F.A.S. PUBLIC INTEREST REPORT

Journal of the Federation of American Scientists (FAS)

START II

Volume 43, No. 6

June 1990

ON TO START II—NOW!

Harold A. Feiveson and Frank von Hippel

The START agreement will set a ceiling of 6,000 each on the number of *counted* warheads on strategic ballistic missiles and long-range bombers in the US and Soviet arsenals. It will limit the number of warheads deployed on each side's ballistic missiles to less than 4,900—down from about 7,800 and 10,000 respectively in the 1989 US and Soviet strategic arsenals (see table on p. 7)—and eliminate one half of the 308 Soviet "heavy" SS-18 intercontinental ballistic missiles (ICBMs). The agreement will also establish a set of verification measures that will markedly increase US and Soviet knowledge of each other's strategic forces and establish new benchmarks for cooperative verification arrangements.

However, because of the treaty's counting rules, the cuts will be much less than the 50 percent once promised, and additionally will provide both sides with an incentive to deploy nuclear weapons on bombers. Each strategic bomber *not* equipped to carry air-launched cruise missiles (ALCMs) will be counted as carrying only *one* warhead—although a standard load for a US bomber is 16. The approximately 1,500 nuclear warheads deployed on 97 B-1s and another 1,200 to be deployed on the 75 planned B-2s will therefore count as only 172 warheads against the START total. An additional few hundred nuclear weapons deployed by each side on long-range sea-launched cruise missiles will not be counted at all.

Overall, it appears as if the Soviet strategic force will be reduced to 6,000-7,000 warheads (from about 11,000 in 1989), but because of the US non-ALCM bombers, the US strategic force will carry 9,000-10,000 (down from about 13,000).

Perhaps the greatest shortcoming of START, however, is that it doesn't deflect the US and Soviet nuclear establishments from their continuing obsession with developing new "counterforce" weapons to make each other's forces vulnerable. START is designed to protect all of the US and Soviet strategic "modernization" programs including, on the US side, the B-2 bomber and the Trident II submarine-launched ballistic missile (SLBM), which have been justified primarily by their improved capabilities to attack Soviet strategic forces and command and control systems. With such counterforce postures, both sides will continue to rely on dangerous launch-on-warning capabilities to assure that their weapons will not be destroyed before they can be used.

Furthermore, because START would not stop the new systems, it will achieve only modest budget savings. The Congressional Budget Office estimates a saving of about 3 billion dollars per year due to START.

FAS-Soviet Project Studies Reductions

This article is based on a chapter which will appear in the forthcoming book, *Reversing the Arms Race: How to Achieve and Verify Deep Reductions in the Nuclear Arsenals*, which is a product of the FAS-Committee of Soviet Scientists cooperative research project on arms reductions. Another related article by the same authors, "Post-START Strategic Arms Control: The Case for Much Deeper Cuts," appears in this summer's issue of *International Security*. ■

New Weapons Programs May Go Forward

If military assent has to be bought with new weapons systems, the ratification of START may even result in *increases* in the strategic-weapons budgets. General John Chain, the chief of the Strategic Air Command and director of the Joint Targeting Staff, has stated to the Senate Armed Services Committee that he will testify against Senate approval of START unless Congress commits itself to funding the purchase of 75 B-2 bombers. (However, he previously made the same threat if he did not get all of the 132 B-2s originally requested.)

General Chain's argument is that the US needs the B-2s and their bonus warheads above the START 6000-warhead limit to carry out the US Single Integrated Operating Plan (SIOP): "I can tell you, as the person who has to target, that 1,000 weapons is critically important to me. We are talking 15 percent of the total weapons that I would have available to me to be able to flesh out the SIOP." As long as the US and Soviet Union maintain their current emphasis on large-scale counterforce, it may be difficult to deflect such arguments. This makes it essential that the US and Soviet Union move as rapidly as possible, upon the completion of START, to a START II Treaty with much deeper reductions.

Meanwhile, Soviet spokesmen have pressed for the negotiation of such a treaty immediately following the completion of START, with the goal of achieving "reductions in strategic forces [such that] they will be devoid of any potential to strike first."

That there is plenty of room for reductions is evident from the fact that, even after a START I agreement has been implemented, the US and Soviet arsenals will each carry a total destructive power equivalent to about 50,000 Hiroshima bombs. One percent of this could destroy either country as a modern state.

Continued on page 2

SDI Airborne Test—Page 3; Appeal on Environment—Page 4

continued from page 1

Political Climate Favors Deep Reductions

Given the expected Soviet withdrawal from Eastern Europe, the political conditions seem very favorable both for deep post-START I reductions in the strategic arsenals and for the virtual elimination of tactical nuclear weapons. Indeed, the context which shaped the START I negotiations now appears virtually prehistoric.

