most important states—the super-powers—were deeply engaged. There were significant differences among the political systems of the three states principally involved. The negotiations covered a long time period. During this period, the distribution of military power in the international system shifted. Again as a result of their length, the

negotiations spanned two administrations within the United States. Among other things, the change in administrations brought changes in personnel, in administrative organization and procedures, and in presidential-legislative relationships. The nuclear test ban negotiations were conducted in a variety of forums, ranging from bilateral talks, through a tripartite conference and a larger committee, to the general international organization with the broadest membership, the United Nations. In several respects, therefore, the negotiations offer the opportunity of comparative analysis. And as an unique series of events, because of their importance, the negotiations had sufficient salience to permit at least some conclusions to be drawn.

II

The Formulation and Execution of American Security Policy

With respect to the formulation and execution of American security policy, analysis of the test ban negotiations yields not so much new insights as confirmation and refinement of the consensus-building model. The circle of participants in the consensus-building process widened or narrowed depending upon issues and circumstances. In most instances during the course of the negotiations decisions concerning what American policy should be, or how it should be executed, could be made by the executive branch acting alone. Since the end product of the negotiations was envisaged as being an international treaty, however, the Senate always had a potential role; and, because certain inspection procedures could have required modifications in American legislation concerning atomic energy, the House of Representatives also had such a role.

Except for a few brief periods, such as when the USSR abrogated the moratorium on nuclear testing or immediately before and after the signature of the Moscow Treaty, the test ban negotiations elicited little public interest. Certain segments of the public, however, followed the negotiations very carefully and were deeply and often emotionally interested. These groups included large numbers of scientists. Those scientists who worked on weapons development obviously had a direct professional interest. Other scientists were involved through their feeling of personal or collective responsibility for the consequences of the development of nuclear weapons. Among

the lay public, attentiveness was largely confined to those especially concerned about peace on the one hand and the United States military posture on the other. Members of SANE and the Women's Strike for Peace provide examples of the former; members of veterans' organizations the latter. Given the nature of the issues and the limited extent of Congressional involvement, the interested members of the public had few means at their disposal, other than publicity, to give effect to their views.

Consensus-Building in the Eisenhower Administration

In these circumstances the process of consensus-building was more often than not confined to the executive branch. This did not necessarily make the process smoother or easier. The Eisenhower Administration was deeply divided on several questions relating to the nuclear test ban negotiations, including even the wisdom of attempting to negotiate on this issue. President Eisenhower himself saw little advantage from the viewpoint of American security policy in a test ban as such, and—responding to the advice of the Atomic Energy Commission—he was not convinced of the great danger of the radioactive fallout that would result from continued testing. Fundamentally, he was doubtful that when the chips were down the Soviet Union would agree to a treaty acceptable to the United States, or that a treaty, even if agreed upon, would be followed by a substantial slowdown in the arms race. Although it entails great oversimplification and some distortion of their detailed positions, the various interested agencies in the Eisenhower Administration can be ranked along a continuum.¹ The Atomic Energy Commission, which had the greatest doubts about the wisdom of a nuclear test ban, would be at one extreme. The Department of Defense would be next to the AEC. It tended to be somewhat more favorably inclined toward a test ban than the Commission. Next, in a center, although slightly positive position, would be the Central Intelligence Agency. The Department of State would come next, and then the President's Science Advisory Committee, at the opposite extreme from the AEC. Both on balance were favorably inclined toward a nuclear test ban.

As a consequence of these divisions, when policy was made by

¹Compare this ranking with that given by Sir Michael Wright, *Disarm and Verify*, p. 120.

committee, as it usually was, the result tended to be a compromise which straddled the issues and occasionally contained contradictory elements. The position which the United States adopted at the outset of the political negotiations in the fall of 1958 is an example. The United States was willing to agree to a nuclear test ban, but it insisted that after a specified period, the continuance in force of the ban would be dependent upon satisfactory progress being made in other areas of arms control and disarmament. This "link" with other measures of arms control and disarmament was eventually dropped, but it was dropped only at the time when the "new seismic data" had raised serious obstacles to achieving a nuclear test ban. Thus one set of obstacles replaced another. The American insistence on technical conferences in 1959 can be seen as a neutral policy, acceptable both to those who were enamored with the prospects of obtaining a nuclear test ban and to those who seriously doubted the wisdom of such a measure. When the United States did hint at the possibility of a partial ban in 1959 as a first step toward a comprehensive ban, it failed to specify in detail what control measures it would demand, but in any case made it clear that they would be fairly extensive. Yet a year earlier Senator Gore had stated that an atmospheric ban could be policed by control instruments under the unilateral control of the United States, and this is what the United States eventually proposed in 1961, and in 1962, and it is what was finally accepted in 1963.

In addition, under the Eisenhower Administration largely because of the deep divisions of opinion, decisions were taken at an extremely slow pace. Countless examples can be recalled. To cite only one, although Technical Working Group I accepted virtually all of the American proposals, a month and a half elapsed before the American Ambassador could even accept "the report as a correct technical assessment . . . in the light of presently available scientific knowledge."² It was not until after the Kennedy Administration had assumed power that the United States would finally submit treaty language based on the report.

Under the Eisenhower Administration, consensus-building also tended to exercise a gyroscopic effect on policy. In the period from 1958 through 1960, once negotiations were underway, it proved

²GEN/DNT/PV. 127, p. 4.

almost impossible for the United States to break them off, or to radically alter their course.

This is not to imply that all of the agencies which participated in these decisions did not have vital interest in them and an important contribution to make, nor that American policy necessarily would have been better had it been formulated exclusively by one agency. At least one major decision during this period was not made within an elaborate committee structure. This was the proposal for a conference of experts. In this instance President Eisenhower acted solely on the advice of Secretary of State Dulles. This meant that the participants in the decision were confined to the White House Staff and the Secretary of State with a few of his advisors. This decision has been and can be criticized. In proposing a conference of experts, the United States committed itself to a course of action with potentially far-reaching consequences without having fully explored the consequences and without having formulated appropriate and adequate contingency policies. Of course, proposing a conference of experts solved certain immediate tactical problems, and provided a needed response to a Soviet initiative. Two questions, however, can be raised. The first is whether or not the short-range gains outweighed the longer-range difficulties. The second is whether or not the short-range gains could not have been obtained without also incurring the longer-range difficulties.

The Advent of the Kennedy Administration

From 1961 on decisions within the executive branch concerning a nuclear test ban flowed more rapidly and smoothly.³ This was partly because different personnel headed the relevant agencies, and the new men held more homogeneous views concerning the wisdom of a nuclear test ban. However, the change in administrations did not bring a complete change in personnel. Allen W. Dulles continued to serve as Director of the Central Intelligence Agency until September 27, 1961, when he was replaced by John A. McCone. Mr. McCone had also been a member of the Committee of Principals during the Eisenhower Administration, in which he had served as Chairman of the Atomic Energy Commission. Moreover, the extent to which

³See Sir Michael Wright, *Disarm and Verify*, pp. 121, 127.

principal officers are bound to the collective viewpoints of their agencies should not be underestimated.

