Toward a Comprehensive Test Ban

Steve Fetter

TOWARD A COMPREHENSIVE TEST BAN

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To Emily

LIST OF ABBREVIATIONS AND ACRONYMS

ABM	antiballistic missile
ACDA	Arms Control and Disarmament Agency
ACM	advanced cruise missile
ADM	atomic demolition munition
AEC	Atomic Energy Commission
AFAP	artillery-fired atomic projectile
ALCM	air-launched cruise missile
ANFO	ammonium nitrate and fuel oil
ASAT	antisatellite
ASROC	antisubmarine rocket
ASW	antisubmarine warfare
ATB	advanced tactical bomber (stealth bomber)
B	bomb or bomber
BMD	ballistic missile defense
C^3	command, control, and communications
CCD	Conference of the Committee on Disarmament
CD	Committee on Disarmament
CDS	command disable system
CEP	circle of equal probability
CIA	Central Intelligence Agency

cm	centimeter
CTB	comprehensive test ban
CTBT	comprehensive test ban treaty
DOB	depth of burst
DoD	Department of Defense
DoE	Department of Energy
DT	deuterium-tritium
EMP	electro-magnetic pulse
ENDC	Eighteen Nation Disarmament Conference
EPW	earth-penetrating warhead
ESD	environmental sensing device
ft	foot
GLCM	ground-launched cruise missile
HIE	hide-in-earthquake
Hz	hertz (cycles per second)
ICBM	intercontinental ballistic missile
ICF	inertial-confinement fusion
IHE	insensitive high explosive
INC	insertable nuclear component
INF	intermediate nuclear forces
JCS	Joint Chiefs of Staff
keV	kiloelectron-volt
kg	kilogram
kJ	kilojoule
km	kilometer
kt	kiloton
ktap	kilotap (kilodyne/cm^2/s)
LANL	Los Alamos National Laboratory
lb	pound

LiD	lithium-deuteride
LLNL	Lawrence Livermore National Laboratory
LTBT	Limited Test Ban Treaty
LYTTB	low-yield threshold test ban
LYTTBT	low-yield threshold test ban treaty
m	meter
MAD	mutually assured destruction
MADM	medium atomic demolition munition
MaRV	maneuvering reentry vehicle
m_b	seismic compressional wave (P-wave) magnitude
MCs	military characteristics
MeV	megaelectron-volt
MILSTAR	military strategic and tactical relay
MIRV	multiple independently targeted reentry vehicle
MRV	multiple reentry vehicle
M_s	seismic Rayleigh-wave magnitude
Mt	megaton
MX	missile experimental (Peacekeeper)
NBD	nuclear depth bomb
NCA	National Command Authority
NDEW	nuclear directed-energy weapon
nmi	nautical mile
NPT	Non-Proliferation Treaty
NRDC	Natural Resources Defense Council
NTM	national technical means
NTS	Nevada Test Site
OSI	on-site inspection
PAL	permissive action link
PBV	post-boost vehicle

p_d	probability of detection
PNE	peaceful nuclear explosion
PNET	Peaceful Nuclear Explosions Treaty
$p(q\|x)$	probability of misclassifying an explosion
psi	pounds per square inch
$p(x\|q)$	probability of misclassifying an earthquake
RV	reentry vehicle
SADM	special atomic demolition munition
SALT	Strategic Arms Limitation Treaty
SAM	surface-to-air missile
SDI	Strategic Defense Initiative
SDIO	Strategic Defense Initiative Organization
SLBM	submarine-launched ballistic missile
SLCM	submarine-launched cruise missile
SNM	special nuclear material
SNR	signal-to-noise ratio
SRAM	short-range attack missile
SSBN	nuclear-powered ballistic missile submarine
START	Strategic Arms Reductions Talks
STS	stockpile-to-target sequence
SUBROC	submarine rocket
TBM	tactical ballistic missile
TNT	Trinitrotoluene
TTBT	Threshold Test Ban Treaty
W	warhead

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1 INTRODUCTION

A ban on all nuclear testing is one of the oldest and most elusive proposals to control nuclear armaments. For over thirty years, a succession of U.S. presidents have stated that a comprehensive test ban (CTB) is a goal of U.S. policy. Perhaps because the idea of a CTB has been around so long, there is a tendency not to think very hard about it. Concerned citizens, defense intellectuals, policymakers, military leaders, and weapon designers continue to reiterate many of the same arguments made decades ago, even though the strategic and political environment has changed considerably.

After three decades of analysis and discussion, the test ban question is still far from being resolved. Although the late 1980s have witnessed renewed public and congressional support for a test ban, the Reagan administration and the U.S. nuclear weapons establishment as a whole remain opposed to further restrictions on testing, despite repeated Soviet statements that they are now willing to accept any verification measures the United States deems necessary. All of the Democratic candidates in the 1988 presidential campaign support a CTB or a one-kiloton threshold test ban treaty. I believe that the time is ripe for a thorough reexamination of the issues surrounding a test ban. This book challenges the conventional wisdom of CTB proponents, who claim that a CTB would end the arms race and curb proliferation and that the problems of verifying a ban have long since been solved; and of CTB opponents, who claim that the United States must test as long

as it depends upon nuclear deterrence for its security and that the Soviets could obtain important advantages by cheating. This book is intended primarily for policymakers and citizens in the United States who are trying to determine the relevance of a CTB in today's world, but I hope that it will also be useful to arms control experts and to citizens of other countries.