Ever since the 1950s, the principal rationale for having such a large surplus in the US strategic nuclear arsenal, well over the requirement for an effective retaliatory capability, has been the perceived need to have a nuclear deterrent to a Soviet conventional attack on Western Europe. The argument has been that in order to make the deterrent credible, the US needs the ability to mount a reasonably effective first strike against the Soviet strategic nuclear forces. Now that the Warsaw Pact is effectively dissolved as a serious military alliance and a treaty is expected on conventional force reductions in Europe that will eliminate Soviet advantages, this argument has lost its wind.

War plans for nuclear attacks upon thousands of military facilities never made sense in any case. Such attacks would have killed tens of millions of civilians and would not have differed much in effect from attacks with hundreds of warheads directly on the Soviet civilian population.

Another factor favoring deeper cuts is the economic pressure on both the US and Soviet governments to sharply cut back their military budgets. Given the huge costs of new weapons systems such as the B-2 and the Soviet Blackjack bomber, and the sudden visibility of the terrible environmental and safety problems in the nuclear weapons production complexes of both countries, nuclear weapons no longer appear the obvious means to get "more bang for the buck" (or ruble).

Objectives for START II

The principal objective of START II should be to wean the United States and Soviet Union from their current reliance on unusable and destabilizing large-scale counterforce capabilities. Most of the weapons in the current strategic arsenals are dangerous junk and we should get rid of them.

The primary design criterion for START-II forces should be that at least several hundred deliverable warheads would survive any conceivable first strike. The forces should be sufficiently enduring so that after riding out an attack, the remaining elements of the national leadership of the attacked side would have at least a few days to be able to reestablish communications and decide how to respond. Such a "ride-out and then decide" posture would be much less susceptible to mistaken, accidental or unauthorized actions than the current launch-under-attack postures.

Reduction of US and Soviet strategic arsenals to 2,000 warheads each appears a reasonable goal for a START-II agreement. Forces on this order could be sufficiently powerful and robust to meet the design objectives. Still deeper reductions would be desirable, but would probably require negotiations including the United Kingdom, France, and China.

Continued on page 5

The FAS Public Interest Report (USPS 188-100) is published monthly except July and August at 307 Mass. Ave., NE, Washington, D.C. 20002. Annual subscription $25/year.

POSTMASTER: Send address changes to FAS, 307 Massachusetts Avenue, NE, Washington, D.C. 20002.

STAR WARS AIRBORNE OPTICAL SYSTEM CHALLENGES THE ABM TREATY

On May 11 FAS released an analysis by John Pike raising questions, under the ABM treaty, about the flight testing of the Airborne Optical Adjunct. What follows is a brief summary of the background for the FAS release.

The recent initiation of flight testing of the Airborne Optical Adjunct (AOA) has renewed concerns about the impact of the SDI program on the ABM treaty. AOA is a modified Boeing 767 aircraft carrying an infrared telescope to track and identify reentry vehicles, while they are still above the atmosphere, for interception by mid-course and terminal defenses.

Flight testing of AOA began in late 1987. In mid-1988 the telescopic sensor was added to the aircraft, and flight testing with this sensor began in May 1990. In the Fall of 1990, AOA is to be moved to the Kwajalein Missile Range, one of the agreed ABM test ranges under the ABM treaty, and at that point it would clearly be associated with ABM activities.

Article V of the Treaty bans the development or testing of ABM components that are air-based. AOA testing over the next several months thus would appear to be inconsistent with this provision of the ABM treaty. But the Administration offers four lines of reasoning under its "permissive reading of the traditional interpretation" of the ABM treaty to support its contention that AOA is Treaty-compliant.

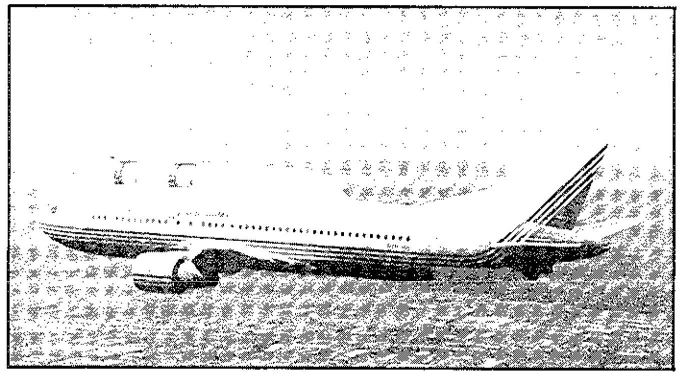
Four Excuses

The first rationale is that the Boeing 767 cannot stay aloft for a sufficient period of time to be an effective ABM component. But in fact the Boeing 767 currently has a maximum airborne endurance of about 10 hours, comparable to the endurance of the E-3 AWACS which performs an air defense function analogous to the missile defense function performed by AOA.

