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**Collaborative Verification and
the Control of Nuclear Tests**

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Collaborative Verification and the Control of Nuclear Tests¹

Nancy W. Gallagher

Nuclear arms negotiations epitomize the mixed motives that characterize international cooperation. Arms control offers mutual benefits by averting war, minimizing destruction, and lowering the cost of security. Yet, leaders often hesitate for fear of cheating, unequal benefits from mutual compliance, and internal opposition to arms control.

Verification is often viewed as a technical solution to the political problems of collaboration with no global authority to enforce contracts and protect cooperative players.² Both cooperation theory and U.S. security policy maintain that accurate judgments about compliance can increase cooperation.³ Reliable detection capabilities lower the risk of exploitation by providing timely warning when violations occur. Reciprocal strategies deter defection and encourage cooperation if states know whether to punish or reward other players. Finally, publicizable information about compliance raises domestic support for successful accords and reduces popular pressure for arms control with unreliable partners. In this benign view of verification, more is better. When technical or diplomatic limits on verification capabilities exit, policy makers must decide “how much is enough?”—that is what detection probability makes the benefits of arms control outweigh the costs and risks.⁴

The Reagan administration used this reasoning to depict Soviet support for joint efforts to improve verification as the “litmus test” of their commitment to arms control.⁵ At that time, Americans longed for mutual cooperation, but worried about being “tricked again.”⁶ They sought a “low-risk, working relationship that improves only if and when the good faith of the other side has been clearly demonstrated.”⁷ Verification collaboration—ranging from passive acceptance of satellite surveillance to data exchanges to inspections at suspect sites—appealed to ambivalent Americans as second-order cooperation (i.e., joint measures that are not an end in themselves, but facilitate more substantive cooperation). Such proposals offered a low-risk way to test Soviet intentions and minimize the role of trust in arms control. When Soviet acquiescence to unprecedented verification cooperation preceded accords on intermediate-range nuclear forces (1987), conventional forces in Europe (1990), strategic arms reductions (1991), and verification protocols for two détente-era treaties on nuclear

¹. The author would like to thank the following individuals for helpful comments and suggestions: Thomas Cochran, Martha Crenshaw, Anthony Daley, Vicki Golich, Richard Harknett, Warren Heckrotte, Peter Rutland, and Jacob Scherr.

². For the purposes of this paper, “verification” is defined as decision-making about the extent to which cooperation is occurring in a formal or informal arms control regime. The process of verification includes the definition of cooperation, information collection, analysis, and evaluation. “Monitoring” will refer to data collection about any type of military activity and “intelligence gathering” or “espionage” will refer to monitoring efforts that support unilateral security options rather than arms control cooperation. These distinctions are important because definitions that equate verification as a neutral process of information collection to increase transparency ignore both the political aspects of defining, analyzing, and evaluating cooperation, and the possibility that the information will be used to support unilateral action rather than cooperation.

³. The classic statement of the U.S. policy position that arms control verification should detect, deter, and reassure is U.S. Arms Control and Disarmament Agency, *Verification: The Critical Element of Arms Control*, Publication No. 85 (Washington, DC: GPO, March 1976). Robert Barker, the Assistant Secretary of Defense (Atomic Energy) under President Ronald Reagan, discusses verification in similar terms, although his formulation places more emphasis on detecting violations than on deterring them. See “The Verification of Arms Control, Disarmament Agreements and Security,” *Disarmament* 11:2 (Summer 1988): 2–11. On verification as a means to increase transparency in cooperation theory, see Kenneth Oye, *Cooperation Under Anarchy* (Princeton, N.J.: Princeton University Press, 1986), pp. 16–18; Robert Keohane, “The Demand for International Regimes,” in Stephen Krasner, ed., *International Regimes* (Ithaca, N.Y.: Cornell University Press, 1983), pp. 159–161; and Arthur Stein, *Why Nations Cooperate* (Ithaca, N.Y.: Cornell University Press, 1990), pp. 113–150.

⁴. Allan Krass, *Verification—How Much is Enough?* (London: Taylor and Francis, 1985), pp. 140–152. Other works on the politics of verification include Krass, “The Politics of Verification,” *World Policy Journal* 4 (Fall 1985): 731–753; Michael Krepon, “The Political Dynamics of Verification and Compliance Debates,” in William Potter, ed., *Verification and Arms Control* (Lexington, Mass.: D. C. Heath, 1985), pp. 137–141; Mark Lowenthal and Joel Witt, “The Politics of Verification,” pp. 153–168 in Potter; and Mark Lowenthal, “The Politics of Verification: What’s New, What’s Not,” *The Washington Quarterly* 14:1 (Winter 1991): 119–130.

⁵. Eugene Rostow, *Statement before the Committee on Armed Services*, U.S. Senate, 24 July 1983.

⁶. Daniel Yankelovich and Richard Smoke, “America’s ‘New Thinking,’” *Foreign Affairs* 67:1 (Fall 1988): 1–17.

⁷. Yankelovich and Smoke, p. 16.

testing, many Americans concluded that verification collaboration was the safest and surest route to arms control.⁸

The test ban case offers an excellent opportunity to test this conclusion. Presidents from Eisenhower to Carter maintained that an “adequately verifiable” Comprehensive Test Ban (CTB) would enhance security if both sides agreed on a verification system. The USSR claimed to share this goal, but its reluctance regarding technical talks and intrusive verification raised U.S. doubts about Soviet intentions and contributed to failure in two rounds of trilateral CTB talks (1958–63 and 1977–80). The modest treaties that were negotiated—the 1963 Limited Test Ban Treaty (LTBT), the 1974 Threshold Test Ban Treaty (TTBT), and the 1976 Peaceful Nuclear Explosions Treaty (PNET)—minimized verification disputes but did not slow the arms race. Reagan raised concerns about verification and compliance to justify further delay in TTBT and PNET ratification, and an end to CTB negotiations. Two collaborative projects in the mid-1980s—an in-country seismic monitoring demonstration by the Natural Resources Defense Council (NRDC) and the Soviet Academy of Sciences (SAS), and a Joint Verification Experiment (JVE) of on-site yield estimation at U.S. and Soviet test sites—preceded TTBT and PNET ratification and accompanied agreement on a “step-by-step” approach toward a CTB. On the surface, then, the test ban case supports the view that verification collaboration increases cooperation.

This paper analyzes the causes and consequences of verification collaboration in three periods: (1) the early comprehensive talks that culminated in the LTBT, (2) test ban cooperation and controversy during the rise and fall of détente, and (3) the competing collaborations of the mid-1980s. It examines the main components of arguments about verification and the strategies used to manage conflicting concerns about verification during domestic debates and international negotiations. Cross-temporal analysis explores continuity and change in the impact of collaborative proposals at times when official preferences are mixed, favorable, or uncondusive to arms control. Detailed analysis of two projects in one period compares the effect of transnational and intergovernmental collaboration.

The test ban case shows that verification collaboration is more, rather than less, political because it is second-order cooperation. Even definitions are controversial: for example, Soviet plans for cooperative verification often involved joint judgments about compliance while U.S. proposals invariably differentiated between international efforts to improve information collection and national responsibility for compliance evaluation. Calls for collaborative projects are advanced by many different actors, some of whom are not seriously concerned about improved verification, and some of whom are not really interested in arms control at all. Whereas previous works on the politics of verification have advocated efforts to “depoliticize” verification by first achieving a national consensus on the benefits, costs, and risks of arms control,⁹ I find that negotiators and domestic groups often try to frame verification questions as technical problems to avoid discussion of deeper questions. Attempts to reach consensus or to take test ban verification decisions out of the political arena never succeeded. Instead, the success or failure of test ban proposals depended on shifting patterns of alignment and alliance among groups with divergent first principles—that is bedrock beliefs about the value of arms control, other states’ intentions, deterrence stability, and the nature of verification itself. Judging compliance involves tradeoffs between maximizing the value of compliance information and minimizing the costs and risks of verification itself. U.S. proposals for verification collaboration emphasized its benign features, while Soviet reactions stressed the costs and risks. The superpowers never outlawed any tests which either side still wanted to conduct, largely because these lop-sided ways of thinking about verification undermined support for significant arms control. Instead of offering an escape from the political dilemmas of cooperation, controversies over collaborative verification complicated and perpetuated domestic disagreements about arms control policy, U.S.–Soviet disputes about compliance evaluation, and global attempts to address the contradictions inherent in arms control and deterrence.

⁸. For example, Ronald Lehman II, head of the Arms Control and Disarmament Agency (ACDA) under President George Bush, concluded that “verification glasnost led to and reinforced political glasnost,” fundamentally reshaping U.S.–Soviet relations. See “Lehman’s Lessons: The Arms Control Agenda,” *Arms Control Today* 21:10 (19 December 1991): 9.

⁹. See, for example, Lowenthal and Witt’s argument that the way to depoliticize verification is to have a national discussion about “what we can expect from arms control, how much risk we are willing to accept, and how much uncertainty we can tolerate,” p. 168.

Framework For Analysis

In the politics of verification, suspicious states and contentious domestic groups struggle to reach agreement about the principles and procedures to use for evaluating arms control compliance. Proposals for verification collaboration are part of a much larger argument between negotiators and among domestic groups who reason about verification from conflicting first principles:¹⁰

- 1) Is mutual cooperation on this issue desirable?
- 2) Is the other side seriously interested in arms control?
- 3) Would low levels of cheating and/or unequal relative gains matter?
- 4) How does verification alter arms control outcomes?

In this section, I use these four questions to categorize the main groups engaged in test ban verification politics and to suggest how proposals for technical collaboration are used in strategies to alter arms control outcomes.

Applying the framework to the test ban case shows which actors use various strategies most effectively and why test ban technology collaboration often produces unexpected results.

First principles spring from individual and organizational interests as well as general foreign policy beliefs. Attitudes toward arms control and verification are complex and do not always correspond neatly to power positions or bureaucratic roles. Different U.S. presidents have held divergent views about a CTB and some, such as Eisenhower, changed positions over time. Each attitude has adherents in the Executive Branch, Congress, the scientific community, and the attentive public, and many individuals hold contradictory beliefs or hybrid principles. But only by comparing and contrasting basic assumptions that shape verification preferences can we see how arguments turn into arms control outcomes.

This framework rests on two other important simplifications. First, my analysis of domestic politics focuses primarily on the United States, both because more information is available and because it is reasonable to assume that social groups will have greater influence in more pluralistic countries. However, the distinction that I develop between arms control advocates, cautious cooperators, and unilateralists can be a valuable heuristic to distinguish the structure of any state's official arms control policy, to compare competing interpretations of motives behind official declarations, and to characterize internal debates that are accessible to external analysts. Second, my analysis of test ban negotiations focuses primarily on superpower interactions. The TTBT, PNET, and the nuclear testing talks of the late 1980s were strictly bilateral, while the United States and United Kingdom usually coordinated positions in the two generations of CTB negotiations. When U.S. and British positions diverge, or when third parties play an important role in test ban verification politics, however, the framework can encompass these developments.

Domestic debates about verification are shaped by common and conflicting answers to three questions. Table 1 summarizes these answers and the resulting verification predisposition.

Arms Control Advocates seek a CTB to slow the arms race, preserve deterrence stability, hamper proliferation, and decrease environmental damage caused by nuclear tests.¹¹ To them, the logic of nuclear vulnerability dictates that other countries should also want to lower the costs and risks of deterrence. Arms control advocates expect CTB compliance to be high because a mutual ban serves everyone's interest. Both superpowers can destroy each other many times over, so arms control advocates do not worry about small tests that might escape detection.

¹⁰. The most explicit statement of the idea that arguments about arms control and verification are structured by incompatible assumptions can be found in the essays in Lynn Eden and Steven E. Miller, eds., *Nuclear Arguments*, (Ithaca, N.Y.: Cornell University Press, 1989). As I have argued elsewhere, previous works on the politics of verification traced preferences to underlying beliefs about Soviet intentions or U.S. nuclear strategy in ways that over-simplified the structure of verification arguments and failed to recognize that ideas about verification have an independent effect on arms control outcomes. See Nancy W. Gallagher, *The Politics of Verification* (manuscript).

¹¹. Steve Fetter, *Toward a Comprehensive Test Ban* (Cambridge, Mass.: Ballinger, 1988) provides an excellent assessment of the main arguments for and against a CTB.

Table 1 Divisions in Domestic Verification Debates

	<i>Arms Control Advocates</i>	<i>Cautious Cooperators</i>	<i>Unilateralists</i>
Is mutual cooperation desirable?	Yes	Yes	No
Does the other side want arms control?	Yes	Maybe	No
Would cheating or unequal relative gains matter?	No	Yes	Yes
Resulting verification predisposition	Flexible	Critical	Rigid

Since they value cooperation, expect voluntary compliance, and discount low-level cheating, they can be *flexible* about verification arrangements.

Cautious Cooperators agree with arms control advocates about the value of a reciprocated CTB, but worry about other states' intentions and deterrence stability. Deep ambivalence about nuclear vulnerability characterizes many Americans' attitudes toward arms control.¹² For cautious cooperators, the destructive power of nuclear weapons creates incentives and opportunities both for mutual cooperation and unilateral action. They assume that foreign leaders also have mixed motives and may be tempted to exploit arms control. Cheating is a serious concern for cautious cooperators: secret tests would either provide a military advantage or indicate willingness to violate treaties for little military benefit. Verification is *critical* to cautious cooperators' support for arms control depends because they experience the arms control dilemma most intensely. The more doubtful they are about other's motives and deterrence stability, the greater will be their verification demands.

Unilateralists neither desire mutual limits on weapons tests nor believe that other nuclear powers intend to stop testing. They reject reciprocal restraint for any or all of three basic reasons. First, many unilateralists oppose arms control in the belief that one preserves peace by preparing for war. Nuclear tests, they believe, are necessary to modernize arsenals; improve stockpile reliability and survivability; increase accuracy; develop strategic defenses; and enhance command, control, and communication during a nuclear war. If so, banning tests would destabilize deterrence and increase destruction should war occur. Second, many belong to organizations designed to protect national security through unilateral means. Regardless of whether soldiers and weapons scientists are philosophically opposed to arms control, they have organizational incentives to preserve flexibility and to maximize resources for nuclear tests.¹³ Third, unilateralists fear the relative impact of arms control. Would a test ban lock less developed players into permanent inferiority or prevent more advanced countries from exploiting a comparative advantage? Would states that could develop weapons without testing or compel nuclear scientists to continue clandestine research suffer less under a CTB?

Unilateralist opposition to arms control is exacerbated by a deep distrust of the adversary and a strong conviction that low levels of cheating and unfavorable relative gains would give others a devastating advantage. Whereas cautious cooperators think about mixed motives and temptations to cheat, unilateralists view interstate relations as pure competition and assume that adversaries will exploit each other whenever possible. When realpolitik notions are compounded by ideological assumptions about the adversary's devious intentions, the picture grows still grimmer. Since unilateralists also believe that small differences in the quantity or quality of nuclear systems provide political leverage or military advantage, their opposition to a CTB is over determined regardless of verification capabilities. Unilateralists, however, often use *rigid* verification demands to sabotage negotiations or to maximize national advantage if some limits seem inevitable.

Since arms control advocates and unilateralists share one first principle with cautious cooperators, they have used verification arguments to compete for the support of cautious cooperators in the absence of national consensus on the benefits, costs, and risks of arms control. Unilateralists tried to convince cautious cooperators

¹². Numerous studies have shown U.S. public opinion to be relatively constant, but deeply ambivalent and highly misinformed on matters of nuclear security. For example, Everett Carl Ladd found a forty-year tradition of support for arms control and distrust toward the Soviet Union, national technical means of verification, and legalistic solutions to security problems. See "The Freeze Framework," *Public Opinion* (August–September 1982).

¹³. Arms control advocates and cautious cooperators may self-select into organizations, such as grassroots activism groups or think tanks, that reinforce preexisting beliefs about arms control principles, but national defense bureaucracies can have an independent socializing effect on unilateralists that is not paralleled in the other two groups.

that the USSR would never accept intrusive verification so that debates about whether reciprocated restraint could serve U.S. security interests would be pointless. Arms control advocates tried to persuade cautious cooperators that obtainable verification arrangements would lower the risks of noncompliance far below the benefits of a mutual ban so that their combined pressure for negotiations might outweigh unilateralists' opposition. Thus, although neither arms control advocates nor unilateralists would request verification collaboration if their compatriots accepted their arms control principles, they often propose it as a domestic political strategy to court cautious cooperators.

Competition for the middle ground explains why actors often use language in ways that create confusion about their motives for advancing or opposing verification collaboration. U.S. policy in the 1970s resembled the arms control advocate's position and demands for "adequate" verification were explicitly tied to an operational standard: the ability to detect militarily significant violations in time to compensate for any disadvantage.¹⁴ The 1980s requirement for "effective" verification is more problematic because the concept was never formally defined or operationalized.¹⁵ Reagan entered office convinced that arms control was fatally flawed, the USSR was an "evil empire," and the nuclear balance favored the Soviet Union, so his notion of "effective" verification initially matched a unilateralist's "excessive" demands. As public pressure for arms control talks grew, some U.S. officials sounded more like cautious cooperators and adopted legalistic language to describe "effective" verification. The Intermediate-range and Shorter Range Nuclear Forces Treaty (INF) shows that Reagan eventually valued some arms control and believed that Gorbachev faced similar incentives for cooperation. U.S. officials described INF verification as "effective," yet the monitoring provisions focus primarily on militarily significant violations. The shifting meaning of "effective" emphasizes the need to analyze calls for verification collaboration in terms of first principles and operational requirements rather than arms control rhetoric.

This three-fold distinction clarifies domestic debates about monitoring requirements, but confounds analysis of Cold War disputes about verification collaboration. The USSR claimed to value verification, yet leaders before Gorbachev consistently tried to minimize monitoring and maximize national control over inspection. Soviet negotiators maintained that states only sign agreements that they intended to keep, that national technical methods could detect militarily significant cheating, and that a small probability of discovery would deter clandestine tests. Such themes resonated with U.S. arms control advocates who believed that the USSR accepted mutual vulnerability and recognized the need for arms control. With different frames of reference, cautious cooperators and unilateralists in the West drew other lessons. Those whose commitment to arms control hinged on accurate compliance information saw resistance to cooperative verification as evidence that the USSR did not really want a CTB. U.S. unilateralists used Communist opposition to verification as a decisive argument in their case against arms control.

These conflicting interpretations shared the assumption that increased verification always improves cooperation. To encompass superpower arguments about CTB verification, or key controversies in multilateral arms control negotiations and surprising shifts in official U.S. verification preferences, one must analyze divergent ideas about the benefits, costs, and risks of verification itself. To the extent that all three domestic groups share basic assumptions about the relationship between verification and cooperation, "conception of verification" is an independent variable that cannot be derived from other first principles.¹⁶

¹⁴ . In the Richard Nixon, Gerald Ford, and Jimmy Carter Administrations, treaty provisions were "adequately verifiable" if "any Soviet cheating which would pose a significant military risk or affect the strategic balance would be detected by our intelligence in time for the United States to respond effectively." See *The SALT II Treaty: Hearings before the Committee on Foreign Relations* U.S. Senate, 96th Congress, First Session (Washington, D.C.: GPO, 1979) Part 2, pp. 239–240.

¹⁵ . Comments about effective verification by senior Reagan officials suggest the following guidelines. First, arms control can only enhance American security if the United States first determines what limits would be strategically-significant and then decides on measures to ensure verifiability. Second, treaty language must specify obligations clearly and precisely. Third, verification systems must provide *unambiguous* evidence of *any and all* violations. Fourth, U.S. officials must be able to document noncompliance without compromising valuable sources of secret intelligence. Finally, U.S. leaders must be willing to expose and respond to suspected violations even if that causes a rift in U.S.–Soviet relations. For specific statements, see William Rowell, *Arms Control Verification: A Guide to the Policy Issues for the 1980s* (Cambridge, Mass.: Ballinger, 1986), pp. 86–87.

¹⁶ . The best source of information in English about Soviet verification policy during the Cold War is R. M. Timerbayev, *Kontrol'za Organicheniyem Vooruzheniy i Razoruzheniyem* (Moscow, 1982) translated by Foreign Broadcast Information Service as *Verification of Arms Limits and Disarmament* (November 1984).