We begin by reviewing the long history of test ban negotiations and by isolating the key issues. The following chapters discuss in detail the subjects that are central to the current test ban debate: weapon modernization, stockpile confidence, verification, nuclear strategy, proliferation, and the politics of détente. Although the first three of these subjects are technical, it should be emphasized that the crucial judgments in these areas cannot be apolitical. Although agreement is possible on technical facts in principle (and even this is often impossible in practice), one must still judge the relative political and strategic importance of these facts. I have tried to be evenhanded in my assessments, but my bias in favor of a test ban inevitably shows through. There is always a tension between objectivity and advocacy whenever science and politics mingle, as they certainly do in the test ban case.

PAST TEST BAN NEGOTIATIONS

The long and often fascinating history of test ban negotiations could fill several volumes, but only a brief overview can be presented here.[1] Proposals for a nuclear test ban did not surface until almost a decade into the nuclear age. The rate of testing was fairly low in the late 1940s (only nine nuclear explosions took place during the years 1945 through 1950),[2] and the hazards to public health from fallout were not widely recognized. Nuclear arms control efforts immediately after World War II focused on general and complete disarmament, or schemes designed to remove nuclear weapons and the ability to produce them from all nations. The flagship of such proposals was the Baruch Plan, which was submitted by the United States to the United Nations in June 1946. The plan would have turned over all nuclear activities—reactors and research facilities as well as weapon development—to an international agency, which would have performed thorough and unrestricted inspections of all parties and reported violations to the U.N. Security Council. The Security Council would then have voted to mete out

punishment, which might have included war and the use of nuclear weapons, to those found cheating. Unlike other U.N. decisions, the Baruch Plan would not have permitted the permanent members of the Security Council to veto these actions.

In retrospect, there was little possibility that the Soviet Union could have accepted a proposal that required such a substantial surrender of its sovereignty, especially since the plan did not satisfy Soviet security goals. The United Nations was overwhelmingly pro-American at the time, and the Soviets must have feared that the plan's inspection and enforcement provisions would have been used to interfere in their internal affairs. The United States would have secured a permanent monopoly on nuclear know-how and the Soviet Union would have been frozen into a position of inferiority. The Soviets obviously believed that building their own nuclear arsenal provided a safer route than the Baruch Plan for eliminating the American nuclear advantage. The United States and the Soviet Union exchanged proposals for general and complete disarmament over the next decade in an attempt to sway world opinion. With the detonation of the first Soviet weapon in 1949 and the outbreak of the Korean War a year later, a compromise on nuclear matters was nowhere in sight.

Eisenhower and the Moratorium

The idea of banning nuclear tests appeared suddenly in 1954, after the United States detonated a large thermonuclear device, code-named BRAVO, on an island in the South Pacific on 1 March. The explosion's 15-megaton yield was twice that expected, and shifting winds deposited fallout on a Japanese fishing boat and on the nearby Marshall Islands. Dozens suffered from radiation sickness and one of the fishermen died. Fear about the health effects of fallout touched off a series of protests against nuclear testing, lead by some of the world's most respected statesmen and scientists.

The Soviet Union, which had included a test ban as part of an arms control proposal as early as May 1955, was quick to capitalize on the worldwide outrage against atmospheric testing. American officials, on the other hand, sought to minimize the hazards of fallout. The United States consistently maintained that testing was necessary to develop advanced weapons to deter Soviet aggression. This was a period of tremendous growth and innovation in the U.S. nuclear stockpile: high

yield-to-weight thermonuclear bombs, various battlefield nuclear weapons, and ballistic missile warheads were just being developed. Roughly one third of all nuclear weapon types ever to enter the U.S. stockpile were tested during the late 1950s.[3]

Meanwhile, public pressure for a test ban continued to mount. It had become increasingly apparent that negotiations for general and complete disarmament would never bear fruit. Indeed, the Eisenhower administration, while reassessing its position in 1955, had decided that advocating complete nuclear disarmament would no longer serve U.S. interests. When Adlai Stevenson made the test ban a central issue in the 1956 presidential race, the Soviets informally offered a test ban as a separate proposal. When the British exploded their first thermonuclear weapon in May 1957, the Soviets proposed a ban on thermonuclear weapon tests. During the later half of 1957, the Soviets made two offers for a three-year moratorium on testing. All were rejected. The United States offered a two-year moratorium, but this was rejected because it was linked to a cutoff in the production of fissile material. (In the absence of additional arms control measures, a cutoff would have left the United States with a much larger number of nuclear weapons than the Soviet Union.)

After 1957, public pressure to end the radioactive contamination of the environment could no longer be ignored by Eisenhower. The United States suffered propaganda drubbings each time it refused to consider a test ban as a separate issue. While the debate within a badly divided U.S. government gathered momentum, the Soviet Union announced on 31 March 1958 (just four days after Khrushchev became premier) that it would refrain from testing if other nations did not test. In a major policy shift, Eisenhower responded one week later by proposing that scientists from the two countries meet to discuss how compliance with a test ban could be verified. Although the Soviets maintained that verification posed no problems, Khrushchev, perhaps feeling that the meeting was politically necessary for Eisenhower, agreed.

The Conference of Experts. The Conference of Experts to Study the Possibility of Detecting Violations of a Possible Agreement on Suspension of Nuclear Tests was convened in Geneva on 1 July 1958. Less than two months later, the conferees concluded that a control system composed of 160 to 170 control posts scattered around the world would be capable of detecting and identifying atmospheric explosions yielding more than 1 kiloton and underground explosions with yields