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Thank you for inviting me to come and speak about deterrence and U.S. nuclear policy. My research on these topics has benefited from the support of American University, the Program on Science and Global Security at Princeton University, and the Carnegie Corporation of New York. The views expressed here today are my own.

This subcommittee is asked to make choices to maintain a safe, secure, and effective nuclear deterrent. That task would be easier if you knew exactly when our deterrent would be challenged – which adversary, where they would act, and with what. It would also be easier if we could agree on the best response, the consequences of that choice, and our willingness to pay the price for our actions. But the future is unknowable. So, we have to predict – to make an educated guess and then consistently seek to analyze, critique, and refine that guess to make our national security stronger.

Deterrence is an elusive goal. Besides not knowing exactly when or how an adversary might challenge us, deterrence requires psychological profiling – what does the adversary hold dear, how much do they tolerate risk, how rational is their decision making? We also need to know how they understand when we will use nuclear weapons and the consequences of that use. Unfortunately, these things are often difficult to know in advance, reasonable people may disagree on the answers, and our adversary's behavior may change over time or with circumstances.

Yet we have to translate the political and psychological relationship that is deterrence into force structure – to research, design, procure, field, and train with the weapons and people that constitute our deterrent. Usually, however, when we discuss force structure, the uncertainties of deterrence get solidified into "requirements," suggesting that replacing the Ohio-class submarine, modernizing the ICBM force, being able to produce 80 pits per year are all "required" to maintain deterrence. Once something becomes a requirement, it tends to be assessed as a function of cost and schedule rather than its contribution to deterrence and whether there might be better options.

Today I want to reframe these questions of force structure as choices about deterrence, not "requirements." My hope is that doing so will help identify alternatives, make clear the tradeoffs that are at stake, and highlight some considerations that should not be ignored.

I'll begin with GBSD. Before coming today, I reviewed previous testimony on this, and other issues related to nuclear force structure and strategy. Originally, the argument made for GBSD was based mainly on cost: it is cheaper to modernize than to sustain. When independent analysis suggested otherwise, the argument shifted – Minuteman III cannot be sustained, it has to be replaced. That has also now been called into questioned. Today, arguments for GBSD increasingly discuss new threats that can't be covered by Minuteman III. Thus, GBSD is a "requirement" for deterrence.

To decide whether to pursue GBSD, sustain Minuteman III, or reduce ICBMs requires understanding the alternatives for covering this new set of targets. For example, are we worried about a new technology that applies to the entire Chinese nuclear arsenal, makes it more capable, and thus only GBSD can hold it at risk? Or are we talking about a small set of targets? If the latter, can those targets be held at risk by submarine-launched nuclear weapons?

Most importantly, to what extent does deterrence depend on holding at risk this set of targets? If the SSBN force can hold at risk 95% of the nuclear targets in China, is it worth the estimated $264 billion life cycle cost of GBSD to increase that to 97%?

This is not a rhetorical question. The imbalance between the arsenal necessary to meet military "requirements" and the existing stockpile has been an enduring characteristic of U.S. nuclear decision making. In the early 1960s, Secretary of Defense Robert McNamara argued that assured destruction of the Soviet Union would require the ability to destroy 20-25% of the Soviet population and half its industrial capacity. McNamara translated this analysis of what could plausibly deter the Soviet leadership into 400 one-megaton warheads. At the time, the United States has just under 18,000 megatons in its arsenal. McNamara felt that he needed to translate deterrence into a precise requirement otherwise it would be difficult to constrain spending on nuclear weapons.

More recently, in 2012, the military concluded it could meet all necessary military requirements with about 1,000 deployed strategic warheads rather than the approximately 1,550 we have now under New START. This suggests that the size of our arsenal is derived from something other than military requirements and that there is room for significant reductions without compromising deterrence.

Let me offer another example that links decisions about GBSD to deterrence by looking at our competition with Russia. Some argue that a modern ICBM force is necessary because it "complicates" Russia's calculations. Because U.S. ICBMs can quickly deliver a devasting attack on Russian nuclear forces, Russia would have to spend a significant portion of its nuclear arsenal targeting U.S. ICBMs, leaving Putin with perhaps only one-third of his nuclear forces to respond to the inevitable U.S. retaliation. U.S. ICBMs, and the million or so people who live around them, "soak up" incoming Russian nuclear weapons. Such an attack, so the argument goes, would both ensure a devasting U.S. response, plus leave Russia with far fewer forces to retaliate. Knowing this, Russia is deterred.

This argument rests on a number of problematic assumptions about how to deter Russia. First, if the United States had no ICBMs, the "smaller" Russian attack – typically assumed to include targeting our two nuclear submarine bases and the three Air Force bases with nuclear missions – would likely kill a million or more Americans, potentially destroying Seattle, part of northern Florida, Shreveport, as well as other locations. The casualties would increase significantly if Russia's "smaller attack" were expanded to include a few nuclear command and control targets, such as Washington, DC. Surely Russia would have to assume that any U.S. president would likely use nuclear weapons in response to such an attack. If that's the case, then the ICBM sponge is not necessary for deterrence.

