National Institute for Deterrence Studies & Peter Huessy Seminar

Nuclear Testing Explained: History, Risks, and the Road Ahead

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Abstract

This National Institute for Deterrence Studies (NIDS) virtual seminar examines the evolution, consequences, and contemporary relevance of nuclear testing in the context of global deterrence, strategic stability, and national security. Bringing together leading technical experts and senior policy practitioners, the roundtable explores how nuclear testing shaped the development of the U.S. nuclear arsenal, informed deterrence theory, and influenced arms control norms from the Trinity test through the end of U.S. yield-producing testing in 1992.

The discussion traces two major eras of nuclear testing—initial yield expansion and subsequent miniaturization for missile delivery—before turning to the post-testing era of science-based stockpile stewardship. Panelists assess how advances in high-performance computing, experimental facilities, diagnostics, and subcritical testing have enabled the United States to maintain confidence in the safety, security, and reliability of its nuclear deterrent without explosive testing. Particular attention is given to the role of transparency, open science, and stewardship reporting in reinforcing deterrence credibility.

The seminar also addresses unresolved strategic and policy questions surrounding the nuclear testing moratorium, including verification challenges, the implications of potential low-yield or hydronuclear testing, and the opportunity costs and risks associated with resuming yield-producing tests. Panelists present differing perspectives on whether exclusive reliance on stockpile stewardship remains sufficient in an increasingly multipolar and competitive nuclear environment, particularly in light of Russian and Chinese modernization efforts.

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Concluding discussions emphasize the need to situate nuclear testing debates within a broader framework of integrated deterrence, alliance assurance, escalation control, and emerging forms of warfare. Rather than offering prescriptive conclusions, the seminar underscores the importance of historical understanding, rigorous technical assessment, and strategic clarity as policymakers consider how best to sustain effective deterrence and reduce the risk of nuclear use in the decades ahead.

Executive Summary

This NIDS virtual seminar convened senior technical experts and experienced policy leaders to examine the historical role of nuclear testing, the evolution of U.S. stockpile stewardship, and the strategic implications of continued adherence to the nuclear testing moratorium in an increasingly complex global security environment. The discussion underscored that nuclear testing is not a narrow technical issue, but a multifaceted question that sits at the intersection of deterrence credibility, alliance assurance, arms control norms, and strategic risk management.

The seminar began with a historical overview of U.S. nuclear testing, tracing the program from the Trinity test in 1945 through the cessation of yield-producing tests in 1992. Panelists highlighted two distinct testing eras: an initial period focused on expanding yields and weapon types, followed by a second phase emphasizing miniaturization and integration with missile delivery systems. This testing legacy—more than 1,000 U.S. tests—provides a uniquely deep empirical foundation that continues to inform confidence in the U.S. nuclear arsenal.

The discussion then turned to the post-testing era and the development of science-based stockpile stewardship. Panelists emphasized that stewardship is an active, disciplined enterprise, not a passive maintenance function. Advances in high-performance computing, experimental facilities, diagnostics, and subcritical testing have enabled continuous assessment of weapon health, performance margins, and aging effects without explosive nuclear testing. Transparency mechanisms, including congressionally mandated reporting and selective open scientific publication, were identified as deliberate tools for reinforcing deterrence credibility through demonstrated confidence.

A central theme of the seminar was the distinction between **scientific justification** and **policy justification** for nuclear testing. From a technical perspective, panelists noted that modern diagnostic and computational tools now provide insights that were not available during the testing era, raising questions about the marginal scientific value of renewed yield-producing tests. At the same time, verification challenges—particularly at very low yields—remain significant and complicate enforcement of a strict zero-yield standard.

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From a policy and strategic perspective, panelists offered differing assessments of whether exclusive reliance on stockpile stewardship remains sufficient. Some argued that continued restraint supports stability, reduces proliferation incentives, and avoids granting adversaries disproportionate learning opportunities. Others cautioned that long-term deterrence credibility, particularly in a rapidly changing threat environment marked by Russian and Chinese nuclear modernization, may require reconsideration of testing assumptions if new capabilities are deemed necessary.

The seminar further explored how nuclear testing debates intersect with broader deterrence challenges, including alliance assurance, escalation management, and emerging forms of warfare that prioritize precision, system disruption, and critical infrastructure vulnerabilities over large-scale destruction. Participants emphasized that deterrence effectiveness ultimately depends not only on technical performance, but on adversary perceptions, political judgment, and strategic communication.

The discussion concluded with a shared recognition that nuclear testing decisions cannot be evaluated in isolation. They must be integrated into a coherent theory of deterrence that accounts for today's multipolar dynamics, technological change, and alliance relationships. While the seminar did not seek to produce a single policy recommendation, it highlighted the importance of historical understanding, rigorous technical analysis, and strategic clarity as the United States considers how best to sustain a credible, stable, and effective nuclear deterrent into the future.

Unabridged Transcript

(Note: there will invariably be some word errors in the following transcript.)

00;00;07;10 - 00;00;41;28
Kimberly Cherington
Good morning, everyone. I'm Kimberly Cherington, and on behalf of the National Institute for Deterrence Studies, or NIDS, it's my pleasure to welcome you to today's seminar, Nuclear Testing Explained: History, Risks in the Road Ahead. Our NIDS roundtable features expert panelist Dr. Don cook, Dr. Laura Berzak Hopkins, Henry Sokolski, and the Honorable David Trachtenberg. Some of our favorites today for a discussion on how nuclear testing has shaped global deterrence, diplomacy, and public safety.

00;00;42;01 - 00;00;54;08
Kimberly Cherington
Please join us next week as we host Mr. Sean McDonald Laboratory Directorate of Weapons Production at Los Alamos National Laboratory, advising NNSA leadership and coordinating discussions on and decisions on the integrated Plutonium program across the nuclear security enterprise. We hope you can join us for that. Now, throughout today's presentation, we encourage you to submit your questions in the

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chat box or the Q&A button at the top of your screen.

00;01;13;20 - 00;01;34;27
Kimberly Cherington
We'll address those during the designated Q&A portion of today's seminar. Now, it is my pleasure to introduce to you...we're waiting on Peter Hussey. So, I'm going to introduce our president of the National Institute for Deterrence Studies, Dr James Petrosky, who'd like to welcome our speakers today. Jim.

00;01;35;00 - 00;01;51;23
James Petrosky
Yeah. Thank you. Kimberly and I believe Peter just got in. We had a couple of technical issues, but, thanks for giving me the floor to say thank you to our elite panel. I don't want to take up much of their time. But we've been waiting a long time to have this panel discussion, and it's probably going to follow on with others.

00;01;51;25 - 00;01;54;09
Peter Huessy
Yep. Go ahead. Don, you're up.