All decision makers face a choice between making verification “workable” and making it “tolerable.” At any given time, though, circumstantial factors may make some states more sensitive to one side of the equation. As a liberal democracy arguing with a more closed and authoritarian society, the United States stressed the positive functions of verification information during the Cold War, while Soviet writings and negotiating positions emphasized the negative features of verification.¹⁷ The USSR acknowledged the reassurance functions of verification, yet condemned the potential military, political, and economic costs of intrusive monitoring. Although U.S. security specialists often argued that the Soviets had less need of verification because military activities are more transparent in the West, this misstates the main contextual difference. All countries try to protect the military information most relevant for monitoring compliance, and all have intelligence sources searching out their rival’s secrets. In the USSR, foreign policy decisions were made by a small group with access to classified intelligence information, while “verification in the United States is as much a matter of open and sometimes uninformed public debate as it is of hard calculation based on self-interest.”¹⁸ While U.S. policy makers worry less about increasing popular support for security policy or more about admitting foreigners to sensitive locations, they show more sensitivity to verification trade-offs. Access issues explain why Americans rejected arms control inspections as infringements on sovereignty in the beginning of the Twentieth Century, and why they scaled back demands for intrusive verification in the post-Cold War era.

Verification includes many fixed costs. Monitoring tests requires money, trained personnel, and sophisticated technology. Cooperative verification can also complicate procedures for conducting permitted nuclear blasts and chemical explosions. While these expenses are small compared with the size of U.S. and Soviet defense budgets, they decrease the value of arms control as a cost-cutting measure. Budget constraints currently prevent the International Atomic Energy Agency from fully implementing nonproliferation safeguards. Likewise, financing the verified dismantlement of nuclear warheads in the former Soviet Republics is one issue slowing the START ratification.

The known costs of successful cooperation cause less concern than the uncertain risks that verification may be abused for competitive gain. Where secrecy is a security asset, transparency poses military risks.¹⁹ Knowledge needed to assess compliance can be dangerous if cooperation breaks down. For example, data about testing practices exchanged during CTB talks would improve yield estimations and predictions about weapons development if negotiations fail. Moreover, verification may reveal information about military programs that are not covered by arms control agreements.

Verification also poses political risks. For example, false accusations generate negative publicity and hostility, while ambiguous compliance evidence fuels domestic debates about security policy. Increased contact through cooperative verification may correct misperceptions and improve relations, or generate friction, harassment, and institutionalized mistrust. When states restrict information and limit contact with foreigners as a means of social control, then data exchanges, site visits, and other forms of verification collaboration raise the risk of political subversion. Liberal and conservative Americans hoped that cooperative verification would “democratize” the USSR, but Soviet leaders were reluctant to be changed against their will.

Finally, monitoring may involve economic risks, especially when treaty-limited technology has both military and civilian uses. The Nonproliferation Treaty (NPT) provides the clearest example. Countries with advanced nuclear energy programs objected that safeguards would increase industrial espionage, accounting expenses, and sales restrictions, while less developed states feared that nonproliferation verification would slow modernization. In the test ban case, the main economic risk reflects the opportunity costs of foregoing peaceful nuclear explosions (PNE) when states cannot verify that they are not being used to circumvent limits on military tests.

¹⁷. One theoretical article by an American who discusses some verification tradeoffs is Stephen Meyer, “Verification and Risk in Arms Control,” *International Security* 8:4 (Spring 1984): 111–126.

¹⁸. Alan B. Scherr, *The Other Side of Arms Control* (Boston, Mass.: Unwin Hyman, 1988), p. 256.

¹⁹. For example, a U.S. representative to the 1958 Surprise Attack Conference remarked, “We were much impressed by the importance which Soviet representatives attached to secrecy as a military asset. In effect, they seem to believe it enables them to possess a form of ‘hardening’ of their bases which we do not have. Thus they regard any encroachment upon this secrecy as a unilateral disarmament step . . . on their part which must be compensated for by other measures.” Statement by William C. Foster, *Disarmament and Foreign Policy*, Hearings before the Senate Committee on Foreign Relations, 86th Congress, 1st Session, pp. 61–63.

Table 2 Preferences in International Verification Politics

<i>View of Verification</i>	<i>Divisions in Domestic Debates</i>		
	<i>Arms Control Advocates</i>	<i>Cautious Cooperators</i>	<i>Unilateralists</i>
Purely Benign	4 Adequate	5 Exacting	6 Excessive
Involves Tradeoffs	3 Acceptable	2 Minimal	1 Insufficient

Notes: Expressed interest in technology collaboration: 6 = most; 1 = least

Arms control advocates, cautious cooperators, and unilateralists in the USSR share verification predispositions (flexible, critical, or rigid) with their American counter-parts, but their concern about the costs and risks of verification produce different verification preferences. Table 2 incorporates both dimensions into the analytical framework:

While arms control advocates in the USSR rarely saw a need for test ban technology collaboration, they were more likely than their compatriots to accept some cooperative verification because they valued a CTB, assumed that others will use verification to sustain arms control, and doubted that low-level collateral information collection or political friction would destabilize relations.²⁰ The costs and risks of verification increase ambivalence for cautious cooperators: their support for arms control depended on accurate compliance information, yet their belief in mixed motives and temptations to defect exacerbated anxiety about the probability and potential consequences of verification abuse. They would tolerate technology collaboration only if national monitoring methods were clearly deficient and projects are designed to minimize risk. Finally, unilateralists who thought in terms of verification trade-offs held a malign view of technology collaboration, both because they expected it to be exploited for competitive advantage and because they opposed test limits regardless of the value of verification. Because American unilateralists saw international relations in much the same terms as their Soviet counterparts, they could anticipate and exploit Soviet concerns about verification trade-offs more readily than could other U.S. groups.

Once one recognizes verification trade-offs, technical collaboration is not a free good or a low-risk way to test intentions and increase compliance information. Players who are content with national monitoring systems will want concessions from players whose higher verification requirements increase the costs and risks of cooperation. A “try before you buy” approach asks states concerned with verification trade-offs to pay some costs and accept some risks of verification with no commitment to an arms control sale.²¹ When verification cooperation is cost-free to some participants and extremely risky to others, intensity of expressed interest in technical collaboration does not correlate with depth of commitment to serious arms control.

In short, this framework facilitates the systematic analysis of test ban verification collaboration in several ways. Differentiating between arms control advocates, cautious cooperators, and unilateralists reveals continuity in verification argument even when group membership and policy influence change over time. Evaluating U.S. policy by the first principles that it embodies indicates when official preferences favor cooperation and whether technical collaboration could promote arms control. When examining Soviet attitudes toward collaboration, one can compare characterizations advanced in the United States and recognize distortions caused by ignoring verification tradeoffs. The framework indicates important changes in official Soviet verification policy and incorporates available evidence about internal disputes. Finally, it draws attention to strategies can alter arms control outcomes.

The rest of this paper examines how negotiators and domestic groups used verification collaboration in identification, alliance, realignment, and avoidance strategies. Americans often advanced proposals for test ban technology collaboration to identify other actors as arms control advocates, cautious, cooperators, or unilateralists. Drawing conclusions about other’s interest in arms control from their attitude toward technical collaboration, however, ignores the ways in which preferences are shaped by concerns about verification

²⁰. Citations—Timerbayev and Israelyan.

²¹. Richard Lugar, “Verify and then Trust,” *New York Times*, 6 June 1989, p. 23.

tradeoffs. Thus, American unilateralists could use collaborative proposals to disguise their own antipathy toward arms control and to misidentify Soviets who might have actually wished to cooperate.

In alliance strategies, arms control advocates or cautious cooperators portray verification as a technical problem or promote collaborative verification as domestic political maneuvers designed to woo cautious cooperators. Their goal is to build a strategic coalition that can shape domestic security policy without a national consensus on arms control principles. Actors may also see collaboration as a way to forge transboundary alliances in order to promote their position in domestic debates or intergovernmental negotiations.

In realignment strategies, the goal is to alter individuals' beliefs about arms control and verification so as to change the political balance at home or abroad. For example, joint research projects could convert cautious cooperators into arms control advocates by altering perceptions of intentions and monitoring abilities. Alternatively, Western demands for inspections could convince cautious collaborators in the USSR to resist verification abuse, while Soviet rejection of collaborative verification might then persuade cautious cooperators in the United States to embrace unilateral security strategies.

Finally, calls for cooperative projects to improve verification can be used to avoid dealing with conflicting incentives for arms control and competitive weapons development. Arms control and deterrence can both be seen as contradictory exercises, arms control because it involves cooperating with an adversary and deterrence because it requires credible threats to undertake irrational actions. Rather than face these contradictions directly, national leaders often avoid them by expressing support for cooperation at some future date after verification problems have been solved.

Analyzing technology collaboration in terms of identification, alliance, realignment, and avoidance strategies suggests that interactions between domestic and international politics are extremely complex. Negotiating and ratifying a verification agreement is not simply a matter of satisfying domestic groups and national leaders with fixed interests.²² Arguments about test ban verification collaboration are also employed to define the game, to change its structure, and to determine whether or not it even gets played.

Disarmament Deadlock, Technical Collaboration, and Early Test Ban Talks

Early arms control advocates hoped that test ban technology collaboration could solve the verification deadlock that blocked disarmament during the first nuclear decade. By proposing a partial measure where long-distance monitoring systems provided extensive compliance information, they tried to identify and ally with cautious cooperators. Optimism soared in 1958, when scientists from the East and West agreed on a CTB verification system. Yet, in a period when superpower policy reflected a cautious cooperator's ambivalence about arms control, technical talks failed to "depoliticize" verification and promote cooperation. Instead, scientific consensus obscured political disputes. To minimize risks for the West, U.S. negotiators justified exacting verification demands as purely benign and technically determined. This reinforced Soviet fears about the costs and risks of verification. It also set precedents that U.S. unilateralists then used to raise cautious cooperators' resistance to compromises that could have secured a CTB.

Verification disputes were the most visible reason that ten years of disarmament proposals produced no agreements. The West wanted comprehensive verification before arms reductions as a guarantee against cheating, while the East wanted disarmament first to reduce tensions and temptations for verification abuse. Both sides maintained that their concerns were legitimate and that the other made unreasonable demands to sabotage negotiations. Nobody could resolve the disarmament deadlock without knowing whether these disputes reflected cautious cooperators' anxiety or unilateralists' clever maneuvers.

If one considers U.S. and Soviet security situations, both positions were compatible with sincere interest in stable cooperation.²³ Since the United States had a nuclear monopoly but a conventional disadvantage and an

²² The fullest statement of the two-level games approach to explaining international cooperation is Peter B. Evans, Harold K. Jacobson, and Robert D. Putnam, eds., *Double-Edged Diplomacy* (Berkeley, Calif.: University of California Press, 1993).

²³ For information about how the U.S. and Soviet security situations shaped their early arms control preferences, see Bernhard Bechhoefer, *Postwar Negotiations for Arms Control* (Washington, DC: The Brookings Institution, 1961).

information handicap vis-à-vis the secretive Soviet Union, they would not relinquish their “winning weapon” without “foolproof” verification. The Soviets worried less that the United States would cheat and more that they would manipulate the control organization in order to spy, interfere with internal affairs, or legitimate preemptive attack against suspected violations. To them, secrecy was a security asset that must be preserved until tensions decreased.

While the disarmament deadlock might represent a tragic case of misperception and missed opportunities for cooperation, it might also reflect a lack of serious interest in arms control.²⁴ U.S. politicians, military leaders, scientists and citizens were deeply divided over the extent to which nuclear weapons guaranteed or threatened security.²⁵ Faced with cautious cooperators’ ambivalence about nuclear weapons, the Department of Defense and the Atomic Energy Commission used unobtainable verification demands to avert a “toboggan slide” toward nuclear disarmament.²⁶ Likewise, arguments about sovereignty kept inspectors out until the USSR built a bomb of its own.

To American arms control advocates, a test ban offered an attractive way to appeal to cautious cooperators. Compared with total disarmament, a CTB was a partial measure involving clear mutual benefits, yet relatively low costs and risks. It would reduce fears about fallout, symbolize superpower cooperation, hamper proliferation, and dampen the arms race. Banning tests carried few immediate costs; it would neither constrain current military programs nor reduce nuclear arsenals. Furthermore, the U.S. advantage in nuclear technology minimized the risks of cheating. Soviet tests that could escape detection would not close the gap, while large scale violations or sudden breakout would spur a U.S. response before the Soviets surged ahead.²⁷

Proponents hoped that technology collaboration could produce a mutually-acceptable verification system if superpower leaders really were cautious cooperators. A CTB poses three verification problems: detecting seismic events; Determining their location; and discriminating between earthquakes, nuclear tests, and nonnuclear explosions. The CIA doubted that the USSR could hide explosive yields above a few kilotons from the U.S. test monitoring system.²⁸ Technology collaboration could reduce residual concerns about verification in two ways. Scientists could increase the accuracy of national verification systems by exchanging data on testing practices and monitoring methods. They could also pool their technical knowledge to reach consensus on the detection, discrimination, and location capabilities of different international verification arrangements.

Neither superpower initially supported test ban verification collaboration. Although the Soviets expressed support for a CTB, they insisted that unilateral methods could “record any explosions of atomic and hydrogen weapons, wherever they may be detonated.”²⁹ U.S. military leaders rejected test limits because they wanted “usable” nuclear weapons to compensate for Soviet conventional strength. Over time, though, President Eisenhower and Secretary of State John Foster Dulles began to see test ban talks as a way to peek behind the Iron Curtain, explore cooperative controls on the arms race, and increase domestic support for U.S. nuclear policy. Faced with Khrushchev’s dramatic decision to suspend Soviet tests, Eisenhower invited East bloc scientists to discuss monitoring requirements for a negotiated ban. Khrushchev’s proposal and Eisenhower’s response fit the traditional pattern. The moratorium represented arms control without verification, while the scientific conference involved verification research with no commitment to arms control. For various reasons, though, both leaders were increasingly inclined to interpret each other’s behavior through the eyes of a cautious

²⁴. The classic statement of the view that the superpowers cynically manipulate arms control negotiations to avert meaningful limits on nuclear weapons and to institutionalize the arms race, see Alva Myrdal, *The Game of Disarmament* (New York: Pantheon Books, 1976).

²⁵. Gregg Herken, *Counsels of War*, revised ed. (New York: Oxford University Press, 1987) documents the deep divisions about nuclear weapons among American policy makers. Robert Divine, *Blowing on the Wind* (New York: Oxford University Press, 1978) details the public debate over nuclear testing in the years before the LTBT.

²⁶. “Memorandum for the Secretary of Defense from the Joint Chiefs of Staff, 30 April 1954,” in National Security Archives.

²⁷. Weber argues that U.S. technical superiority provided a buffer that made American policy makers more willing to accept some risks for an ABM agreement and MIRV restraints, see p. 279.

²⁸. The size of nuclear explosions are measured by comparing the yield of a test to the amount of energy released by a kiloton of dynamite. Memorandum for Director, Central Intelligence, “Effectiveness of Nuclear Test Detection System,” from Herbert Scoville, Jr., Assistant Director, Scientific Intelligence, 11 May 1957, in NSA.

²⁹. “Letter from the Soviet Premier (Nikita Khrushchev) to President Dwight Eisenhower, 22 April 1958,” in *Documents on Disarmament 1945–1959*, II (Washington, D.C.: U.S. Department of State, 1960): 999. Hereafter cited as *DOD*.

cooperator. In an unprecedented move, Khrushchev agreed to send delegates to Geneva in July 1958 to discuss verification for a ban on nuclear tests.

At first, scientific collaboration seemed to have solved the disarmament deadlock. The Conference of Experts unanimously concluded that 170 ground and ship-based control posts, plus inspections of ambiguous events, offered a “workable and effective” way to detect and identify tests above 1 to 5 kilotons.³⁰ When the United States, USSR, and Britain agreed to start CTB negotiations, Eugene Rabinowitch declared that technical collaboration had triumphed over politics:

Once an international problem has been formulated in scientifically significant terms, scientists from all countries, despite their political or ideological backgrounds, will be able to find a common language and arrive at an agreed solution.³¹

Once negotiations opened, participants realized that technical consensus had papered over political disputes. The Geneva report said nothing about how many on-site inspections (OSIs) would occur. Nor did it specify who would initiate OSIs, staff control posts and inspection teams, or evaluate compliance. Negotiating stances reflected divergent concerns about spying and cheating. The USSR stressed confidence building: it minimized intrusion and maximized Soviet involvement in decision making. The West denounced these plans as “self-verification.” They emphasized information-gathering and minimized host country participation in verification processes.

The West tried to prevail in these negotiations by portraying their verification preferences as scientifically-necessary, and thus nonnegotiable. Dulles sent no senior diplomats to the Conference of Experts and told delegates to treat their work “as a purely scientific, technical job.”³² The Soviets responded that the allocation of verification benefits, costs, and risks was intensely political and eminently negotiable. They sought to minimize monitoring and to ensure that verification authority would be shared. Khrushchev underscored the political nature of verification by sending a leading diplomat to the Conference of Experts and treating the Geneva System as an agreement not subject to unilateral revision. After data from U.S. tests in mid-1958 indicated that the Geneva System’s identification threshold might be 20 kilotons rather than 5 kilotons, the West urged the USSR to accept a partial ban, more control posts and OSIs, or further research on international monitoring.³³ The USSR responded by accusing the West of ratchetting up verification demands to spy and stall arms control.³⁴ They also observed that every proposed formula for calculating OSI quotas produced twenty annual inspections, and thus dressed political preferences in scientific garb.³⁵

As some U.S. policy makers grew more sensitive to Soviet concerns and more willing to reduce Western verification demands in order to reach a test ban agreement, others continued to argue that arms control would not serve U.S. interests unless monitoring capabilities could defeat any cheating scenario. When the State Department favored an OSI quota rather than the right to inspect each suspicious event, the Atomic Energy Commission called this a “technical issue” on which the stricter standards of its experts should prevail.³⁶ Unilateralists from RAND and the weapons labs theorized endlessly about evasion scenarios such as reducing seismic signals several hundred times by testing inside giant underground cavities.³⁷ The “Big Hole” theory

³⁰ “Communiqué and Report of the Conference of Experts to Study the Possibility of Detecting Violations of a Possible Agreement on the Suspension of Nuclear Tests, 21 August 1958,” in *DOD* pp. 1090–1111.

³¹ Eugene Rabinowitch, “Nuclear Bomb Tests,” *Bulletin of the Atomic Scientists*, 14:8, October, 1958, p. 287.

³² U.S. Department of State *Bulletin*, 38:992 (30 June 1958): 1085.

³³ Further research showed that the Geneva System’s true detection threshold was somewhere between these two figures.

³⁴ Tsarapkin insisted that scientific progress would necessarily support the Soviet position by raising, not lowering, the capabilities of the Geneva System. “Statement by the Soviet Government Regarding the Geneva Negotiations on the Discontinuance of Nuclear Tests, January, 1959,” in *DOD*: 1342.

³⁵ Glenn Seaborg, *Kennedy, Khrushchev, and the Test Ban* (Berkeley, Calif.: University of California Press, 1981), pp. 20–22, 41. The USSR, however, was not above using science in support of political goals. For example, they argued that the Geneva System should remain the basis for negotiation because scientific innovation would always improve detection capabilities. See Harold Jacobson and Eric Stein, *Diplomats, Scientists, and Politicians* (Ann Arbor, Mich.: University of Michigan Press, 1966), pp. 162–163.

³⁶ Jacobson and Stein, pp. 180–181.

³⁷ Albert Latter, *A Method of Concealing Underground Nuclear Explosions* (Santa Monica, Calif.: RAND Corp. RM-2347–AFT, 1959).

implied that the Soviets could muffle the seismic waves from a 300 kiloton explosion to the point where the Geneva System could not conclusively identify it as a nuclear test. Such analyses emphasized remote technical possibilities and worst-case assumptions, but they generated anxiety among cautious cooperators and sapped Congressional support for a CTB.³⁸

By portraying extreme verification demands as scientifically correct, unilateralists increased cautious cooperators' resistance to compromises that met Soviet concerns. Lack of support for a proposed moratorium on underground blasts with magnitudes below 4.75 on the Richter scale—about 20 kilotons for U.S. tests—while the signatories conducted joint seismic research reflected Eisenhower's belief that Western demands for twenty annual OSIs had become a "political fact of life," a sacrosanct symbol of rigor, and a requisite for ratification.³⁹ After the Cuban Missile Crisis, Khrushchev offered three annual OSIs to indicate Soviet sincerity and increase Senate support for a total ban. Despite Kennedy's personal commitment to a CTB and his private regret that the West had used improbable evasion scenarios to justify excessive OSI demands, he felt that he could not settle for fewer than six inspections for fear that unilateralists and cautious cooperators would ally to block ratification.⁴⁰ Tripartite talks ended with the 1963 Limited Test Ban Treaty, which banned tests in the atmosphere, outer space, and underwater, but allowed unlimited testing underground.

