Project on Nuclear Issues Fall Conference

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Presentation Abstracts

Stockpile Sustainment and the Future of the Nuclear Enterprise

Stockpile Stewardship and Beyond: Why Science is Important to the US Nuclear Deterrent
Matt Cowan, Integrated Experiment Team Project Engineer, Lawrence Livermore National Laboratory

The United States government's decision to stop nuclear testing while maintaining a viable, safe, and secure nuclear weapon deterrent had a profound impact on the technical work conducted at the US weapons laboratories. The concept of Science Based Stockpile Stewardship was born to mutually support these potentially conflicting goals. Under Stockpile Stewardship, our technical focus shifted to developing predictive analytical capability based on high performance computing rather than rely solely on highly integrated weapons physics experiments. In order to maintain a tie to reality and relevance to our nuclear test database touchstone, increased computational performance requires improved validation methods, advanced experimental facilities, and focused scientific experiments. These new capabilities expand the horizons of our understanding, refine our knowledge of what is essential, and are critical to developing the next generation of nuclear weapon scientists to extend our continued technical confidence in the US nuclear deterrent.

Overview of Weapons Enterprise Transformation and Mathematical Assessment Tools
Carol Meyers, Mathematician, National Security Engineering Division, Lawrence Livermore National Laboratory

The US nuclear weapons complex has undergone considerable consolidation in the past decade. The National Nuclear Security Administration has been tasked with creating a smaller, safer and more secure nuclear weapons enterprise, while simultaneously experiencing a smaller budget than in years past. Complicating this task is the fact that infrastructure within the complex was largely built during the Cold War, and as such is aging dramatically. This presentation will provide an overview of some of the inherent challenges in weapons enterprise consolidation, as well as some of the plans that have been proposed to address these issues. Particular emphasis will be placed on mathematical tools that have been developed for assessing the relative benefits of different stockpile transformation scenarios, and the kinds of policy questions each of these tools can help to address. It will also contain a brief discussion of the types of results that can be obtained using such tools, and the resulting implications on policy analysis.

An overview of Nuclear Detonation Safety

Raymond Wolfgang, Member of Technical Staff, Sandia National Laboratories

How does the US ensure that its Nuclear Weapons safe to store, handle and transport? The requirements for weapon safety in both normal environments (day-to-day storage, maintenance and transport) and abnormal environments (fire, plane accident) are robust – and rightly so. How does the United States verify that weapon designs meet the stringent safety requirements in both types of environments? We develop weapons according to a nuclear weapon safety theme, called Enhanced Nuclear Detonation Safety (ENDS). The ENDS theme allows one to assert a weapon system is safe and secure to the Walske criteria, which is a requirement of the US military placed on the weapon development labs. This talk presents the three design principles of the theme - Isolation, Incompatibility, and Inoperability. The brief also shows how the concept of independent subsystems allow a producible design. The brief concludes with how the principles let us assert safety in both normal and abnormal environments

Nuclear Forensics Science and Technology

Multi-actinide Resonance Ionization Mass Spectrometry (RIMS) for Nuclear Forensics Applications and Rapid Response

Kim Knight, Post-doctoral Fellow, Chemical Sciences Division, Lawrence Livermore National Laboratory

Obtaining accurate actinide isotopic data is critical to the timely interrogation materials of nuclear origin. Dissolution and purification are necessary prior to attempting most U and Pu isotopic analyses by mass spectrometry, and are generally the time-limiting step in obtaining isotopic data. Multi-actinide resonance ionization mass spectrometry (RIMS) uses precisely tuned lasers to selectively excite and ionize atoms of an element of interest, permitting analyses of samples as collected, without complications from isobaric (same mass) interferences. RIMS can minimize or even obviate chemical separation and sample preparation steps for uranium isotope analyses in a variety of matrices, but as an analytical technique it is still in its infancy with respect to applications in nuclear forensics. We have been developing methods for U and Pu isotopic analysis by RIMS, working to optimize elemental selectivity, enhance background suppression, and minimize detection limits. Our initial experiments have provided several promising results, and we have demonstrated that we can easily move between RIMS schemes for two elements in samples of mixed actinides (U and Pu), as well as discriminating against interfering masses (238U and 238Pu). Rapid measurement of the isotopic composition of multiple elements in a mixed actinide sample without significant interferences lays the foundation for actinide isotopic analyses using state-of-the-art resonance ionization mass spectrometry.