A second factor explaining the smoother flow of decisions after the advent of the Kennedy Administration was that the institutional balance was altered. In September 1961, the United States Arms Control and Disarmament Agency was established. The Director of ACDA immediately became a member of the Committee of Principals, and even before ACDA was established, President Kennedy's adviser on disarmament, John J. McCloy, met with the Committee. Thus, starting in 1961 the balance on the Committee of Principals was altered by the addition of an individual more or less institutionally committed to advocate measures of arms control and disarmament. The creation of ACDA also meant that many more resources within government were devoted to analyzing issues of arms control. Positions could be explored more thoroughly before being advocated and the analyses would be done from the point of view of trying to achieve agreements. Furthermore, there were many more people available for consensus-building efforts. Unlike the State Department in the past, ACDA had its own scientific advisers.

On balance, however, the fact that the quest for a test ban was approached with a new intensity and drive in the Kennedy Administration seems to have been more important than the institutional changes. The advent of a new Administration brought the appointment of a new principal negotiator in Geneva, Arthur Dean. Although his predecessor held a strong personal conviction of the desirability of a test ban and was an experienced and skillful negotiator, it is demonstrable that Ambassador Dean made a greater effort to understand the technical issues involved in the negotiations, devoted more energy toward trying to stimulate new policies, and at least partially as a consequence was more actively involved in the formulation of American policy. More importantly, President Kennedy himself seems to have devoted more attention and energy to this issue than President Eisenhower. President Kennedy appears to have been more interested in achieving a nuclear test ban than President Eisenhower was. He certainly was more willing to take risks, in terms of both domestic and international politics, to gain such an agreement than President Eisenhower. This was in large measure a reflection of President Kennedy's general policy of seeking to engage the Soviet Union in a continuing realistic dialogue designed primarily to clarify

positions and remove misunderstandings and also to explore avenues toward possible agreements. The test ban negotiations offered an obvious opportunity in this respect. President Kennedy also made a greater effort to understand the technical intricacies involved in the test ban negotiations. Jerome B. Wiesner, the President's science adviser, has written that President Kennedy "made himself an expert on these subjects."⁴ It was only by becoming an expert that he could successfully cope with the expert advice which he received. President Kennedy gave his Administration a greater sense of direction on this issue, and his Administration responded with a more forthcoming process of decision-making.

It was only after President Kennedy assumed office that the United States tabled an entire draft treaty for a nuclear test ban. Such a draft had been in existence for some time, but it had been impossible to obtain agreement among the relevant interested agencies to table it, and President Eisenhower had not insisted that agreement be achieved. It was only during the Kennedy Administration that the United States submitted alternative draft treaties. All of these steps were at least partly attributable to the President's leadership. Without this leadership, a test ban might never had been achieved. In a decision-making structure as decentralized as that of the American government, Presidential leadership is necessary for action to be taken.

The Contribution of Congress

Much has been written about the decline of the legislative branch of government in the modern era. On the surface the test ban negotiations might be viewed as another case supporting this general thesis. Yet full examination reveals that Congress played an important role in the shaping of United States policy.

In the first place, the record indicates that Congress had ample opportunity to obtain information relevant to the test ban negotiations. Congressional hearings produced a wealth of technical and political data. It is true that different Congressional committees tended to develop different kinds of data. The Joint Committee on Atomic Energy tended to rely mainly for its information on the Atomic Energy Commission and sources provided or sponsored by that agency. The Senate Committee on Foreign Relations and its

⁴Jerome B. Wiesner, *Where Science and Politics Meet*, p. 11.

Subcommittee on Disarmament, on the other hand, tended to rely mainly on the Department of State and later on the Arms Control and Disarmament Agency. Partly as a consequence, the policy positions of the two committees tended to reflect the differences between the executive agencies. However, any individual Congressman, if he had the inclination and the time, could read the records of both committees. Moreover, some Congressmen, notably Senator Albert Gore and Bourke B. Hickenlooper, served on both committees, thus providing a bridge and an element of continuity. These two men also served as Congressional advisers to the American delegation in Geneva and were able to gain additional data through this means. In sum, so far as obtaining data, Congress was not at a serious disadvantage in relation to the executive branch. It could not engage in research itself, it is true, but almost all of the governmental experts and all of the private experts within the United States were available to it. Careful staff work on the part of the staffs of the committees made it possible to utilize the expertise rationally and wisely. The only group of experts within the administrative branch not available to Congressional committees were those within the Executive Office of the White House, namely the Special Assistant to the President for Science and Technology and his immediate staff. In this instance, the inability to question these individuals does not appear to have been a serious obstacle to obtaining relevant information. In broad terms, Congress appears to have been as well informed as the executive branch was on this issue.

In the formal or procedural sense, the initiative in formulating policy, of course, always rested with the executive. However, Congress and Congressmen were able to influence in important ways the manner and purposes for which the executive branch utilized its powers. At the very outset, the hearings of Senator Humphrey's Subcommittee on Disarmament clearly contributed to the pressure on the executive to separate the test ban issue from other measures of disarmament and to enter negotiations on this issue alone. On the other hand, during the course of the next several years the frequent hearings of the Joint Committee on Atomic Energy kept before the public the difficulty of controlling underground nuclear explosions and no doubt this inhibited the executive's freedom. Whether or not the executive branch would have followed a more flexible policy had it not been for this is naturally an unanswerable question. At

least prior to 1961 it probably would not have; however, even if the executive had wanted to make concessions, it would have found it difficult to do so in view of the activities of the Committee. Indeed there can be serious doubt that the Senate would have ratified the comprehensive treaty which the United States proposed in 1962 and 1963 had the USSR accepted it.

In October 1959, Senator Humphrey suggested in a public speech, that the United States should propose that a partial ban should be accompanied by a moratorium of limited duration on testing in those environments where control techniques were not at the moment adequate, the hope being that by the end of the moratorium adequate control measures would have been discovered so that the ban could be extended to cover all environments. The following spring the United States made such a proposal.

Toward the end of the negotiations, the resolution sponsored by Senator Dodd and others and adopted by the Senate clearly strengthened President Kennedy's hand. Although the content of the President's American University speech might have been the same even without this resolution, clearly it was easier for him to announce that the United States would forego further testing of nuclear weapons in the atmosphere after the Senate had recommended that this country should take such action.

The test ban negotiations also indicate the limits of Congressional influence on the formulation of policy by the executive. As early as November 1958, Senator Albert Gore proposed that the United States should abandon the attempt to negotiate a comprehensive ban on nuclear weapons tests and concentrate its efforts on attempting to achieve a partial ban. Several other Congressmen repeated this suggestion in the following years. Despite this, it was not until August 1962 that the United States seriously proposed a partial treaty; and as late as the Moscow talks in July 1963, American negotiators were still instructed to give priority to a comprehensive ban. But even here, Congressmen can be said to have shaped the environment in which a partial ban became the most feasible outcome.

Science and Security Policy

Implicit in the foregoing discussion of the formulation of United States policy is the assumption that judgments on scientific issues

played a crucial role. It is self-evident that any rational decision on the wisdom of attempting to negotiate a nuclear test ban would postulate in the first place some judgment about the danger to human life resulting from the fallout and other by-products of past and continued testing of nuclear weapons both with respect to immediate and long-range genetic effects, if any. Again, one would have to form some estimate of the gains that could be achieved in weapons technology through further testing, and of the gains that could be made without testing. Finally, one would have to assess the technological feasibility of establishing control measures to insure the observance of a test ban. Each of these is almost a purely scientific question.