The LTBT represents a retreat from collaboration; verification is not mentioned because monitoring is solely by national technical means (NTM).⁴¹ Signatories vowed to seek a CTB, yet the LTBT involved a withdrawal from cooperative control of the arms race. Kennedy promised conservatives a "comprehensive, aggressive, and continuing underground nuclear test program" as insurance against cheating or treaty abrogation.⁴² Thus, verification doubts minimized limits adopted in 1963 and created obstacles to a future CTB.

In short, early efforts to break the disarmament deadlock by using technological collaboration for test ban verification failed to secure a CTB for two reasons. First, Western assertions that verification was a technical problem of collecting compliance information gave little credence to Soviet concerns about the costs and risks of intrusive verification. Claims that new data from one test series rendered the Geneva System inadequate reinforced Soviet fears that technical analysis was an excuse for endless delays and new verification demands. Second, by the time that the political leadership in the United States, United Kingdom, and USSR concurred that broad limits on nuclear tests were mutually-desired and obtainable if they acknowledged each other's verification concerns, U.S. unilateralists had used scientific arguments and rigid verification requirements to render any compromise treaties unratifiable.

Test Ban Cooperation and Controversy During the Rise and Fall of Détente

Détente was the time during the Cold War when one would expect the highest probability that technology collaboration would secure a CTB. The offensive ceilings, antiballistic missile defense restrictions, and sole reliance on national technical means of verification in the 1972 Strategic Arms Limitation Treaty indicated that U.S. and Soviet leaders shared the basic beliefs of arms control advocates, at least in some issue areas. The official policy of both superpowers claimed to want a CTB once verification disputes could be resolved and work done during the 1960s suggested that answers were at hand.⁴³ Yet, test ban technology collaboration achieved

³⁸. The Berkner Panel on Seismic Improvement, composed primarily of independent scientists, considered the decoupling scenario to be impractical and improbable. To decouple a 10 kiloton (kt) shot by a factor of three hundred, an evader would need a spherical hole three thousand feet underground with a diameter of 360 feet. Further research has reduced the maximum factor to seventy and found numerous practical problems with decoupling anything over a few kt. See U.S. Congress, Office of Technology Assessment, *Seismic Verification of Nuclear Testing Treaties*, OTA-ISC-361 (Washington, DC: GPO, May 1988), pp. 95–106. Hereafter cited as OTA.

³⁹. Seaborg, p. 41.

⁴⁰. Seaborg, pp. 128, 178–181, and p. 191. The quota question was not the only issue blocking agreement. East and West were still deeply divided over the way in which inspections would be conducted, data analyzed, and judgments reached.

⁴¹. The phrase "national technical means" refers to all monitoring capabilities under the full control of the verifying country. For test limitation treaties, these include such methods as teleseismic monitoring, atmospheric sampling, satellite surveillance, and communication interception. The term "technical" is used to indicate that intelligence collection by human agents is not included.

⁴². "Report by the Senate Foreign Relations Committee on the Test Ban Treaty, 3 September 1963," *DOD*, p. 473.

⁴³. Seismologists had shown that the ratio of various seismic waves could differentiate between earthquakes and small (1–10 kt) explosions, while neutral members of the U.N. Conference on Disarmament had suggested that "invitational" OSIs could give host countries some control, but fill most functions of mandatory OSIs.

little more during the heyday of arms control than at the height of Cold War competition. The roots of failure rest in decisions to use rigid and incompatible verification demands to finesse conflicting pressures from arms control advocates and unilateralists. When superpower leaders decided to negotiate new limits on nuclear tests, both sides made concessions to minimize the costs and risks of verification. But because U.S. leaders did not popularize the notion of inevitable verification trade-offs, unilateralists could employ rigid verification demands to alter the structure of test ban policy, to stall the second generation of CTB talks, and to convince cautious cooperators that verification compromises in the TTBT and PNET made those agreements unratifiable.

Rather than using verification advances to secure stable cooperation in a mixed motive game, superpower leaders juggled contradictory pressures to ban tests and to modernize arsenals by clinging to incompatible verification demands. Neither side made a serious effort to see whether new seismic techniques and “invitational” OSIs offered “win/win” solutions.⁴⁴ By claiming to want cooperation and blaming the absence of real constraints on the others’ unreasonable verification demands, leaders could appeal to cautious cooperators and justify their dual-track policy as an unfortunate necessity, given an adversary who might exploit a CTB by cheating or spying. This shifted attention from lack of serious negotiations to national verification research programs. It also split the arms control community over tactics: should they push for CTB talks that might never produce a ratifiable treaty; resolve CTB verification concerns before requesting negotiations; or demand an immediate ban on all tests above the verification threshold?

When Nixon and Brezhnev needed a symbol of détente to sign at the Moscow summit, they chose a 150 kiloton limit on underground nuclear tests. This ceiling reflected weapon design requirements rather than verification capabilities.⁴⁵ Because no one doubted that national technical means could detect, identify, and locate the source of large disturbances, the TTBT neither increased confidence in seismic verification nor narrowed the gap on OSIs. Prohibiting only large tests created a new verification problem: yield measurement. As we will see, the Reagan-era debate about Soviet TTBT compliance revolved around the extent to which estimates based on U.S. tests would systematically exaggerate the size of Soviet blasts due to difference in test site geology.⁴⁶

In a situation where those who hold a benign view of verification would see little need for technology collaboration, U.S. and Soviet negotiators worked together to reduce the risks and costs of verification. Since neither side seemed strongly motivated to test over 150 kilotons, both deemed unilateral methods sufficient to detect violations and deter cheating. To minimize potential political problems due to false alarms and wrongful accusations, the TTBT protocol involved data exchanges to calibrate yield estimates—the first bilateral verification cooperation beyond passive acceptance of NTM.⁴⁷ To reduce fears about spying, though, the protocol did not provide for independent measurements at each other’s test site to confirm yield data and geological information. Furthermore, because new designs can produce larger than anticipated yields and random

⁴⁴. Much more is known about the internal dynamics that determined U.S. inflexibility on the OSI issue than those that shaped the Soviet position. Soviet opposition to OSIs during the 1970s may have reflected habit more than conscious choice. Kokeyev and Androsov argue that “before parity was achieved, Soviet cautiousness with regard to inspection was understandable, whereas after parity was achieved, it was an anachronism to retain that position.” Mikhail Kokeyev and Adrei Androsov, *Verification: The Soviet Stance* (New York: United Nations, 1990), p. 8.

⁴⁵. By the early 1970s, most weapons research focused on designing tactical weapons and warheads for smaller, more accurate strategic weapons. A Swedish study analyzed generally available seismic data for 1969–73 and concluded that few Soviet or American tests were exceeding the 150 kt. threshold even before the treaty was signed. Since both sides did have some projects that required large tests, they agreed that the TTBT would not enter into force until 1976.

During Senate Foreign Relations Committee ratification hearings for the TTBT, Assistant Secretary of Defense David McGiffert was asked if 150 kt. represented the threshold below which verification problems might arise. He replied, “No, it is a good deal higher than that,” in “Threshold Test Ban and Peaceful Nuclear Explosions Treaties,” Hearings before the Committee on Foreign Relations, United States Senate, 95th Congress, 1st Session, 1977, p. 52. See also, Jozef Goldblat, “The Nuclear Explosion Limitation Treaties,” in Jozef Goldblat and David Cox, eds., *Nuclear Weapon Tests: Prohibition or Limitation?* (New York: Oxford University Press, 1988) pp. 128–129.

⁴⁶. Seismologists estimate size by comparing the magnitude of waves from a new test to waves from blasts with known yields. Signals from similar shots in different locations, however, attenuate at different rates. Nevada, the one place where the United States tested after the early 1970s, is tectonically active, so waves propagate less efficiently than in more settled regions near Soviet test sites.

⁴⁷. The protocol stipulates that the signatories would exchange “yield, date, time, depth, and coordinates for two nuclear weapons tests for calibration purposes from each geophysically distinct testing area where underground nuclear weapon tests have been and are to be conducted.”

errors in seismic estimates can inflate some apparent yields, the delegation heads agreed that questionable cases might require consultation, but that one or two “slight, unintended” breaches per year would not be violations.⁴⁸

Negotiators spent eighteen months ensuring that groups of PNEs with high aggregate yields could be conducted without TTBT compliance concerns.⁴⁹ During the late 1950s and 1960s, the US and USSR had experimented with nuclear explosives for such purposes as excavating waterways, stimulating natural gas and oil production, and creating large underground storage facilities. By the mid-1970s, the United States was backing away from PNEs due to decreasing industrial interest and growing public concern about the environmental consequences. The USSR, however, still saw PNEs as an interesting technology. The unprecedented Soviet decision to tolerate OSIs on their territory reflected the recognition that seismic monitoring can neither distinguish “civilian” from “military” explosions nor differentiate between three simultaneous 100 kiloton PNEs and a single 300 kiloton explosion. Furthermore, since PNEs occur away from sensitive sites, the risks of verification abuse are lower. Still, negotiators worried that inspections might reveal explosive design information or interfere with PNE procedures. Therefore, they relied on cooperation during OSIs to minimize both cheating and spying. For example, host country nationals take pictures and install yield estimation equipment under the supervision of “designated personnel” from the other side. This OSI breakthrough had little effect, though, because the United States conducted its last PNE in 1973 and the USSR ended group PNEs large enough to trigger an inspection. Likewise, because the United States neither ratified nor rejected the TTBT for fifteen years, the superpowers were legally obligated to observe the 150 kiloton limit but not to exchange data needed to verify precisely their restraint.

Although nonratification did not involve serious doubts about TTBT verification, it did reflect discontent that CTB verification concerns had been used to avoid difficult decisions about nuclear testing policy. Arms control advocates and unilateralists attacked the TTBT in order to discredit the aspect of the dual track policy that they disliked. CTB supporters such as Senator John Glenn (D, Ohio) and MIT scientist George Rathjens, contended that setting the threshold far above monitoring capabilities mocked U.S. claims to want a CTB once verification problems were solved.⁵⁰ CTB opponents worried that the TTBT might increase pressure for lower limits on underground tests.⁵¹ They employed a narrow construction of the verification problem to belittle the “Whoops Clause”—their term for the understanding about the possibility of slight, unintended breaches—as legitimizing violations and to discount the data exchange because it did not include independent validation of yield data. They then utilized uncorrected yield estimates to claim Soviets violations of even the high limits of the TTBT.⁵² In this environment, President Ford chose not to submit the treaties for ratification because he feared that Reagan would use it as ammunition against Ford if Reagan sought the Republican nomination. Thus, treaties intended as uncontroversial extensions of an ambivalent policy revealed widespread dissatisfaction with the two track practice of advocating an “adequately verifiable CTB” while using rigid verification demands to delay serious negotiations.

President Carter entered office committed to nuclear test restraint. Rather than trying to ratify minor treaties, he hoped that a total ban could be built around ideas developed over the past decade by seismologists, the UN Conference on Disarmament, and negotiators for the TTBT and PNET. The second generation of tripartite talks

⁴⁸. *Arms Control and Disarmament Agreements: Text and Histories of Negotiations* Sixth Edition (Washington, D.C.: U.S. Arms Control and Disarmament Agency, 1990), pp. 185–186.

⁴⁹. The United States ended its PNE program in 1977, largely due to public opposition and economic considerations. The Soviet Union continued to see PNEs as an attractive solution to numerous problems, especially the construction of large underground storage reservoirs in the permafrost region. Between 1957 and 1988, the USSR conducted eight times more PNEs than the United States did (120 versus 15). Thus, the Soviets were more motivated than the United States to determine a way to continue conducting PNEs without creating TTBT compliance concerns. See Goldansky, pp. 31–32 and Iris Borg, “Nuclear Explosions for Peaceful Purposes,” pp. 59–74 in Goldblat and Cox.

⁵⁰. See statements by Senator John Glenn and George Rathjens in SFRC 1977, pp. 50, 106. Arms control advocates also feared that the PNET would encourage other countries to follow India’s example and develop a nuclear weapons capability via “peaceful” nuclear blasts.

⁵¹. For arguments advanced by weapons laboratory staff members that precedents set by the TTBT and PNET cannot be used to support a CTB, see Robert W. Helm and Donald R. Westervelt, “The New Test Ban Treaties: What Do They Mean? Where Do They Lead?” *International Security* 1:3 (Winter 1977): 162–178 and the response from George Rathjens and Jack Ruina on pp. 179–181 of the same issue.

⁵². Information about the tests in question can be found in Thomas Halsted, “Why No End to Nuclear Testing?” *Survival* 19 (March–April 1977): 60–66.

opened in October 1977. The United States, United Kingdom and USSR soon settled several issues, including “invitational” OSIs, an International Seismic Data Exchange, and a PNE moratorium. Since regional signals (seismic waves measured within 2,000 kilometers of the source) have a better signal to noise ratio than do teleseismic signals (waves that travel more than 2,000 km) and are less affected by decoupling, the three states agreed to establish National Seismic Stations (NSS) for in-country monitoring.⁵³ Agreement on these issues reflected a shared desire to find a CTB verification system that would detect, deter, and reassure without itself posing unacceptable costs and risks.

Once again, groups opposed to a CTB used technical arguments to stall negotiations. Unilateralists encouraged the directors from the national labs that build nuclear weapons to tell Carter that a ban would degrade stockpile reliability. Judgments differ as to whether Carter came to believe that a CTB would reduce confidence in retaliatory capabilities and destabilize deterrence. The visit, however, clearly increased Carter’s ambivalence by underscoring unilateralist opposition to a CTB.⁵⁴ In an attempt to appease his critics, Carter shifted from supporting a permanent CTB to a three-year moratorium that exempted small nuclear experiments (this failed to satisfy the Joint Chiefs of Staff, because they feared that public opinion would prevent renewed testing when the three years were up). Concern about the Chinese nuclear program convinced the Soviets to support a short trilateral moratorium while efforts were underway to bring the other nuclear weapons states on board, but hard-liners argued against allowing NSS and OSI for anything short of a permanent ban.⁵⁵ Internal debate produced a rigid stance: all signatories must accept the same number of stations. Insisting that Britain install ten NSS seemed “to emphasize—with a vengeance—[the Soviet] view that verification is a political, not technical, matter.”⁵⁶ According to Herbert York, the Chief U.S. negotiator, this minor issue turned into a major impasse because unilateralists in the United Kingdom and United States convinced Prime Ministers Callaghan and Thatcher to accept only one NSS.⁵⁷ Negotiations continued until 1980, but the participants lacked the political will to resolve this and other relatively minor verification disputes.

Reagan was unambiguously opposed to test ban cooperation when he entered office. He maintained that arms control efforts had been fatally flawed because the Soviets preferred exploitation to arms control and would cheat at every opportunity. He rejected the standard that “adequate” verification should detect militarily significant violations. Instead, “effective” verification must provide unambiguous proof of all infractions. Finally, he and the other unilateralists shaping official U.S. policy contended that arms control often hurt U.S. security even when the Soviets complied.

Reagan withdrew from CTB talks and postponed TTBT ratification. He alleged “likely violations” of the TTBT.⁵⁸ Since seismic evidence was “not inconsistent” with these charges, but also not conclusive, Reagan wanted more verification before sending the TTBT to the Senate.⁵⁹ Finally, he declared that a CTB was not now

⁵³ . In-country monitoring could reduce or obviate the need for OSIs because regional signals have larger amplitudes and higher frequency ranges than do teleseismic waves. A better signal to noise ratio aids identification, while high frequencies minimize decoupling effects. For details about regional monitoring, see Willard J. Hannon, Jr., “In-Country Seismic Stations for Monitoring Nuclear Test Bans,” pp. 191–202 in Goldblat and Cox.

⁵⁴ . Herbert York, *Making Weapons, Talking Peace* (New York: Basic Books, 1987), pp. 284–287. For more information about the demise of the second generation of CTB talks, see G. Allen Greb, “Survey of Past Nuclear Test Ban Negotiations,” in Goldblat and Cox, pp. 105–109.

⁵⁵ . Victor Slipchenko, quoted in Dale Van Atta, “Inside a U.S.–Soviet Arms Negotiation,” *The Nation*, 19 December 1981, pp. 666–668.

⁵⁶ . Warren Heckrotte, “Soviet Views on Verification,” *Bulletin of Atomic Scientists* 42, October 1986, p. 14.

⁵⁷ . York, *Making Weapons*, pp. 305–310.

⁵⁸ . Because the United States and the Soviets announced their intention to abide by the TTBT in 1976, they were bound to observe its central provisions pending ratification, but not to complete the data exchanges in the protocol. The Reagan administration also charged the Soviets with violating the LTBT by allowing radioactive debris from underground tests to vent outside its own territory. In fact, both the Soviets and the United States are guilty of inadvertent extra-territorial venting. This usually indicates failure to follow adequate safety precautions, but does not provide any military advantage. See Gloria Duffy, ed., *Compliance and the Future of Arms Control* (Cambridge, Mass.: Ballinger, 1988), pp. 52–58.

⁵⁹ . Accusations about TTBT noncompliance are often traced to a classified study by two Lawrence Livermore scientists with a long history of involvement in test ban negotiations, Warren Heckrotte and Peter Moulthrop. Their work, begun during the Carter administration, showed that the pattern of Soviet testing was compatible with TTBT compliance, but that the inherent uncertainty in seismic yield determination made it impossible to rule out some minor violations. CTB opponents focused only on the second part of this analysis. When asked how the Reagan administration could accuse the Soviets of TTBT violations based on such weak evidence, the deputy manager of Livermore’s seismic monitoring program said “most people in my laboratory believe that the evidence is equivocal.

desirable *even if* verification problems could be solved because deterrence required weapons development and reliability tests.⁶⁰

Reagan's nuclear testing policy encountered strong domestic opposition. In the frigid climate of the early 1980s, conditioning a CTB on "effective" verification, sweeping nuclear arms reductions, balanced conventional forces, and the obsolescence of nuclear deterrence seemed like saying "not in a million years." This vision of endless confrontation increased popular pressure for arms control. 54 percent of Americans opposed the decision to suspend CTB negotiations, while only 42 percent supported it.⁶¹ Furthermore, while many arms controllers disliked the TTBT, they did not want false verification and compliance complaints used to torpedo this treaty or to block lower limits.

Since Reagan used verification arguments against test limitations, arms control advocates counter-attacked on technical grounds. Independent seismologists, such as Charles Archambeau, Jack Evernden, Lynn Sykes, and Paul Richards, charged that Reagan's policy rested on three unscientific estimation practices.⁶² First, claims that some central yield values (the most likely actual yield of a test) exceeded the 150 kiloton threshold ignored random fluctuations in seismic signals. If the same technique were applied to U.S. tests, equally many blasts would seem to violate the TTBT.⁶³

Second, gauging Soviet tests with an uncorrected magnitude to yield ratio from the Nevada Test Site (NTS) systematically exaggerated Soviet yields by .3 to .4 orders of magnitude.⁶⁴ The NTS method makes some Soviet tests since 1976 appear as large as 650 kilotons, but a bias correction brings them into the range of random scattering around 150 kilotons.⁶⁵ After two noncompliance reports using the old methods, the CIA updated its procedures in 1986.⁶⁶ The Arms Control and Disarmament Agency (ACDA) and the Department of Defense (DOD), however, retained the NTS method. They altered or deleted sections of public hearings that mentioned the revised compliance record.⁶⁷

Third, they claimed that seismology was inherently imprecise. Official declarations that seismic monitoring had a "factor of 2 uncertainty" meant that 95 percent of all yield estimates will be normally distributed in a range from one half to two times the true amount. Test ban opponents distorted these statistics. For example, one official testified that "a Soviet test for which we estimate a yield of 150 kilotons may have, with 95 percent

The administration and the military just want to believe the worst." Quoted in R. Jeffery Smith, "Scientists Fault Charges of Soviet Cheating," *Science* 220, 13 May 1983, pp. 695–697.

⁶⁰ . The Reagan administration conducted between fourteen and eighteen tests a year. Based on interviews with administration officials, the Institute for Defense and Disarmament Studies estimated annual number of tests conducted for a variety of purposes: new warheads (8–12); SDI and other third generation technologies (3–4); reliability (1–2); survivability (1–2); and nuclear physics (1–2). This list contains no mention of improving warhead safety, one of the Reagan administration's main public justifications for continued nuclear tests. See Institute for Defense and Disarmament Studies, *Arms Control Reporter* (1987): 608–B, 148.

⁶¹ . Harris Poll, September 1983.

