

**House Armed Services Committee  
Strategic Forces Subcommittee  
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**Testimony of  
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Thank you for the opportunity to discuss an issue vital to the future national security of the United States – the transformation of our nuclear deterrent and the suite of capabilities that will ensure its safety and reliability for years to come. I strongly believe that these transformations can only be done following a rigorous analysis of the requirements for nuclear weapons in a rapidly changing world. There are four key questions that must be addressed:

- What is the mission for nuclear weapons in the twenty-first century?
- What weapons are required to meet this mission?
- What is required to sustain these weapons?
- How can this capability be provided at minimum cost and risk?

I will address each of these in turn.

**Nuclear Weapons in the Twenty-First Century**

The fundamental role of nuclear weapons is the same today as it was during the Cold War – to provide an unassailable deterrent force that assures any aggressor that they cannot win a military engagement that threatens the survival of the United States. While the basis of deterrence remains intact, the means by which we support that deterrence will certainly change. Some missions, such as holding at risk mobile missiles containing weapons of mass destruction, no longer require nuclear weapons for their success. Advanced conventional weapons on long-range delivery platforms can accomplish the same thing without the use of nuclear explosives. However, there are other assets, such as deeply buried weapons facilities and very large targets, that are beyond the capabilities of any conventional weapon. Only a nuclear weapon can hold these targets at risk and fulfill the fundamental mission of deterrence by assuring an adversary that they cannot shield offensive capability that could be used against us.

**Types and Numbers of Nuclear Weapons**

We will need fewer nuclear weapons in the future due to changes in the geopolitical environment and because non-nuclear weapons can replace nuclear weapons in certain missions. However, I believe that a rigorous analysis of nuclear missions may reveal that current weapons are ill-suited to future missions for two reasons. First, the high yields of some current weapons are not required for most future missions. Second, the very sophisticated nuclear weapons designs of the past are difficult to maintain and lack desirable security and safety features. High performance nuclear weapons are no different from high performance automobiles in this respect – each requires care and maintenance to avoid mission failure.

It would be counterproductive to maintain an arsenal of very high yield weapons when smaller, safer weapons are actually better tuned to the mission. This does not mean that we should make more “usable” weapons. I strongly believe that the United States should be among the last nations to use a nuclear weapon for the simple reason that our superb conventional forces can handle military contingencies short of all-out strategic war on several fronts. Indeed, the United States should do everything that it can to reinforce the mystique surrounding nuclear weapons and the notion that any nuclear use would cross a fundamental threshold in international affairs. Nuclear weapons – regardless of their yield - are weapons of last resort designed to deter or destroy an existential threat to our interests.

### **Sustaining Our Nuclear Deterrent**

All of the nuclear weapons in our arsenal were designed during the Cold War. None were intended to last for the very long periods currently anticipated and none are able to be remanufactured “just the way we made them” due to changes in material availability and manufacturing.

I do not believe that the United States will be able to sustain its current nuclear arsenal indefinitely without nuclear testing. There are three alternatives:

1. Accept lower confidence in our current weapons
2. Replace our current arsenal with more robust designs
3. Return to some level of underground nuclear testing.

Nuclear weapons are extraordinarily complex objects that achieve conditions found nowhere else in nature outside of exploding stars. They are highly compact and were designed to employ the minimum amount of nuclear materials to achieve their mission. Some of the materials and processes that were used in their manufacture are no longer available – either because they were deemed a risk to health and safety or because we no longer have the capability to make them. Using new materials and manufacturing processes is certainly possible, but doing so introduces small changes into the weapon, the effects of which we can only estimate. We can be confident of the safety and performance of our nuclear arsenal today – the issue is how long that confidence can be maintained.

An alternative to maintaining old designs is to introduce new ones that are easier to maintain and have larger margins than our existing weapons. The Reliable Replacement Warhead is a step in this direction. It is intended to improve our ability to maintain an existing military capability; hence it is not a new nuclear weapon. It is based on tested designs so it has a demonstrated pedigree. And it is capable of being manufactured and maintained into the future. However, the RRW is only a step toward the transformation of the nuclear stockpile, one that depends on the requirements analysis discussed above.

I see no specific technical issue that would demand a return to nuclear testing, but I also appreciate that science – including the science behind nuclear weapons - proceeds through an interchange between theory and experiment, between hypotheses and the testing of hypotheses. NNSA’s Advanced Strategic Computing program has achieved extraordinary progress since its inception – we now have supercomputers that can perform over one thousand trillion calculations per second, enabling unprecedented levels of detail to be included in a computer simulation of a nuclear explosion. But science requires a balance of theory and experiment. Any experienced scientist will tell you that it is entirely possible for even the most powerful computer

to get the wrong answer because of gaps in our understanding of underlying phenomena. The National Ignition Facility will play a vital role in accessing conditions close to those occurring in a nuclear weapon, but we must also maintain an ability to perform experiments on weapons-scale quantities of plutonium and high explosives: experiments that can only be performed at the Nevada Test Site.