In addition, there are several questions which, although not as purely scientific, involve, in varying degrees, important scientific elements. One would want to have an estimate of the types and qualities of nuclear weapons presently held by other states and a sense of how these compared with one's own nuclear arsenal. One would also want to have some sense of the possibilities of the dispersion of nuclear weapons capabilities among the presently non-nuclear countries and of the consequences of this. It would finally be necessary to make judgments about the role of nuclear weapons in military strategy in the light of all the available knowledge of their effects.

Finally, there are essentially nonscientific questions containing nevertheless a limited scientific component. Thus a decision-maker would want to make some estimate about the likelihood of the opponent state violating the treaty. In part this would involve the scientific issue of the risk of detection through available technical devices that a potential violator would have to face. But it would also involve a perhaps more important judgment concerning the general attitude and willingness of the potential violator to run such a risk. Again a decision-maker would also have to have some notions about the dangers arising from the nuclear arms race, such as the possibility of war by accident, which would have to reflect, among other things, an evaluation of the technical safeguards. Finally, he would have to make an estimate of what kind of treaty the Senate, the American people, and other states would be likely to accept. While this would call for an exercise of political judgment, the scientific component is readily identifiable.

To take a position on a nuclear test ban, any policy-maker would have to deal in some fashion with all of these questions. He could of course choose to ignore one or more of them, but even that would be dealing with them. Moreover, a policy-maker's task is complicated by the fact that many of these questions involve issues concerning which there is great scientific uncertainty. It is highly unlikely that any given forecast of future scientific developments would prove to be completely accurate. Nor are the first answers formulated in any scientific inquiry always the best, and many technical questions were raised in the test ban negotiations for the first time. Again, the scientific element is often so closely intertwined with nonscientific factors that it would require great restraint and discipline to limit a judgment to the scientific element. Concerning all such questions a scientist can give a wide range of answers without violating his scientific integrity. The answer that a scientist gives will depend partly upon his personal preferences and predilections, including his concept of international relations and his political orientation, and on his experience and maturity. It will also depend on the way in which the question is phrased and asked and the form and type of answer permitted.

Scientists as Policy Advisers

In a theoretical model of rational decision-making, it might be desirable for the decision-maker to permit each of his advisers to speak only on matters affecting his special area of expertise. In such a scheme scientists would confine their observations to scientific questions, economists to economic questions, lawyers to legal questions, military experts to military questions, and political experts to political questions.

There is a great deal to be said for keeping this model as an ideal goal that participants in the American system ought to strive to approximate. Much has been written demonstrating what poor advisers specialists are when they stray beyond their areas of special competence, and Albert Wohlstetter has persuasively demonstrated the weaknesses of some scientists when they have ventured into the realm of military strategy.⁵ Clearly certain scientists such as Linus Pauling and Edward Teller blatantly violated the precepts of this

⁵See "Strategy and the Natural Scientists," pp. 174-239 in Robert Gilpin and Christopher Wright (eds.), *Scientists and National Policy-Making* (1964).

ideal model in their public comments on the nuclear test ban issue. To say that the risk from radioactive fallout caused by continued testing in the atmosphere was intolerable or could be ignored, or to maintain that the control system devised by the Geneva Conference of Experts was adequate or inadequate, implicitly involved judgments on a number of issues, some of which were not at all scientific in character. On the other hand, other scientists, Wolfgang K. H. Panofsky, for example, phrased their pronouncements very carefully, distinguishing as well as they could between the scientific and nonscientific elements which were involved.

It is difficult to estimate with any degree of accuracy the effect in this instance of the tendency of scientists like Linus Pauling and Edward Teller to stray beyond the areas of their expertise. Probably public and perhaps even official understanding would have been easier had these individuals distinguished more clearly between their role as scientists and their role as citizens. Unquestionably, the policy-maker had to scrutinize their scientific advice and judgments with greater care, and their standing in this respect was impaired. However, to ask them to refrain from speaking freely on any issue risks robbing the American system of one of its most dynamic elements. These men played important roles in the test ban negotiations because they had deep convictions extending far beyond their scientific expertise. There is little question that they contributed to the motive force without which policy might have atrophied on dead center. Moreover, the admixture of nonscientific elements in the pronouncements of individuals such as Teller and Pauling was often so obvious that its discovery was not a task of inordinate intellectual difficulty. Admittedly, there has been a tendency in American society to transfer authority earned in one field to other fields; but if this is a problem, a better corrective might be to strive to develop greater official understanding and more sophisticated public attitudes, than to harness the scientists.

In the nuclear test ban negotiations the subtle mixing of scientific and nonscientific elements in judgments offered by scientists was much more bothersome than the blatant mixing mentioned above. As has been shown, when a scientist was asked to give advice on certain seemingly scientific questions, his personal, nonscientific views almost inevitably intruded. In these instances, it could be extremely difficult for the nonscientist decision-maker to detect the

nonscientific elements implicitly interwoven into the answer. How could the decision-maker know whether his scientist adviser had been, within the range of scientific uncertainty, excessively optimistic or excessively pessimistic? The problem was complicated by the fact that, despite their uncertainty, the scientists could answer questions in quantitative terms, which could give a misleading impression of precision.

In retrospect, it would seem that the scientists advising the President and the Secretary of State prior to and during the time of the Conference of Experts may well have allowed their hopes for a more orderly international political system to interfere with their giving as properly qualified technical answers concerning control possibilities as they should have on the basis of the scientific evidence then available to them.

At the same time, the scientists did not have an unlimited opportunity to present their views. Issues concerning a nuclear test ban were only a few of countless numbers facing top decision-makers. The amount of attention that the decision-makers could devote to any individual issue was inevitably limited. Furthermore, even concerning a nuclear test ban, there were several technical issues which had to be considered. In this case, a second factor explaining why the principal decision-makers perhaps did not understand the technical complexities relating to the control of nuclear explosions as fully as they might have during most of 1958 is simply that they did not spend enough time on these issues. Within the limited amount of time that they could spend considering what position the United States should adopt with respect to a nuclear test ban, most of their attention—perhaps rightly—was devoted to considering issues other than control. They were particularly concerned about comparing American and Soviet nuclear strength and about the possibilities for future developments in the realm of weapons technology. The point is not to question the allocation of their attention, for these may well have been the most important questions, but merely to point out that little time was left for considering the technical aspects of control.

The Need for "Scientific Literacy" Among Nonscientists

A final, more subtle, factor also seems to have been involved in the communications difficulties which were apparent in American

policy-making during the earliest stages of the negotiations. To understand fully what a scientist means when he says, "*On the basis of one experiment, we think that . . .*," one must have some notions about the way in which science progresses from initial tentative estimates to more fully documented and more definitive judgments. Similarly, if one is to understand all of the ramifications of the scientists' report that the seismic magnitude of the Rainier explosion appears to be 4.1 on the Richter scale rather than 4.25 as had previously been thought, one must know something about how many more earthquakes there are at the smaller seismic magnitude. It would also be helpful to know something about the way in which these figures are calculated, and that measurements in this area of the Richter scale are usually given with the understanding that the margin of error may be plus or minus .4.