00;01;54;12 - 00;02;22;26
Don Cook
All right. Thank you. Peter. Kimberly. Jim, you know, the title of this is Nuclear Testing Explaining History, risks, and the Road ahead. And so, I'm going to begin by covering the history in a very brief way. So, the first test, as most of you know, was called Trinity. It was at Alamogordo, New Mexico, in July 16th, 1945.

00;02;22;28 - 00;02;34;03
Don Cook
The first NTS, Nevada Test Site underground test was called uncle. That occurred in November 1951.

00;02;34;06 - 00;03;10;10
Don Cook
July 19th. I'm sorry. 17, 1962. There was a limited test beam treaty. Agreed. And after that, just for historical reference, there were 828 underground tests at NTS that followed until 1992, when testing was stopped by, George Bush Jr. I'm sorry, George Bush senior prior to Bill Clinton, who extended the moratorium. The last underground test was called divider.

00;03;10;13 - 00;03;48;14
Don Cook
It occurred September 23rd, 1992. All in all, more than a thousand nuclear tests were carried out by the US. And now I'm going to quickly go through a couple of phases of that test. And the first era, ran from 1945 through 1962. The main objectives of those tests were to get more types of tests, even including something that we knew was the Davy Crockett, which was a shoulder launched projectile that had a nuclear explosive on it.

00;03;48;16 - 00;04;24;29
Don Cook

Sounds risky today, but that was that was done in those times. And so, getting more types and specifically larger yields was the objective. The B 53, which was a gravity bomb, basis was a test called hardtack Oak. It was conducted at any wet talk. June 28th, 1958, if you recall, or you're a student of history, you know that key parts of that island were just removed by the, that test was not in the underground test area.

00;04;24;29 - 00;04;55;24
Don Cook
That was in the above ground test area, both in Nevada and elsewhere. Now, for a moment, just to understand the impact of these weapons, the B 53 yield, which is now declassified since the last unit was disassembled in October 2011. I recall this very specifically because Parliament went out and Nevada, I was heading defense programs from 2010 to 2015.

00;04;55;24 - 00;05;25;10
Don Cook
And, we were able finally to talk about that, the yield of that weapon, once the last one was taken apart, that yield was 9 million tons of explosive. Now, for reference, Hiroshima, about 20 kilotons. Nagasaki. But over 20 kilotons, but not much. And so, the yield of the B 53, if I did the correction is, is like, 450 times that.

00;05;25;11 - 00;05;58;28
Don Cook
I get that right. I think so. So just huge for reference, the total ordnance used by the U.S. in World War two was 3.3 million tons. And so now when you think about both the history and the future of nuclear weapons, I'm asking you to recall that in a single weapon and we had hundreds of them, the yield exceeded three times the explosive ordnance of all the bombs used by the US in World War two.

00;05;59;01 - 00;06;34;01
Don Cook
That's a historical point. And that was the point at which the peak yield of the first era, running from 45 to 62, was achieved. Secondary, I'll say, ran from 1963 to 1992. And in that era, the main objectives were to reduce the size and the weight for missile deployment. As we look around other nations of the world, they may be in that phase to achieve the capability to launch system intercontinental.

00;06;34;04 - 00;07;07;12
Don Cook
For reference, I lived through but, many of you almost certainly did not the launch of Sputnik by the USSR, which was a surprise. What was recognized by the US and certainly by Russia, was that any missile that could boost satellites into orbit could also carry weapons, across continents. So that was a big wake up. In 1959, the US deployed the Atlas booster for deployment in Titan.

00;07;07;12 - 00;07;36;27
Don Cook
One and a year later in 1960. And this is not a coincidence. John F Kennedy announced the goal of getting a manned safe to the moon and returning safely to the Earth. Now, there were two tracks. One was peaceful development of systems for space exploration, but the other was, it was well known that was going to put the real focus on, missile development for a nuclear deterrent.

00;07;36;29 - 00;08;05;01
Don Cook
So those were the first and second eras. In that second era, the objective was to reduce the size and the weight while keeping reasonably effective yields as much as possible. And so, if you think of an alphabet going from A to B to C, maybe we're at the stage of SRT these days. These systems are quite finely tuned.

00;08;05;01 - 00;08;30;22
Don Cook
And we stopped testing present era Israel, the stockpile stewardship and management area. I suspect that Laura is going to talk more about that. I'll briefly touch on a couple of things. Computational capability since 1992 has increased more than a million times, and it's moving on now to being 10 million times more than we had at the end of testing.

00;08;30;24 - 00;09;02;20
Don Cook
High energy density facilities have been developed. The national mission solely at Livermore, the Z machine at Sandia and Omega, which does only unclassified experiments at the University of Rochester. And then we have a wide range of hydrodynamic facilities, the Jasper Gascon, which can use plutonium, Nevada dirt at dual axis radiographic hydro test capability of Los Alamos that cannot use plutonium contained firing facility at Livermore.

00;09;02;22 - 00;09;36;17
Don Cook
You want a now called pulse? Nevada. And what's coming into place now is the enhanced capability for subcritical experiments with the Scorpius accelerator. Now, I'm coming to the conclusion, and I'll just get a couple of things for you to think about. First, what's the real benefit of an underground test? It's probably having a discernible go- or no-go event, you know, either proves that that a bomb will work or not work.

00;09;36;19 - 00;09;59;00
Don Cook
In that era, we have other diagnostics as well. Pinhole X-ray images and neutron images. Certainly. That could be done, too. Let me turn for a minute to the benefit of EMC, and I'm going to talk quickly. It's going to be rather technical, but the objective is to determine the position of plutonium at all times during scaled weapon configurations.

00;09;59;00 - 00;10;22;24
Don Cook
So, you take up here. I won't say how big that is because you're classified. You sort of see my hands and you shrink it down to a smaller size, but keep all the weapon configuration, and implode that with high explosive real plutonium after doing surrogates. And what we have now is the ability to get one flash during an implosion.

00;10;22;24 - 00;10;53;13
Don Cook
What we'll have in the next generation going to place now is the ability to get four times. There was a key innovation. I've just got one thing to show you, and it looks like this. This is a photonic Doppler velocimetry.

No big words, but it works like, light bouncing off the inside of a pit. So, think of yourself at the inside with all the walls of plutonium now rushing toward you.

00;10;53;18 - 00;11;22;02
Don Cook
What our capability going in place will do is just like you hear a train moving past you. Going even. That's the Doppler effect. At first the sound is compressed, and later on the sound kind of expanded. So, it changes frequency, high explosive and flows things fast enough. You can see a Doppler shift in as many as a thousand points of light in a single event.

00;11;22;04 - 00;11;50;05
Don Cook
And the blue shift and the timing give you both velocity and position. And using neutrons as diagnostic gives you density. Achieving those things. There's something we could never get in the past in underground testing, and it is, powerful. The combination is powerful. At this point. I'm going to stop. Move on to Laura. But I thank you for your attention.