⁶² . For examples of articles that appeared in popular journals, see Richard Garwin, "The Administration's Case Against a Comprehensive Test Ban is Wrong," *Public Interest Report, Journal of the Federation of American Scientists* 39:10 (December 1986); and Lynn Sykes and Jack Evernden, "The Verification of a Comprehensive Nuclear Test Ban," *Scientific American* 247:4, October 1982.

⁶³ . OTA, p. 17.

⁶⁴ . The Reagan Administration argued that bias corrections made in 1978 systematically underestimated the yields of Soviet tests. As evidence, they pointed to a discrepancy between estimates of Soviet tests and warhead yields, and asserted that the Soviets had doubled the size of their high yield tests just when the United States altered its estimation practices. See Peter Samuel, "Why the U.S. Insists on On-Site Checks of Nuclear Tests," *Defense Week* 6:32, 5 August 1985, pp. 1, 7.

⁶⁵ . Paul Richards and Lynn Sykes, *Verification of Limits on Nuclear Testing: A Review of Historical, Technical and Political Issues* (Manuscript, 1989), p. 29; OTA, p. 124.

⁶⁶ . Michael Gordon, "CIA Changes Way that it Measures Soviet Atom Tests," *New York Times*, 2 April 1986.

⁶⁷ . Michael Gordon, "How Public Remarks Became Classified Data," *New York Times* 20 February 1987. The officials who persisted in using the NTS method claimed that nonseismic intelligence indicated that they were correct, but they were unable or unwilling to support this claim. When Archambeau circulated a draft article describing how DOD corrupted the peer review process to thwart "efforts by competent seismologists to bring about an estimation procedure for Soviet test yields that would be realistic," DOD quickly classified the article. The quote is from a scientist who read the original draft in Len Ackland, "Testing—Who is Cheating Whom?" *Bulletin of the Atomic Scientists* 42:8, October 1986, p. 9.

probability, an actual yield as high as 300 kilotons—twice the legal limit—or as low as 75 kilotons.”⁶⁸ Even when used correctly, uncertainty estimates reflect political choices as well as technical capabilities. Arms control advocates argued that uncertainty could be reduced to 1.5 by exchanging data and correcting biases or using more than one type of seismic wave. Agreements to use in-country monitoring and test only in areas of known geology could lower uncertainty still further.⁶⁹

Reagan officials fought verification technology with verification technology. They cut funds for seismology⁷⁰ and promoted an on-site method called CORRTEX.⁷¹ Shock waves expand more quickly near larger explosions. U.S. officials claimed that using CORRTEX at Soviet test facilities could lower uncertainty to 1.3, although small location errors increase uncertainty to the factor of 2 associated with basic seismological methods.⁷² They also asserted that CORRTEX was inherently better because hydrodynamic verification is “direct” and seismic monitoring is “indirect,” even though both measure a signal that has traveled some distance from its source.⁷³

Three differences between hydrodynamic and seismic monitoring explain the unilateralists’ fondness for CORRTEX.⁷⁴ First, on-site methods multiply the costs and risks of arms control. CORRTEX monitors are present for ten weeks before and during each test, while seismologists can work outside national boundaries or at internal locations far from test facilities. To achieve 1.3 uncertainty, CORRTEX monitors also need detailed data such as the degree to which the explosion is designed to be symmetrical or asymmetrical—information that might reveal the purpose and/or performance of the test.⁷⁵ Second, promoting CORRTEX would decrease opposition to U.S. testing policy. Since domestic arms control advocates and neutral countries can access seismic data to refute TTBT noncompliance accusations, privileging a government-controlled mode of verification would protect such charges. Promises to improve compliance information would appeal to cautious cooperators who held a benign view of verification. Arguing about the relative merits of seismic and hydrodynamic monitoring would waste arms control advocates’ time and energy, and make them fight a two-front battle for intermediate limits and a total ban. Finally, seismic networks can detect extremely small tests around the world, but CORRTEX is increasingly impractical for yields below 50 kilotons and useless for unannounced tests. Establishing that seismology was insufficient at high yields would give unilateralists precedents against future limits.⁷⁶

⁶⁸. Assistant Secretary of Defense for Atomic Energy Robert Barker, quoted in Richards and Sykes, p. 55. It would be more accurate to say that there is only one chance in forty that a single test with a central yield value of 150 kt. was actually a 300 kt. shot. The chances of conducting two 300 kt. shots while still appearing to be in compliance with the TTBT would be one in 1600.

⁶⁹. Paul G. Richards, “Stages Towards a New Test Ban,” in Krepon and Umberger, pp. 83–84.

⁷⁰. Senatorial efforts to increase money for seismic research ran into trouble in the mid 1980s. An amendment to the 1986 Defense Authorization bill to spend \$10 million more on seismic studies was reduced to \$3.5 million, most of which was diverted to Los Alamos to support work on CORRTEX. When asked about the funding cuts for seismic research, the DOE said that “the Administration has stated that a test ban or moratorium is not now in the security interests of this country” and that it “would not support or fund any effort that is contrary to Administration policy.” See Anson Franklin, “Letter to the Editor,” *Science* 233, 26 September 1986, p. 1367.

⁷¹. CORRTEX relies on the fact that shock waves from large explosions expand more quickly than those from smaller shots. Monitors put an electrical cable in a vertical hole (the test shaft or one near it) and measure shock front expansion by seeing how quickly the point where the front crushes the cable moves upward. For a full explanation of CORRTEX, see Fred K. Lamb, “Monitoring Yields of Underground Nuclear Tests Using Hydrodynamic Methods,” in Dietrich Schroeder and David Hafemeister, eds., *Nuclear Arms Technologies in the 1990s* (New York: American Institute of Physics, 1988), pp. 109–148.

⁷². Roger Clark and John Baruch, “Verification of a Comprehensive Test Ban,” in Frank Barnaby, eds., *A Handbook of Verification Procedures* (New York: St. Martin’s Press, 1990), p. 133.

⁷³. An interagency study prepared by ACDA on “Verifying Nuclear Testing Limitations: Possible U.S.–Soviet Cooperation” asserted that “direct measures” (i.e. CORRTEX) have the benefit of allowing the verifying party to control the means of monitoring . . . [they are] much more definitive than any remote sensing method for determining the yields of Soviet nuclear tests.” (p. 2) This study was released by the State Department Bureau of Public Affairs as Special Report No. 152, and dated 14 August 1986. For a discussion of this claim, see Lamb.

⁷⁴. In 1988, arms control advocates found and leaked a 1982 memo in which the Director of Lawrence Livermore National Lab questioned the need for CORRTEX even before the Reagan administration had decided to insist on increased verification for the TTBT. This memo strongly suggests that the Reagan attack on seismology was not motivated by an official consensus that the United States needed more compliance information, *New York Times*, 26 May 1988.

⁷⁵. An asymmetrical blast could be used for such purposes as developing directed energy weapons for strategic defenses. See Clark and Baruch, p. 133.

⁷⁶. One Administration expert admitted that the campaign to push CORRTEX was largely driven by a desire to prevent more significant limits on nuclear tests. “If you boost the bona fides of seismology, in the view of the Administration, that can build political

In short, key players in the Reagan administration preferred CORRTEX not because it improved compliance information but because it raised the costs of high yield limits for the Soviets, undercut criticisms of current testing policy, and set precedents that could prevent future administrations from concluding a low-yield limit or comprehensive ban. Frank Gaffney, one of the architects of the Reagan administration's unilateralist testing policy, later acknowledged the motivation behind demands for this type of collaboration:

the more time wasted on discussions and experimentation of monitoring techniques irrelevant to the verification of an environment in which there are no legal tests, the easier it will be to stave off demands for the more constraining comprehensive test ban.⁷⁷

The irony of test ban technology collaboration during détente is that it provided the tools that Reagan unilateralists used to chip away at the TTBT and to build a barricade against a CTB. Those who were directly involved in détente-era negotiations learned about both the other sides' verification concerns and the practical problems encountered when designing verification systems that are both workable and tolerable. Negotiators had identified the verification issues that later became so controversial—unintended breaches, random fluctuations in seismic signals, differences in signal propagation due to test site geology, and limitations of remote sensing capabilities. For each issue, they crafted verification provisions that balanced the benefits of new information against potential costs and risks. Yet, because nobody popularized this multi-faceted way of thinking about verification, arms control critics could ridicule compromises as sacrificing rigorous verification to gain a weak agreement. A narrow construction of verification became a potent and popular weapon in the Reagan-era backlash against détente.

Competing Collaboration In the 1980s

By the end of Reagan's first term, arms control prospects were bleak. Since the United States opposed a CTB even if verification problems could be solved, the unilateralist structure of official policy suggests little role for test ban technology collaboration. Yet, Reagan's second term saw two unprecedented cooperative responses to test ban verification arguments. The Natural Resources Defense Council joined with the Soviet Academy of Sciences to establish in-country seismic monitoring stations near both sides' test sites. This project was designed to promote shared objectives: to reassure anxious Americans about Gorbachev's intentions and U.S. monitoring capabilities and to satisfy skittish Soviets about the value of verification (TTBT ratification and CTB negotiation) relative to the low costs and risks of in-country seismic monitoring. By contrast, the United States and Soviet governments conducted the Joint Verification Experiment (JVE) for radically different reasons. When transnational cooperation failed to alter U.S. nuclear testing policy, Gorbachev hoped that intergovernmental collaboration would promote a CTB and seismic verification inside the domestic policy-making processes of both superpowers. The Reagan administration, however, wished to weaken pressure for a CTB by convincing cautious cooperators in the United States to insist on modest limits and intrusive verification methods that the Soviets would resist. Comparing these competing projects shows how technical collaboration can be used in strategies both to promote and to prevent arms control breakthroughs. It also reveals the successes, limitations, and unintended effects of transnational and intergovernmental collaboration.

From Nuclear Stalemate to Collaborative Verification

Both the NRDC-SAS project and the JVE began as alternative responses to the opposition and ambivalence generated by Reagan's nuclear testing policies.

Reagan first suggested that U.S. and Soviet scientists experiment with hydrodynamic yield measurements at each others' test facilities in his September 1984 address to the U.N. General Assembly. The timing of this invitation reflected an electoral strategy to tone down Reagan's bellicose image. Congressional support for the nuclear freeze, TTBT and PNET ratification, and new CTB talks showed that the Cold War rhetoric was frightening voters, endangering defense spending, and eroding support for deterrence. By 1984, 69 percent of

pressure to move you closer to a comprehensive test ban." Quoted in Michael Gordon, "Atomic Test Data Weaken U.S. View," *New York Times*, 11 September 1988, p. A12.

⁷⁷. Frank Gaffney, "Test Ban Would Be Real Tremor to U.S. Security," *Defense News*, 5 September 1988, pp. 36-37.

Americans favored a CTB.⁷⁸ World opinion was also losing patience with the “game of disarmament.” The leaders of six nonaligned states issued a declaration from New Delhi that called for a complete freeze on the testing, production, and deployment of nuclear weapons, while the neutral states at the Conference on Disarmament refused to discuss test ban verification except in the context of work toward a CTB. Like Carter, Reagan had become increasingly aware of domestic incentives and popular pressures that ran counter to his own test ban preferences.⁷⁹

Soon after coming to power, Gorbachev tried to generate new momentum for nuclear cooperation by announcing a moratorium on Soviet nuclear tests as part of a package of arms control initiatives.⁸⁰ He conceded to U.S. demands on START, INF, SDI, and chemical weapons, but used the moratorium to increase popular pressure against U.S. testing policy. The 1985 Nonproliferation Treaty Review Conference, for example, almost collapsed over nuclear testing. The United States and United Kingdom were harshly criticized by nonaligned states like Mexico, but the USSR, less than one month into their moratorium, escaped unscathed.⁸¹

In a third-party maneuver to magnify the impact of the moratorium, the New Delhi Six offered to help the superpowers set up in-country seismic stations and to place monitoring devices on their own territory.⁸² Several of the American scientists most opposed to Reagan’s test ban policy had helped devise this collaborative proposal. Monitoring a relatively short moratorium would be technically and politically easier than verifying a CTB, they argued, because one need worry only about preexisting test sites. With narrower goals and needs, moratorium monitoring should spark fewer fears about cheating or spying. Scientists could see how new seismic techniques functioned “in the field” so that diplomats would not need to negotiate and implement a full-blown system based on unproved technology.⁸³

Gorbachev’s favorable response to the New Delhi Six was one of many indications of increased Soviet flexibility on verification.⁸⁴ This shift started as early as 1982, when Foreign Minister Gromyko suggested that part of the Soviet peaceful nuclear program might be opened to International Atomic Energy Agency safeguards.⁸⁵ At the 1985 Geneva Summit, Gorbachev agreed to discuss arms control and verification simultaneously. He also promised that the Soviet Union would pose no verification problems if the superpowers agreed to end nuclear tests. Avowals that verification issues must not preclude cooperation filled his major disarmament speech on January 15, 1986. Foreign Minister Shevardnadze sounded like a true arms control advocate when he announced that the problem of verification “is nonexistent now” because the USSR was ready for international monitoring and OSIs, as well as NTM.⁸⁶

Gorbachev’s decision to champion collaborative verification, like earlier Soviet opposition to intrusive monitoring, can be understood in several ways. The Reagan administration depicted it as further evidence of Soviet duplicity: Gorbachev was not serious about arms control, but hoped to put the burden of noncooperation on the United States by offering radical sounding verification for treaties that Reagan would never accept. A more neutral explanation emphasized a tactical shift rather than a new approach to verification. In this interpretation, the USSR might accept more monitoring than it deemed necessary because it knew the political

⁷⁸. Harris Poll, November 1984.

⁷⁹. Much of the Reagan Administration’s early arms control efforts were motivated primarily by public relations concerns. For example, one ACDA official said that European public opinion accounted for 75–95 percent of U.S. policy concerning INF. See interviews in Jeffery W. Knopf, “Beyond Teo-Level Games: Domestic-International Interaction in the Intermediate-Range Nuclear Forces Negotiations,” *International Organization* 47:4 (Autumn 1993): 618.

⁸⁰. Jonathan Dean, “Gorbachev’s Arms Control Moves,” *The Bulletin of the Atomic Scientists* 43, June 1987, pp. 34–40.

⁸¹. Jozef Goldblat, “The Third Review Conference of the Nuclear Nonproliferation Treaty,” *Bulletin of Peace Proposals* 17:1 (1986): 13, 17.

⁸². Raul Alfonsin, et. al., “To Reagan and Gorbachev,” *New York Times*, 30 October 1985, p. A27.

⁸³. Charles Archambeau, “Monitoring of a Nuclear Test by Seismic Methods,” Report prepared for the New Delhi Six monitoring offer. (Manuscript).

⁸⁴. For details, see William C. Potter, with Leonid V. Belyaev and Mark Lay, “The Evolution of Soviet Attitudes toward On-Site Inspection,” in Lewis A. Dunn with Amy E. Gordon, eds. *Arms Control Verification and the New Role of On-Site Inspection* (Lexington, Mass.: Lexington Books, 1990), pp. 195–197.

⁸⁵. On the agreement to safeguard two Soviet facilities, see Melvyn B. Nathanson, “Soviet Reactors Open for International Inspection,” *Bulletin of the Atomic Scientists* 41:6 (June–July 1985), pp. 32–33.

⁸⁶. “Soviet Union Daily Report,” *Foreign Broadcast Information Service*, 27 January 1986, p. C9.

value of verification for the United States, but it would exploit each verification concession for maximum negotiating leverage. A third view saw Gorbachev's statements as evidence of a new-found belief that secrecy fuels the arms race and that cooperation requires widespread access to accurate compliance information. In retrospect, each interpretation holds some validity, with the mix of motives depending on the issue at stake.⁸⁷ At the time, though, Gorbachev's offers for collaborative verification exacerbated U.S. domestic debates about his intentions instead of convincing Americans that he sincerely sought stable arms control cooperation.

U.S. unilateralists ridiculed the proposal. National Security Advisor Robert McFarlane accused the Soviets of conducting a "flurry" of tests before the moratorium, although the nine tests in 1985 were only one third of the known Soviet annual average since 1978.⁸⁸ A closed society, ACDA Director Kenneth Adelman argued, could conduct clandestine tests or secret preparations for a breakout.⁸⁹ A moratorium would also halt vital U.S. research on strategic defense, accurate warheads, and communication during nuclear war.⁹⁰ Thus, Gorbachev's proposal would undermine "the safety, reliability, effectiveness, and credibility of our nuclear deterrent which keeps the peace."⁹¹

Reagan repeated Eisenhower's response that joint efforts to improve verification would be safer and more meaningful than a testing moratorium. The day that Gorbachev announced his halt, the United States invited Soviet scientists to observe a CORRTX display "as a demonstration of our seriousness."⁹² The USSR refused because watching CORRTX might condone testing, postpone CTB talks, and legitimize criticisms of seismic monitoring.⁹³ It wanted the treaties ratified and implemented as negotiated, saying that further verification should be discussed only if original arrangements proved inadequate.⁹⁴

Despite this damage control, the Soviet moratorium posed a public relations problem for Reagan. Voters were intensely concerned about nuclear weapons, but attitudes toward testing revealed deep contradictions. Before the Geneva Summit, 60 percent of respondents thought that Gorbachev's initiatives were meant to influence world opinion, but only fourteen percent saw real interest in major arms reductions.⁹⁵ Still, majorities in four polls between August 1985 and April 1986 would reciprocate Soviet restraint.⁹⁶ Preferences cut across party

⁸⁷. See Stuart D. Goldman, Paul E. Gallis, and Jeanette M. Voas, "Verifying Arms Control Agreements: The Soviet View," Congressional Research Service Report No. 87-316F (15 April 1987), pp. xx-xxiii.

⁸⁸. Jeffery Duncan, "How Many Soviet Tests Make a Flurry?" *The Bulletin of the Atomic Scientists*, 41:9, October 1985, pp. 8-9. Of the three nuclear blasts detonated in by the Soviets in July 1985, two were at the regular test site near Semipalatinsk and one was believed to be a PNE in the northeastern part of the Soviet Union. The PNE was explained in the context of a program to create underground storage for substances like natural gas or biological wastes. However, it led to veiled accusations that the Soviets had purposefully created a large cavity so that decoupled explosions during the moratorium would not be detected. See Paul-Joachim von Stulpnagel, Permanent Representative of the Federal Republic of Germany to the Conference on Disarmament at the 6 November 1986 "Forum on Verification of a Comprehensive Test Ban: Progress, Problems and Prospects," the transcript of which is available in *Disarmament* (Winter 1986-87): 27.

⁸⁹. Kenneth Adelman, "Nuclear Test Ban: A Long-Term Goal," *NATO Review* (April 1986): 7. For a detailed rebuttal of the oft repeated charge that the Soviet decision to resume testing in 1961 proved that they were not sincere about arms control, see Robert Divine, "Early Record on Test Moratoriums," *The Bulletin of the Atomic Scientists* 40:5 (May 1986): 24-26.

⁹⁰. "U.S. Official Says Two Key Projects Require More Atomic Tests," *New York Times*, 30 July 1985, p. A6.

⁹¹. Adelman, p. 5.

⁹². Gerald M. Boyd, "U.S. and Russians Make New Offers on Nuclear Tests," *New York Times*, 30 July 1985, p. 1.

⁹³. In the eyes of the Tass News Agency, "by again inviting the Soviet Union to exchange 'observers' at nuclear weapons tests, the American Administration suggests actually only to register nuclear blasts and thus to legalize them." Quoted in Seth Mydans, "Soviet to Stop Atomic Tests; It Bids U.S. Same," *New York Times*, July 30, 1985, p. A6.

⁹⁴. This position reflects concerns not only about verification per se, but also about the reliability of the United States as a negotiating partner. The Soviets worried that renegotiating the TTBT and PNET before ratification would set a bad precedent for future arms control efforts. See Goldman, et. al., p. 116.

⁹⁵. Of the remaining respondents, twenty percent had no opinion and six percent volunteered that Gorbachev sought both favorable world opinion and real reductions, *Gallup Report* 243 (December 1985): 8.

⁹⁶. The four questions that discussed the Soviet moratorium prompted the following responses about U.S. policy:

8/1985 The Soviet Union recently announced that it would suspend tests of nuclear weapons. Do you think the United States should also agree to suspend tests of nuclear weapons as long as the Soviets do? (ORC): Yes, 57 percent; No, 30 percent; Don't Know, 13 percent.

