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Thoughts on Verification of Nuclear Disarmament

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By
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It is my pleasure to be here to day to participate in this Conference. My thanks to the organizers for preparing such an interesting agenda on a very difficult topic. My effort in preparing my presentation was performed under the auspices of the U.S. Department of Energy by University of California, Lawrence Livermore National Laboratory under Contract W-7405-Eng-48. And as many of you know Lawrence Livermore National Laboratory is now, as of Oct 1st, under contract to the Lawrence Livermore National Security LLC.

There has been a long history of how to view verification of arms control agreements. The basis for verification during the days of SALT was that verification would be based on each country's national technical means. For treaties dealing with strategic missiles this worked well as the individual items subject to verification were of such a size that they were visible by the National Technical Means available at the time. And it was felt that the counting of missiles and launchers could be verified by our National Technical Means.

For nuclear testing treaties the use of seismic measurements developed into a capability that was reasonably robust for all but the smallest of nuclear tests. However, once we had the Threshold Test Ban Treaty, there was a significant problem in that the fidelity of the measurements were not sufficient to determine if a test was slightly above the 150 kt limit or slightly below the 150 kt limit. This led some in the US to believe that the Soviet Union was not living up to the TTBT agreement. An on-site verification protocol was negotiated in 1988 and 1989 that allowed the US to make hydrodynamic yield measurements on Soviet tests above 50 kt yield and regional seismic measurements on all tests above 35 kt of yield; and the Soviets to make the same type of measurements on US tests to ensure that they were not over 150 kt. These on-site measurements were considered reasonably intrusive. Again the measurement capability was not perfect and it was expected that occasionally there might be a verification measurement that was slightly above 150 kt. But the accuracy was much improved over the earlier seismic measurements. In fact some of this improvement was because as part of this verification protocol the US and Soviet Union provided the yields of several past tests to improve seismic calibrations. This actually helped provide a much needed calibration for the seismic measurements. It was also accepted that since nuclear tests were to a large part R&D related, it was also expected that occasionally there might be a test that was slightly above 150 kt, as you could not always predict the yield with high accuracy in advance of the test.

While one could hypothesize that the Soviets could do a test at some other location than their test sites, if it were even a small fraction of 150 kt it would clearly be observed and would be a violation of the treaty. So the issue of clandestine tests of significance was easily covered for this particular treaty.

When one considers verification of warhead dismantlement or nuclear disarmament, you must remember that the size of the objects that we are looking for could be placed in almost any railcar, any truck, and if one is willing to give up the usual shipping container, in the trunk of a car. The use of the standard National Technical Means is not viable for counting warheads if they are separate from the missiles that may carry them. And unlike the INF treaty where inspection of missiles leaving a plant was allowed to ensure that they were not one of the banned intermediate range missiles, the number of vehicles that would be subject to inspection in looking for nuclear warheads or parts of nuclear warheads would be a significant burden to inspectors and a hindrance to operations at a nuclear weapon manufacturing site.

A key item that one must remember about an on-site inspection regime dealing with nuclear warheads is that you are looking at sites that either we or they have identified as the places where warheads are located or where their manufacture or destruction takes place. But that does not rule out the existence of other places where this work could take place. And it raises the question of whether there is an obvious signal that cannot be easily concealed, like in the case of nuclear testing under the TTBT, that clearly alerts you to the potential of a violation. If there is a lack of confidence that the possibility of clandestine operations cannot be observed, confidence in the treaty verification regime can easily be eroded.

The DOE labs, principally LANL, LLNL, and SNL actually did extensive work on the issue of Warhead Dismantlement transparency in the 1990's. It is noteworthy that we called it transparency and not verification. And a substantial part of what was done was shared with the Russians. And a great deal of Russian work was shared with the US.

We did one exercise where a real US pit was measured (gamma spectrum and neutrons) in a system with an information barrier in the presence of Russian visitors to demonstrate the fact that warhead dismantlement transparency was possible. The system made gamma spectral measurements and neutron measurements such that it could determine that a container held weapons grade plutonium of approximately the right mass for the pit of a weapon. The information barrier provided only a yes / no answer as to whether the item, in its container, met the criteria or did not meet the criteria for a weapon pit.

It took us over a year to do the Red Teaming for this exercise to demonstrate to the various agencies in Washington that no classified information would be revealed in the demonstration. But we finally got permission to proceed. We were then delayed by the wildfire that swept through the LANL site and parts of the town. However, we did successfully complete this demonstration. We were hoping that the Russians would do a

similar demonstration of methods for warhead dismantlement transparency but they never did.

This first system could not be considered verification of nuclear disarmament, because even after this measurement we would not have been able to tell if this was a pit from a stockpile weapon or a pit from a stock of reserve pits, or a pit produced just to satisfy the objective of measuring the existence of a pit before it was destroyed, or that whatever we measured was simply returned to the stockpile.

A system to monitor the true reduction of nuclear weapons would need to encompass the entire nuclear weapons manufacture capability and deployments of the nuclear weapons of a country. One would need to monitor the number of weapon and/or pits being produced, and the number being destroyed, and have at least a declaration of how many existed at some point in time in the process of disarmament. The declaration would need to cover not only the active stockpile of nuclear weapons but also any and all inactive reserves or stocks of warhead components (namely pits). It would need to ensure that there was no method to produce and insert new weapons into this system through clandestine means. Such a system would entail far more intrusive processes than we have ever negotiated in any of the Arms Control agreements in the past. It may be possible but it would be an unprecedented step in transparency or verification.

But would this really satisfy those who would apply the standard of "effective verification"? The answer is almost certainly not. In earlier Treaties when we talked of effective verification there were observations that could be made through National Technical Means that could independently verify the declarations that were made by a state (in the past this was the Soviet Union). A verification regime that relies on on-site monitoring will in general always be suspect. Such regimes are like the person that lost his keys on a dark street walked up the street a few car lengths and was hunting for them under the streetlight. Someone asked why he as looking there and he answered "Because that is where there is light". In the same way on-site inspections are done where one has permission to look. But that will not answer the question of whether there are other locations or other activities that one should be observing that are at different locations.

The next issue in verifying nuclear disarmament involves the capacity to build weapons. As you know, currently the US has limited capacity to build new weapons. There has been a lot of talk about developing a "responsive infrastructure" that will provide the US the ability to maintain its stockpile in the future and to have the capability to respond to a build up by an adversary if needed. But it does not yet exist. However, if an adversary has a large capability to build weapons and we have a limited capacity to build weapons, there will be a perceived vulnerability under the assumption that a break-out from the treaty might occur. If the adversary can build a robust force in one year and for the US it takes five years, this will be viewed as a problem. So would or should a treaty dealing with nuclear disarmament take into account the break-out potential of the facilities and materials available to each party.

And finally there is what I call the virtual nuclear weapons states. States who have never built a nuclear weapon. If the US, Russia, France, the UK and China were all at very low numbers of weapons, could a state prepare to go nuclear by developing the infrastructure and technical expertise to become a nuclear weapons state. Then if they felt it was important to their national security objectives (defensive or offensive), could they quickly divert or use that infrastructure and expertise, originally built for other purposes, to produce nuclear weapons and become a nuclear power in a short time. One might say that is impossible today, and it might be. But will it be impossible in 25 years or 50 years. With the improvement in the understanding in the fields of physics, chemistry, and material science, I believe that it will be possible in something like 25 years.

So if we are to put the genie back into the bottle. We had better make sure that the bottle is still capable of containing the genie.

Compliments of Dave Brown: People can develop more than one genie, and we have to expect that when they put that genie back, they might hide some bottles.