The second rationale argues that AOA is compliant as long as tests do not involve the transfer of data in real-time to an ABM interceptor conducting an intercept of a target. But this cannot be a requirement for the prohibitions in Article V to apply, since the prohibitions must be verifiable by national technical means. To prohibit *only* tests that involve the transfer of data would require a detailed understanding of the computer software and communications capabilities of AOA (since one would have to prove that data was actually transferred), which is clearly beyond the capabilities of national technical means. Thus a more general interpretation of the prohibition is needed.

The third argument notes that the sensor focal plane array (the electronic chip that actually forms the image of the target) is not fully populated (that is, it does not contain a full complement of sensor elements). But as with the previously discussed communications links and computer software, the capabilities of the focal plane array cannot be monitored by national technical means, and thus is an inadequate basis for determining compliance.

The fourth argument assumes that a device would not be a Treaty-accountable ABM component unless it could perform the complete function of, or substitute on a "stand alone" basis for, an ABM component as defined in Article II



Airborne Optical Adjunct, a sensor system for SDI.

of the Treaty. If a device could only perform part of the function of an ABM radar, launcher, or interceptor, then it would not be constrained as an ABM component under the Administration's interpretation of the Treaty. This definition of a component would require a single sensor to search for attacking warheads, acquire (identify) individual warheads, discriminate these warheads from decoys and other objects, track each warhead, assign an interceptor to the warhead, instruct the interceptor during its flight and provide updated guidance information to it, and assess whether the interception was successful.

Although there are some missile defense systems with a single sensor (such as the proposed Site Defense system that was under development in the United States in the 1970s), they are the exception, rather than the rule. In practice, most missile defense systems have more than one sensor component, each of which plays some role in the management of the battle. The early Nike-Zeus system had not one or two, but four separate types of radars, for target acquisition, decoy discrimination, target tracking and interceptor tracking. Under the Administration's interpretation of the Treaty, all of these radars would be considered to be adjuncts of one another, and none of them would be considered to be a component.

The Soviet ABM-X-3 system consists of the Flat Twin target tracking radar and the Pawn Shop interceptor guidance system. Neither of these systems can function without input from other sensors such as the Pechora-class radar, and neither can function without the other, but the Administrations's concerns about the compliance of these systems with the ABM treaty clearly assume that both Flat Twin and Pawn Shop are Treaty-accountable components.

Conclusion

The Airborne Optical System performs a role similar to that of the Perimeter Acquisition Radar in the Sentinel/Safeguard system, which had capabilities similar to those of the Soviet Krasnoyarsk radar. Radars such as these were clearly considered to be ABM components, and subjected to strict limitations in the Treaty. Thus while AOA may not be able to perform all of the functions that an ABM radar might be required to perform, it nonetheless is capable of substituting for *an* ABM radar, and since it is air-based, it is banned under Article V of the Treaty. □

— *John Pike, Director of the space policy project*

SCIENTISTS APPEAL TO WORLD RELIGIOUS COMMUNITY

What follows is a document organized by Carl Sagan and signed initially by about 50 (largely environmental) scientists which was released in January as part of an appeal to the world religious community at the Global Forum of Spiritual and Parliamentary Leaders, then taking place in Moscow.

Subsequently, 270 well-known spiritual leaders from 83 countries—patriarchs, lamas, chief rabbis, cardinals, mullahs, archbishops and professors of theology—have signed their names to it. This is an attempt at raising the consciousness of mankind through religion.

Preserving and Cherishing the Earth: An Appeal for Joint Commitment in Science and Religion

The Earth is the birthplace of our species and, so far as we know, our only home. When our numbers were small and our technology feeble, we were powerless to influence the environment of our world. But today, suddenly, almost without anyone noticing, our numbers have become immense and our technology has achieved vast, even awesome, powers. Intentionally or inadvertently, we are now able to make devastating changes in the global environment—an environment to which we and all the other beings with which we share the Earth are meticulously and exquisitely adapted.

We are now threatened by self-inflicted, swiftly moving environmental alterations about whose long-term biological and ecological consequences we are still painfully ignorant—depletion of the protective ozone layer; a global warming unprecedented in the last 150 millennia; the obliteration of an acre of forest every second; the rapid-fire extinction of species; and the prospect of a global nuclear war which would put at risk most of the population of the Earth. There may well be other such dangers of which, in our ignorance, we are still unaware. Individually and cumulatively they represent a trap being set for the human species, a trap we are setting for ourselves. However principled and lofty (or naive and short-sighted) the justifications may have been for activities that brought forth these dangers, separately and together they now imperil our species and many others. We are close to committing—many would argue we are already committing--what in religious language is sometimes called Crimes against Creation.