11/1985 The Soviet Union has decided, on its own, not to test nuclear weapons for six months and has called on the United States to join in negotiations for a complete ban on all such tests. Some people say the Russians have declared this unilateral test moratorium because they really want to reduce world tensions. Other people say that since the Russians have more nuclear weapons than we do, a temporary halt of testing would slow down the U.S. effort to catch up. Do you think the United States should join in a moratorium on

lines; 51 percent of Republicans wanted to join the moratorium, while only 43 percent agreed with Reagan's position.⁹⁷ Yet, nuclear ambivalence remained. Most respondents considered arms control very important, but few believed that recent negotiations had reduced the chance of nuclear war. Additionally, more respondents feared that war would result from loss of U.S. nuclear strength than from continuing the arms race.⁹⁸

Arms control advocates of the mid-1980s faced a situation much like the disarmament deadlock of the 1950s. Superpower leaders espoused extreme verification demands and blamed each other for negotiating failures. U.S. citizens questioned the motivations behind both leaders' positions on verification, longed for a cooperative response to the dangers of deterrence, yet worried that arms control might advantage the other side. In the past, widespread ambivalence and ignorance had minimized the impact of public opinion on nuclear policy. Yet, the Nuclear Freeze movement was breaking through this paralyzing doubt. Cautious cooperators constituted a potential pool of support for a CTB *if* activists could inform and energize them.⁹⁹

Arms control advocates longed for a national debate to determine the amount of information needed to detect, deter, and reassure so that cautious cooperators could differentiate between sincere and cynical verification demands. Yet, this question was rarely discussed in depth because it involved complex judgments about arms control, nuclear strategy, Soviet intentions, and verification functions.¹⁰⁰ Debate often deteriorated into arguments over minimalist and maximalist views of deterrence or adversarial and cooperative conceptions of the USSR. Each side accused the other of rigging verification criteria to produce their preferred arms control outcome.¹⁰¹ The main questions were frequently avoided because the Cold War climate and the benign view of verification left those who questioned extreme verification vulnerable to charges of being naive, irresponsible guardians of US security.¹⁰²

Much of the debate, therefore, focused on three safer and more technical issues. Had the USSR violated the TTBT? Could seismology achieve a factor of 1.3 uncertainty without excessive intrusion and expense? Finally, could the USSR show that it was sincere about underground test limits without accepting CORRTEX? The NRDC–SAS seismic monitoring project and the U.S.–Soviet JVE gave different answers to these questions. Both argued that joint research could break the test ban deadlock, and both sought to control the informative and the symbolic functions of cooperative verification. In short, both tried to use technical collaboration for political purposes, the first to promote far-reaching new limits on nuclear tests and the second to prevent them.

atomic tests, or do you think we should continue to test nuclear weapons? (LAT) roper 1342, 3837: Yes, join in moratorium, 47 percent; No, 44 percent; Not sure, 8 percent; Refused, 1 percent.

2/1986 The Soviet Union has had a ban on underground nuclear testing since August, 1985. The United States has continued to test, arguing that the tests are necessary to develop new weapons and to assure the reliability of existing ones. Do you think the United States should, or should not agree to a ban on all nuclear testing if the Soviet Union continues their ban? (Gallup/NW): United States should agree, 52 percent; United States should not agree, 41 percent; Don't know, 8 percent.

4/1986 The Soviet Union has had a ban on underground tests of nuclear weapons since last August. The United States has rejected such a ban and has conducted eight underground tests since then. The Reagan administration argues that these tests are necessary to develop new weapons and to assure the reliability of existing weapons. Do you think the United States should or should not agree to a ban on nuclear testing if the Soviet Union continues their own ban? (AIPO 1262G) GR 247: Should, 56 percent; Should not, 35 percent; No Opinion, 9 percent.

Another question asked in April 1986 that did not mention the Soviet moratorium produced very different results:

4/1986 The Soviet Union has asked the United States to stop all nuclear testing, but President Reagan has refused to do so. Do you think the United States should go along with the Soviet request to stop nuclear testing, or not? (NBC/WSJ) Rope 4020: Yes, go along with request to stop, 33 percent; No, don't go along, 55 percent; Only if Russians don't test, 6 percent; Not Sure, 6 percent.

⁹⁷. Among Democrats, 58 percent wanted the United States to join the moratorium, and 33 percent objected. "Public Favors Halting A-Tests if Soviet Moratorium Continues," *The Gallup Report* 248 (May 1986), pp. 20–21.

⁹⁸. See *Gallup Report* 248 and "Americans Consider Arms Treaty Very Important, Yet Many Doubt Effectiveness of Negotiations," *Gallup Report* 249 (June 1986), pp. 26–29.

⁹⁹. On public opinion and the nuclear freeze, see David S. Meyer, *A Winter of Discontent* (New York: Praeger, 1990).

¹⁰⁰. The complexities of a fuller debate are covered in James Schear, "Verification, Compliance, and Arms Control: The Dynamics of Domestic Debate," pp. 264–319 in Eden and Miller.

¹⁰¹. For example, seismology supporters charged Reagan with requiring 1.3 uncertainty for the TTBT because that fit the alleged capabilities of CORRTEX, and the Soviets opposed on-site yield measurement, not because the number reflected careful cost/benefit/risk calculations. Unilateralists countered that arms control advocates would accept ineffective verification because they viewed arms control agreements as ends in themselves.

¹⁰². Allan Krass argues that American politicians must perform a "credibility ritual" in which they start all discussions of verification by insisting that they do not trust the Soviet Union. See Krass, *How Much is Enough?*, p. 160.

The NRDC–SAS In-Country Seismic Monitoring Project

Spurred by a sense of responsibility for the development of nuclear weapons and a belief that scientific knowledge transcends national borders, arms control advocates and cautious cooperators in the scientific community have had a long history of transnational collaboration. In addition to government-sponsored events, like the Conference of Experts and the technical working groups at the U.N., private organizations such as the international Pugwash movement and the Federation of American Scientists have a long history of bringing scientists together to talk about the arms race and to explore approaches to arms control verification. Interactions among U.S. and Soviet scientists usually focused on the exchange of technical information, although back-channel discussions about the destabilizing effects of antiballistic missile defenses may have contributed to the Soviet decision to sign SALT I.¹⁰³ Two events, a 1983 conference on Nuclear Winter and the 1986 accident at the Chernobyl nuclear power plant, brought increased openness and a greater sense of urgency to these efforts.

The NRDC, a large American environmental advocacy organization composed primarily of scientists and lawyers, grew interested in seismic verification while publishing nuclear test data as part of a project to educate citizens about technical aspects of weapons development and arms control. At the time, the U.S. government only announced some of its tests.¹⁰⁴ The U.S. Geological Survey (USGS) collected data from many other seismic events, but did not identify any of them as secret tests. Even less was known about the Soviet program because the USSR had never announced its tests and Soviet seismologists either turned off their equipment or had their data confiscated.¹⁰⁵ In January 1986, the NRDC pieced together enough information to estimate the number of secret U.S. tests and to show that some, but not all, had probably been detected by the USGS or a seismic array located in Sweden.¹⁰⁶ From this analysis, they argued that existing seismic systems could reliably detect underground tests at NTS above one to three kiloton and that dedicated seismic stations could lower the threshold still further.

NRDC members joked about putting a station near the NTS, but worried that it might seem “unpatriotic for NRDC unilaterally to release information which the US government was, for some reason, keeping secret . . .”¹⁰⁷ In February 1986, Thomas Cochran, a senior scientist at the NRDC, began working on a plan for nongovernmental scientists in the US and USSR to monitor jointly the presence or absence of nuclear tests in each country. Since monitoring around NTS could occur on private land, the project would not require U.S. government support, beyond granting visas for Soviet scientists to come to the United States and export licenses for equipment shipped to the USSR. When Cochran and NRDC Chairman Adrian Dewind discussed the idea with Deputy Secretary of State John Whitehead, he expressed concern about how the project related to official U.S. testing policy, but did not oppose the effort.¹⁰⁸

¹⁰³. See Evgeny P. Velikhov, “Science and Scientists for a Nuclear Free World” and Frank Von Hippel, “Arms Control Physics: The New Soviet Connection,” both in *Physics Today* 42:11 (November 1989), pp. 31–46.

¹⁰⁴. In a working paper published in 1986, NRDC analysts estimated that at least forty-six unannounced nuclear tests had occurred between July 1945 and December 1987. Two years later, they presented data on 802 announced tests and 117 unannounced ones, but observed that “since an undetermined number of very small explosions are suspected to have occurred . . . the real number of U.S. tests could be as many as one thousand.” In December 1993, the Clinton Administration disclosed that the United States had conducted 1051 nuclear tests during the Cold War. A total of 204 of these had been previously unannounced. See Robert S. Norris, Thomas B. Cochran, and William M. Arkin, “Known U.S. Nuclear Tests July 1945 to 31 December 1987,” *Nuclear Weapons Databook Working Paper NWD 86-2* (Rev. 2A) published in January 1988 by the NRDC, and John H. Cushman Jr., “204 Secret Nuclear Tests By U.S. Are Made Public,” *New York Times*, 8 December 1993, p. A20. A detailed picture of the complete U.S. testing program is provided in Robert S. Norris and Thomas B. Cochran, “United States Nuclear Tests July 1945 to 31 December 1992,” *NWD 94-1* published in February 1994 by the NRDC.

¹⁰⁵. In August 1990, the Soviet government announced that the Soviet Union had conducted 714 tests in the forty-one years since its first nuclear explosion. This number was seventy-two more tests than can be documented, but about the number that Western analysts suspected. The figures that the USSR provided for the number of British, French, and Chinese nuclear tests it had detected matched Western accounting. Their estimate of 1080 U.S. tests was judged to be quite high at the time, but they were significantly more accurate than the NRDC assessment. See Robert Norris and William Arkin, “Soviet Test Numbers Revealed,” *Bulletin of the Atomic Scientist* 46:9 (November 1990), p. 48.

¹⁰⁶. Thomas B. Cochran, Robert S. Norris, William M. Arkin, and Milton Hoenig, “Unannounced U.S. Nuclear Weapons Tests,” *NWD 86-1* published by the NRDC in January 1986.

¹⁰⁷. Philip Schrag, *Listening for the Bomb*, (Boulder, Colo.: Westview, 1989), p. 12.

¹⁰⁸. Letter from John C. Whitehead, Deputy Secretary of State, to Adrian DeWind, Chairman of the NRDC Board of Trustees, 4 March, 1986.

Collaboration to demonstrate and improve seismic monitoring technology, appealed to reform-minded Soviet leaders for many reasons. Gorbachev wanted to connect new thinkers in the East and the West at a time when many Americans were still in “evil empire mode.”¹⁰⁹ Letting Western scientists monitor the absence of testing would rebut charges that the new openness was a public relations gambit and the moratorium a ploy. Joint seismic monitoring could also buttress the Soviet position that on-site verification was superfluous for TTBT ratification and CTB negotiation.

Arms control advocates in the Soviet Union envisioned international technology collaboration as a tool to influence internal policy-making processes of both superpowers. Yevgeny Velikhov, vice-president of the Soviet Academy of Sciences and Gorbachev’s unofficial science adviser, invited U.S. scientists to a seismic verification symposium in May, 1986, where he embraced the most “political” suggestion—the Cochran plan to put three stations near the test site in Kazakhstan and Nevada.¹¹⁰ Desire for a quick and visible test ban breakthrough explains why Velikhov wanted the NRDC–SAS project to start by the end of June—barely a month away.¹¹¹ He knew that Congress would vote in August on a one kiloton moratorium as part of the FY87 defense authorization bill. Velikhov also expected that Soviet hard-liners would try to block an extension when their moratorium expired that same month.

American participants in the NRDC project had several motives. For leading seismologists who agreed to operate the seismic stations in the USSR, the initial attraction was to “do good science”—that is to collect new data relevant to the TTBT compliance controversy and the CTB verification debate. Measuring waves that have traveled from U.S. tests to seismic stations in Kazakhstan provides data about signal attenuation between the United States and USSR. If the stations could record when the Soviet Union resumed testing, scientists could also compare regional waves with signals measured at teleseismic distances. Cochran saw the project as a form of hypothesis testing: since Gorbachev maintained that access would not be a problem for CTB verification and Reagan insisted that verification remained a major obstacles, requesting permission for in-country monitoring stations provided an “opportunity to make a liar out of one of them.”¹¹² For Jacob Scherr, the NRDC lawyer who led the project with Cochran, the primary purpose was to change public perceptions of the Soviet Union: if Gorbachev was really willing to allow the stations—and many people at the NRDC doubted that he actually would—then a dramatic demonstration of this new openness would reassure cautious cooperators in a way that words alone never could.¹¹³ For this reason, the stations were located “right on the doorstep” of the main Soviet test facility, ready to detect tiny explosions should the USSR violate its own moratorium.¹¹⁴

To start monitoring by the end of June, the NRDC had a month in which to raise over a million dollars, select equipment, secure export licenses, and convince scientists to participate.¹¹⁵ They succeeded, in part because they found official allies who shared their objectives and could expedite arrangements. According to Philip Schrag, some members of the State Department saw the project as a way to end the TTBT compliance controversy, to set useful verification precedents, to learn about short-range seismic monitoring, and to refine U.S. negotiating positions.¹¹⁶ Whitehead quietly assigned a liaison and expedited export licenses for the project. He did not, however, want his agency publicly associated with efforts to reverse U.S. policy. State officials were told to answer questions about the NRDC project by applauding Soviet willingness to share additional verification data, while questioning the merits of an asymmetrical arrangement between scientists sponsored by the Soviet government and a private organization acting in opposition to official U.S. policy:

¹⁰⁹. Interview with Jacob Scherr, Senior Staff Attorney at the NRDC, Washington D.C., 14 April 1989.

¹¹⁰. Ackland, p. 11. Evgeny Velikhov discusses his reasons for promoting the joint seismic monitoring project, as well as other ways in which cooperation minded scientists influenced Soviet defense and arms control policy in “Science and Scientists for a Nuclear-Weapon-Free World,” *Physics Today* 42:11 (November 1989), pp. 32–36.

¹¹¹. Schrag, pp. 12–13.

¹¹². Interview with Thomas Cochran, Senior Staff Scientist with the NRDC, Washington, D.C., 9 June 1994.

¹¹³. Interview with Jacob Scherr, NRDC Senior Staff Attorney, Washington, D.C., 9 June 1994.

¹¹⁴. Scherr interview, 4 April 1989.

¹¹⁵. Ultimately, the NRDC raised 4.5 million dollars for the project, which makes this the largest private U.S.–Soviet scientific venture ever.

¹¹⁶. Schrag, pp. 74, 78–79.

because effective verification is a matter that can only be resolved at the government-to-government level, one would expect the Soviets—if indeed they are serious regarding verification improvements—to accept the standing US invitation for a meeting of US and Soviet government experts to discuss verification improvements for the TBT and PNET.¹¹⁷

After the NRDC team arrived in Moscow in July, Velikhov encountered resistance from the Soviet Foreign Ministry and Ministry of Defense who opposed granting official permission for the Americans to go near the Soviet test site. Velikhov was instructed to circulate an issue paper among the senior Soviet policy makers, but failed to do so, due perhaps to confusion in the decision-making process or to a conscious decision to postpone debate until the NRDC had arrived. The Americans waited in Moscow for four days while, Velikhov (who was hospitalized) argued that sending them home now would create a major public embarrassment. Since the military's concern dealt with monitoring once the test moratorium was over, the stand-off was resolved after the NRDC representatives signed a document which said that monitoring a Soviet nuclear test was not essential to the purpose of their project.

The onset of in-country monitoring produced an upsurge of U.S. support for arms control. Publicity shots of U.S. seismologists working in Kazakhstan provided tangible evidence of glasnost in action. As Jacob Scherr put it, once the NRDC took *New York Times* reporters, television crews, and *National Geographic* photographers to Semipalatinsk, U.S. conservatives could not easily ignore or dismiss the moratorium.¹¹⁸ On August 8th, the House voted 234 to 155 to withhold funds for nuclear tests above one kiloton for a year if the USSR reciprocated and permitted in-country seismic verification. Chris Paine, the staffer for Senator Ted Kennedy who led the push for a one kiloton moratorium, believes that a well-orchestrated series of briefings about the NRDC project and display set up in the lobby on the day of the House vote helped the measure to pass by the largest margin of any arms control vote in Congress. The key to victory, according to Paine, was that supporters made openness and verification, not test limitations per se, the focus of the vote.¹¹⁹

Unilateralists in the Reagan administration worried about how the NRDC project would affect public support for nuclear testing. Their concerns increased when they saw that the Soviets would allow in-country monitoring and that this could convince Congress to cut off funds for most nuclear tests. Richard Perle, the Assistant Secretary of Defense for International Security Policy, led the charge. As one of Perle's assistants said:

the NRDC's goals were totally the opposite of our own. They went into this project to prove that a CTB is verifiable [and we'd made verification into the main public objection to a CTB because] verification is such a "show stopper," as Richard Perle is fond of saying.¹²⁰

A Defense Advanced Research Projects Agency (DARPA) memorandum written soon after the NRDC-SAS agreement was signed shows how much importance unilateralists placed on convincing cautious cooperators that "effective" verification must involve intrusive monitoring even for very high yield limits.¹²¹ Any response, the memo declared, should serve two policy objectives: the promotion of current U.S. testing policy and the reduction of influence, propaganda value, or political gains for the USSR. The authors argued that in-country monitoring would provide unreliable information because the USSR could locate the seismic stations in noisy or unrepresentative locations. Nevertheless, they expected arms control advocates to interpret ambiguous data as evidence to support their claims for seismic capabilities. The real danger was that the project could convince cautious cooperators that the Soviets would now accept exacting verification demands. It might "divert attention from, or claim to be a substitute for, the standing U.S. proposal to make CORRTX measurements on nuclear tests. It will be hard for the public to distinguish between an essentially irrelevant and a highly valuable measurement program." Thus, the administration faced a delicate situation. It could try to delay exports, discredit

¹¹⁷. State Department press directive, quoted in William Sweet, "NRDC and Soviet Academy Sign Unusual Test-Verification Pact," *Physics Today* 39:7 (July 1986), pp. 63–64.

¹¹⁸. Scherr interview, 14 April 1989.

¹¹⁹. Interview with Chris Paine, Staff Member for Senator Kennedy, Washington, D.C., 12 April 1989.

¹²⁰. Ed Nawrocki, quoted in Schrag, p. 84.

¹²¹. Defense Advanced Research Projects Agency, Natural Resources Defense Council Proposal to Place Seismic Monitoring Stations Near the Soviet Nuclear Test Site 3 (June 26, 1986) (Memorandum to Richard Perle). Within DOD, DARPA researches and develops methods to monitor foreign nuclear tests.

NRDC scientists, and distance itself from the project, but it wanted to avoid heavy-handed tactics that could be portrayed as intransigence on test ban verification.¹²²

For a variety of legal, practical, and political reasons, Perle focused on the issue of visas for SAS members to visit the United States. The State Department wanted to reciprocate Soviet openness by granting unconditional visas. Perle saw “the second level issue of how to react to the NRDC project, and particularly whether to grant the visas” as a surrogate for disputes between Defense and State over general nuclear testing policy.¹²³ The Department of Defense, therefore, insisted that SAS members come only as government officials and solely to observe a CORRTEX demonstration. Rather than debate the real issue, the National Security Council (NSC) staff minimized interagency conflict by “splitting the difference.” SAS members could make an official visit, watch CORRTEX, and go wherever else they wished, or be guests of the NRDC on highly restricted visas. Because the Soviets chose the second option, they were denied visas that would permit them to visit potential seismic monitoring sites in the United States. The project was saved only because SAS scientists selected their monitoring sites based on geological maps, photos, and rock samples; and analyzed data sent to the Soviet Union.

Internal opposition was weaker in the USSR because the project suited Gorbachev’s policy objectives and public diplomacy strategy.¹²⁴ Conservative Politburo members objected that the SAS had bypassed formal negotiations and encroached on their turf.¹²⁵ Some traditionalists had trouble tolerating the new openness in Soviet verification policy.¹²⁶ The loudest outcry came from critics of unilateral test restraint. When asked about the moratorium in August 1986, Marshal Sergei Akhromeev hinted that the military would not tolerate much longer the “damage” done by unreciprocated restraint.¹²⁷ Each U.S. test created new objections to Gorbachev’s public diplomacy strategy.¹²⁸

Arms control opponents in both countries reinforced each others’ efforts to restrict collaboration, while NRDC–SAS participants searched for creative responses. When Congress dropped test restrictions from the defense authorization bill and the Reykjavik summit floundered over SDI, Gorbachev bowed to hard-line pressure: the moratorium would end after the first U.S. nuclear blast in 1987. This occurred on February 3rd, less than two weeks before the NRDC started full-scale monitoring at Semipalatinsk. In the same month, the NSC again refused to grant an unrestricted visa unless the Soviet team watched a CORRTEX demonstration (this time, the SAS declined to come at all). These events must have made arguments that Soviet verification concessions would not secure a CTB seem increasingly plausible to cautious cooperators in the USSR. Soviet domestic politics, Scherr believes, explains why the NRDC was told to stop monitoring before the Soviet test on February 26th. “A lot of chits had been used up by Gorbachev in enforcing the moratorium for eighteen

¹²². As part of a strategy to discredit the collaboration, Frank Gaffney, Perle’s deputy, suggested that the Soviet government was sponsoring the project to “confuse the domestic debate about the need for American nuclear testing” and to “promote an inequitable and unverifiable ban on nuclear testing.” Perle dismissed the NRDC scientists as “a bunch of seismologists feathering their own nests.” See Frank Gaffney, “Test Ban: The Quick Fix Won’t Work,” *Washington Post*, 29 August, 1986, p. A15; and the transcript of, “Perle and the Scientists,” KRON-TV, San Francisco, 9 May 1986.