00;11;50;07 - 00;12;30;23
Laura Berzak Hopkins
Great. Excuse me. Thank you so much, Don. I appreciate the passing of the baton. And, and also really appreciate building from the history that you've just provided. I'm going to walk us through, a little bit on, what has what has come for the weapons complex, since the cessation of testing. And, I'll, I'll start with, a question posed to, to the brand-new weapons designer, and, and that question is, when was the last time the U.S. used our nuclear arsenal?

00;12;30;26 - 00;12;54;29
Laura Berzak Hopkins
And the answer, which often catches people by surprise is that, we use the US nuclear arsenal every day. This is our strategic deterrent, and it is the communication of our global power. Our deterrent is safe, secure and effective. And we don't we don't just hope that this is the case. We don't just wish it to be true.

00;12;55;01 - 00;13;30;10
Laura Berzak Hopkins
We certainly don't guess this to be true. This is true, and it's not by accident. It’s not solely due to the innovations of the weapon years. Who came before the current generation. This has been made true and affirmed through the multi-decade endeavor, which is the style stewardship program. And with the cessation of yield, producing nuclear tests in the U.S in 1992, we built from, really the illustrious history that Don has just walked us through.

00;13;30;12 - 00;13;58;09
Laura Berzak Hopkins
And from 1992 onwards, we entered this new era of stewarding the U.S stockpile. And that that term stewarding. It's really important. What does stewarding mean? It's far more than just caretaking. So, this is not the case of dusting bomb cases in some storage silo and, and, you know, looking with, with the saw mill, it looks pretty good.

00;13;58;11 - 00;14;37;13
Laura Berzak Hopkins
Absolutely not. Of the stewarding of the stockpile is the active process of detailed monitoring and surveillance of weapon health. And this is an undertaking that bridges from empirical observation to predictive capability. And so building from that illustrious test history and moving beyond estimating trends to quantifying and controlling for sensitivities. And that that is the the genesis, the motivation for what we have been working on in the complex and establishing an enduring foundation for which is science-based stockpile stewardship.

00;14;37;16 - 00;15;04;19
Laura Berzak Hopkins
So, for more than 30 years now, the complex has been working to develop, and in many ways, it's a triad in its own right. So, it's, it's computation that includes the advanced high performance computing. It also includes the theory and the algorithms that capture that theory. And then the, algorithm capturing that theory that can run on that advanced supercomputing.

00;15;04;19 - 00;15;47;01
Laura Berzak Hopkins
So, this compute component, it includes the experimental component. And so that's the data generation. It's the access to detailed material behaviors and physical phenomena with the associated diagnostic developments that give data collection at the requisite level of fidelity. And it's the people, it's the skilled workforce who can utilize these, these tools and who are confident enough to ask probing questions, to explore those questions, to to look at uncertainties and unknowns and identify what type of experiments are needed to go after those unknowns.

00;15;47;07 - 00;16;24;00
Laura Berzak Hopkins
What type of modifications to the theory need to be, included to address those unknowns? And then how do we assure that we fully understand that we validate, we verify, and we have a broad set of trusted tools that we can utilize. And so stockpile stewardship has been this, very purposeful and deliberate, disciplined approach to weapon surveillance, life extension, and this development of predictive capabilities that factor together into a very deliberate annual continual assessment of the state of health of the stockpile.

00;16;24;07 - 00;17;00;16
Laura Berzak Hopkins
And, and an assessment of, confidence and safe, secure and reliable. When we think about deterrence as a whole, which is the function of our stockpile, we can boil it down to these three C's of deterrence. So, capability, credibility and communication and, and it's very important that we think about, not just the, the specific, implementation scenario, but what are our end goals?

00;17;00;16 - 00;17;28;24
Laura Berzak Hopkins
What are we trying to enable? What are we trying to deter. And how does that factor within this consideration of overall deterrence, construct deterrence theory and really pushing on those three pillars, capability, credibility and action. And so, when we when we look at how does stockpile stewardship fit within that capability, credibility and communication? I'd like to highlight a couple of key examples.

00;17;28;26 - 00;17;58;26
Laura Berzak Hopkins
So, one is the annually issued and congressionally mandated SSMP stockpile Stewardship and Management plan. This is a document that is an NNSA document, and it's written and authored by NNSA leadership as well as contributors from across the labs, plants and sites. And this is absolutely part of U.S communication about our stockpile, about challenges that the complex is facing.

00;17;58;26 - 00;18;28;29
Laura Berzak Hopkins
And we are the only nation that has this level of transparency. And I will argue that that's not accidental. We are able to have this level of transparency because we have this level of confidence. And it's not it's not misplaced or uncertain confidence. So, we move forward with this type of transparent communication. At the other piece is in thinking about how does stockpile stewardship factor within, the, the three C's of deterrence?

00;18;29;01 - 00;18;55;01
Laura Berzak Hopkins
We openly discuss in open journal publications and conferences, beyond the SSMP document, which goes through at a high level, different capabilities and aspects of the complex. We also put forth detailed science, of course, it's unclassified and it's very carefully, derivative classified to assure that the appropriate material is being released and sensitive material is not.

00;18;55;03 - 00;19;27;10
Laura Berzak Hopkins
But that open science is, in many ways, it's a way for us messaging that this is the, the tip of the iceberg. So, this is the unclassified material that we release to the global community. And this unclassified material is frankly, it's a demonstration of preeminent scientific innovation and achievement. And it's a demonstration of U.S. technical prowess, the tip of the iceberg, in the sense that this is what we talk about openly.

00;19;27;16 - 00;20;00;28
Laura Berzak Hopkins
And you, you know, that there's the bulk of the iceberg, below the waterline. And so, this is the open science that we speak to. And the message is clear that there's an extensive quantity, the bulk of the science below the waterline that we don't speak to. So, these three seas of deterrence, capability, credibility, communication, it factors into how we think about what the scientific capabilities are being developed and how are we communicating them and thinking about, moving forward.

00;20;00;28 - 00;20;28;24
Laura Berzak Hopkins
So, stockpile stewardship has been this established capability for 30 more than 30 years now. And so what comes next? The Strategic Posture Commission report that was released, I think in 2023, someone can date. Check me on that. It spoke to entering a new global era. This era of multipolarity and shifting geopolitical stability.

00;20;29;01 - 00;20;56;18
Laura Berzak Hopkins
And it highlighted the need for consideration of new and/or different weaponry. The knowledge, tools and capabilities in the workforce that's been honed through, what I'll term the first generation of stockpile stewardship are quite literally purposed built. So, so established on purpose, to meet the challenges of today and also be ready to meet the challenges of tomorrow and those same tools, knowledge, capabilities, people are positioned to address this, this changing demand and to enter into what we could consider SSP 2.0 Stockpile Stewardship program. The second generation. And we need to ask ourselves, what role do nuclear weapons play in this changing environment. And that factors into what is our theory of victory? What does success look like? Does the historical view of targets to hold at risk and then the accompanying weapon number and associated yields?