By their very nature these assaults on the environment were not caused by any one political group or any one generation. Intrinsically, they are transnational, transgenerational and transideological. So are all conceivable solutions. To escape these traps requires a perspective that embraces the peoples of the planet and all the generations yet to come.

Problems of such magnitude, and solutions demanding so broad a perspective must be recognized from the outset as having a religious as well as a scientific dimension. Mindful of our common responsibility, we scientists—many of us long engaged in combatting the environmental crisis—urgently appeal to the world religious community to commit, in word and deed, as boldly as is required, to preserve the environment of the Earth.

Some of the short-term mitigations of these dangers—such as greater energy efficiency, rapid banning of chloroflourocarbons or modest reductions in the nuclear arsenals—are comparatively easy and at some level are already underway. But other, more far-reaching, more long-term, more effective approaches will encounter widespread inertia, denial, and resistance. In this category are conversion from fossil fuels to a nonpolluting energy economy, a continuing swift reversal of the nuclear arms race, and a voluntary halt to world population growth—without which many of the other approaches to preserving the environment will be nullified.

Carl Sagan

As on issues of peace, human rights and social justice, religious institutions can here too be a strong force encouraging national and international initiatives in both the private and public sectors, and in the diverse worlds of commerce, education, culture and mass communication.

The environmental crisis requires radical changes not only in public policy, but also in individual behavior. The historical record makes clear that religious teaching, example, and leadership are powerfully able to influence personal conduct and commitment.

As scientists, many of us have had profound experiences of awe and reverence before the universe. We understand that what is regarded as sacred is more likely to be treated with care and respect. Our planetary home should be so regarded. Efforts to safeguard and cherish the environment need to be infused with a vision of the sacred. At the same time, a much wider and deeper understanding of science and technology is needed. If we do not understand the problem, it is unlikely we will be able to fix it. Thus, there is a vital role for both religion and science.

We know that the well-being of our planetary environment is already a source of profound concern in your councils and congregations. We hope this Appeal will encourage a spirit of common cause and joint action to help preserve the Earth. □

Continued from page 2

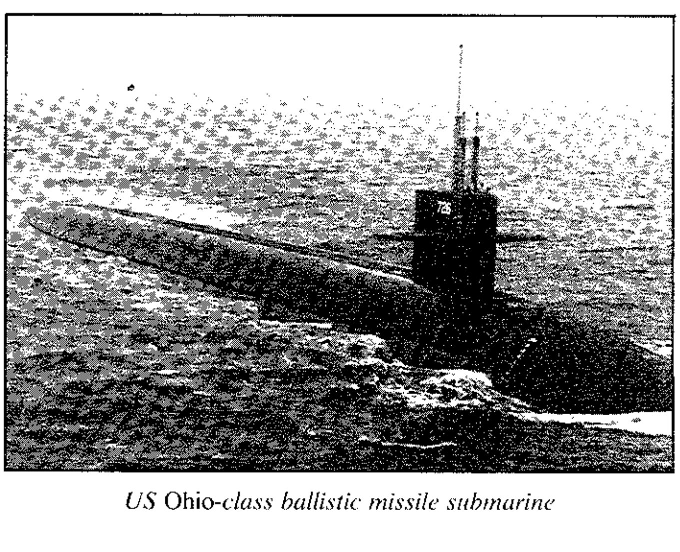
ILLUSTRATIVE FORCE STRUCTURE UNDER A START II AGREEMENT

A START II agreement should give both sides considerable flexibility in designing their strategic forces. Still, without prescribing restrictions on each party's options, it is useful to illustrate the stability of the nuclear balance that could be achieved with 2,000 warheads on each side using only weapons systems that are already deployed, in production, or in advanced development.