¹²³. Schrag interview with Perle, 18 August 1987, p. 111n.

¹²⁴. The collaboration also secured export licenses for some equipment that surpassed Soviet technology. The equipment cost \$800,000 in scarce hard currency.

¹²⁵. Interview with Thomas Cochran, Washington, D.C., 6 June 1989.

¹²⁶. The head Soviet negotiator for the Conference on Security and Cooperation in Europe (CSCE) recalls that some participants in a 1986 Politburo discussion about accepting OSIs to get a CSCE agreement were uncomfortable with the idea of foreigners seeing all parts of the Soviet territory. This suggests that Gorbachev also faced concern about the wisdom of inviting American scientists to enter sensitive locations near the main Soviet test site. See the comments by Oleg Grinevsky in Don Oberdorfer, *The Turn* (New York: Simon and Schuster, 1991), p. 233.

¹²⁷. Akhromeyev made this remark at a news conference in which he pressed the United States to join the moratorium and work toward a CTB. His comments appear designed to rebut U.S. unilateralist claims that the moratorium was a public relations gimmick with no military significance and to suggest that Soviet internal politics would bring about an end to the moratorium if the United States did not react soon. He also tried to link test restraint to American goals for the Soviet Union by arguing that money for resumed Soviet tests would be made available even if it meant diverting resources away from Gorbachev’s efforts to revitalize and reform the Soviet economy. See the coverage of the press conference by Philip Taubman, “Moscow Says Its A-Test Halt is Militarily Beneficial to U.S.” *New York Times*, 26 August 1986, p. A4.

¹²⁸. Vitaliy Goldansky, “Verificational Deterrence and Nuclear Explosions,” *International Affairs* (June 1988), p. 31.

months—he wasn't willing to spill any more blood over keeping the equipment on."¹²⁹ U.S. officials used the shut-down request as evidence that Gorbachev never was serious about in-country monitoring for anything short of a total ban, while the NRDC tried to put the situation in a positive light by claiming credit for the first public notification of an impending Soviet test.

The renegotiation of the NRDC–SAS agreement in June 1987 suggests that domestic politics in both states convinced Gorbachev to shift his test ban strategy. After the House voted again for a one kiloton moratorium (234 for, 187 against), the USSR extended the NRDC–SAS project for fourteen months. According to SAS members, though, lack of reciprocal access had strengthened hard-liners.¹³⁰ NRDC members hoped that moving their stations 600 miles away from Semipalatinsk would help convince the military to accept monitoring during nuclear tests. NRDC scientists also wanted to enlarge the network as a foundation for the 20 to 30 in-country seismic stations that Charles Archambeau had suggested for CTB verification. Gorbachev allowed the NRDC to relocate its three existing stations, build two new ones, and monitor during Soviet tests, so long as they left daily operations to Soviet nationals. Off-site monitoring had less media value in the United States, but did set important precedents for in-country monitoring of an active testing program in the USSR.

This decision signaled a shift in Soviet test ban strategy because monitoring an active test program provide facilities and practical experience needed for a low-yield threshold treaty.¹³¹ As unilateral initiatives and independent collaboration failed to alter U.S. testing policy, Gorbachev began using public diplomacy less to push for a total ban and more to facilitate intergovernmental negotiations over step-by-step limits that the Reagan administration preferred. Since July 1986, the superpowers had held “expert-level discussions” on test ban verification questions. Early meetings involved predictable sparring. U.S. delegates used various “cheating scenarios” to justify CORRTEX. Soviet scientists objected that a system to detect improbable forms of noncompliance would institutionalize “mutual distrust” that ignore important tradeoffs between accuracy (high detection and low false alarm rate), nonintrusiveness (low collateral information), and practicality (low expense and inconvenience).¹³² But as they learned that seismic collaboration could not overcome U.S. insistence on CORRTEX as the price for TTBT ratification, Soviet scientists began to ask more detailed questions and consider the tradeoffs more carefully.¹³³ Rather than renew an unreciprocated moratorium, Gorbachev agreed to “step by step” negotiations but insisted that a CTB should be a near-term goal, not a by-product of nuclear obsolescence. The two countries argued for nearly a year about the name and agenda for the meetings. Finally, in September 1987, they agreed to start “Nuclear Testing Talks” (NTT) to draft new verification protocols for the TTBT and PNET, pursue intermediate limits, and progress toward a CTB.

Meanwhile, another component of the NRDC–SAS project, seismic monitoring of simulated nuclear blasts, was generating useful data without altering U.S. policy. In September 1987, three days before the Senate reconsidered a one kiloton moratorium, an NRDC–SAS team detonated three chemical blasts near Semipalatinsk. They showed that regional monitoring could detect a decoupled one kiloton explosion and that the NTS formula exaggerated Soviet yields. When an earthquake near New Zealand shook the seismometers before the third detonation, the collaborators obtained striking evidence against the “hide in an earthquake” cheating scenario because the big earthquake and the small explosion generated very different signals.¹³⁴ The USSR also invited U.S. Congressmen and NRDC experts to tour the Krasnoyarsk radar, site of an alleged violation of the Antiballistic Missile Treaty. Neither the verification breakthroughs nor the Krasnoyarsk visit changed Senate unilateralists’ attitude toward a short moratorium. Even many moderates who supported the amendment in 1986 voted against a ban in 1987 because official efforts now seemed like they might produce

¹²⁹. Scherr interview, 14 April 1989.

¹³⁰. See Schrag, p. 89.

¹³¹. Charles Archambeau, “Verification of a Very Low Yield Nuclear Test Ban,” pp. 279–280 in Goldblat and Cox.

¹³². Robert Barker, “The Verification of Arms Control, Disarmament Agreements and Security,” *Disarmament* 11:2 (Summer 1988): 6–8. Barker used these criteria to create a double bind for the Soviets. CORRTEX was necessary, he argued, regardless of whether or not the Soviets had complied with the TTBT because seismic verification was either failing to provide definitive proof of noncompliance or raising false alarms. In other words, even unfounded accusations could be used to raise verification requirements because “if a party which has complied is bombarded with data consistent with a historic adversary’s violation, then the situation can, in its view, be worse than if the treaty *never* existed” (emphasis in the original).

¹³³. Interviews with Administration officials, in Goldman, et al., pp. 121–122.

¹³⁴. *The Amicus Journal* (a publication of the NRDC), “Nuclear Glasnost,” (Fall 1987), p. 17.

results.¹³⁵ In Scherr's words, the "window of public diplomacy" closed in September 1987. The Reagan administration had moved just enough to mollify cautious cooperators in Congress but not enough to sustain Gorbachev's grassroots strategy against his internal critics.

Soviet willingness to discuss testing on the Reagan administration's terms gave U.S. unilateralists a new incentive to obstruct the NRDC-SAS collaboration. The day after the INF treaty was signed, Gorbachev and Reagan agreed to monitor an explosion at each others' test site. While the United States planned to showcase CORRTEX, the USSR hoped to demonstrate that seismology could out-perform hydrodynamic methods with less intrusion and expense. Advance visits by SAS scientists to seismic stations around NTS could improve the accuracy of in-country monitoring for the JVE. The NSC denied a third visa request even though the Soviets now agreed to watch CORRTEX.

SAS members finally visited NRDC stations in the United States after the resignations of Perle, Gaffney, and Weinberger left DOD less inclined to block visas in order to protect current testing policy.¹³⁶ The House voted for a testing halt again in April 1988, shortly after the SAS team established the first Soviet-equipped and operated seismic stations in the United States. A day later, three small chemical blasts in Nevada were recorded by the new Soviet stations, three permanent NRDC sites, and 150 seismometers hundreds of miles away. One optimistic observer declared:

The world had changed. No more could governments pretend that a Comprehensive Test Ban Treaty would be unverifiable . . . The NRDC has given hope . . . by showing that determined private citizens can lead even superpower governments out of the deadly traps they fashion for themselves.¹³⁷

Janne Nolan of the Brookings Institution, by contrast, believes that the NRDC failed to change either public attitudes or official policy. In fact, nongovernmental collaboration may have reduced support for arms control:

efforts such as [seismic monitoring and the Krasnoyarsk visit] have not enjoyed broad political support or helped dispel suspicion among critics . . . Partly this has been due to the composition of the delegations, which have not been bipartisan. More important, it reveals the inherent limits of unofficial site visits. If anything, these citizen-diplomat efforts have intensified conservatives' fears that on-site inspections are a new weapon in the Soviet arsenal of propaganda and deception.¹³⁸

What exactly did the NRDC-SAS collaboration accomplish? If one assesses the project in terms of three objectives—to promote and improve in-country seismic monitoring technology, to influence internal debates over nuclear testing policy, and to move the world closer to a Comprehensive Test Ban Treaty—a complex picture emerges. Project leaders were most successful when they had official allies who wanted to promote policy objectives through nongovernmental channels. Where the NRDC used transnational collaboration to undercut national leaders, though, they could place issues on the agenda and challenge misinformation used to justify official policy, but they could not convince cautious cooperators that the collaborators' intentions were benign.

The NRDC-SAS project collected important data on high frequency waves and signal attenuation, yet the regional findings had to be analyzed in conjunction with global seismic data from other sources to minimize accusations that evidence which contradicted current policy lacked scientific objectivity. For example, when the Office of Technology Assessment proposed a project to evaluate seismic verification capabilities, some Congressmen on its board feared that this subject would be too "political" for a technical agency. They agreed to

¹³⁵. Before the vote, Mark Hatfield (Rep., OR) commented that "the opposition to this initiative was handed some good rhetoric last week" by the tentative agreement to start step-by-step talks. After the vote, one of the staffers responsible for the amendment lamented that they failed to secure support from most of the swing moderates. See *Congressional Quarterly Almanac 1987 XLIII* (Washington, D.C.: Congressional Quarterly Inc., 1988).

¹³⁶. The decision to grant unrestricted visas also reflects another internal change: Congress had recently decided, for unrelated reasons, to suspend the Reagan Administration's ability to deny or condition nonimmigrant visas based on applicants' beliefs or associations. See Schrag, p. 130.

¹³⁷. Robert Park, "Bold Plan," *Washington Post*, 22 January 1989, p. D3.

¹³⁸. Janne E. Nolan, "Public and Congressional Attitudes Toward On-Site Inspection," in Lewis A. Dunn with Amy E. Gordon, eds., *Arms Control Verification and the New Role of On-Site Inspection* (Lexington, Mass.: D.C. Heath, 1990), p. 173.

support the project only after the Office of Technical Assistance (OTA) director promised not to focus overly much on the NRDC data.¹³⁹ Cochran, the scientist most responsible for in-country seismic monitoring in the USSR, did not participate in the study, nor were any contributors explicitly linked to the NRDC project. Instead, the workshops and advisory panel included a range of independent scientists and representatives from DOE, DOD, and the Intelligence Community. The report on “Seismic Verification of Nuclear Testing” concurred with the NRDC’s main technical conclusions: it found no evidence of TTBT violations; it determined that CORRTEX offered little, if any, advantage over sophisticated seismology; and it concluded that high-quality internal seismic system could monitor a ban on tests above 5 kilotons. Despite these careful attempts at consensus-building, the report still encountered harsh criticism from test ban opponents when it was released in May 1988.¹⁴⁰

The NRDC–SAS collaboration also had mixed success at increasing interest in seismic verification. Since Gorbachev wanted to show that seismology was sufficient for a CTB, the project fostered links between SAS scientists and Soviet military seismologists.¹⁴¹ Excitement generated by the project also led to a “blossoming” of interest in seismic verification among independent scientists in the West.¹⁴² U.S. government scientists, by contrast, were explicitly told to “keep their hands off” the NRDC project because it was a “political hot potato.”¹⁴³ DOE, DARPA, and the USGS, all expressed interest in 1985 when Jack Evernden first mentioned the possibility of putting in-country seismic stations in the USSR, but quickly distanced themselves from the high-profile project run by an independent group opposed to U.S. policy.¹⁴⁴ By making their data public, NRDC seismologists created openings for tacit collaboration with like-minded scientists inside the government. Archambeau and Paine also devised a complicated plan whereby DARPA could fund the in-country network’s operation and expansion without openly undercutting the Reagan administration stance on seismic verification.¹⁴⁵

¹³⁹. Interview with Gregory van der Vink, Project Director for OTA study, Washington, D.C., 12 April 1989.

¹⁴⁰. When the OTA report was released, Robert Barker, the first head of the American NTT delegation testified that it “homogenized fact with fiction.” He objected to the tone of the report, questioned the expertise of those who compared seismic and hydrodynamic methods, complained that DOE participants had not been allowed to review drafts of the report, and insisted that the OTA report contrasted speculation about the future capabilities of seismology against hard evidence about the demonstrated capabilities of CORRTEX. When invited to prepare a substantive line-by-line critique of the report, however, neither Barker’s staff nor other scientists actually did so. Barker was thoroughly rebutted by the head of OTA, Van der Vink, and many scientists who participated in the study. For details, see the testimony in “Nuclear Testing: Arms Control Opportunities,” Hearing Before the Subcommittee of Arms Control, International Security and Science of the Committee on Foreign Affairs, House of Representatives, 100 Congress, 2nd Session, 28 June 1988 (hereafter cited as HFRC 6–28–88).

¹⁴¹. Cochran interview, 6 June 1989. The project laid the groundwork for collaborations on other issues, such as a series of NRDC-sponsored workshops in the Soviet Union on nuclear weapons transportation, safety, and dismantlement; various joint projects to improve verification; and a new journal in which U.S. and Soviet scientists make detailed presentations of the technical bases for new arms control agreements and verification systems. For details, see Christopher Paine and Thomas Cochran, “Kiev Conference: Verified Warhead Controls,” *Arms Control Today* 21:1 (January–February 1991), pp. 15–17; and von Hippel, pp. 39–46.

¹⁴². Roger Clark, “UK–USSR and US–USSR Joint Research Programmes in Seismic Verification,” pp. 99–111 in J. Altman and J. Rotblat, eds., *Verification of Arms Reductions* (Berlin: Springer-Verlag, 1989).

¹⁴³. Interview with Holly Eissler, a seismologist at the University of California at San Diego, Urbana, IL, 2 December 1988.

¹⁴⁴. In late 1985, the Director of DARPA’s geophysical division wrote that DOE and DARPA had been researching in-country monitoring methods ever since the USSR agreed in principle to NSS during the second generation of CTB talks. DOE had placed a prototype network in the United States and Canada, but could not determine how such a network would perform in the USSR without knowing more about the area around its test sites. Ralph Alewine III writes that “research efforts are handicapped by the lack of adequate geophysical and seismological data from key regions in Eurasia. Any action to make such data available would provide a major contribution to the effort to improve our seismic monitoring capabilities.” See “Seismic Sensing of Soviet Tests,” *Defense* 85 (December 1985), p. 21. When Evernden proposed to secure such data by placing a seismic network inside the USSR, various officials at DARPA, DOE, and the USGS expressed enthusiasm for the idea. DARPA allegedly made a verbal offer to provide funds if the Soviets accepted, and one of Evernden’s superiors at the USGS explicitly stated that Evernden’s initiative could be considered an “informal USGS proposal.” After these declarations of support were disclosed in conjunction with an article on the NRDC–SAS project, however, officials from all three agencies disavowed any connection and denounced Evernden’s efforts as “a private trip to the Soviet Union at his own initiative . . . to pursue his own research.” The article that started the controversy is R. Jeffery Smith, “Soviets Agree to Broad Seismic Tests,” *Science* 233 (1 August 1986), p. 511. The disavowals, and responses from Evernden and Smith are in “Letters,” *Science* 233 (26 September 1986), p. 1367.

¹⁴⁵. When the Senate voted to increase funding for seismic verification, the money went to DARPA, which channeled it to the Incorporated Research Institute for Seismology (IRIS), a consortium of U.S. universities. In 1988, IRIS signed an agreement with the SAS to install five sophisticated seismic stations in the Soviet Union and to expand this network further if funds could be obtained. The IRIS effort was run by the Scripps Institute at the University of California at San Diego, the same group that fielded the NRDC team of seismologists. The initial IRIS stations in the Soviet Union were colocated with the NRDC stations. Officially, the arrangement was for “scientific cooperation and data exchange in the field of earth structure and earthquake processes.” Improved methods of monitoring

Increased openness and more accurate verification information may have expanded diffuse support for cooperation, but they did not decrease cautious cooperators' ambivalence about arms control. Popular perceptions of U.S.–Soviet relations brightened dramatically during the NRDC–SAS project. The percentage of respondents who thought that relations were stable or improving increased from 37 in October 1986 to 90 in July 1988.¹⁴⁶ Support for a CTB remained relatively high but unchanged, at 69 percent in 1984 and 67 percent in 1987.¹⁴⁷ Furthermore, even after NRDC scientists were allowed to monitor simulated nuclear blasts at Semipalatinsk, 68 percent of Americans still believed that “we cannot trust what Soviet leaders say.”¹⁴⁸ Thus, technical collaboration did not translate into more faith in Gorbachev's arms control intentions or greater support for a specific nuclear accord.

The NRDC project brought verification to the forefront of Congressional deliberations in ways that perpetuated the conflict between those who wanted far-reaching limits on nuclear tests and those who supported the President's position. Many House members used the project as evidence that the Soviets would cooperate to improve test verification.¹⁴⁹ A Congress Research Service report applauded the project but questioned its relevance for intergovernmental agreements because “welcoming a private group that advocated negotiations toward a CTB does not necessarily imply readiness to welcome an official group that may be perceived as adversarial and primarily interested in detecting violations.”¹⁵⁰ Most Congressional Republicans, by contrast, refused to reduce Reagan's negotiating leverage when the Soviets were making concessions or to reward Gorbachev for collaborating with Reagan's critics.¹⁵¹

These conflicts produced weak test ban legislation. Even before the NRDC project, Congress had passed nonbinding legislation urging the President to submit the TTBT and PNET for ratification and to resume CTB talks.¹⁵² In return for dropping the one kiloton moratorium amendment before the Reykjavik summit, Reagan promised to submit the TTBT and PNET once verification issues were resolved and then immediately invite the USSR to begin step-by-step negotiations aimed ultimately at a ban on nuclear tests. Despite two more House votes for a moratorium, the Senate never withheld funds for nuclear tests in the 1980s. The few binding measures that survived both Houses involved “apple pie” issues that arms control advocates, cautious cooperators, and unilateralists all could support, such as increased funds for seismic research and studies about stockpile reliability.

In sum, “direct action” and “citizen to citizen” collaboration in the NRDC–SAS project had mainly indirect effects on test ban cooperation. In-country seismic monitoring kept nuclear test limits on the public agenda by providing a series of dramatic demonstrations that verification problems could be resolved. These visible, understandable counter arguments to claims that the Soviets had violated the TTBT and would oppose all intrusive verification for a CTB, made it harder for Reagan to avoid nuclear testing negotiations altogether. The project also may have encouraged Gorbachev to return to resume test ban negotiations. Evidence that in-country monitoring need not involve espionage, interference, and increased international tension helped him reassure cautious cooperators and rebut Soviet unilateralists. At the same time, it convinced Gorbachev that unilateral restraint and grassroots pressure could not secure new test limits based on seismic verification alone.

nuclear tests are not explicitly mentioned, but implied in the phrase “mutual benefit of exchanging broad band digital seismological data for solving various seismological tasks.” The text of this agreement is in HFRC 6-28–88, p. 113–115.

¹⁴⁶. Yankelovich and Smoke, p. 3.

¹⁴⁷. Harris, November 1984; Roper, October 1987.

¹⁴⁸. Yankelovich and Smoke, p. 6.

¹⁴⁹. For examples, see *Congressional Record* August 1986, H 5738 (Fascell); 5739 (Gephardt); 5744 (Markey).