00;21;33;13 - 00;22;14;10
Laura Berzak Hopkins
In many ways, that starts to feel less applicable in today's world. And today's deterrence strategy of non-kinetic types of adversarial advances as well as evolution of, of modern weapons themselves, the high precision weapons and with other forms of, yield and destructive capability. And so, in thinking about nuclear testing in this current environment, I find it very important to separate the scientific justification from any type of policy justification.

00;22;14;12 - 00;22;50;04
Laura Berzak Hopkins
So I've, I've walked through a lengthy description of the capabilities of science-based stockpile stewardship and, and, and thinking about any, scientific justification for testing, it's important to look at that cost benefit analysis, including the associated opportunity costs. So without doubt, the yield producing tests that Don walked us through, provided extensive value at the time and frankly, continue to provide, an incredible foundation that only the U.S and, and Russia, can leverage.

00;22;50;10 - 00;23;23;04
Laura Berzak Hopkins
And so that is a unique point for us, for the confidence in our capabilities and confidence in our stockpile, that the incremental knowledge that we, the U.S, would gain, would likely pale in comparison to the learning opportunity that would be afforded to other nations. And that that's the concern that breaking the current moratorium this is a concern, the opportunity cost that if the U.S were to break this current global moratorium, it is not unlikely that other nations would consider pursuing the same.

00;23;23;07 - 00;23;59;06
Laura Berzak Hopkins
That is likely destabilizing. Certainly, has environmental and, and societal risks overall reducing the taboo on implementation through creating craters, may also raise the likelihood the comfort level with actual state implementation and in in the kinetic interaction and the incremental knowledge again, that the U.S would gain, it, it is an open, open question on how do we compare that with the potential leaps and bounds that another nation with a less robust existing test history could, could look to?

00;23;59;08 - 00;24;23;17
Laura Berzak Hopkins

There's also the financial burden of testing. It's quite high. It's not just making a hole in the desert in order to have useful information from a test. It requires extensive diagnostic needs. There has to be a purpose. We also have to ask the question of how do we think to an individual test. So, there's in any experimental capability, there's rarely a conclusive experiment. And any type of nuclear test is by definition a surrogate for any employment scenario. And we're not using a delivery vehicle, etc.. So, it becomes a slippery slope on moving from, one test inconclusive to a single test to a series of tests to a multiple theories. And that financial burden can be, can be a stranglehold on how we think about developing integrated capabilities.

00;24;50;28 - 00;25;39;12
Laura Berzak Hopkins
And it doesn't provide us with something that we build upon. As fascinating as overlooking the sedan crater. Is it the Nevada Test site? I have not come across anyone who would identify this as some type of enduring infrastructure. That we can build from and expand. So I'll, I'll conclude on, a note which is pushing on, distinguishing between a stratagem for deterrence, comprising tactical, individual, responsive components that we, we seek to force, other states or adversaries into a cost benefit calculus and decision making, versus a global strategy of deterrence, where we're considering an integration of capabilities and employment options across timelines and the purpose protecting our homeland, our allies, and our global priorities. And so, we sit here at this challenging moment in time and potentially at the cusp of a new world order. So, it's critically important that we think about our history, what we have established, how do we leverage that for enduring success into the future? And, and how do we how do we build from here?

00;26;00;20 - 00;26;09;05
Laura Berzak Hopkins
So, with that, I'll, I'll pause. I look forward to discussion and I'll happily turn the microphone over to, my colleague Dave Trachtenberg.

00;26;09;07 - 00;26;31;05
David Trachtenberg
Yes. Thank you. Laura. I want to thank Peter Tucci and NIDS for the invitation to participate in this roundtable discussion. I also want to thank my distinguished colleagues on the panel for their perspectives. They have much greater technical knowledge than I do. I'm just a policy wonk. And I'm no expert on the technical aspects of stockpile stewardship.

00;26;31;07 - 00;27;11;22
David Trachtenberg
But I'd like to make three brief observations. First, I have no doubt that we have gained tremendous knowledge from the Stockpile Stewardship program. However, I would suggest that acknowledging its historical and contemporary value may actually be sort of focusing on the wrong issue here. The relevant question, in my opinion, is whether the United States should continue to abide by the nuclear testing moratorium and rely exclusively on stockpile stewardship to ensure the US deterrent remains reliable and credible now and into the future.

00;27;11;24 - 00;27;49;22
David Trachtenberg
Now, I don't doubt the remarkable modeling and simulation capabilities of our stockpile stewardship

enterprise, but I do question whether such substitutes for explosive testing can guarantee the reliability and credibility of our nuclear deterrent, and extended return in perpetuity under the existing test moratorium. My own view is that such a course is increasingly risky, and that there is a deterrent value in resuming nuclear testing, but perhaps that's a broader discussion for another day.

00;27;49;24 - 00;28;18;24
David Trachtenberg
Nevertheless, my second observation from a policy perspective, is that many of the arguments in favor of continued exclusive reliance on stockpile stewardship are flawed. For example, the notion that US testing will open the floodgates to testing by others, including Russia and China, and that those states have more to gain from a resumption of nuclear testing than the United States assumes.

00;28;18;29 - 00;28;53;09
David Trachtenberg
Assumes that others will inexorably follow the US lead. In other words, if we test, both Russia and China will too, and a new arms race will follow, or so the argument goes. In reality, the notion of a U.S driven action reaction arms race dynamic is false. As a National Institute study several years ago demonstrated, look states act in their own interest based on their own threat perceptions, security considerations, and strategic goals and objectives.

00;28;53;13 - 00;29;32;22
David Trachtenberg
They do not simply parrot U.S actions. Moreover, the corollary argument that U.S restraint is a necessary prerequisite to engender adversary restraint is similarly flawed. In my view. In the U.S. government's opinion, China and Russia have not refrained from nuclear testing, even though the United States hasn't conducted an explosive nuclear test in more than three decades. So, the U.S government has confirmed that American restraint has not resulted in similar restraint on the part of America's nuclear adversaries.

00;29;32;25 - 00;30;18;12
David Trachtenberg
In that respect, Russia and China have presumably already gained at least some additional knowledge where the United States does not. But more importantly, perhaps most importantly, in my mind, is my third observation, and it's one that rarely, if ever, gets discussed in this context. And that deals with the road ahead. The world we face today is arguably more dangerous than ever with both America's, with both America's major nuclear adversaries building and deploying and threatening to use nuclear weapons in support of their own strategic goals and objectives.

00;30;18;15 - 00;30;50;18
David Trachtenberg
The nuclear modernization programs of both Russia and China are extensive. Over the past few years, Russia has modernized virtually its entire nuclear triad and developed a range of new, more exotic nuclear weapons. China is apparently no longer content with a second-rate nuclear arsenal and is building out its own nuclear triad, greatly expanding its strategic and non-strategic nuclear missile forces.