Comparison of Model and Experimental Data for Resonance Ionization Mass Spectrometry of Uranium: Predicting and Guiding the RIMS Method

Brett Isselhardt, Post-doctoral Fellow, Chemical Sciences Division, Lawrence Livermore National Laboratory

Resonance Ionization Mass Spectrometry (RIMS) has been developed as a method to measure relative uranium isotope abundances. In this approach, RIMS is used as an element selective ionization process to provide a distinction between uranium atoms and potential isobars without the aid of chemical purification and separation. This presentation explores the laser parameters critical to the ionization process and their effects on the measured isotope ratio. It describes the predictions of a rate equation model of the relative ionization probability for free uranium atoms in a volume undergoing irradiation by the 3-color, 3-photon ionization scheme. The model has been fairly successful at describing the distribution of observed isotope ratio as a function of wavelength for the narrow bandwidth experiments. The model agrees with the broad bandwidth data in that the isotope ratio is less sensitive to wavelength in the region between the two resonances. This work demonstrates that RIMS can be used for the robust measurement of uranium isotope ratios.

Monte Carlo Modeling of a Cavity Ion Source: Pushing the Frontiers of Isotopic Detection Sensitivity

Laurence Lewis, Graduate Student Researcher, University of California, Berkeley and Lawrence Livermore National Laboratory

Mass spectrometry is a powerful analytical tool, yet is limited by sensitivity and precision, which are crucial for samples that contain low concentrations of the elements of interest. Thermal ionization mass spectrometry (TIMS), the method presently used to report the most sensitive and precise isotope ratio data, uses a sample deposited onto a rhenium ribbon filament as the ion source, and generally ionizes material with <1% efficiency (percent of ions out to sample atoms in). A recently explored alternative known as the cavity ion source (CIS) ionizes refractory elements with much higher efficiency than TIMS Filaments, achieving efficiencies of up to 39%. This means that much smaller concentrations of sample could be measured without giving up any presently realizable precision. Colliding with the cavity wall also allows ions to recombine (with >99 % probability). A CIS, therefore, must be optimized to extract the ions before they neutralize. How to design a cavity such that ionization is maximized and recombination is minimized is not known. We have developed Monte Carlo models of a cavity ion source (using SIMION 7.0) to determine how the ionization efficiency (and thus ionization and recombination rate) depends on the cavity's length, radius and extraction potential. The study predicts that while ionization efficiency is not very dependent on cavity dimensions or extraction potential, wider cavities and higher extraction potentials do increase the cavity's efficiency, while longer cavities do not. This work is an example of how development of the next generation of analytical instrumentation is explored and moved forwards.

Improving Nuclear Security While Expanding Access to Nuclear Energy

Refining Multilateral Nuclear Approaches (MNA) to Achieve Nonproliferation and Fuel Assurance Goals

Peter Hong, Research Analyst, National Security Office, Los Alamos National Laboratory

A more than 60-year long effort to create multilateral nuclear approaches (MNAs) is gaining renewed attention. These initiatives are part of a goal to ensure an uninterruptable supply of nuclear that, if robust, could reduce the need for states to pursue indigenous fuel cycle activities. MNA supporters reason that building a more robust and economical global supply of assured nuclear fuel would reduce the incentive to pursue enrichment and reprocessing. Despite progress, many states remain wary of the proposed MNAs, and see them as a way to restrict technologies such as enrichment and reprocessing, and some even consider MNAs as a pretense to allow commercial nuclear suppliers to form a cartel. The current set of MNA proposals does not include important details which undermines their attractiveness and their anticipated benefits. Refining existing proposals, in conjunction with back end proposals, can contribute to reinforcing the global nuclear infrastructure and provide barriers to proliferation.

The Thorium Fuel Cycle: A Proliferation-Resistance Focus Shift for the Future

Matthew Duchene, M.S. Student, Nuclear Engineering, University of Illinois

In addition to the uranium fuel cycle, certain states have expressed great interest (particularly India) in pursuing the thorium fuel cycle (TFC) as a major option for nuclear energy production in the future. While research in the proliferation resistance (PR) of the TFC has shown an increased resistance in some areas, there are vulnerabilities in other areas. While the TFC provides many increases in PR at specific points of the fuel cycle, it also exposes certain vulnerabilities in others – hence there is a PR-shift. The superior fissile material qualities of U-233 and the future prospect of states using thorium to produce U-233 for energy consumption necessitate attention on how to make the TFC more proliferation resistant.