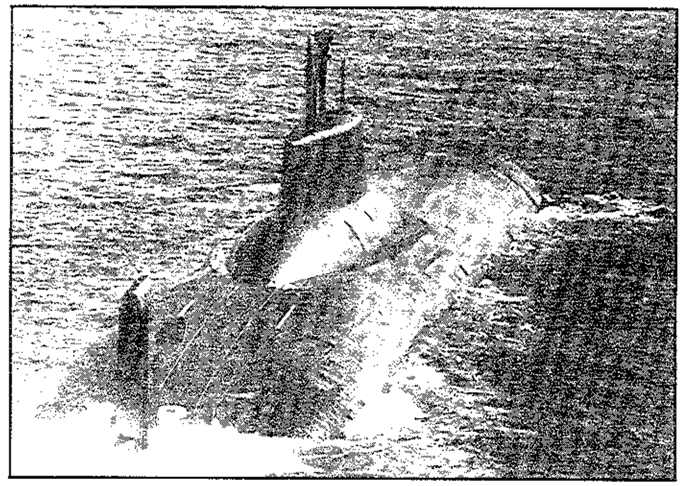
In designing illustrative forces we have assumed that, for both institutional reasons and because of the inherent value of diversity, both sides will continue to deploy a strategic "triad" consisting of land-based intercontinental ballistic missiles (ICBMs), SLBMs and air-launched weapons carried by long-range bombers. As shown in the table, we assume that the US would deploy about one half of its strategic warheads on ballistic-missile submarines and the USSR would similarly continue to favor ICBMs.

At sea, we assume that the 1,020 US SLBM warheads will be based on 21 Trident submarines—approximately the number currently completed (9) or under construction. Each of these submarines would carry 48 warheads—down from the 196 on each Trident today. The 480 Soviet SLBM warheads would be based on 20 submarines, each carrying 24 warheads. We assume that the reductions would be accomplished by reducing the number of 8-warhead missiles carried by the US submarines from 24 to 6 each and by deploying six 4-warhead SS-N-23 missiles on a mix of Delta IV submarines (currently carrying 16 SS-N-23s each) and Typhoons (currently carrying twenty 10-warhead SS-N-20s each). We assume that neither side would choose to deploy any of its 2,000 warheads on nuclear-armed sea-launched cruise missiles (SLCMs). In range, speed, and ability to penetrate defenses, SLCMs are inferior to SLBMs. And, given their small size and similarity to non-nuclear cruise missiles, non-zero limits on nuclear SLCMs would be more difficult to verify.

We assume that the ICBM component of the START II forces would be made up of single-warhead missiles. The obvious Soviet candidate is the mobile single-warhead SS-25, of which about 200 are already deployed. The US missile could be the Midgetman, based either in Minuteman silos or on a hard mobile launcher. Although missile silos are increasing in vulnerability, they remain a viable basing mode for single-warhead ICBMs since more than one warhead would be needed to destroy each silo-based warhead.



US Ohio-*class ballistic missile submarine*



Soviet Typhoon-*class ballistic missile submarine*

We assume that both the US and Soviet forces would contain 125 long-range nuclear bombers, each equipped on average with four air-launched cruise missiles (ALCMs). As the carrying capacity of current strategic bombers could not be verifiably limited to 4 nuclear ALCMs each, verification of the ALCM limits would have to be accomplished through separate limits on the nuclear-armed cruise missiles themselves (see below).

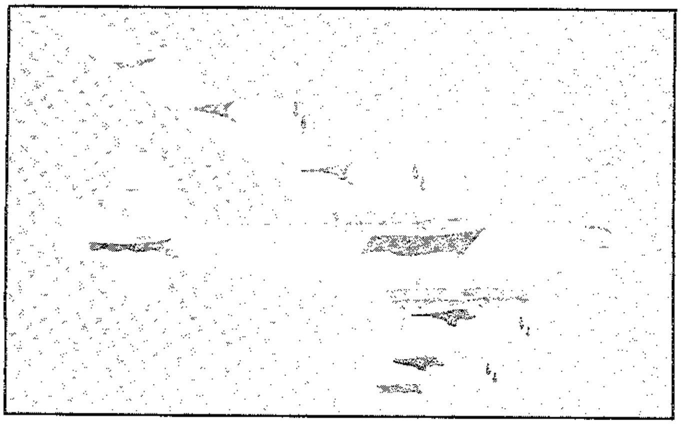
Achievement of such deep reductions will be possible only if the ABM Treaty is maintained in something like its present form. In the START negotiations, the issue of ballistic missile defense has been finessed by the Soviet willingness not to insist on a formal US commitment to abide by the ABM Treaty as a precondition for a START agreement. But the Soviet Union has also made clear that it reserves the right to break out of the START limits if the US breaks out of the ABM Treaty. It is likely that, if there were a serious possibility of Soviet deployment of an ambitious ballistic missile defense system, the US would adopt a similar stance.

Stability

Under alert conditions similar to those adopted by the US today, over one-half of the warheads in both the US and Soviet illustrative 2,000-warhead forces would either be already dispersed or would be able to quickly disperse on warning of ballistic missile attack. In the case of submarines at sea, such dispersal would ensure survivability for weeks, at least.