00;30;50;20 - 00;31;27;12
David Trachtenberg

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And based on recent published reports, China's nuclear tests are intended to completely transform its nuclear arsenal into the world's most technologically advanced. This raises the issue of whether the United States needs to augment its own nuclear arsenal with additional capabilities, and if so, can those new capabilities be developed and deployed and serve as credible deterrence without nuclear testing?

00;31;27;15 - 00;31;50;02
David Trachtenberg
As my colleague Keith Payne has noted, the question of testing is not only about whether the existing nuclear stockpile is safe, reliable and effective, but about what nuclear capabilities are needed for the future to deter and hedge against emerging threats. And what are the implications.

00;31;50;25 - 00;32;30;03
David Trachtenberg
Testing as a bipartisan strategic posture, Commission acknowledged, the current nuclear modernization program of record was initiated in the Obama administration when the threat environment was much more benign than it is today. If we need to augment our own nuclear capabilities to strengthen deterrence against growing nuclear threats from major adversaries like Russia and China, either independently or working together in concert, then I believe a sensible argument can be made in favor of a resumption of nuclear testing.

00;32;30;05 - 00;32;55;25
David Trachtenberg
And let me close with this thought. It's difficult for me to understand why we require every weapon in the US arsenal to be fully tested, except for the nuclear weapons on which our ultimate deterrent rests. Of course, I could be wrong. As I said, I'm only a policy wonk. But let me stop there. I look forward to the discussion.

00;32;55;25 - 00;33;01;22
David Trachtenberg
And, I'll turn the microphone over to my friend and colleague, Henry Sokolski.

00;33;01;24 - 00;33;09;08
Henry Sokolski
All right. How's that? Can you hear me? Okay, well.

00;33;09;10 - 00;33;41;02
Henry Sokolski
First of all, I want to thank Peter and the Institute for putting this panel together and allowing me to contribute. The folks here have actually educated me a bit further. I it's quite interesting, but I think, David is right. The only thing more dangerous than physicists being diplomats could be us fuzzy heads trying to be technical.

00;33;41;04 - 00;34;11;26
Henry Sokolski
And, we need to be careful to understand our limitations here. I will try not to make many technical remarks. The person who has influenced me the most, and I would encourage. I don't know how you get

him to talk publicly. Is Bruce Goodwin, and I recommend his insights. I try to reflect on them by quoting him in an article, which I placed in the chat room.

00;34;11;26 - 00;34;34;18
Henry Sokolski
You can look at that. I will really restrain myself from referring to those arguments, some of which I think Laura has already made, and they're quite interesting. In any case, I think the current debate over yield testing, let's be clear, there's lots of testing going on. It's the kind of testing we're debating about, and it's not do we test or not test?

00;34;34;18 - 00;35;08;27
Henry Sokolski
It's do we yield test or not? And I think that debate has been focused on some pretty narrow technical things. How might the Russians and Chinese cheat on their pledges not to yield test? What advantages would they gain from yield testing? What might we gain? Technically, if we did yield testing now, it's fascinating, particularly to people like me, that listen to this debate, because I don't know much about it and I learn things.

00;35;08;27 - 00;35;41;22
Henry Sokolski
But of course, what we fuzzy heads learn from technical debates may not enable us to reach sound conclusions. Why is that? Well, there are a lot of soft things that matter. Maybe more than anything, that can be resolved by listening to people debate about the merits and the anon merits of yield testing. What we need to think about are some of the non-technical points of the debate that are not getting much attention.

00;35;41;24 - 00;36;12;28
Henry Sokolski
That is, I think, how much might we gain? And this was raised again by Laura, which I thought was pretty good. How much might we gain in our ability to deter adversaries and to win rewards? By doing yield testing? Does it help us forget what the other guys are doing for the moment when you know it's America first, second could yield nuclear testing, increase the prospects for proliferation or reduce them?

00;36;13;03 - 00;36;40;00
Henry Sokolski
This was raised, by the way, I don't think you can answer it. And I'll give you another counterfactual to give you a headache, but it might slow you down to think about this because you hate to be fueling that fire. Because, you know, I do think the more folks that have these weapons, it reduces our agency as a nation on international affairs and a minimum and.

00;36;40;00 - 00;37;02;07
Henry Sokolski
Yeah, you know, and on a really bad day, someone might pop one of these things off. Who knows that that oil and don't want that could yield testing increase. You know, what else might help achieve these objectives? Now I am going to deviate from my promise not to be technical at all but just raise some historical points.

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00;37;02;10 - 00;37;31;02
Henry Sokolski
So, we get by with simply overengineering. You know, the Israelis have a nuclear arsenal. Don't tell anybody. They don't test very much. But last I checked, I mean, you know, maybe once in the South Atlantic, it's best. Not maybe. Probably definitely there. But what was once over the long time ago. France. Also, I don't think people sit around thinking, well, well, well, the French weapons go off.

00;37;31;04 - 00;38;07;00
Henry Sokolski
You know, they may not choose to use them, but they probably go off. They don't test. Why is that? My hunch is they add metal, and we've done this with one weapon. At least the 80. It was so high performance. It didn't work. And, I'm told. And so, we added metal. Now, even if we could satisfy ourselves that our weapons were 100% what we wanted them to be, whether, you know, any kind of testing, I think there's another set of problems that are really soft and really important.

00;38;07;03 - 00;38;37;22
Henry Sokolski
I know Keith Payne is looking at this, and that is, you know, how reliable do our allies think we are to back our nuclear guarantees? And how credible does Russia and China think our threats to use these things might be against them. Those concerns are not something that is determined by anything technical, really, or at least not very much, but a lot of other things.

00;38;37;24 - 00;39;05;20
Henry Sokolski
And, you know, we're going through the traps on that right now because some people in Europe are nervous and we're frightened that the Chinese may think, well, blank. So, you know, these concerns are not going to be addressed by whether we do the kind of testing we're doing now versus the doing yield testing. In addition, I mean, my guess is it's not terribly leveraged on those fronts.

00;39;05;22 - 00;39;39;04
Henry Sokolski
Now, might there be other ways to shore up the nuclear and non-nuclear extended deterrence guarantees I mentioned in passing at one gathering? And I keep doing it. I really am enamored of this idea of an escrow account that Bruce Bennett at Rand where we get them, our allies, to pay to refurbish things we are going to get rid of, dismantle, keep the weapons here in the States, harden facilities for the possible storage at some later date, if there was a crisis in...like Yeah, like we do normally with any close nuclear guaranteed ally.

00;39;39;07 - 00;39;57;24
Henry Sokolski
My guess is that would give you quite a lot. Now, I don't know whether it would work to keep these countries from going nuclear eventually. I don't know, but we ought to be trying that or at least thinking about it.