### **The Role of the Nevada Test Site in Maintaining the Nuclear Deterrent**

The Nevada Test Site (NTS) is a 1375 square mile NNSA facility located approximately 60 miles northwest of Las Vegas, NV. Originally established as a continental test site during the early years of the nuclear weapons program, it has evolved into a unique multi-function national security asset.

NTS is the only location that can perform experiments with weapons-relevant quantities of plutonium and high explosives. These do not involve a nuclear explosion, hence the term “sub-critical experiments”, but they can include all of the engineering and material features involved in a real weapon. For example, scientists can take a newly-manufactured plutonium pit and high-explosive assembly, place a measuring device at its center, and compare the quality of the implosion of remanufactured components to original factory-produced items. They can measure the subtle effects of aging on weapons implosions. In a subcritical experiment, everything happens as it would in a nuclear detonation – the high explosive is detonated and the plutonium is imploded - but the assembly never goes critical and hence produces no nuclear energy. These experiments are conducted safely and securely in our U1a facility, located 963 feet below the desert floor 76 miles from Las Vegas.

The Device Assembly Facility (DAF) at NTS was intended as a facility in which to build nuclear explosives for underground tests. It is a modern facility with outstanding security. Approximately one third of DAF will be occupied by the Critical Experiments Facility, which will house nuclear experiments moved from TA-18 at Los Alamos National Laboratory. This leaves over 40,000 square feet of nuclear-certified space for other national missions at a time when new nuclear space costs on the order of \$65,000 per square foot to construct.

The JASPER gas gun at NTS is a high-precision cannon that fires projectiles at small samples of plutonium to measure plutonium’s response to intense shock waves, such as are found in an operating nuclear weapon. We know that we don’t know enough about plutonium and JASPER is filling in key aspects of our understanding.

NNSA’s Complex Transformation plan envisions moving all open-air high explosive testing to NTS. Our Big Explosives Experimental Facility (BEEF) currently conducts a wide range of high-explosives experiments safely and far from residential areas. (The closest residence to BEEF is in the small town of Amargosa Valley, 36 miles away.)

The Non-Proliferation Test and Evaluation Complex (NPTEC) can release toxic materials such as chlorine into the air to measure vital parameters associated with a possible terrorist attack involving chemicals. At the other extreme, the chemically clean nature of our desert environment enables NPTEC to test sensors for detecting minute quantities of materials associated with foreign WMD activities. Industrial firms come to NTS to train their personnel in realistic chemical environments, improving their ability to respond to real-world emergencies.

NTS is the only place where substantial quantities of special nuclear materials can be brought out into the open to test nuclear detectors for the Department of Homeland Security and others. Detectors being considered for placement at border crossings and other locations were tested at NTS.

NTS has trained over 60,000 first responders in how to deal with a radiological emergency. We work closely with organizations as diverse as the New York City Police Department and United States Central Command to enable detection and neutralization of threats to our country and our troops abroad. Much of our work in the area is classified, but field commanders have repeatedly noted that technology provided by NTS saves lives in Iraq and Afghanistan.

### **Complex Transformation**

Nuclear weapons are not scientific curiosities - they are real objects that require maintenance and occasional remanufacture. The weapons fabrication capability in the United States is in dire need of refurbishment. Some buildings, dating from the early 1950's, are literally falling down and simply need to be replaced. Others require substantial modifications to comply with modern safety and security regulations. NNSA's Complex Transformation plan uses current military requirements to define a weapons complex that can satisfy future needs at minimum cost. However, this plan was based on a large stockpile of weapons that may not represent the best picture of the future. It is vital that the United States conduct an "end to end" review of its nuclear needs and the capabilities required to meet those needs. Only after we know how many and what types of weapons we must maintain for national security, and then identify those activities - science, engineering, and manufacturing - needed to ensure the deterrent, can we identify the facilities required to perform those activities.

There is a base set of capabilities that must be maintained no matter how many weapons we require. NNSA must maintain a capability to manufacture plutonium pits, a capability that employs unique skills and technology and one that is unique to the nuclear weapons mission. While the production capacity will depend on the size of the stockpile, the time required to effect a significant build, and the anticipated life of existing pits, the existence of a production line is essential, just as it is in maintaining other special-purpose production lines such as those related to submarines. A similar argument can be made for maintaining a uranium production capability, ability to manufacture high explosives, and assembly/disassembly operations on weapons.

While part of the nuclear weapons complex is old and expensive to maintain, other facilities are new, capable, and underutilized. Before building new buildings and machines, we should ensure that those currently available are fully utilized. This may require shifting missions from one site to another, always a difficult proposition, but the alternative is to spend billions of dollars to maintain a capability at a specific site while other space stands idle.

The United States is at a crossroads in its nuclear forces. The geopolitical environment has changed with the breakup of the Soviet Union and the proliferation of nuclear weapons to other countries. New technologies have arisen that reduce the need for a large nuclear weapons stockpile. We have the opportunity to redefine the notion of deterrence in the post Cold-War period and size the NNSA complex to meet the needs of the future. Thank you again for the opportunity to share these thoughts with you.