A second assumption is that if the United States had a smaller ICBM force or none at all, Russia would be less likely to be deterred because, after any initial attack, Putin would have a larger retaliatory force with which to threaten the United States. This argument assumes that deterrence is a function of comparable levels of retaliatory capability – that victory after a nuclear war goes to the side that has the most remaining nuclear weapons. A counter argument is that Russia is deterred by the over 200,000 kilotons of nuclear yield the United States has on submarines. In a counterforce attack, this would kill approximately 30 million or more Russians and destroy most of Russia's ability to sustain any war, while still holding some weapons in reserve for use against China. For ICBMs to be a requirement for deterrence, proponents need to make the case that Russia's past actions show it is willing to risk this level of destruction rather than be deterred by it.

One could object to these examples, arguing that a "bolt from the blue" or intentional nuclear attack is no longer the primary threat that needs to be deterred. Instead, the need is for low-yield nuclear options to control escalation and credibly deter Russia's supposed plans to use nuclear weapons to offset its conventional inferiority. But there is reason to question whether low-yield options are "requirements" for deterrence.

Support for low-yield nuclear weapons is predicated on the assumption that escalation can be controlled. Deterrence, in contrast, is based on the notion that controlling escalation is unlikely. After the first even limited nuclear use by Russia, to what extent does U.S. credibility dictate that the president responds, not in kind, but with just a bit more? This is supposedly the logic behind escalate-to-deescalate – that you threaten to ratchet up the violence to make your adversary back down. If both Russia and the United States adopt this logic, then escalation is unlikely to be controlled and the use of even low-yield nuclear options runs a significant risk it will lead to mutually assured destruction. From the perspective of deterrence, low-yield nuclear options are not a requirement, but rather a tool for brinksmanship and competitive risk taking.

Let me offer yet another example of how to reconsider the debate over modernization as a question of deterrence: the production of pits for nuclear weapons. We are told that pit production soon and on a large scale is vital because without it nuclear weapons may not function as specified in military "requirements."

If nuclear weapons don't work, then deterrence suffers. This is because deterrence rests on the capability to inflict damage – the ability to hold at risk things the enemy values. But the current debate over pit production is not about whether the weapons will work but how well they will work.

Military requirements for weapons performance are classified, but presumably members of this subcommittee can be briefed on these requirements and the degree to which they may suffer if pits do not function exactly as intended. For example, if we have 90% confidence that a nuclear weapon will explode on target with 98% of its anticipated yield, does that deter less than a weapon in which we have 95% confidence? Given that we have about 1,550 warheads deployed, plus perhaps twice that number in the hedge, how many of these weapons have to work at what level to deter? Or do we have enough redundant capability to at least call into question the need to spend $18 billion (or likely much more) on the "required" pit production capability?

To summarize, if deterrence is the objective, then the process by which we have been considering modernization can be improved. It can be improved if we remember "requirements" are actually choices – one alternative among several. Our choices about modernization need to consider each component of the nuclear arsenal as part of a collective contribution to deterrence, not in isolation from one another. Instead, it appears we do the opposite – as Admiral Richard told the House Armed Services Committee in April of this year, the triad is designed to meet all presidential requirements even if one leg is lost. This suggests that the triad is composed of redundant, not complementary capabilities.

Additionally, choices about modernization can improve deterrence if we remember that the most important costs are not fiscal. Instead, we need to consider that too much modernization is dangerous – that our modernization might provoke our adversaries to modernize, innovate, and expand their arsenals. Such arms race instability – recognized as a danger since the 1950s – has an impact on our national security because it diverts money and emphasis from other tools of national power, including the strength of our economy and the health and safety of Americans.

Some will suggest that Russia and China do not base their nuclear weapons choices on U.S. actions. If that is the case, then our conception of deterrence has a fatal flaw because deterrence is inherently based on the assumption that our actions – the threat of pain and the denial of gain – influence the choices of our adversaries. Moreover, the frequent use of Chinese and Russian modernization as a justification for U.S. modernization suggests we certainly respond to their actions.

Let me close by addressing one more assumption that is fundamental to deterrence: rational decision making. Deterrence assumes leaders can weigh the costs and benefits of their actions, at least to some degree. But anyone who has ever been involved in a crisis understands that assumption is unrealistic. This is confirmed by a vast literature from foreign policy decision

making, behavioral economics, and behavioral psychology that repeatedly shows people rely on a variety of less-than-rational shortcuts, especially in a crisis and when the stakes are high, information is either missing or uncertain, and time is short.

We know from past research that people tend to assume the current situation is “just like” one they recently experienced, or make a decision on the basis of a “gut feeling” rather than analyzing the data. In a crisis, people tend to assume their motivations are clearly understood, or that they are more in control of a situation than they actually are. Of particular concern is the tendency in crises for people to be biased towards risk taking rather than playing it safe. Given that in a nuclear crisis, the president is likely to have 15 minutes or less to make a decision, that would suggest that the area we should modernize is our thinking about how and who gets to decide if the United States launches nuclear weapons.