00;39;57;29 - 00;40;29;27

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Henry Sokolski
But, you know, maybe I'm wrong. Do we have missile defenses that cover our allies? You know, are they good enough? Do we have. And do we want to share hypersonic systems that are accurate, that can hold, China and Russia and Iran, everybody else at risk, you know, do we want to share that kind of technology, let's say, with Australia, which is very vulnerable.

00;40;30;00 - 00;40;52;14
Henry Sokolski
And I'm concerned about that because my wife came from Australia. Hypothetical. So nonproliferation, I think, David, you're right. It can't know whether if we do it, someone else will do it. Okay. But you can't. No, it goes both ways. It's a point of for people who are nervous. They, they should bite their nails.

00;40;52;14 - 00;41;30;23
Henry Sokolski
Still, I think another one is if we go ahead and test, it really probably will be seen or could conceivably be seen as a thumbing of our nose at our allies. Why they've all ratified the comprehensive test ban. Now, put aside that that thing is in desperate need of clarification. If we go ahead and we don't, take any of their counsel, this could push them to think, once again, we don't care about what they think about their defense that could, you know, caused problems in a lot of ways.

00;41;30;24 - 00;41;58;23
Henry Sokolski
And again, I can't prove that any more than, you know, the other argument, but it's something policy people should be thinking about. You know, a lot of things in policy you can't prove, but you still should think about them. So that's the hypotheticals. I think, meanwhile, I have to tell you, the chattering classes both on the left and right are getting attracted to the argument that, well, you know, more might be better.

00;41;58;26 - 00;42;29;28
Henry Sokolski
You know, it might save some money if everyone had nukes and everything will deter. We had wonderful experiences about deterrence in the First and Second World War. Surely if the munitions nuclear work even better. I'm being sarcastic because it was an enormous failure. So, you know, that talk is coming up. I think because of that throwing, testing and activity into the mix, you know, you got to wonder about those arguments I said that are hard to prove.

00;42;30;00 - 00;42;35;26
Henry Sokolski
You could be igniting a big problem. I think if we were serious about these soft points, we would be at least as concerned about a whole list of things we do not want to talk about. You know, will the Ukraine war be resolved in a fashion that isn't coercive? You know, depending on that, people might reach the conclusion that you can't trust the United States.

00;43;00;11 - 00;43;24;07
Henry Sokolski
How are we going to supply nuclear submarines and fuel to South Korea? Are we going to let them get to the edge of, making, more generally, how are we going to deal with Chinese and Russian challenges to

force deployments of nuclear weapons? They argue it violates the NPT. Are we going to say anything about that? We have how are we going to manage security guarantees south in Saudi Arabia, Quatar, that we've given. How are we going to deal with Turkey announces it wants to get nuclear weapons. The answer to these questions I think, you know, really make this testing debate look small. I'll end on one note. Many years ago, Richard Perle made the argument that testing was a nonproliferation initiative because it would make everyone realize that our deterrent was effective and it was so effective, they didn't need to get them.

00;43;57;10 - 00;44;29;16
Henry Sokolski
Fred.... was in the room, his eyes rolled and Richard had to defer to Fred. And Fred said, you know, of all the uncertainties, the policy and military planners would have if we shot one of these things, the exact yield would probably not be on the top five list, but somewhere closer to 50 to 100. I think he had a point there, and we need to think about that.

00;44;29;18 - 00;45;03;25
Peter Huessy
Okay. Thank you. Henry, I have a question for Laura and David. I'm going to have to combine because I've got about 20 questions in here in the chat, but I'm going to just arbitrarily, it's a combination. Chris Yeaw has said that the Chinese engaged in a small test go back to 1999 and Yeltsin's decree build small yield, very usable battlefield nuclear weapons, which I believe is what Putin has been doing.

00;45;03;28 - 00;45;30;10
Peter Huessy
Given what the Chinese did, the question is, do the Chinese... is what they're gaining is, in fact, the ability to develop battlefield weapons and would restraint on our part saying we're not going there, give us a disadvantage given what they're doing? Or is it going to help us? And, Laura, why don't you take that and we're at....we've got about 11 minutes left now.

00;45;30;10 - 00;45;42;20
Peter Huessy
Sorry about the time, but if you... we'll send all these questions to guys anyway and you can on your leisure, answer them however we may want and we could post those as well. But Laura, go ahead.

00;45;42;22 - 00;46;25;03
Laura Berzak Hopkins
Sure. Thank you for the question. So, a couple of initial thoughts. One is pulling the thread on Henry's closing comment that in thinking about employment scenarios and the different uncertainties that impact the uncertainty in the outcome, yield is likely rather low on the list in terms of concerns over the, the resulting uncertainties. So, from that perspective, there are a huge number of ways that the U.S already engages in development and confidence building measures for our weaponry and our delivery vehicles.

00;46;25;05 - 00;46;51;08
Laura Berzak Hopkins
So, so from what, from what China may be learning, from Russia, Russia attempted to learn, the U.S. has not been sitting and dusting bomb cases. The U.S has been developing delivery vehicles and accuracy, and

many of the other enabling components for really affecting the desired outcome in that type of...scenario.

00;46;51;10 - 00;47;31;02
Laura Berzak Hopkins
The, the other the other piece that I'll make reference to in terms of thinking about the, the more narrow issue on what would what yield producing testing enable versus not when we are thinking about, exploring quantum computing, we are not pursuing resurrecting UNIVAC to do that. And so, I think really thinking about bringing modern capabilities to modern challenges is where it's very effective to point, as opposed to, looking back to our history and resurrecting aspects.

00;47;31;05 - 00;47;35;01
Laura Berzak Hopkins
So, let's, let's look ahead and build on the modern capability.

00;47;35;03 - 00;48;08;04
David Trachtenberg
Yeah, very briefly. Peter. Let me just say, I think only the Chinese leadership understands the rationale behind what it is they're doing and why they're doing it. Yeah. And now the Chinese do have an extensive nuclear modernization program underway. If you if you buy the, the, reports from the U.S government, the statements, Chris Yeaw and others, the Chinese have been conducting nuclear the kinds of nuclear testing that presumably support the programs, their own modernization program.

00;48;08;04 - 00;48;42;03
David Trachtenberg
So, you know, that they're going forward with does this put the United States at a disadvantage? I would argue that that the US continued U.S. restraint while U.S. major adversaries are proceeding along the lines that, you know, in which they're proceeding does potentially put the United States at a greater advantage, because it also affects the perceptions, of allies as well, to whom we extend our clear umbrella, our, our, our extended deterrent in terms of the reliability of the United States.

00;48;42;06 - 00;49;14;25
David Trachtenberg
So, my concern is, is that we are seeing adversary developments being supported. Through modernization programs and testing activities that are inconsistent with our zero-yield standard. And we are not sort of in the same game and the perception of us not being in the same game, I believe, runs the risk of lowering the credibility of our deterrent threats.

00;49;14;28 - 00;49;20;01
David Trachtenberg
So, I do see that as an asymmetric challenge.