Bombers and (any hardened mobile missiles) on alert would also be highly survivable. At inland bases, they would have at least 15 minutes warning time of attacks by warheads launched on minimum-energy trajectories from plausible launch areas 2,000 to 3,000 km away. Assuming that they began to scatter 8 minutes after the initial warning, they would be widely dispersed and not susceptible to barrage by the time the SLBM warheads arrived. For example, a bar-

Continued on page 6



B-52 bomber carrying cruise missiles

continued from page 5

rage attack on the area around an airbase with five alert bombers, each carrying 4 nuclear warheads, would require 48 attacking 100-kt warheads per bomber warhead destroyed.

Perhaps the most important source of crisis instability in the current balance is the vulnerability of the command and control systems to a "decapitating attack." But this is primarily due to the fact that current postures demand that the command and control systems be able to coordinate an attack against the other side's strategic forces while they are themselves under attack. A START II force designed for second-strike retaliation and not counterforce would only have to be able to attack a variety of fixed targets on the other side within a period of days. Therefore the command and control systems for such a force would only need to be reconstitutable using, for example, easily-launched lightweight relay satellites for communications.

Verification

As with SALT II, monitoring of START II limits on numbers and types of deployed ballistic missile submarines, ICBM silos, and strategic bombers could be accomplished principally by satellite imaging, while MIRV testing and throwweight limits on ballistic missiles could be verified principally with radar and telemetry interception.

Limits on the number of deployed mobile ballistic missiles, production constraints on new ballistic missiles and the elimination of missiles and mobile launchers could all be monitored by procedures similar to those that have been established by the Intermediate Nuclear Forces (INF) Treaty and that are being established by START I. New tasks would include verification of reductions in the numbers of missiles deployed on ballistic missile submarines, limits on numbers of nuclear-armed cruise missiles and limits on non-deployed nuclear warheads.

Reductions in the numbers of missiles carried by ballistic missile submarines could be accomplished most directly by filling the extra launch tubes with concrete and sealing them. Inspectors from the other side could take ultrasonic images of the welds used to seal the tubes and agreements could be established to allow subsequent short-notice checks of the welds any time a submarine was in port.

Direct limits on nuclear-armed cruise missiles (ALCMs and SLCMs) would be desirable since virtually any long-range aircraft, submarine or ship could be equipped fairly quickly to launch them. Verification of such limits could be based on the control system for naval nuclear missiles described by Valerie Thomas in the May *Public Interest Report.* It would include monitoring of the portals of cruise missile production facilities, where each departing cruise missile canister would be checked for radiation (revealing the presence of a nuclear warhead) and nuclear-armed cruise missiles would be tagged. Nuclear cruise missiles which had already been produced would similarly be tagged or destroyed. Storage and deployment sites for both nuclear and conventional cruise missiles would be declared, with random on-site inspections at the declared sites and challenge inspections elsewhere used to deter the deployment of undeclared nuclear cruise missiles. Detection of *any* cruise missile entering or leaving an undeclared facility would then be evidence of a violation.

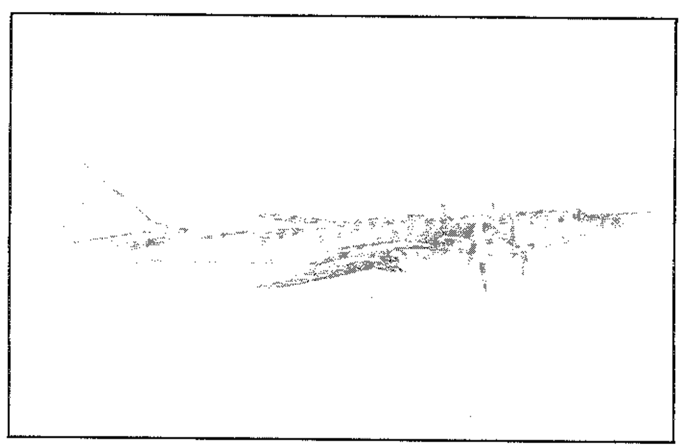
Direct Controls on Warheads

The most significantly novel approach to verification that should be introduced in a START II agreement is a system of explicit controls on nuclear warheads and on the fissile materials from which they are produced (ordinarily, plutonium and highly enriched uranium). Such controls would be complementary to limits on launchers and delivery vehicles and would provide the elusive means for limiting nuclear weapons systems, such as nuclear-armed fighter bombers and nuclear artillery, which are hard to distinguish from non-nuclear versions of the same systems without direct inspection for the presence of a nuclear warhead.

A comprehensive system for implementing and verifying warhead reductions would include a verified cutoff in the production of fissile materials for weapons, dismantlement of warheads being retired, placement of the recovered fissile material under safeguards, and declarations of total stockpiles of nuclear warheads and fissile materials.