¹⁵⁰. Goldman, et al., pp. 128.

¹⁵¹. House Republican Leader Robert Michel called the 1986 1 kt amendment the “first step of a radical and unprecedented attack by the President's critics to capture and dominate arms control policy and foreign policy.” Quoted in John Isaacs, “House Challenges Reagan on Arms Control,” *Bulletin of the Atomic Scientists* 42:8 (October 1986), p. 6.

¹⁵². This measure was adopted in a 77 to 22 vote by the Senate in 1984 as an amendment to the FY85 defense authorization bill. The House planned to vote on it as a nonbinding resolution (H J Res 3) in October 1985, but agreed to wait until after the Geneva Summit. They approved the measure in a 268–148 vote the next February. The Senate again adopted similar language in the FY87 defense authorization bill just before the House approved the 1 kt moratorium. For details, see *Congressional Quarterly Almanac* 42 (1986): 461–462.

Intergovernmental Negotiation and the Joint Verification Experiment

In contrast to the NRDC–SAS project, where the collaborators shared many common goals, the JVE involved ongoing arguments about the objectives, procedures, results, and implications of intergovernmental collaboration. Soviet Foreign Minister Shevardnadze initiated the JVE to demonstrate improvements in seismic verification. The USSR invited the United States to take local and regional data along with hydrodynamic measurements, but the United States refused—to the dismay of U.S. seismologists, and even the CIA.¹⁵³ Before the JVE, the two countries exchanged data covered by the 1974 TTBT protocol and information about five historic nuclear tests. The Soviets were willing to accept a few data exchanges and hydrodynamic calibration of yield information to improve seismic CTB monitoring, still argued that routine OSIs need not be a regular feature of TTBT verification.

Once the Soviets agreed to watch CORRTEX, Reagan officials quickly tried to lower expectations. They repeatedly stated that “one data point” could neither resolve TTBT compliance concerns nor increase confidence in low yield limits.¹⁵⁴ Instead, the U.S. objective for the JVE was to convince the USSR that on-site monitoring would not compromise military secrets.¹⁵⁵ In January 1988, twenty experts visited the other’s site to learn about testing practices. Then, negotiators hammered out a hundred page protocol which, the U.S. hoped, would enable 140 Americans to live and work at the Soviet test range for several months without incident. But in July, three members of the U.S. preparation team were caught secretly shipping home soil samples, rocks, and other prohibited material. U.S. officials called the situation “embarrassing” but portrayed it as “unauthorized souvenir collecting” rather than espionage.¹⁵⁶ Although the incident did not derail the JVE, it substantiated fears that CORRTEX was an excuse for collateral information collection and demonstrated that meticulous treaty language could prevent friction and ambiguity during the verification process.

The first JVE explosion occurred at NTS on August 17, 1988, and the second transpired at Semipalatinsk four weeks later. Both sides took hydrodynamic measurements, while the NRDC–SAS stations monitored regional waves and international seismologists watched for teleseismic signals. The participants prepared a joint report detailing agreed data and technical disagreements, but the U.S. side was instructed not to sign.¹⁵⁷ Both governments called the JVE a success, but only the USSR agreed to publicize the results. Because neither side could release data unless both agreed, the United States blocked revelations which might “limit the range of options and tactics” for NTT negotiators.¹⁵⁸

Data leaks suggest three reasons why the U.S. government refused to provide its own citizens with information given to the USSR.¹⁵⁹ Leading newspapers printed reports that the true yield at NTS was in the

¹⁵³. An administration representative said that setting up seismic stations *on Soviet territory* during the JVE would “serve no practical purpose” because the United States already knows how *teleseismic* verification compares with CORRTEX. “Our efforts therefore were concentrated on achieving test conditions that would demonstrate the practicality and effectiveness of CORRTEX and not other less effective systems” (emphasis added). When asked whether they had looked at data from the NRDC–SAS stations, the representative replied that this information was “not relevant to these negotiations.” See the Reagan administration’s response to questions submitted by Representative Dante Fascell included in the record of HFRC 6-28–88, pp. 141 and 144.

¹⁵⁴. The joint statement announcing the JVE explicitly states that the experiment “will not be designed to produce statistically significant results.” Quoted in C. Paul Robinson, “The Joint Verification Experiment: A Unique Approach to Developing Verification Agreements,” *Disarmament* 12:2 (Summer 1989): 91.

¹⁵⁵. Michael Gordon, “U.S. Opposes Release of Soviet Nuclear Test Data,” *New York Times*, 23 March 1989, p. A7.

¹⁵⁶. R. Jeffery Smith, “Soviets Catch U.S. Nuclear Inspectors,” *Washington Post*, 12 August 1988, pp. A1 and A6; “3 Inspectors Barred from Soviet A-Test,” *Washington Post*, 13 August 1988, pp. A1 and A6.

¹⁵⁷. Wolfgang Panofsky, “Verification of the Threshold Test Ban,” *Arms Control Today* 20:7 (September 1990): 6. It is not clear why the U.S. team was told not to sign the joint report. Warren Heckrotte recalls that one of the arguments over OSIs in the 1977–80 CTB negotiations involved whether both sides should reach independent conclusions about compliance (the U.S. position) or produce a joint report with a conclusion state whether or not a violation had occurred (the Soviet preference). He speculates that the U.S. decision not to sign the JVE report may have been due to the desire not to set a precedent for joint judgments. Personal communication, 12 September 1994.

¹⁵⁸. C. Paul Robinson, chief NTT negotiator, quoted in Michael Gordon, “U.S. Opposes Release of Soviet Nuclear Test Data,” *New York Times*, 23 March 1989, p. A7.

¹⁵⁹. An NRDC request for the JVE data was denied. They filed suit under the Freedom of Information Act to obtain the historical yield data exchanged in conjunction with the JVE. When the judge ruled against them, he justified his decision by saying that the JVE agreement required both the United States and the USSR to consent before data could be released to the public, and that since the Soviet Union no longer existed, it could not approve the release.

mid-140s. NRDC–SAS seismologists judged the yield to be 139 kilotons, while three hydrodynamic estimates put the size at 155, 163, and 170 kilotons.¹⁶⁰ If these figures are correct, the first implication is that in-country seismic monitoring could be more accurate than any hydrodynamic method while costing much less than the \$28 million spent by the United States on the JVE. Second, the results illustrate the danger of ignoring the uncertainty inherent in all verification. An unsophisticated reading of the hydrodynamic results implies that the United States violated the TTBT. Yet, all four estimates fall well within the 1.3 uncertainty range for a 145 kiloton test.¹⁶¹ Third, teleseismic monitoring confirmed that the NTS formula systematically over-estimated Soviet yields. The magnitude of the shot at Semipalatinsk would be equivalent to a 350 kiloton blast at NTS. Yet, regional seismic signals and Soviet hydrodynamic measurements suggest a yield in the mid-120s, while CORRTEX registered 115 kilotons. For CTB-supporters, these leaks reinforced concern that CORRTEX was a “needlessly complex and circuitous assault on a largely manufactured problem.”¹⁶²

C. Paul Robinson, the head of the American NTT delegation, interpreted the results quite differently. He portrayed the JVE as a “trial run” which showed that the superpowers *could* use hydrodynamic equipment at each others’ test sites, and thus *should* routinely do so. Asked to compare seismic and hydrodynamic methods, he spoke only of early teleseismic estimates that the NTS was 80 to 100 kilotons and suggested that the Soviets were rethinking their reliance on seismic verification. He ignored the OTA findings and asserted that seismology had an uncertainty of 1.7 or 1.75, far greater than the 1.3 claimed for CORRTEX. Rather than discuss what the JVE said about past TTBT compliance, he insisted on CORRTEX to avoid future false alarms.¹⁶³ Finally, he predicted that the new TTBT protocol could be drafted quickly and precisely since the detailed JVE provisions had been field-tested and potential problems corrected.¹⁶⁴

The two year delay before TTBT ratification indicates that conflicts continued between the superpowers and inside the U.S. government. As the Conference of Experts showed, scientific collaboration cannot transcend controversy unless participants share principles with which to interpret evidence. “Consensual knowledge” was missing here.¹⁶⁵ As one senior U.S. official said at the end of NTT in December 1988, “the experiments essentially convinced each side that their own approach is best. We seem to be stuck.”¹⁶⁶

The JVE convinced some proponents of U.S. nuclear testing to ally with arms control advocates who argued that routine use of CORRTEX would be overly expensive, intrusive, and inconvenient. Before the JVE, the CIA had warned that “if the Soviets said ‘yes’ to our initial proposals, we would be in trouble” because the United States had not considered the costs and risks of admitting foreign inspectors to NTS.¹⁶⁷ Afterwards, one of Livermore Lab’s testing experts testified that CORRTEX should be used for calibration purposes alone:

It used to be that we knew the Soviet Union would reject almost all of our verification proposals . . . Today she appears willing to accept almost any verification proposal made by the United States and then to throw in a few ideas of her own . . . With any verification scheme, there are costs and benefits which must be balanced. For the TTBT, the costs can be measured in terms of the dollars and the resources required, the interference and the diversion with our ongoing research and development

¹⁶⁰. The lowest figure is a measurement made in the emplacement hole, the middle is a U.S. measurement in a satellite hole, and the largest is from the Soviet version of CORRTEX. From Michael Gordon, “Soviet Test Data Rekindle Dispute,” *New York Times*, 30 October 1988, p. 12. See also Michael Gordon, “Atomic Test Data Weaken U.S. View,” *New York Times*, 11 September 1988, p. 12 and Robert T. Scott, “Joint Nuclear Tests Raise Questions About Administration Policy,” *Arms Control Today* 18:8 (October 1988): 26. In-country seismic data taken by the NRDC stations during the Soviet JVE is available in Keith Priestley, et al., “Regional Seismic Recordings of the Soviet Nuclear Explosion of the Joint Verification Experiment,” *Geophysical Research Letters* 17:2 (February 1990): 179–182.

¹⁶¹. Although DOE would not reveal the radio-chemical analysis done to insure that the actual yield of the NTS shot was not much larger than expected, the chief nuclear test negotiator confirmed that the detonation fell below 150 kt.

¹⁶². Spurgeon Keeny, Notes from the Underground,” *Arms Control Today* 18:5 (June 1988): 2.

¹⁶³. Interview with C. Paul Robinson, “Verifying Testing Treaties—Old and New,” *Arms Control Today* 20:6 (July–August 1990): 3–7.

¹⁶⁴. Robinson, “JVE . . .” pp. 94–95.

¹⁶⁵. On the importance of consensual knowledge in arms control negotiations, see Emanuel Adler, “The Emergence of Cooperation: National Epistemic Communities and the International Evolution of the Idea of Nuclear Arms Control,” *International Organization* 46:1 (Winter 1992): 101–145.

¹⁶⁶. Quoted in R. Jeffery Smith, “U.S., Soviets Fail to Reach Nuclear Test Accord,” *Washington Post*, 16 December 1988, p. A42.

¹⁶⁷. Quote in Michael Krepon, “CIA, DIA at Odds over Soviet Threat,” *Bulletin of the Atomic Scientists*, 43:4 (May 1987): 6.

programs and the possibilities of providing classified information to the other country on our nuclear design program. The JVE demonstrated that the dollar and the resource costs associated with such measurements will be substantial.¹⁶⁸

If technical collaboration confirmed Soviet opposition to routine hydrodynamic verification, validated U.S. arms control advocates' skepticism, and raised new doubts among Reagan and Bush officials, why did the superpowers finally agree to on-site yield measures for all shots over 50 kilotons?¹⁶⁹

Soviet acquiescence is best explained as part of a political strategy to use the West's technical approach to verification to increase popular pressure for arms control. By 1988, the Soviets had embraced "verificational deterrence." Given the "deficit of mutual trust," they argued that cooperative security involved deep arms cuts combined with the "most stringent mutual verification."¹⁷⁰ Henceforth, when the West asked for "double verification," they would respond "with readiness for triple verification."—that is NTM, obligatory OSIs, and international verification arrangements.¹⁷¹ As the arms control measure that could be most easily verified and most effective in ending the arms race, a CTB was integral to their strategy.¹⁷² In the past, they said, real or alleged verification problems had blocked a CTB. The JVE, however, showed that these issues could be settled through "businesslike deliberations" rather than ideological confrontations.¹⁷³ Now, "everything revolves around the political will and responsible attitude of Washington. The ball is in the American court."¹⁷⁴

The Soviets switched from talk about "triple verification" to agreement on a TTBT verification triad once they concluded that the new protocol would involve few costs and risks. Budgetary pressures made it unlikely that the United States would routinely spend ten million dollars on CORRTEX when compliance could be confirmed by less expensive means. Besides, popular protests in the USSR reduced the number of Soviet tests to be monitored. In March 1990, they decided to close the Semipalatinsk site and test only at Novaya Zemlya, where inhospitable conditions and difficult logistics constrain operations. Nordic outrage soon complicated this plan.¹⁷⁵ The only Soviet test under the new protocol occurred on October 24, 1990, too soon after ratification to prepare for CORRTEX.¹⁷⁶ Moscow sent monitors to tests at NTS in September 1991 and March 1992. One cannot, however, evaluate how the TTBT protocol worked in practice because the signatories never released such information.¹⁷⁷

¹⁶⁸. Testimony of Milo Nordyke, Senate Foreign Relations Committee, "Test Ban Issues," One Hundredth Congress, Second Session, 6 October 1988, pp. 14–15.

¹⁶⁹. The 1990 protocol to the TTBT permits signatories to conduct OSIs for any test over 35 kt. and to use OSIs, hydro-dynamic yield estimation, or in-country seismic stations for all tests over 50 kt. If the parties do not conduct tests large enough to trigger these new verification procedures, the other side can implement them for a set number of smaller tests each year. For details, see Jozef Goldblat, "Nuclear Test Limitation Treaties," in Serge Sur, *Verification of Current Disarmament and Arms Limitation Agreements* (United Nations Institute for Disarmament Research, 1991) pp. 103–106.

¹⁷⁰. Kokeyev and Androsov, p. 12

¹⁷¹. Press background document for Moscow Summit, (29 May–2 June 1988), p. 78. To support his contention that the Soviets would not ultimately argue that CORRTEX was too disruptive or intrusive for the USSR, Barker refers to a similar statement by Ambassador Oleg Grinevsky at a UN verification conference in April 1988. See Barker's testimony before the HFRC, 28 June 1988, pp. 44–45.

¹⁷². Goldansky, p. 28.

¹⁷³. Harald Rose, "Nuclear Test Ban and Verification," *Disarmament* 12:3 (Fall 1989): 20.

¹⁷⁴. Goldansky, p. 35.

¹⁷⁵. In February 1989, two Soviet underground tests leaked radioactive material. Soviet officials claimed that the leaks were harmless, but a radioactive cloud drifted over a town forty-five miles from Semipalatinsk. Concerned citizens formed the antinuclear group "Nevada," and called for an end to testing there. See Chris Paine and Gregory van der Vink, "The Politics of Verification: Limiting the Testing of Nuclear Weapons," *Science and Global Security* 3 (1993): 261–288; Robert Norris and William Arkin, "Soviet Testing Move," *Bulletin of the Atomic Scientists* 46:4 (May 1990): 56; R. Jeffery Smith, "Soviets Close Major Site of Underground Atomic Tests," *Washington Post*, 10 March 1990, p. A1; and Peter Zheutlin, "Nevada, USSR," *Bulletin of the Atomic Scientists* 46:2 (March 1990): 10–12;

¹⁷⁶. Velikhov invited Von Hippel and other U.S. scientists, including some from the weapons labs, to testify before Supreme Soviet. The Bush administration urged government scientists not to participate. Ray Kidder, a well-respected and independent-minded physicist at LLNL who produced a study debunking the stockpile reliability rationale for nuclear tests, made the trip with Von Hippel. The United States did make preparations to observe one Soviet test scheduled for Spring 1992. The test was never conducted, though, because the Soviet Union announced a new moratorium in 1991, soon after the U.S. team went to Novaya Zemlya for preliminary discussions.

¹⁷⁷. The only other test large enough to trigger on-site inspection was conducted soon after the September fourteenth test, so the Soviets chose not to inspect it. Phone interview with Derek Scammel, Department of Energy Public Relations Officer at the Nevada Test Site, 22 February 1994.

The United States refused to decrease its CORRTEX demands for two reasons. First, by the time that some U.S. officials publicly acknowledged the costs and risks of intrusive verification, the idea that routine use of CORRTEX was essential for effective verification had become another “political fact of life,” much like requirements for twenty annual OSIs were for Eisenhower. Unilateralists averted compromise and obstructed future cooperation by insisting that tests limits below 150 kilotons would only be acceptable if DOE could minimize espionage and disruption without lowering U.S. requirements for highly intrusive verification. Such precautions might be possible at high yield limits, but are increasingly difficult at lower yields and impossible for a total ban.

Second, some in the Executive branch wanted extensive verification for competitive, rather than cooperative, reasons. The Joint Chiefs of Staff recommended ratification only if the United States exercised its full spectrum of monitoring and inspection rights and Congress supported five safeguards similar to those adopted for the LTBT. The Joint Chiefs of Staff (JCS) representative told the Senate Armed Services Committee that “effective verification procedures . . . allow us to make more accurate judgments regarding the significance of Soviet tests.”¹⁷⁸ In other words, the military wanted to use CORRTEX not only to monitor compliance with the 150 yield threshold but also to collect collateral information about such things as the design of much smaller permissible tests.

The safeguards also did more to advance U.S. nuclear testing than to promote test ban cooperation. The JCS wanted an “insurance policy” in the form of Senate pledges to test up to treaty yield limits, maintain modern nuclear laboratories, preserve abilities to test in prohibited environments and yield ranges, and fund strong verification and intelligence programs. Resource constraints and conflicting priorities had forced DOE to cut the annual number of tests from seventeen in the early 1980s to eight in 1990. The laboratory directors wished to double the test rate, but only got a six percent budget increase for FY91. The safeguards conditioned arms control at high yields on increased money for nuclear tests below the 150 kiloton limit.¹⁷⁹ They also created obligations that could postpone further negotiations because DOE declared that it must test at the current rate for ten more years just to determine whether lower yield limits would serve U.S. interests.¹⁸⁰

On September 25, 1990, the Senate ratified the TTBT and PNET with little debate and few illusions about future constraints. Reagan had created a double bind by linking further test limits to a parallel program of weapons cuts, yet saying that reductions might require more tests to ensure the safety, reliability and survivability of the remaining arsenal.¹⁸¹ The Soviets considered it “senseless to sign agreements to eliminate stocks of existing weapons with one hand and to fling open the door to new and more sophisticated types of weapons with the other.”¹⁸² But even before the TTBT protocol was signed, Bush repudiated Reagan’s pledge to follow ratification with immediate talks on intermediate limits. No further negotiations would occur during a “period of observation . . . to assess the verification lessons learned” by implementing the TTBT protocol—that is verification concerns were used again to justify delay.¹⁸³ The irony was not lost on arms control advocates. Largely despite the JVE rather than because of it, the Soviets had finally implemented an intrusive program for monitoring test ban compliance. But instead of building on this breakthrough to achieve more meaningful test restraints, the United States now wished to spend tens of millions of dollars and unknown

¹⁷⁸. Rear Admiral Thomas R. Fox, Testimony at the hearings on “National Security Implications of Nuclear Testing Agreements,” Committee on Armed Services, United States Senate, 101st Congress, 2nd Session, 17 September 1990, p. 68 (Hereafter cited as SASC 9-17-90).

¹⁷⁹. Testimony of Dr. Victor Alessi, Director, Office of Arms Control, Department of Energy, in SASC, pp. 71–72.

¹⁸⁰. Dunbar Lockwood, “Continued Testing ‘Essential,’ DOE Tells Congress,” *Arms Control Today* 20:4 (May 1990): 29.

¹⁸¹. Ronald Reagan, “The Relationship Between Progress in Other Areas of Arms Control and More Stringent Limitations on Nuclear Testing,” Report to Congress released by White House Office of the Press Secretary on 8 September 1988. Arguments for continued testing to insure stockpile reliability are presented in George Miller, Paul Brown, and Carol Alonso, “Report to Congress on Stockpile Reliability, Weapon Remanufacture, and the Role of Nuclear Testing,” Lawrence Livermore National Laboratory UCRL-53822 (October 1987). Ray Kidder, was more skeptical about the need for nuclear testing. See “Maintaining the U.S. Stockpile of Nuclear Weapons During a Low-Threshold or Comprehensive Test Ban,” UCRL-53820 (October 1987). The debate about weapons safety tests is covered in a symposium on “Nuclear Weapon Safety,” in *Bulletin of the Atomic Scientists* 47:3 (April 1991): 29–40.