00;49;20;03 - 00;49;51;10
Henry Sokolski
Dave, let me ask you...I mean, my understanding is, just one test is hundreds of millions, if not a billion. By now, reliability testing for any given design, I'm told, requires multiple tests of the single design. That is a lot of money and a lot of time. If we put out more weapons, as we are proposing to do weapons designs,

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without that, that wouldn't be enough, number one.

00;49;51;10 - 00;50;16;09
Henry Sokolski
The next question and I'll stop is, I think, the problem of verifying, decoupling is really challenging, but are we proposing to threaten to test that yield, to try to get talks, to double down on what that verification would require? Or are we saying we don't want to go down that route?

00;50;16;12 - 00;50;28;18
David Trachtenberg
No, I think, Henry, I think I think the real question is, do we need nuclear testing, if we decide that we need to augment our arsenal with more modern weapons...

00;50;28;18 - 00;50;29;19
Henry Sokolski
Yield testing....

00;50;29;25 - 00;50;57;11
David Trachtenberg
Yield testing, and so, yeah, that's what I'm talking about. That's exactly what I'm talking about when I, when I talk when I talk about nuclear testing, I'm talking about yield testing. The question is and I'll defer to Don and I'll defer to Laura on this for the technical aspect. But if we intend to develop new kinds of weapons, for whatever reason, to try to offset what we see adversaries doing, the question in my mind then becomes, do we actually need to?

00;50;57;13 - 00;51;21;22
David Trachtenberg
I'm not talking about explosive testing for reliability purposes. Vis-A-Vis the existing stockpile I'm talking about. I'm asking, do we need to conduct yield producing explosive tests to ensure that any new weapons we may want to develop as part of our, our greater deterrent, are required, but I think that's more.

00;51;21;22 - 00;51;47;00
Peter Huessy
Henry, please, I've got to go over to Don cook. Don, I have a two-part question, and I know you've got something else, but here's the issue. The people have talked about. Without testing, we're making LEP work more expensive. Number one. Number two, how would you enforce a genuine zero yield CTBT? And then third, I think you have a question or comment you want to make anyway.

00;51;47;03 - 00;51;51;06
Peter Huessy
So, if you can address those two issues, and again we're down to five minutes.

00;51;51;13 - 00;52;17;12
Don Cook
Yeah. I'll be quick. I want to address and provide some more information to the audience. Really. So, the first point is, I will say having a verifiable zero yield testing, in my opinion, I'm a technocrat, not a political

person, is pretty much impossible. I think that we can verify, maybe down to a fraction of a kiloton.

00;52;17;12 - 00;52;47;12
Don Cook
I'll be careful not to express that fraction, but, I will, say again, I headed the atomic weapons establishment as the director for four years. When the North Koreans were testing and there is worldwide capability that is really fantastic. And so but verifying below some level is really, really difficult. So, for policy, people might begin thinking, you know, what's the benefit of hydro-nuclear, for one.

00;52;47;12 - 00;53;20;15
Don Cook
Does an actual test with a full size, pit or primary, but only, the technical jargon is “tickles the dragon.” And, you know, this is where a technical debate ought to be had I alluded to that at the beginning, saying, what the capability of testing might be at a very low level and what the ability of non-yield producing testing, as Henry said quite accurately, is now I want to address quickly another thing.

00;53;20;17 - 00;53;44;15
Don Cook
Let's see the yield was talked about lots of discussion of modernization in China. And Russia developing low yield systems. If you recall and know the details, the US put the W 76-2 in place a few years ago specifically to alleviate a concern about a lack of proportional response. I don't need to say any more here.

00;53;44;17 - 00;54;13;00
Don Cook
On that topic, the third is stockpile Stewardship. Originally got a bad idea, and I think that David referred to a little bit about this, that, you know, the, it's all about simulation experiments are happening. When I came back from heading into we, we too had defense programs. My biggest concern was we weren't pushing plutonium with high explosives in a weapon relevant geometry.

00;54;13;03 - 00;54;24;10
Don Cook
And so, within two years, from 2010 -12, I challenged the labs. And by the end of 12, they had done exactly that. It goes on from there. Back to you, Peter.

00;54;24;13 - 00;54;47;06
Peter Huessy
And the last question has to do with how do we react to what Russia's threats, which have been... you can count between 30 and 40 or even 60 for Putin or some of his colleagues have threatened the use of nuclear weapons with respect to the Ukrainian theater, there are a couple issues that have come in the chat function, which is what should we do in terms of countering such threats?

00;54;47;09 - 00;55;14;23
Peter Huessy
Two, I was intrigued by Laura's comment that we may have to change our deterrence strategy, but in the interim, I would think we'd have to keep at least what's now on the table. And third, the issue is, should we counter specific questions... Should we counter the Russian threats by redeploying something like the

neutron bomb or the sea launch cruise missile, which we'd have to develop in and get in Europe?

00;55;14;23 - 00;55;25;23
Peter Huessy
Now, I know we have two minutes or maybe even less, but, when we start with Laura and then go to David and then Don Cook, if we have a little time, we can go back to Henry.

00;55;25;26 - 00;55;30;23
Henry Sokolski
Thank you for considering me.

00;55;30;25 - 00;55;59;04
Laura Berzak Hopkins
I really appreciate this discussion. Because these are critical issues that, really a deep thought is required in order to disentangle the competing concerns and priorities and really look toward, what is our theory of victory and victory described in a set of different ways? What is our end goal and what steps do we need to take in order to get to that end goal?

00;55;59;04 - 00;56;40;10
Laura Berzak Hopkins
So, when we when we think very, very tactical and granular, we are likely to miss the forest, for these trees. So, one point that I wanted to make, which is, sorry, Peter, only peripherally related to your actual question. It's just a I don't want to miss the opportunity to note. We cannot undervalue the strength in messaging that the adversary may need to resort to yield testing due to their low confidence in their capabilities and to their limited ability to design and to explore parameter space.

00;56;40;12 - 00;57;09;14
Laura Berzak Hopkins
We in the U.S do not suffer from that limitation. So, I want to make that point there. I think the important question is that Peter actually did ask is to disentangle, what do we need the integrated deterrent structure to look like both today, tomorrow and into the future. And then what are the associated test and modernization capabilities that we need to bring to bear for that?

00;57;09;16 - 00;57;19;27
Laura Berzak Hopkins
I think absent that, clear direction, vision and path, we're flying a little bit blind in terms of assessing a test or not.

00;57;19;29 - 00;57;23;04
Peter Huessy
Don or David, either one.

00;57;23;06 - 00;57;49;01
Don Cook
Yeah. I'll go, I'll go quickly. Peter. Another fact with a thousand nuclear tests, by my opinion, knowing the details, we have roughly a stockpile of 300 designs. I don't see a need for underground testing to develop

new designs at this point. Most people don't have access to the record. Don't know how many different designs we tested.