Understandably, the individuals who were the principal decision-makers in the United States during the earliest stages of the negotiations seem to have known little about modern science. They had received their education prior to the First World War, and thus prior to the great expansion in scientific activity which has occurred after that time. During most of their earlier careers both President Eisenhower and Secretary of State Dulles had not been deeply involved in science. Their background for fully comprehending scientific advice was not especially strong. Of course, one could use intelligent questioning to make up for an inadequate background. Often, however, the ability to ask intelligent questions is dependent upon having at least a minimal background. Moreover, questioning takes time, which was in extremely short supply in this instance, and probably will be in similar cases.

Thus it is clear that the first prerequisite to adequately coping with the problems posed by the growth of the role of science in security policy is the development of more "scientific literacy" among policy-makers, both politicians and diplomats. Only then will the nonscientists be able to make the best use of their scientist colleagues. In this connection, it should be noted that at least some of the scientists found the higher level policy-makers more willing to be concerned with and to make an effort to understand the technical details which were involved in the nuclear test ban negotiations than the professional diplomats, members of the Foreign Service. These scientists felt that many of the latter group tended to take

the attitude that what was important was the technique of negotiation, that a personal knowledge of the substance was secondary and might in fact be disturbing toward reaching an agreement. Obviously, the need for "scientific literacy" is as great among the diplomats as it is among the politicians. Just as the process of formulating policy cannot be divided into rigid compartments horizontally, and experts confined to their area of expertise, it also cannot be divided vertically. Improper understanding of technical issues at a lower level may be equally as damaging as improper understanding at a higher level; among other possibilities it could prevent important questions from ever reaching the higher level.

Scientific Advice at the Highest Levels of American Government

The experience in the nuclear test ban negotiations suggests that for communications between scientists and nonscientist decision-makers at the highest levels of American government to be as effective as possible, policy-makers must receive advice from several scientists rather than one. This appears to be the most effective means of guarding against the tendency for advice on scientific matters to be colored by personal predispositions. The President's Science Advisory Committee, with about twenty members and additional scientists who serve as regular consultants, can adequately meet the need for divergent viewpoints. If the Committee is to meet this need, however, it must develop adequate techniques for transmitting divergent views. The President and other top decision-makers must also be willing to receive conflicting advice and to assume the responsibility for deciding which advice they should accept as bases for policy. Ideally the top policy-makers should have the opportunity to witness in some manner a confrontation between scientists who hold divergent views. If a scientist is to remain true to the training and to the canons of his work, he must acknowledge certain facts. The test ban negotiations supply evidence that scientists will behave in this manner. Thus Hans Bethe readily acknowledged the correctness of Albert Latter's decoupling theory even though it presented a new obstacle on the road to a test ban agreement which Bethe strongly favored in principle. One of the virtues of the Congressional hearings was that they provided forums for confrontation among scientists holding divergent viewpoints. Such confrontations, by clearly developing the points concerning which the scientists

agree and disagree, can significantly clarify the issues and thereby ease the policy-makers' problem of choosing among divergent advice.

There is also another reason why policy-makers at the highest level should receive advice from several scientific sources if they are to act as rationally as possible. Most problems with which policy-makers must deal have several facets. Their scientific segments alone often involve not one but several academic disciplines. In the light of the difficulties concerning the detection of underground nuclear explosions which plagued American policy during the test ban negotiations, it may have been significant that there was no seismologist on the President's Science Advisory Committee until 1962. The Committee headed by Hans Bethe which conducted an overall appraisal of the situation with respect to the nuclear test ban in early 1958, and on which initial American policies were based, did not include a seismologist either. The President's Science Advisory Committee has generally been dominated by scientists who specialized in aspects of nuclear energy, particularly physicists. It can be argued that PSAC might have been a more effective source of advice if its membership had included a wider spectrum of disciplines. The counter-argument that scientists in all disciplines are employed by the government and therefore available to PSAC does not completely meet the problem, because having the proper mixture of disciplines is as important in the final stages involving evaluation of data and drafting of recommendations as it is in early stages involving data collection.

Scientific Expertise Within the Bureaucracy

Providing advice for policy-makers at the highest level is only one aspect of the problem of integrating scientists into the procedures for formulating American security policy. Obviously, decisions which are taken at a lower level also involve scientific questions. In addition, frequently scientific and technical research must be conducted in order to develop necessary data. An overwhelming number of the scientists who have been involved in the formulation of American security policy thus far have been employed by the Atomic Energy Commission and the Department of Defense. There can be no doubt that these two agencies have had the greatest need for scientists. However, the experience during the test ban negotiations illustrates that other agencies, such as the Department of State, also deal with questions which have scientific elements, and it can be argued that

American policy would have been better had scientific expertise been interspersed more widely throughout all of the agencies working in the area of security policy. It is not sufficient merely to have access to scientists in another agency. For one thing, having to go to another agency immediately raises all of the physical and psychological problems involved in inter-agency coordination. For another, as was apparent during the test ban negotiations, there are what can be called "agency viewpoints" on policy questions, and the views of most individuals are affected more or less strongly by the milieu in which they work. Moreover, an individual's tasks and responsibilities are bound to be defined in terms of the priorities of the agency for which he works.

It is easy to argue that governmental agencies which have only peripheral responsibilities in scientific fields ought to have more scientists on their payroll. Unfortunately, implementing this recommendation is extremely difficult. A scientist long in the employ of an agency such as the Department of State will soon lose his expertise. On the other hand, short term service involves considerable waste in terms of time lost in gaining familiarity with problems and procedures of the agency and in preparing to leave government service. Furthermore, employment in a nonscientific government agency has few attractions for a promising young scientist, deeply interested in and committed to his discipline. Joining the Department of State, for example, means substantial risk of losing contact with his discipline.

With respect to getting research done and investigating technical problems, the typical pattern, much in evidence during the test ban negotiations, has been either to assign the tasks to scientists employed by the government or to let contracts to institutions outside the federal government, and then to have the results reviewed by panels of governmental and nongovernmental scientists convened on an *ad hoc* basis. This system has much to recommend it. It involves independent checks and is in accord with the pluralistic pattern and structure of American life. However, it is cumbersome and time-consuming. For this reason, it is not responsive to the needs of modern diplomacy. In addition, it has meant that within the government the only agencies dealing with security policy equipped to conduct scientific research themselves have been those which have had as their primary responsibility maintaining the nation's military

strength or developing uses of nuclear energy. Since the Vela Program has always been administered by the Department of Defense, even after the establishment of the Arms Control and Disarmament Agency, it seems that these are also the only agencies deemed capable of administering large-scale scientific research programs, regardless of their purpose. Inevitably, the approach of these agencies to security problems has been colored by their primary responsibilities.

A possible and perhaps the best way of overcoming the difficulties involved in getting high quality scientists to serve in non-scientific government agencies at the lower and middle ranks, and also easing those connected with the conduct of research, might be to establish a national scientific institute or to expand some existing facility, such as the Bureau of Standards. Such an institute would have to allow scientists great freedom to pursue their own interests, but it might also be capable of responding to some of the government's needs. If a promising young scientist could look forward to a career in such an institute, the prospect of a brief assignment with a nonscientific government agency might not seem so unpalatable. Presumably the scientific staff of the institute would be chosen so that their interests would have some relevance to governmental needs. Given this concurrence of interests, the institute might be able to conduct certain research itself and to monitor projects entrusted to institutions outside the government which would be of immediate use to the government.

