

**Statement of John S. Foster, Jr.**  
**Before the Senate Armed Services Committee**  
**October 7, 1999**

Mr. Chairman, I thank you for the opportunity to appear before the Committee regarding the ratification of the Comprehensive Test Ban Treaty (CTBT). As the committee knows full well, this question involves not only the technical aspects of nuclear weapons but also important broader issues such as those connected with proliferation and arms control which involve political and economic initiatives. From my experience as a weapons designer and manager relative to defense matters, I will limit my comment to just the technical aspects of providing reliable and safe weapons to maintain deterrence against the threat of the use of weapons of mass destruction.

From that limited scope, I oppose ratification of the CTB because without the ability to perform nuclear weapons tests the reliability and safety of our stockpile will degrade. How it degrades and how quickly will depend on what we do. But more importantly, we will not know when we have inadvertently introduced a degradation. And we will not be able to prove that the stockpile is safe and reliable.

Mr. Chairman, those are strong statements. However, my sense is that others who have had the responsibility for designing and testing many different nuclear weapons will not dispute them.

Ratification of the CTBT would introduce a number of risks over the long term and the need to address them as best we can. Since you have already heard from the administration and the directors of the nuclear weapons laboratories on these matters, I will be brief.

The need for dependence on nuclear weapons has been expressed many times. For instance this last April, before this Committee, Edward Warner, the Assistance Secretary of Defense for Strategy and Threat Reduction stated:

**A**In summary, for the foreseeable future, the United States will retain sufficient strategic and theater nuclear forces to help deter any hostile future leadership with access to nuclear weapons from acting against vital U.S.

interests, and to convince such a leadership that seeking a nuclear advantage would be futile. U.S. nuclear forces also help deter an adversary's use of chemical or biological weapons as well. We intend to insure that our nuclear deterrent is safe, secure, reliable, effective and sufficient into the future, and will seek to achieve this within prudent fiscal guidelines."

The challenges facing the design laboratories and the production complex start with the need to assure that the stockpiled weapons continue to be useful. If a threat develops which requires that the US threaten the use of nuclear weapons, does our present stockpile contain the appropriate types for that future situation? Considering the dramatic technological changes that military systems are undergoing, it is hard to believe that the problems of deterrence several decades from now will require the same type of weapons as were required one or two decades ago. We should be prepared to change the types of weapons in our stockpile. Some changes are possible without testing, many are not. Similarly in the past, questions of nuclear safety have often come up unexpectedly, if such a question develops a safety test may be needed.

But even if we do not need to change the requirements placed upon our weapon systems, can we depend upon these weapons to just sit and remain reliable? All of these weapons were designed for a limited stockpile life. This was natural since the military requirements and delivery systems were expected to change and, more importantly, the materials in the weapons tend to be unstable, decaying themselves and often interacting with other components. The combination of radioactive materials and unstable organic materials such as the high explosives does not make for an inert object. After several decades these weapons are not the same as those which were confirmed as adequate by proof tests. We must be prepared to repair the damage which time has caused. But because of changes in what is now available in the US economy, changes due to the dynamics of the economy and due to health and safety rules, the repaired systems will be different than the original, tested systems.

The maintenance of almost all complicated technical systems involves a mixture of calculations, simulations and Alive@testing; few systems would

continue to operate successfully without all three, and especially the latter. In the case of nuclear weapons, their destructiveness has already limited the modes in which they can be tested, but the testing which has been performed over the years has clearly shown that our ability to calculate and simulate their operation is incomplete\_our understanding of their basic physics is seriously deficient. Hence I can only answer that a ban upon testing of our nuclear weapons can only have a negative impact on the reliability of the stockpile.

The current generation of nuclear weapons in the U.S. stockpile have been optimized to produce the maximum yield in the smallest size, lightest weight and still be safe. Think of them as devices that have been tuned as much by trial and error as by calculations. As a consequence their performance is very sensitive to small changes in material properties shapes and masses. And we don't know just how much maneuver room is available before unacceptable degradation occurs.

It is now the responsibility of the weapon designers to use their best techniques to judge which changes are acceptable and which are not. This is a judgmental matter; with care the likelihood of error is small but will always be there unless the judgments can be tested. I would expect that as time goes on mistakes will be made and deficiencies in our untested stock would grow in and eventually we will probably have an unreliable stockpile.

One of the purposes of the Stockpile Stewardship program is to improve the ``science" behind these details. For instance new experimental techniques are being developed that should improve our understanding of the physics of the behavior of materials in conditions similar to conditions in exploding weapons. These are expected to clarify some existing questions but they will only approximate the conditions desired. It is doubtful that their results can be shown to fully have settled serious uncertainties.

Without actual weapon testing, uncertainties will grow into our understanding of the stockpile. If we act in a conservative manner in repairing our weapons and if we carefully train our new designers and if we keep a well funded and imaginative Scientific Stewardship program, we should be able to

significantly slow the development of these deficiencies in the stockpile. However, no one can assure that deficiencies, unreliabilities, do not develop; only proof tests will do that.

The certification process will put difficult (indeed, unfair) "requirements" upon the design laboratories. They must determine what changes are to be made to a weapon and, if the indicated type of change is expensive, they are likely to be asked to be "reasonable". In the case of expensive fixes they may have to compromise between cost and confidence; yet they will have no way to evaluate the validity of their confidence.

What level of concern will justify an abrogation? It seems to me that a ratified treaty will make the problems more difficult than the informal present situation. One reason I think this is the continued debate concerning the present ABM Treaty, a treaty with a nation that no longer exists, which shows the persistence that treaties of this type have at least in our society.

The Test Ban Treaty is also a possible tool against proliferation of nuclear weapons; I am convinced that a small sovereign nation can obtain such weapons if its leadership is determined and has the funds. However, the existence of the Treaty is intended to encourage the community of nations to join in preventing such proliferation. As I indicated in my opening paragraph, the Senate will have to decide on the issue of the value of this aspect of the Treaty as compared to its wholly negative impact upon our own weapons.

Many of you will recall the 1958 "Gentleman's Understanding" on a moratorium on nuclear testing and the abrupt Soviet breaking of that understanding. President Kennedy, referring to the agreement said "Once fooled, shame on them; twice fooled shame on us." During the three years of that moratorium we made a great progress with our computer calculations and hydrodynamic experiments. When the Soviets broke the moratorium and we also went back to testing, we found out how badly we had fooled ourselves. We

had made lots of mistakes. I hope that neither our statesmen nor our designers are fooled this time.