Verification of a fissile material cutoff would involve relatively straightforward extensions of International Atomic Energy Agency (IAEA) safeguards to cover shut-down plutonium production reactors and their associated fuel reprocessing plants, any reactors producing tritium for nuclear weapons, gaseous diffusion uranium enrichment plants, and the nuclear fuel cycles for naval propulsion reactors as well.

Continued on page 8



Bear bomber

	Delivery Vehicles 1989[1]		Delivery Vehicles START		Delivery Vehicles START II		Warheads 1989[1]		Warheads START		Warheads START II	
ICBMs	USA	USSR	USA	USSR	USA	USSR	USA	USSR	USA[2,3]	USSR[2,3]	USA	USSR
Minuteman II	450		0		0		450		0		0	
Minuteman III/IIIA	500		200		0		1500		600		0	
MX	50		50		0		500		500		0	
Midgetman	0		344		492		0		344		492	
SS-11/13		409		0		0		409		0		0
SS-17		108		0		0		432		0		0
SS-18		308		154		0		3080		1540		0
SS-19		320		0		0		1920		0		0
SS-24		58		80		0		580		800		0
SS-25[5]		171		336		1020		171		336		1020
ICBM Totals	1000	1374	594	570	492	1020	2450	6592	1444	2676	492	1020
SLBMs												
Poseidon	224		0		0		2240		0		0	
Trident I/II	384		432		126		3072		3456		1008	
SS-N-6/8/12/17		538		0		0		538		0		0
SS-N-18		224		0		0		1568		0		0
SS-N-20		100		120		0		1000		1200		0
SS-N-23		80		256		120		320		1024		480
SLBM Totals	608	942	432	376	126	120	5312	3426	3456	2224	1008	480
Missile Totals	1608	2316	1026	946	618	1140	7762	10018	4900	4900	1500	1500
Bombers												
B-52 ALCM	194		90		0		3480		1800 (900)		0	
B-1/2	97		150		125		1536		2400 (150)		500[4]	
Bear		85		0		0		310		0		0
Bear-H ALCM[6]		75		87		75		450		522 (696)		300[4]
Blackjack		10		50		50		120		600 (400)		200[4]
Bomber Totals	291	170	240	137	125	125	5016	880	4200 (1050)	1122 (1096)	500[4]	500[4]
Strategic Totals	1899	2486	1266	1083	743	1265	12778	10898	9100 (5950)	6022 (5996)	2000	2000

US and Soviet Strategic Nuclear Arsenals in Late 1989; Hypothetical START and START II Forces in the Mid-1990s

1. The numbers for 1989 are from "Strategic Nuclear Forces of the United States and the Soviet Union" (Washington DC: Arms Control Association Fact Sheet, September 1989).

2. For the United States, we assume that, after the START treaty is signed, the number of 24-launcher Trident Ballistic missile submarines will grow to 18, while the remaining 16-launcher Poseidon/Trident I ballistic missile submarines are retired. We assume also that 53 of the 132 B-2 penetrating bombers proposed by the US Air Force will be bought and that the entire fleet of 97 B-1B penetrating bombers and 90 B-52H cruise missile carriers will be retained.

For the Soviet Union, we assume that the program of building 20-launcher Typhoon submarines carrying 10-warhead SS-N-20 missiles halts at six submarines and that the number of 16-launcher Delta submarines carrying four-warhead SS-N-23 missiles will increase to 16, while the older Yankee and Delta submarines are phased out. We assume also that the production of Bear-H ALCM carriers and Blackjack bombers will stop at 87 and 50 respectively.

Eight alternative US START forces were described in a *Report to the Congress on the Analysis of Alternative Strategic Nuclear Force Postures for the United States Under a Potential START Treaty*, submitted by President Bush on 25 July 1989. All forces included 50 MX missiles, 87 B-52 ALCM aircraft, 97 B-1B and 132 B-2 bombers. The number of Trident II warheads waried from 2,880 to 4,224. The forces differed primarily in their assumed mix of Minuteman II, Minuteman III, and mobile single-warhead ICBMs.

3. Numbers in parentheses assume a START counting rule of 10 warheads each for US ALCM bombers, eight warheads each for Soviet ALCM bombers, and the counting rule agreed at the December 1987 Washington summit of one warhead for each non-ALCM bomber. According to information released by the US Air Force on 16 October 1989, a standard load for the B-2, like the B-1, would be eight SRAMs and eight B-61 gravity bombs (Rowan Scarborough, "Air Force Defends B-2, Disputes Report," *Washington Times*, 17 October 1989, p.1). A full loading on a B-52G (H) is eight (twelve) ALCMs plus eight SRAMs and bombs. We assume that all the remaining B-52s under START are B-52Hs.