¹⁸². Goldansky, p. 31

¹⁸³. Warren Strobel, “U.S. Delays Talks on Underground Nuclear Tests,” *Washington Times*, 20 January 1990, p. 9.

years practicing cooperative verification of very high yield tests. In the words of Congressman Jim Leach (R, Iowa), the JVE was “rather interesting enormous progress on step back aspects of verification.”¹⁸⁴

The most obvious conclusion seems to be that technical collaboration cannot promote arms control when one or more parties are using verification concerns to stave off popular pressure for arms control agreements that they do not really want. Yet, the JVE did promote cooperation in ways that Reagan and Bush never intended. The data leaks proved that technological arguments are not infinitely elastic; after the JVE, the only people who could argue that CORRTEX was significantly more accurate than sophisticated seismology were those for whom “validity of the testimony as to technical fact is totally irrelevant. The only validity intended is an expression of Executive Office policy relative to the matter under discussion.”¹⁸⁵ Furthermore, the process of designing and implementing the JVE induced those who conduct U.S. nuclear tests to move away from an abstract insistence on extreme verification demands toward a more practical understanding of verification tradeoffs. Along with the independent scientists involved in the NRDC–SAS project and the OTA seismic study, these DOE scientists could offer valuable expertise if serious efforts are made to construct a CTB verification regime that detects, deters, and reassures, without imposing excessive costs.

Finally, the JVE contributed to the U.S. decision to resume serious CTB talks in January 1994. After Bush answered Gorbachev’s second moratorium by limiting the United States to six tests a year, Congress lost patience. In the summer of 1992, both Houses supported a complete and binding ban for nine months, a brief period of highly regulated safety and reliability tests, and a total ban by 1996. The unilateralists’ attempt to use collaborative verification to block arms control cooperation had contributed to their undoing. Perceptions that Reagan used technology collaboration to subvert the test ban movement rekindled domestic grassroots activism and united those who would accept nothing less than a CTB with those willing to start with lower yield limits.¹⁸⁶ Anger with U.S. inaction also prompted an international amendment conference to convert the LTBT into a total ban.¹⁸⁷ Of equal importance, intergovernmental collaboration gave mainstream Americans more confidence in test ban verification. Regardless of the Reagan administration’s motives, their involvement gave the JVE increased legitimacy for cautious cooperators and increased applicability to formal treaties.

Conclusions and Implications

Analyzing test ban technology collaboration in terms of an ongoing argument among six groups with divergent views on arms control and verification shows that verification collaboration is more, rather than less, political by virtue of being second-order cooperation. Contrary to the benign view of verification that has dominated U.S. policy and cooperation theory, enhanced compliance information offers no easy technical solution to the problems of international cooperation. With neither a global authority to judge compliance, nor widespread agreement about underlying principles, verification politics involve three basic quandaries.

How Much is Enough?

National leaders must decide how much compliance information would make the expected benefits of cooperation outweigh the potential costs and risks. Not once during decades of debate about test ban verification did domestic groups agree about the value of arms control, the other side’s intentions, or the stability of nuclear deterrence. Sometimes the advantages of cooperation so clearly dwarf potential costs and risks that arms control advocates and cautious cooperators would support a range of verification arrangements. The LTBT and the renegotiated TTBT show that when criticisms based on unverifiability would be implausible even to very

¹⁸⁴. HFRC 6-28-88, p. 51.

¹⁸⁵. Letter from Jack Evernden to Representative Dante Fascell in response to Robert Barker’s testimony on the OTA report, in HFRC 6-28-88, p. 99.

¹⁸⁶. Mel Friedman, “Test Ban Battle,” *Nuclear Times* (September–October 1988), pp. 12–21.

¹⁸⁷. Since the United States, United Kingdom, and Soviet Union all hold veto power over any amendments to the LTBT, the January 1991 amendment conference was designed primarily to keep the issue of a CTB on the international agenda. The final resolution called for the president of the Conference to conduct consultations about issues of verification and sanctions, and to resume the work of the Conference at an appropriate time. The origins and results of this effort are detailed in Philip Schrag, *Global Action* (Boulder, Colo.: Westview, 1992).

cautious cooperators, unilateralists will accept modest cooperative measures in return for “safeguards” that ensure support for other forms of competition.

When genuine disagreements about verifiability exist, other tactics are used. As expected, actors frequently tried to take verification decisions out of the political arena by declaring them technical questions on which the judgment of designated experts should prevail. In the first round of CTB talks, Americans used this strategy in both negotiations and domestic debates. During the 1980s, proponents of seismic and hydrodynamic methods disputed the technical credentials and political motivations of scientists on the other side. At the end of the Cold War, the Soviets even adopted the language of the West and suggested that all the verification concerns about a CTB could be solved by letting scientists study the question in a “businesslike fashion.” Yet, negotiators could devise detailed procedures that seemed both workable and tolerable only for the TTBT and PNET—treaties that limited explosions with little military value—and even those pragmatic solutions quickly came under attack from U.S. unilateralists who feared pressures and precedents for a CTB. Whenever stakes were high, nobody who understood test ban verification politics fell for promises that disagreements could be “depoliticized” by bringing in somebody else’s experts to decide. Thus, verification remains the subject of intense political struggle.

Proposals and projects for verification collaboration were often used to assemble a winning coalition of groups who support a particular arms control outcome for diverse reasons. While cautious cooperators value verification collaboration for its own sake, arms control advocates and unilateralists are more likely to initiate technical collaboration as part of identification, alliance, and realignment strategies that often have unexpected results.

Test ban debates and negotiations were characterized by continual uncertainty about motives and frequent attempts to use collaborative verification to identify which actors really valued arms control. During the disarmament deadlocks of the 1950s and early 1980s, U.S. arms control advocates proposed joint research projects in the expectation that cautious cooperators would support them and unilateralists would resist. The Reagan administration made support for cooperative verification the “litmus test” of Soviet commitment to arms control. Gorbachev embraced the NRDC–SAS project in order to represent himself as someone who desired a CTB as much as U.S. arms control advocates and cautious cooperators did.

In the test ban case, using verification collaboration as an identification strategy failed to increase cooperation. The more actors doubt others’ intentions, the more they will suspect strategic misrepresentation. If verification collaboration seems to carry low costs and risks relative to the arms control issue at stake, devious players might collaborate a little to gain a lot by defecting from the larger cooperative enterprise. For many Americans, the NRDC–SAS project simply shifted skepticism from Gorbachev’s motives for making unilateral arms control initiatives to his reasons for collaborating with opponents of U.S. testing policy. There is no evidence, however, to suggest that the Soviets ever agreed to test ban technology collaboration in order to lull the West into signing a treaty with verification weaknesses that the USSR could systematically exploit.

By contrast, U.S. unilateralists often used strategic misrepresentation and misidentification to blame the Soviets for failure to reach agreements that testing proponents did not really want. Because U.S. arms control advocates and cautious cooperators clung to a benign view of verification, they could be manipulated into treating Soviet response to verification collaboration as a valid indicator of interest in arms control. Failure to take seriously the costs and risks of verification created a Catch-22: if the USSR agreed to technical collaboration, unilateralists could belittle it as a cheap way to mislead the West; if they resisted, arms control opponents could claim that the Soviets would not make low-cost concessions for cooperation.

Once participants have identified (rightly or wrongly) the structure of other actors’ beliefs, they can use alliance or realignment strategies to influence domestic policy. For example, U.S. test ban opponents tried to convince cautious cooperators that CORRTEX was both essential for exacting verification and unacceptable to the USSR in order to retain public support for Reagan’s nuclear testing policy. The NRDC, by contrast, sought to persuade cautious cooperators that the Soviets were seriously interested in a CTB and would accept in-country seismic methods that were as accurate as CORRTEX in order to forge an alliance against Reagan’s unilateralist policy on test ban cooperation. Evidence of similar dynamics can be seen in the USSR, where Gorbachev hoped that the NRDC–SAS project could build an arms control coalition by reassuring his own cautious cooperators that verification *glasnost* need not involve intolerable costs and risks.

Realignment strategies can involve education or intimidation. The Reagan administration tried to convert cautious cooperators into confirmed unilateralists. Yet, their campaign to reeducate Americans about the dangers of test limits met with modest and short-lived success: popular support for a CTB fell from 75 percent in 1977 to 54 percent in 1983, but resurgent fear of nuclear war caused a rebound to 69 percent by 1984.¹⁸⁸ The NRDC's plan to use dramatic displays of verification cooperation to substantiate Gorbachev's intentions also failed to turn cautious cooperators into arms control advocates committed to a CTB. Successful realignment strategies involved more intimidation than education. Carter and Reagan entered office with deep convictions about test limitations. While nothing suggests that personal preferences changed, orchestrated opposition convinced both men to act more like cautious cooperators by raising the domestic cost of their preferred arms control outcome.

In short, domestic agreement on verification requirements has rarely been reached through either of the two strategies most commonly discussed by previous works on the politics of verification—establishing national consensus on first principles or circumventing controversy by entrusting verification policy to technical experts. This suggests that efforts to “depoliticize” verification are both futile and undesirable. Historically, arms control advocates, cautious cooperators, and unilateralists have only been able to agree that a particular set of verification provisions are “good enough” when the relatively high benefits and low risks of a treaty made verification largely irrelevant to arms control outcomes. Verification can only tip the scales between cooperation and competition if we understand how identification, alliance, realignment, and avoidance strategies produce provisional verification policies when first principles are hotly contested. Verification offers no easy technical solution to arms control dilemmas because asking “how much is enough?” only multiplies the uncertainty and controversy surrounding nuclear cooperation.

The test ban case also suggests that viewing verification debates solely as decisions about “how much is enough?” obscures two other ways in which nuclear arms control verification is inherently political. Without exploring what I will call the “workable/tolerable dilemma” and the “thermonuclear dilemma,” one cannot understand why actors argue about verification rather than debating first principles directly and how to redirect the politics of verification so that technical collaboration increases security cooperation.

The Workable/Tolerable Dilemma

National leaders must decide not only *how much* compliance information they need to detect, deter, and reassure, but also *what type* of verification to support. A benign, technical view of verification ignores both the costs and risks of different monitoring systems and the full range of effects that verification has on cooperative incentives, capabilities, and perceptions. Even if groups in domestic debates and international negotiations reached consensus on the structure of an arms control problem—that is the relative value of mutual cooperation, asymmetrical compliance, and continued competition—they could not determine optimal monitoring levels without agreement on a second equation. The “workable/tolerable dilemma” involves decisions about the appropriate way to relate the value gained by incremental improvements in verification capabilities to the value lost by making monitoring systems more expensive, intrusive, and inconvenient. Technical experts cannot use a “problem solving” approach to depoliticize negotiations because alternative ways of balancing workability and tolerability produce countless logical arguments for different verification arrangements.

The test ban case supports the hypothesis that national views on verification reflect a state's security situation rather than its arms control intentions. Power imbalances influenced preferences about the amount and timing of test ban verification. The United States was reluctant to relinquish its nuclear monopoly without extensive verification, while the Soviets worried that an international control commission would hamper their nuclear development plans, but never convince the United States to disarm. Likewise, so long as the Soviets saw secrecy as a security asset, they tried to minimize inspection at sensitive sites and to accept intrusive verification *only* in return for accords that brought major arms control benefits. With nuclear parity, Soviet resistance to NTM decreased, but their opposition to OSIs remained intense long after the asymmetry in strategic weapons was gone.

¹⁸⁸ Harris polls March 1977, September 1983, and November 1984.

Political differences also influenced national views on verification. Throughout the Cold War, Western leaders placed greater value on verification information because they had more need to inform the public about Soviet testing programs and treaty compliance without jeopardizing secret intelligence sources. Likewise, Soviet concerns about verification decision making reflected fears that the United States could dominate the international control organization envisioned during early CTB talks, and that the United States and United Kingdom could out-vote the Soviets if the majority ruled in a trilateral regime. The Soviet leaders' desire to minimize domestic opposition by restricting security information and foreign ideas also increased vulnerability to the subversive effects of technical collaboration and cooperative verification.

Unlike his predecessors, Gorbachev saw excess secrecy as a security liability that fueled worst case analyses and arms races. He sought reliable compliance information from revealable sources to increase popular support for cooperative security. Finally, he hoped that broader access to security information and increased contact with Western arms control advocates would strengthen his allies, weaken hard-liners, and institutionalize internal change.

Despite this more positive assessment, Gorbachev never stopped acting in terms of verification trade-offs. The NRDC project appealed to him because it minimized the risks of cooperation relative to the possible gains. If Gorbachev had adopted a benign view of verification, then the JVE would have been equally attractive because it also reduced secrecy; improved detection, deterrence and reassurance capabilities; and involved an exchange of data and experts with the West. Gorbachev's resistance reflected other calculations: conducting the JVE was far more expensive than the NRDC project and involved an extended American presence inside the Semipalatinsk test site, yet working with the Reagan administration was unlikely to secure a CTB or even TTBT ratification without routine intrusions. The Soviets retained their requirements that verification be accurate, nonintrusive, and practical. Agreement on the TTBT verification triad came only as a result of changed security circumstances that lowered the risks of intrusion (budgetary constraints on Western inspectors and an end to Soviet tests) and political compromises in which signatories could use whichever combination of methods they deemed most accurate as long as they paid most of their own expenses.

Acknowledging the differences between national views should not obscure variations in domestic groups' sensitivity to the costs and risks of verification. Even after Gorbachev and other Soviet arms control advocates decided that technical collaboration could make valuable contributions to arms control politics, they faced resistance from their own cautious cooperators who still worried about verification abuse and from unilateralists who opposed unreciprocated access to sensitive locations. Likewise, U.S. unilateralists saw competitive uses of verification and knew what requests would trigger Soviet resistance. Then they could use the myth of benign verification to convince cautious cooperators in the United States that Soviet refusal reflected devious motives. In the competition for the middle ground, unilateralists almost always out-maneuvered arms control advocates because the former understands the dark side of verification demands while the latter clings to the hope that increased information will necessarily enhance cooperation.

When incentives for and against cooperation are roughly even, successful negotiators must know how principal players view verification and believe that acceptable arrangements can be found. The Conference of Experts' consensus helped to initiate arms control talks by promising that conflicting verification preferences could be reconciled. But the technical talks that preceded diplomatic negotiations produced a document that concealed major substantive differences and deep procedural disputes. It generated false hopes, frustration, and angry accusations about bargaining in bad faith.¹⁸⁹

Technology collaboration is most productive when diplomatic negotiators use technical talks to explore and expand the range of feasible options rather than to pressure the other side into accepting particular arrangements. As an official part of the negotiating process or a second-track exchange of ideas in a more informal setting, technical meetings are relatively removed from the glare of publicity and thus allow more freedom for inquiry. One cannot assume that scientists will "talk the truth," or even "speak the same language" because they share a

¹⁸⁹. Using technical talks to create the illusion of common interests and easy cooperation can be dangerous. Sean Lynn-Jones argues that when states which have a mixture of common and competing interests try to improve the atmosphere by cooperating on peripheral issues, they are likely to generate misperceptions, miscalculations, and backlash. See "Detente and Deterrence," *International Security* 11:2 (Fall 1986): 121-150.

technical background. One can, however, compare and contrast their approaches to verification problems to determine the various technical and political principles that shape their thinking. Negotiators can then use this information to find existing verification procedures that suit national preferences, to suggest research projects that might find new means to reconcile conflicting concerns, or explore ways to make arms control objectives and verification attitudes more conducive to cooperation.

Technical talks and joint research projects can clarify or modify participants' verification preferences, but this will only change arms control outcomes if these insights are communicated to policy makers and influential public groups. Participants at scientific conferences and test ban negotiations learned about each other's concerns, recognized important trade-offs, and explored concessions that could secure a mutually-acceptable agreement. Without effective steps to popularize these ideas, compromises that could have secured an early CTB were shunned because Presidents Eisenhower and Kennedy could not answer unilateralists' demands for more verification without losing credibility as guardians of national security. Likewise, Carter settled for a mini-moratorium rather than argue publicly that the Soviets had legitimate reasons to resist expensive and intrusive verification for minimal constraints. TTBT ratification was delayed for sixteen years partly because U.S. unilateralists convinced cautious cooperators that the verification compromises reflected a rash disregard for national security rather than a rational attempt to balance increased information against greater intrusion, interference, and expense. After the JVE, talk about the costs and risks of verification was used to obstruct future cooperation by legitimizing the view that arms control could only serve U.S. interests when the government could maximize compliance information, neutralize the risks, and subsidize the high costs of intrusive verification.

The Thermonuclear Dilemma

Any type of international cooperation involves decisions about the evaluating compliance. Yet, nuclear verification receives much more attention than does monitoring for economic coordination, environmental protection, or humanitarian relief. The intensity and intractability of arguments over test ban technology collaboration suggest a third dimension where the main question is existential rather than distributional. Arguments about test ban verification reflect the thermonuclear dilemma: how best to manage the tremendous uncertainty and vulnerability created by nuclear weapons?

The cooperative control of thermonuclear weapons differs from other joint ventures because a small amount of nuclear material can produce rapid and massive destruction against which other states have no effective defense. Thus, nowhere are the benefits of mutual cooperation greater, or the temptations to defect and the fears of exploitation stronger. No one has solved the logical and practical problems associated with deterrence, nor has anyone found a persuasive answer to the contradictions inherent in collective security.¹⁹⁰ One cannot escape from this dilemma by prioritizing short or long-term benefits, nor by emphasizing absolute or relative gains, because each decision principle can support either cooperative or competitive solutions. Extreme interdependence and intense pressures both for and against cooperation increase the value of verification confidence, while the spread of nuclear capabilities and the disastrous consequences of low-level cheating or espionage make fully-reliable verification impossible to obtain.

The thermonuclear dilemma polarizes some actors and paralyzes others. Arms control advocates and unilateralists respond by discounting arguments against their preferred solution, while cautious cooperators react by worrying about what could go wrong if security policy moves too far in either direction. This explains why arms control advocates and unilateralists are actively employ technical collaboration in strategies designed to secure particular arms control outcomes, while cautious cooperators—the group whose belief structure provides the greatest incentives to initiate technology collaboration—actually play the most passive role in verification politics.

Positions taken in test ban politics often reflect strategies to avoid dealing directly with the thermonuclear dilemma. Arms control advocates do not always take verification seriously because they are so convinced that

¹⁹⁰ For an excellent treatment of the logical and practical dilemmas that characterize both unilateral and collective security, see Barry Buzan, *People, States, and Fear* 2nd ed., (Boulder, Colo.: Lynne Reiner, 1991).

cooperative control of weapons development is essential.¹⁹¹ Unilateralists use verification concerns to avoid thinking carefully about the dangers of endless nuclear tests and weapons development. Cautious cooperators handle their anxieties by believing that benign verification, technical collaboration, and unilateral safeguards can someday secure risk-free cooperation. Democratic leaders use incompatible verification demands to finesse contradictory pressures to negotiate arms control agreements and increase unilateral security capabilities.

Technical collaboration offers “something for everybody,” which explains the popularity of Reagan’s “Trust but Verify” approach to arms control. The rituals of test ban verification politics—including technical talks, joint research projects, and monitoring demonstrations—distract attention from deeper issues. The answer is not to depoliticize verification or avoid controversy by agreeing on lowest-common-denominator forms of technical collaboration. Instead, the key to stable arms control is to acknowledge the many ways in which verification is an intensely political act and to use that knowledge to clarify and confront the central dilemmas of nuclear cooperation.

¹⁹¹. Arms control advocates have developed a number of strategies to fend off verification concerns. David Lilienthal, the author of the first American plan for cooperative control of nuclear weapons development, insisted that the superpowers simply must believe in their ability to cooperate because “the alternative is so bad.” During hearings on the SALT II Treaty, Secretary of Defense Harold Brown argued that potential violators would be deterred by a “double bind” whereby any cheating that was small enough to escape detection would be too small to affect the military balance.” Another common response is to dismiss verification doubts by insisting that the costs and risks of the arms race are far worse. Each of these assertions relates to arms control advocates’ first principles, but need not always be true even if one accepts their basic beliefs. Thus, they must be thought of as articles of faith rather than logical deductions from a coherent understanding of nuclear weapons. See David Lilienthal, Address to the American Chemical Society, reprinted in *Bulletin of the Atomic Scientists* (October 1946), p. 14; and Harold Brown, “The SALT II Treaty,” Report of the Committee on Foreign Relations, U.S. Senate (Washington, D.C.: GPO, 1979), p. 221.