Scientists in Negotiations and as Negotiators

During the nuclear test ban negotiations, scientists were not only involved in the formulation of American policy, they also served at various times and in various capacities as negotiators. There were four conferences conducted primarily by scientists: the Conference of Experts, Technical Working Groups I and II, and the Seismic Research Program Advisory Group. During the Geneva Conference on the Discontinuance of Nuclear Weapon Tests, at least one scientist was always assigned to the American negotiating team. Later, during the meetings of the Eighteen-Nation Committee on Disarmament, several senior American scientists went to Geneva and presented briefings to members of other delegations. Finally,

scientists accompanied diplomats to Moscow when the partial test ban treaty was drafted and initialed.

Evaluating the wisdom of the decisions to assign scientists to these roles and appraising their performance depends upon assumptions about the purposes of the tasks which they were given. In negotiating, any specific move may be made for a variety of reasons, some of which may have little intrinsic relationship to that particular move. Given the decentralized system of formulating security policy within the United States, the probability is high that any move will reflect a variety of motives, and it is by no means inconceivable that these motives might conflict. Thus, any move may at the same time successfully fulfill certain motives and fail to fulfill others. Moreover, a move which satisfied certain short-range motivations of policy-makers may prove to be dysfunctional in terms of their longer-range goals or other criteria.

No one can question the use of scientists as advisers to diplomatic negotiators during the test ban negotiations. This was obviously necessary, and as far as can be determined from the public record, the scientists assigned to these missions performed their tasks creditably. The use of scientists as negotiators, however, was more controversial. Robert Gilpin, for one, has been quite critical of the performance of the American scientists as negotiators. His analysis of the 1958 Conference of Experts led him to conclude that the American scientists "lacking sufficient political guidance, fell into a number of regrettable errors."⁶ It might be fairer, though, to include in an evaluation an assessment of the tasks assigned to the scientists and of the motives for these assignments.

One of the motives behind the original American proposal to hold a meeting of experts was a desire to neutralize the public pressures against testing so that the United States could conduct its planned series of nuclear weapons tests in the summer of 1958. A second motive was a desire to test Soviet intentions; it was thought that this would offer a means of establishing whether or not the Soviet Union would really accept control. The third motive was to provide a tactical response in a diplomatic situation where some Western move was considered advisable. In terms of the first and third motives, the Conference of Experts was undoubtedly a suc-

⁶*American Scientists and Nuclear Weapons Policy*, p. 219.

cess, and it probably was also successful in terms of the second. If other criteria are used, however, the Conference of Experts appears in a less favorable light.

After the new seismic data was discovered and the theory of decoupling developed, some writers criticized the American scientists at the Conference of Experts because they had agreed to a report which then appeared to be excessively optimistic about the possibility of detecting and identifying underground nuclear explosions.⁷ Now that there have been further experiments, this criticism no longer appears valid. So far as the technical work of the American scientists at the Conference of Experts including their part in the drafting of the report, it was probably as good as could be done, given the existing state of knowledge.

Other criticisms, though, can be made of the Conference of Experts. By their report the Experts virtually committed the United States to engage in negotiations, and—what was perhaps even more crucial—to negotiate on the basis of the particular control system which they recommended. As a strategy for getting the United States to take positive action, this course may have been wise. Without some such development, because of the difficulty of formulating an agreed policy within the American government, the United States might never have engaged in the negotiations.

On the other hand, practical as this course may have been, it fell far short of criteria for rational decision-making. Entering negotiations in this manner meant that the threshold of detectability which would be acceptable to the United States was determined in Geneva by a group of scientists temporarily serving as negotiators, with very skimpy instructions, not through a deliberate decision at the highest levels of government. It also meant that until the accession of the Kennedy Administration, the government was not united in support of the negotiations. Thus the United States often seemed to be pulling back; reluctant to accept what its scientists had proposed.

The wisdom of committing the United States to a particular control system at an early stage in the negotiations can also be

⁷See, for example, Freeman Dyson, "The Future Development of Nuclear Weapons," *Foreign Affairs*, Vol. XXXVIII, No. 3 (April 1960), pp. 457-64.

questioned. Doing so severely limited American flexibility. Any control system is composed of variable elements, some predominantly technical, others predominantly nontechnical. All of these elements are interrelated, and changes in one area can be compensated for by adjustments in another. For example, one can compensate for a smaller number of on-site inspections by having a greater number of control posts. Similarly, one might also compensate for less efficient or trustworthy operating personnel by having a greater number of control posts. The ability to make such trade-offs, however, was greatly reduced as long as the Report of the Conference of Experts remained the immutable basis for the nuclear test ban negotiations, and the Soviet Union certainly viewed the report in this light for several years.

The American motivation for insisting on convoking Technical Working Groups I and II was always rather ambiguous. Calling for additional technical conferences was a course which was acceptable within the American government, both to those who wanted to abandon and to those who wanted to continue the negotiations. Since it could be viewed as a means of testing Soviet intentions, it was also agreeable to those who wanted a nuclear test ban treaty, but only under "acceptable" conditions.

From the point of view of the utilization of scientists as negotiators, Technical Working Group I appears to have been by far the more sensible of the two. In TWG I the scientists were given a narrowly defined task—to elaborate a control system for high altitudes and outer space—on which there was substantial agreement among the negotiating partners. The American scientists obviously had profited from their earlier experience at the Conference of Experts: they insisted on much more careful phraseology and on recommending alternative systems rather than a single one.

In Technical Working Group II, the scientists were in effect asked to solve the deep controversies which plagued the negotiations, an obviously impossible task. Moreover, they were asked to do this at a time when the United States was in the process of empirically testing the theory of decoupling, the development of which had done the most to dampen American enthusiasm for a test ban. In addition to failing to accomplish their mission, the scientists participating in Technical Working Group II jeopardized the intricate and delicate network of their personal relationships extending across national

frontiers, which they had so carefully nurtured. One cannot but question whether this was a sensible assignment.

The Seismic Research Program Advisory Group was another matter. It is hard to conceive of any way of planning a joint or coordinated research program other than to have scientists themselves meet and produce agreed elements of a program.

After this meeting, American policy placed less emphasis on formal meetings of scientists, and probably wisely. If the purpose of bringing scientists into the negotiations was either to convince the opposite side or neutrals of the legitimacy of the Western position, there was no inherent reason why this could not be done as well, if not better, through informal sessions rather than through formally constituted meetings of scientists. The use of scientists after 1960 for elucidating and buttressing Western positions seems to have accomplished these goals, to the extent that they could be accomplished, and yet avoided the difficulties of the formal meetings of scientists.

In this connection, the Kennedy Administration had a distinct advantage over its predecessor—and this must be kept in mind in any evaluation or comparison of the conduct and contributions of the two administrations. It was under the Eisenhower Administration that the decision-makers were faced for the first time with the novel and complex scientific issues involved in the test ban and with the difficult task of finding the proper men and devising organizational patterns and procedures through which scientific advice could be integrated in the governmental process. By the time the Kennedy Administration took office a number of career diplomats and other governmental officials had acquired basic background in these problems and some lessons could be drawn from earlier experience. This was necessarily reflected in both the policy formation and in the later shapes of the negotiations.