4. Four ALCMs per long-range nuclear bomber.

5. For the START II case, we assume that the SS-25 or a follow-on single-warhead missile will be put into either a hardened mobile launcher or silo.

6. Evidently the "heavy bomber exhibition" (at Urin air base in the Soviet Union in April 1990), during which the US was allowed to inspect the Bear-H bomber, indicated that the Bear-H could carry only six ALCMs in an internal rotary launcher. This is what we assume for the 1989 and START forces. See Thomas K. Longstreth and Richard Scribner, "Verification of Limits on Air-launched Cruise Missiles," in Frank von Hippel and Roald Z. Sagdeev, eds., *Reversing the Arms Race: How to Achieve and Verify Deep Reductions in the Nuclear Arsenals* (New York: Gordon and Breach Science Publishers, in press).

continued from page 6

Wanted: A Survivable Retaliatory Force

"We in the military would like to provide the National Command Authority with the flexibility to be able to ride out at least some portion of a nuclear attack if that should be necessary . . . we have been able to keep up with the capability to launch on warning, but to go beyond that takes quite a lot of investment."

— General Robert T. Herres, Commander of the North American Aerospace Command, testifying before a subcommittee of the House Committee on Government Operations, 26 September 1985

To be significant, a diversion under a US-Soviet fissile material cutoff agreement would have to be at least hundreds of times larger than the standard of significance for a diversion under IAEA safeguards: the amount of fissile material required to make a single crude nuclear explosive. Clandestine production activities on a scale significant in the context of the US-Soviet balance should be detectable by national intelligence supplemented by challenge inspections.

Once the inflow of new fissile material into the nuclear weapons complex had been halted, agreed amounts of fissile material, produced by the verified dismantlement of the warheads associated with delivery systems being eliminated under START II, could be moved out of the complex. A system to accomplish such verified dismantlement without divulging sensitive weapons design information was described by Ted Taylor in the May *Public Interest Report.*

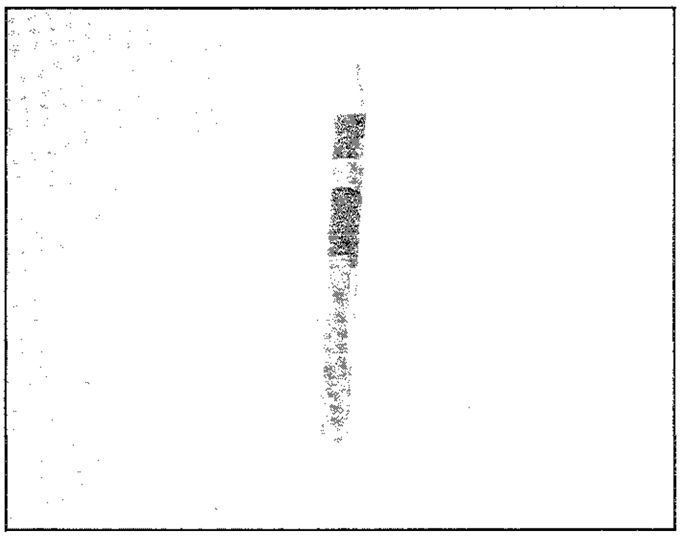
The verification of warhead declarations could most simply be accomplished by adding to the START declarations of the numbers of warheads on each deployed SLBM or ICBM, the numbers of warheads at bomber bases and storage locations—locations already well known to both sides in any case. Verification arrangements would include short-notice spot checks and challenge inspections.

The verification of past fissile material production would require an exchange of available production records, analyses of the consistency of these records with contemporary satellite photographs and other intelligence information, and examination of physical evidence such as certain long-lived components of production reactors. The next phase of the joint FAS-Committee of Soviet Scientists research project on arms reductions will include a more detailed examination of the feasibility of such "nuclear archaeology."

Conclusion

Much deeper reductions than will be achieved by START will be necessary to stamp out US and Soviet fantasies about large-scale counterforce attacks. Well-designed deep cuts could be stabilizing and verifiable. Considerable savings would also be possible, since expensive new weapons systems such as the Trident II and B-2 could be cancelled. ☐

Harold Feiveson is a senior policy analyst at Princeton University's Center for Energy and Environmental Studies. Frank von Hippel is a professor of Public and International Affairs at Princeton and Chairman of the FAS Fund.



"Midgetman" small ICBM in flight test

FAS PUBLIC INTEREST REPORT (202) 546-3300
307 Mass. Ave., N.E., Washington, D.C. 20002
Return Postage Guaranteed
June 1990, Volume 43, No. 6

Second Class Postage Paid at Washington, D.C.