00;57;49;01 - 00;58;23;05
Don Cook
And even if you want to direct what I say, then we have more than 100 designs. So, to a very good point that Henry made about, you know, you can add more metal. I said at the very beginning, we were kind of if you think of the alphabet up to the SRT. range, very high yield, very low weight, we can go back to R Q P, and we have a whole set of things we can do of already tested designs, should we choose to put them in the stockpile.

00;58;23;07 - 00;58;51;01
Don Cook
And we do not have any treaty at all that prevents us from putting previously fully tested designs into the stockpile. That's the point I think we have in mind there what we need to, to deal with Russia or China. My principal concern remains, do we understand everything in that whole set of a thousand tests? And there are still a few but very few uncertainties in the primary physics model.

00;58;51;04 - 00;59;07;12
Don Cook
That's what we're going to get from Nevada with the subcritical testing, pushing plutonium with high explosive, not producing yield, but determining exactly, where it is, how fast it's moving and its density. That's it for me.

00;59;07;15 - 00;59;08;14
Peter Huessy
David.

00;59;08;16 - 00;59;42;05
David Trachtenberg
Yeah. Peter, real quickly, I would say that, look, deterrence is more than just the technical aspects here. It's the technical aspects. And it's also the policy slash political small aspects as well, whether deterrence works effectively or reliably or not is really in the mind of the deteree not the deterrer. Okay. And so, unless you can get into the mind of an adversary or an opponent and understand what's motivating their behavior and what redlines they have, you know, we have to make political judgments.

00;59;42;05 - 01;00;09;14
David Trachtenberg
We have to make policy judgments. The technology assist may assist us for that, but ultimately, we have to rely on subjective policy judgments based on the best information that we have at our disposal. So, the answer is short answer to your question in terms of deterring Russia or what have you is in my view, it's more of a policy judgment than a technical...than the technical one.

01;00;09;17 - 01;00;32;10
Peter Huessy
I agree, I'm intrigued and when Henry put out two years ago a picture of a globe, and I think he had 20

nuclear powers, and he said, if you're one of the nuclear powers and someone is threatening to use a nuclear weapon, how many different problems do you have to deal with in terms of the other 19 potential nuclear aspirants and users?

01;00;32;13 - 01;00;39;11
Peter Huessy
And it got to the point where it was like, you're going to throw up your hands and go on vacation. Let's go. Henry, you get the last word.

01;00;39;11 - 01;01;11;03
Henry Sokolski
Last word. I'll try to be brief. We are transitioning, as was mentioned by Laura to New Generation Warfare, where the emphasis on physically decimating and threatening to decimate military, industrial and demographic capital, which was very popular in the Second World War, is not going to be the coin of the realm. It's going to be hitting nodes, disabling temporarily, if not permanently, so that you can win without physically wiping out.

01;01;11;03 - 01;02;02;06
Henry Sokolski
Now in this transition, you're right, we need weapons. But I think from what I've heard, we have more than enough opportunities to hedge with new weapons and with the things that I've raised to allow us to make that transition. I think it's really important that you not see use before them. And I know we can't determine exactly what might prompt folks to get nuclear weapons and use them, but I would think emphasizing by testing when we don't absolutely need to, when we have so many other things we need to do, including, by the way, non-nuclear testing to make our satellites hard against nuclear effects, that sort of thing needs to get more emphasized than the syllable of this narrow debate.

01;02;05;00 - 01;02;29;13
Peter Huessy
You know, I hear you, I was I had a conversation with Governor Gilmore years ago after his commission report, and he said we identified 32 critical nodes in the United States in our infrastructure that if even a portion of them were taken out the United States economy would collapse. And it's interesting, before he died, Soleimani said, I know where your 32 critical nodes are.

01;02;29;15 - 01;02;56;25
Peter Huessy
And I was amazed because obviously he'd read the Gilmore report or something about it, but he understood that. And I was just yesterday talking to some of the folks down in Barksdale at Global Strike about how critical nodes have taken down make our military bases inoperable. So even if the base itself is not attacked. So, I concur with in part with what Laura and Henry have talked about, is this is something we might have to think about.

01;02;56;28 - 01;03;23;00
Peter Huessy
Again, my apologies, folks. We went over a little bit, but you all were wonderful. I think we should have you back. Maybe October time frame and see what has happened in the interim and what's going on in the

world. Because if you if you read the STRATCOM clips this morning, there's stuff on North Korea they're testing and they're and then you have South Korea again asking for reassurance.

01;03;23;02 - 01;03;46;07
Peter Huessy
Then the Europeans saying, well, maybe we should have a European deterrent that separate from America. And I'm not sure where that goes. But again, these are real. These are important issues. Thank you, all four of you for extraordinary, conversation. Kimberly and I will write up the questions that weren't able to be put on the table and get them to you.

01;03;46;07 - 01;04;05;15
Peter Huessy
And you can answer them as you, as you wish. And again, I apologize to my president, Jim Petrosky. I didn't get to turn it over to him, but I have to run and go talk to my Barksdale people about my June 18th symposium before they kill me. So anyway, thank you all for this. And thank you, Kimberly, for all your work.

01;04;05;15 - 01;04;10;03
Peter Huessy
And thank you, gentlemen and ladies, for a wonderful conversation. Take care.

01;04;10;04 - 01;04;20;15
James Petrosky
Kimberly has Kimberly has a few things to say at the end here. Just get everyone set up. But thank you everyone as well. Go ahead Kimberly, let people know what's coming up.

01;04;20;17 - 01;04;49;06
Kimberly Cherington
Well, I just want to extend our appreciation to all of our speakers. What a wealth of information. And Jim did text me and say, make sure you tell our audience that we will definitely do a follow-up to this. So, we hope you can all join us for that. If you're new to NIDS, we are a 501 C3 nonprofit dedicated to advancing peace and promoting stability through a strong national security and nuclear deterrent.

01;04;49;09 - 01;05;15;17
Kimberly Cherington
We do this by, we offer a wide range of education, surrounding deterrence. We have live and virtual events like this one you just came to. We have weekly podcasts, which you can see on YouTube, or you can hear wherever you get your, your favorite podcasts. And, we have workshops and courses through our NIDS Academy, and we have a full lineup of events.

01;05;15;17 - 01;05;38;02
Kimberly Cherington
In fact, we hope we see you next week. But every single Friday, almost all spring, we have experts who you are not going to want to miss. Thank you for being part of our growing community. And make sure to like us and follow us wherever you find us. I'll have this video out probably by Monday on YouTube.

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01;05;38;02 - 01;05;54;28
Kimberly Cherington
I will send you all a link and make sure when you share it with your colleagues that you like it and that you add your comments on there because it helps us get to a wider audience. Make sure to like, like us and follow us on LinkedIn.

01;05;55;01 - 01;06;04;21
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01;06;04;24 - 01;06;14;24
Kimberly Cherington
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