III

The Substance of American Security Policy

Vacillation and Ambiguity

Much of what has already been said concerning formulation and execution of American security policy obviously has implications for the substance of that policy. Because the Eisenhower Administration

was deeply divided concerning the wisdom of a nuclear test ban, and because President Eisenhower did not take decisive steps to end this division, until 1961 American policy toward the nuclear test ban negotiations was characterized by ambiguity and vacillation. The United States often appeared not to know whether or not it wanted a test ban or what the minimum conditions were that it would accept. It is difficult, if not impossible, to say whether this situation was due primarily to President Eisenhower's basic belief that the Soviet Union was not prepared to accept any agreement except on terms disadvantageous to the United States or to his reluctance to resolve differences within the Administration. In fact, he remained skeptical of the wisdom of the Moscow Treaty even after it was negotiated.

Inadequate Technical Preparation

A second major problem was that throughout the negotiations the level of the United States technical preparation left much to be desired. During the Conference of Experts, the United States based its calculations for elaborating control measures over underground nuclear explosions on one experiment. Subsequent experience proved that this base was too narrow. Several times American scientists discussed and agreed to control devices which did not exist and the real operational capacities of which therefore could not fully be known. An operating prototype of the control station recommended by the Conference of Experts in 1958 did not exist until October 1960. The satellites recommended by Technical Working Group I for the detection of nuclear explosions in outer space were not put into orbit until the fall of 1963, three years before an entire system would be operational. Twice during the negotiations the United States attempted to settle technical issues despite the foreknowledge that relevant experiments would be conducted during the technical discussions or after their conclusion. This occurred, as will be recalled, in the case of the Conference of Experts. It also occurred with respect to Technical Working Group II. The first major experiment in Operation Cowboy, a series of chemical explosions designed to test Albert Latter's decoupling theory, was conducted on December 17, 1959, the day before the Working Group recessed. The tests in this series would continue until mid-March 1960.

This is not to suggest that the level of American technical preparation was inferior to that of the Soviet Union, for the record

certainly does not indicate this. On the contrary, the United States scientists provided by far the largest proportion of the technical data. Given the asymmetrical interest in control, which regardless of whether or not it is desirable will probably continue as long as Western societies maintain a higher degree of openness than Communist regimes, the situation requires that the West be better prepared technically than the East. Nor is it to attempt to set absolute and ideal standards by which to judge the American performance. It is merely to state that the United States' level of technical preparation was not adequate to the seriousness of the task. This criticism of course applies with even greater force to the Soviet Union. Admittedly, it is impossible always to foresee or control the pace of negotiations, but in 1958 a test ban was an issue of long-standing, and the United States was unprepared despite its salience.

In part, technical preparation is a function of administrative and financial support. The United States' position in 1958, among other things, reflected the relatively low priority accorded to arms control and disarmament matters within the government then. Presumably the situation has at least been improved with the establishment of the Arms Control and Disarmament Agency. Clearly more human and physical resources within the government are now devoted to tasks in this area. Whether or not sufficient resources are allocated to these matters, though, is an unanswered question. And one curious effect of the establishment of ACDA has been that because there has now been amassed a wealth of technical detail it has become progressively more difficult for creative outsiders to get a foothold in this field, and therefore the number of technical people not in government employ who are willing to concern themselves actively with trying to find radical solutions has been reduced.

Technical preparation is also a function of the linkage between political intelligence and technical research. Forthcoming technical issues have to be defined far enough in advance so that scientists have ample time to probe their complexities. Again, establishment of the Arms Control and Disarmament Agency should help to create and maintain this linkage. Moreover, the office of the Special Assistant to the President for Science and Technology and the President's Science Advisory Committee—both created as responses to the Sputnik crisis of the fall of 1957—are now much more firmly established as parts of the governmental structure than they were in 1958. Representa-

tives of the scientific community now have an unquestioned place in the nation's highest policy councils. Perhaps as much has been done as is possible in terms of institutional arrangements. The questions which remain—and which by their nature are presently unanswerable—center on whether sufficient thought is given to future problems. As far as the role of ACDA is concerned, there is also a question whether—in the absence of arms control agreements that would give it operating responsibilities—the Agency will be able to retain high quality personnel and assert its place in the mainstream of policy-making in Washington.

The Linkage Between Controlling the Arms Race and Altering the State System

A third substantive problem was the linking of the nuclear test ban issue with American schemes for and concepts of world order. The United States originally proposed and argued that a grandiose organization would be required to monitor a nuclear test ban. This body would have dwarfed all existing international organizations. Interestingly, few of the American participants in the negotiations felt that such a huge organization could long stand with such a limited function; they felt that it would either have to assume additional functions in the field of arms control or collapse. Of course one reason for the extent of the American proposals in this realm was that those within the United States government who questioned the wisdom of a nuclear test ban treaty found this a convenient way of working against a test ban without engaging in a frontal attack. However, more fundamental factors were also responsible. American concepts of world order ultimately looked forward to the hierarchical organization of the world. In considering the organizational requirements of a nuclear test ban the United States drew from past experience with such organizations as the United Nations and also tried to insure that whatever new organizational developments were implemented in connection with the nuclear test ban would fit in with the general long-range goal. Little thought was given to the relationship between the limited arms control functions to be performed and the organizational requirements. As a result, in many ways the United States was as unprepared for serious arms control negotiations when it came to determining the appropriate organizational arrangements as it was lacking in the essential technical data.

Inferring from the American proposals, it appears that little thought had been given in the earlier years of the negotiations to the problem of how to reduce the possibility of nuclear holocaust without at the same time reforming the world political system. Reciprocal or adversary control (more accurately in this instance unilateral control), the technique eventually embodied in the Moscow Treaty, was one obvious response to this problem, but the United States did not even suggest this possibility until 1962. It is apparent from the record that the Soviet Union was equally if not more deficient in thinking about these problems. Throughout the negotiations there was no evidence that within the Soviet government the organizational aspects of disarmament were being considered separate from other policy questions.

The Consequences of the American Position

An assessment of the consequences of the policies pursued by the United States may be made on several levels. It seems clear that these policies caused certain difficulties for the United States in the realm of propaganda, and on these grounds it can be argued that the United States would have been in a better position had it maintained its original position of clearly insisting on linking a nuclear test ban with other measures of arms control and disarmament rather than taking the positions that it did. At least then the United States could not have been accused of negotiating in a disingenuous fashion.

A more fundamental consequence was that Soviet intentions were never fully explored. It may well be that the Soviet Union would not have agreed to any formally binding commitment prior to 1963, nor at any time to a treaty that would have involved on-site inspection. The point is that since American policies were not flexible and generous enough to allow ultimate testing of Soviet motivation these assertions cannot be made with certainty and without fear of contradiction. As the record stands, it is always possible to argue that if only American policies had been framed in terms a bit more acceptable to the Soviet Union, a more far-reaching agreement would have been possible earlier.⁸

⁸Both American and British negotiators have implicitly stated this. See James J. Wadsworth, *The Price of Peace*, p. 73, and Sir Michael Wright, *Disarm and Verify*, p. 109.

On the level of negotiating tactics, the decision to proclaim a one-year moratorium on the testing of nuclear weapons at the outset of the diplomatic negotiations has been seriously questioned. Many have argued that this deprived the United States of one of its most important means of bringing pressure on the Soviet Union to reach an agreement. It is clear that regardless of the course of the negotiations it became very difficult, if not impossible, for the United States to end the moratorium. On the other hand, whether or not the Soviet Union would have consented to engage in negotiations had the United States insisted on continuing its testing is problematical. Furthermore, had it chosen to pursue this course, the United States government would have had to have been willing to face serious pressures from both internal and external sources, the latter especially in the United Nations.

IV

The International System

Open and Closed Societies

The way in which the two sides handled the important issue of the moratorium on testing brings out as clearly as any example drawn from the nuclear test ban negotiations the tactical advantages that a closed society enjoys over an open society in international negotiations. The former can shift course quickly and radically, and can plan its moves in secrecy, thus maintaining the advantage of surprise. Open societies, in contrast, except during crises, tend to move more slowly and to give ample forewarning of their moves. Thus the Soviet Union could break the moratorium suddenly, while the West could not.

A somewhat different disadvantage but stemming from the same cause was that the open and pluralistic societies of the West gave off ambiguous signals. Some in the West spoke in more severe terms than the official policy, others in more lenient terms. Those who took lines which diverged from official policy sometimes even included individuals with policy-making responsibilities. The Kremlin could read these divergent signs as indicating on the one hand that the official policy might be only a cover for a harsher line, or, on the other, as indicating that further concessions would be forthcoming, and that to gain these one need only wait. Of course, the open-

ness of Western society could also be an advantage to the extent that it allowed the West to introduce "feelers" into the negotiations. To make use of this advantage requires skill and care, and also greater control over circumstances than sometimes exists in reality.

Policy-makers in a closed society are less subject to external and internal pressures than their counterparts in an open society. The test ban negotiations indicate that the Western states tended to take such matters as UN resolutions and pronouncements of neutrals more seriously than did the Soviet Union. However, they also show that both sides were affected by such matters to some extent, and that both would ignore them if they felt that their vital interests were at stake. Thus both sides tried to have their position endorsed by the UN, and both also did things that UN resolutions exhorted them not to.

A related difference is that the USSR could appeal to segments of the Western public, over the heads of the Western governments, while the Western states could not as easily engage in similar operations with respect to the Soviet people.

The differences in the nature of Soviet and Western societies, however, affected the negotiations in more fundamental ways than simply with respect to the tactics and relative freedom of action on the part of the negotiators of the two sides. At least partly because of its closed society, the USSR's attitude toward the establishment of control measures was significantly different from that of the United States and the United Kingdom. To the end of the negotiations, the Soviet Union firmly resisted any outside intrusions that it could not control. For a while the Soviet Union appears to have been willing to accept the intrusions connected with the establishment of a limited number of fixed control posts manned by at least some non-Soviet personnel. This position was in a sense an unprecedented step but it was retracted in November 1961 and never reinstated. The Soviet position toward on-site inspection was always so hedged, that—partly for reasons suggested earlier in connection with the United States policies—it is impossible to say that the USSR was ever entirely willing to accept such intrusions. The rationale for the Soviet Union's penchant for secrecy has been amply analyzed elsewhere;⁹ it is only necessary here to note how deeply it affected the

⁹See especially Alexander Dallin and others, *The Soviet Union, Arms Control and Disarmament*, pp. 142-58.

USSR's policy in this instance. No doubt the Soviet Union's secrecy contributes something to its military security, though it is also clear that this secrecy is an important part of the regime in its own right, and as such has a vital effect on arms control negotiations. These remarks are of course not intended to suggest an absence of secrecy and concern with secrecy in the West, but rather to indicate an important difference.

A related point is that the USSR never consented to the establishment of a control organization in connection with a nuclear test ban which could take significant action against its wishes. No doubt the positions of East and West are colored by the experience of the two sides in and with existing and past international arrangements and institutions such as the United Nations, an experience which thus far has been much more favorable to the West in East-West confrontations. But the more important explanation of the differences in the attitudes toward control and inspection probably lies in the differences between the two societies.

The Effects of Technology

The record of the test ban negotiations is interesting in this respect for it showed how these fundamental differences between the two societies—and particularly the closed character of the Soviet society—were being altered among other factors by the growth of modern technology. In 1963 the United States felt that it could do as good a job of detecting underground nuclear explosions within the Soviet Union with stations outside of the territory of the USSR as it had felt in 1958 that it could do with a significant number of stations within the USSR. The development of observation satellites also sharply inhibited the ability of any society to act in secret. Thus the Soviet system has become more open, not necessarily by its own conscious design, but simply because technology has made it easier for others to observe Soviet territory, regardless of Soviet wishes. In the long run, this factor should reduce at least to some extent the difficulty of negotiating arms control agreements, particularly if it is reinforced by the conscious efforts toward greater openness such as increased exchange of persons and scientific cooperation between East and West. As a result, the USSR should become less reluctant to accept intrusions, and the West less insistent on their necessity.

The Role of Nonnuclear States

The proposition that other powers can affect the policies of the superpowers is implicit in what has already been said. The United Nations was one forum available to virtually all states during the test ban negotiations, and many of them sought to and did exercise influence through it. The Eighteen-Nation Disarmament Committee was a more effective instrument for those states which were members; there can be no doubt that both the USSR and the United States were more sensitive to pressures brought to bear and suggestions raised in this organ than in the more diffuse General Assembly. It is also demonstrable, as many British leaders have claimed, that the United Kingdom had influence far greater than that of other states of equivalent size, mainly, in this case, because of its possession of nuclear weapons.¹⁰ It is further clear, though, that ultimately the superpowers, the USSR and the United States, or more accurately political configurations within them, determined whether or not there should be a nuclear test ban treaty. Other states and international organizations could influence the superpowers, and their internal political configurations, but they could not determine the course of events.

Power and Agreements

The record of the test ban negotiations also has relevance for long-debated questions about the relationship between the distribution of power and the achievement of agreements. When the Moscow Treaty was signed, the relative position of the Soviet Union and the United States with respect to the development of nuclear weapons was very different from what it had been when the negotiations began in 1958. In 1958 the United States apparently held the technological lead with respect to all areas and levels of nuclear weapons development. By 1963 the Soviet Union had detonated larger weapons than the United States, and the test ban treaty would make it difficult if not impossible for the United States to develop weapons of such magnitude. In more general terms, the USSR appeared to have become technologically more advanced than the United States in the development of high-yield weapons; that is, weapons with a yield of 5 or 10 megatons or larger. The situation with respect to weapons

¹⁰See Sir Michael Wright, *Disarm and Verify*, p. 141.

with intermediate yield was indeterminate. The United States definitely held the lead in low-yield weapons; that is, weapons with a yield of less than one megaton. However, since continued underground testing was permitted under the treaty, and since weapons with such yields can be tested underground, presumably the Soviet Union could attempt to equal or surpass the United States level of achievement. This consideration might have made the treaty more attractive for the Soviet Union in 1963. It should be noted though that since the signature of the treaty the frequency of underground tests conducted by the United States has exceeded that of tests conducted by the Soviet Union by almost a factor of ten. Whether this is due to a lack of preparation on the part of the USSR, to a low opinion of the value of such tests, or to their high cost and complexity, it is impossible to know.

What was perhaps equally as significant as the exact state of the technological race was that both sides appeared to have neared the theoretical limits of nuclear weapons development in their last series of tests, and also to have discovered most or all that was "interesting" to them in terms of their concepts of military strategy. The Soviet Union, having apparently decided under Khrushchev to put great emphasis on deterrence, had developed the counter-city weapons that it needed for this strategy. The United States under President Kennedy, on the other hand, moved to deemphasize the role of nuclear weapons in its strategy, and in particular became less interested in the development of tactical nuclear weapons.

The changes in positions of the two sides with respect to the development of nuclear weapons should be viewed against the changes concerning total military strength. In 1963 the United States' margin of superiority was significantly greater than it had been five years earlier.

In sum, with respect to military power, in 1963 there were reasons for both sides to have greater confidence in their own abilities to achieve the missions that they might assign to their military establishments than they had in 1958. This bears on the question of whether in an arms race an increase in one side's security necessarily decreases that of the other side, and also on the degree of confidence necessary to achieve arms control agreements. P. M. S. Blackett's argument, though, that the Western superiority in missile strength made the USSR unwilling to accept an international control

system for a test ban on the ground that such a system would detract from Soviet security by possibly revealing the location of Soviet missile sites, should be noted.¹¹ He feels that the USSR counted on the secrecy of these sites to offset the Western numerical superiority. Many strategists disagree with his argument, and in any case observation satellites have to some extent made it obsolete.

The Decline of Bipolarity

At the same time that both the United States and the Soviet Union became more confident concerning their own military capabilities vis-à-vis one another, they each became more worried about other problems on the world scene. In the first place, both appear to have become more concerned about the consequences of the dispersion of nuclear weapons capabilities, and this has marked the emergence of a common interest of the two nuclear superpowers in the status quo. More specifically, for their own reasons both the Soviet Union and the United States became interested in inhibiting increases in Communist China's military power. Again, the Soviet Union had always been concerned about the spread of nuclear weapons capabilities in the West, and especially to Western Germany. Although the United States was never as concerned about the spread of nuclear weapons capabilities within the West as it was within other areas, it foresaw a connection between the spread within the West and elsewhere and increasingly came to oppose the spread within the West also. One purpose behind the American proposal for a multilateral nuclear force under NATO was to foreclose pressures for new national nuclear forces in the West and particularly in Germany although the Soviet Union has refused to view the proposal in this light.

To say that both the Soviet Union and the United States became increasingly interested in a nuclear test ban because they became increasingly interested in inhibiting the nuclear capabilities of other states, implies that this arms control agreement was partially a consequence of decreasing bipolarity. Paradoxically, signing the agreement hastened the dilution of bipolarity, for it meant that each coalition leader had to oppose the wishes of a major ally: the Soviet

¹¹P. M. S. Blackett, *Studies of War: Nuclear and Conventional* (Edinburgh: Oliver and Boyd, 1962), p. 160.

Union, those of Communist China and the United States, those of France.

The Problem of Controlling Modern Technology

The experience with the nuclear test ban negotiations confirms the immense difficulty inherent in the task of controlling modern technology in an environment of the multi-state system. The negotiations brought out how hard it was to arrange matters so that the interests of just two sides (and three states) coincided enough to allow for an agreement. The refusal of Communist China and France to adhere to the Moscow Treaty, although anticipated, reduced the value of the treaty for the two sides and showed that bargains made essentially bilaterally cannot easily be extended to other parties.

The makeup and interests of states are not identical and agreements affect them differently. Constructing an agreement that has an equal range of benefits and disadvantages for many disparate partners is a task of great intellectual difficulty, and one which is made even more laborious if it must be worked out through the mechanisms of multi-governmental bargaining and complex intragovernmental processes such as those existing in the United States.

The fact that modern technology is subject to swift changes—as was amply evidenced during the nuclear test ban negotiations—makes this task even more complicated. The insistence by the West in 1959 that “new data” be brought into the negotiations after the scientists had agreed on the relevant technological basis in 1958—and the refusal by the Soviet Union to agree to this proved a major stumbling block in the negotiations.

If it is difficult to strike a bargain among several disparate parties for a static situation, it is even more difficult to strike one that will accommodate technological change and yet any agreement without such accommodation would be of limited value. Sovereign states are most unlikely to accept agreements which have a built-in potentiality for unpredictable alterations. Thus the Soviet Union would be very unlikely to accept a treaty that would at the outset provide for 20 on-site inspections on its territory annually but might under certain circumstances require several hundred.

The conceivable solutions for this problem are limited. The participating states could give broad powers to a panel of scientists to modify the control system in accordance with new technology,

but during the test ban negotiations neither side seemed very eager or willing to accept such a solution. If the panel of scientists were given such powers the states would be exposed to the danger that the distribution of benefits and disadvantages built into the treaty could be radically altered by a group beyond their control. Moreover, the test ban negotiations show how many different interpretations of some data are scientifically plausible. Thus the margin of discretion would be quite wide and the scientists could not be expected to achieve universally accepted decisions. Another possibility would be to require a periodic review of the control provisions, but what this actually would amount to is a provision for periodic renegotiation, if significant technological changes occurred which vitally affected the subject matter of the treaty. That this renegotiation would be conducted within the framework of the treaty might provide some guidelines and an additional incentive for agreement, but little beyond that. Of course, if an adversary or reciprocal control system were used, as it was in the Moscow Treaty, accommodating technological change could be accomplished on the basis of unilateral decisions by interested parties. Of the various ways of treating the problem, this is clearly the easiest to negotiate and the least cumbersome, but whether or not it can be applied to other than essentially bilateral relationships is open to serious question.

Although it does not show in the terms of the Moscow Treaty, the nuclear test ban negotiations made it apparent that some control measures can be developed as a by-product of peaceful activities. The use of weather stations to collect information on radioactive fallout and of seismological stations to collect information on underground nuclear detonations are examples. Interestingly, as the level of technology has risen, effective exploitation of such developments has often required increased international collaboration. The territories of states are often just too small to exploit new technological developments. The position of the United States in the test ban negotiations concerning the use of already existing stations shows the doubts that many states would have about the reliability of information from such national sources, but perhaps this problem could partially be overcome by having redundant systems for gathering information. Moreover, it is possible that there may be more sources that a state could trust in a multipolar world than in a bipolar world, and for this reason the movement of the world from

bipolarity may make it increasingly possible to rely on information gained from such sources. One can envisage a relatively high degree of control over technology resulting from overlaying the world with multiple networks based on international arrangements for scientific collaboration, established principally to facilitate other purposes such as weather prediction and high-speed, long-distance communication.

As the nuclear test ban negotiations so clearly demonstrate though, the questions of whether or not such control will be established, and the extent of this control, are preeminently political and diplomatic, not technical. Science and scientific research can contribute to the solution of arms control and disarmament problems; it cannot solve them.

It is obviously impossible to give a definitive answer at this stage to the crucial question of whether or not the signature of the Moscow Treaty marked a turning point in the nuclear era. What can be said, though, is that the Treaty represented an attempt to create a turning point; that the attempt has been made is important and it has had an impact on international atmosphere. Furthermore, what has been learned in the process of making the attempt may have been as important as the actual Treaty, for mankind now knows a good bit more about how to proceed in efforts to create a more peaceful world. Finally, the record of the test ban negotiations also shows that the growth of technology may contain within itself important potentialities for control.