Developing a 'Whole of Government' Approach to Improving the Global Nuclear Detection Architecture

Kimberly Proctor, Ph.D. Candidate, University of New Mexico, Technical Intern, Strategic Studies Department, Sandia National Laboratories

The U.S. federal government has implemented a series of programs focused on detecting the illicit shipment of nuclear and radiological materials, but government agencies, such as the Domestic Nuclear Detection Office (DNDO) within the Department of Homeland Security, face a number of technological, coordination, and management challenges. Currently, DNDO coordinates nuclear terrorism and proliferation programs across the various government agencies engaged in the detection and security of special nuclear material. DNDO should use a 'whole of government' approach when developing programs and implementing strategies to prevent nuclear proliferation and nuclear terrorism, which might enable it to leverage resources and improve outcomes. By and large, efforts to establish and build a global nuclear detection framework involve elements of 'hard power,' with an emphasis on equipment, security, and offensive, detection tactics. There is less of an emphasis on 'smart' power in the form of science, diplomacy and scientific engagements. This approach would not require additional

funds, but would simply entail more integrated programming, and could increase the effectiveness of existing DNDO programs.

Characterization of Uranium Oxyfluoride Particles for Nuclear Safeguards
Ruth Kips, Research Scientist, Lawrence Livermore National Laboratory

When IAEA safeguards inspectors collect swipe samples from uranium enrichment facilities, their samples often contain uranium particles with a measurable amount of fluorine. These particles are typically produced when small amounts of uranium hexafluoride (UF6) gas, used for the enrichment of uranium, reacts with moisture from the atmosphere, forming solid uranium oxyfluoride (UO2F2) particles. Somewhat surprisingly however, these samples were also found to contain uranium-bearing particles without a measurable amount of fluorine, suggesting UO2F2 is unstable with respect to the loss of fluorine. Since nuclear safeguards often rely on the analysis of these chemically-sensitive compounds, it is important to understand how exposure to the atmosphere, prior to collection and analysis, may affect the particle characteristics. Given the small size of the particles, highly sensitive and selective instrumentation is required for their analysis. At Lawrence Livermore National Laboratory, a nano-scale spatial resolution secondary ion mass spectrometry (NanoSIMS) was used to measure the fluorine-touranium ratio in lab-synthesized UO2F2 particles. The relative amount of fluorine was compared for samples that were freshly-prepared and samples exposed to different temperature, humidity and light conditions, and this for various amounts of time. The NanoSIMS measurements were complemented with spectral data obtained by micro-Raman microscopy. Micro-Raman spectroscopy was used in a purely fingerprinting manner to identify changes in the Raman spectrum due to humidity exposure. The combined elemental and spectral information obtained from these measurements allowed differentiation of UO2F2 samples with different exposure history, which may benefit the analysis of environmental samples for nuclear safeguards.

Enhancing Monitoring and Enforcement to Counter Nuclear Threats

The Stigmatization of Nuclear Weapons: Implications for the Potential Transfer of Nuclear Material
Patricia Shamai, Lecturer in International Relations at the University Portsmouth

Much of the existing literature on the actions and motivations of terrorist organizations and potential proliferating states, assumes that the existence of these organizations has fundamentally changed the dynamics of the international system. In many important ways they have. However, much of what we think about these groups and the challenge they pose rests in the category of untested assumptions and are taken as given. Previous research has highlights that the stigmatization of WMD is the result of the utilitarian, moral and ethical aspects of these weapons. Efforts to acquire and possess WMD have been associated with perceptions of enhanced political power. The early condemnation of chemical and biological weapons paved the way for the stigmatization of nuclear weapons. This then enhanced the stigma towards all three methods of warfare. The stigmatization of nuclear weapons has shaped arms control efforts. Understanding of this enables a greater appreciation of measures to secure nuclear material and counter the threat of nuclear terrorism. This presentation will highlight several issues, including the historical role of nuclear weapons, public perceptions of WMD, the motivations and likelihood of the transfer of nuclear materials by states, and possible use of nuclear weapons by terrorist organizations.

The Investigative Authority of the International Atomic Energy Agency to Conduct On-Site Inspections in the Second Nuclear Age

Kalman Robertson, Ph.D. Candidate, Strategic and Defence Studies Centre, Australian National University

Nuclear safeguards are an essential element of the non-proliferation regime, responsible for verifying state compliance with international legal commitments and detecting the misuse of nuclear material. The significance of nuclear safeguards has been highlighted by a series of findings of non-compliance in the last twenty years. The International Atomic Energy Agency (IAEA) has investigative authority, quasi-judicial authority and (very limited) enforcement authority to administer nuclear safeguards and deal with non-compliance. This presentation critically examines the legal authority of the IAEA to identify non-compliance in non-nuclear weapon states under the regime created by the Nuclear Non-Proliferation Treaty (NPT). Through a comparison with the authority of the Organization for the Prohibition of Chemical Weapons under the Chemical Weapons Convention, this presentation will argue that the investigative powers of the IAEA are rigorous with respect to the detection of diversion of nuclear material. Within states that have implemented the Additional Protocol safeguards, it may be possible to derive a credible assurance that all nuclear activities have been declared. If global nuclear governance has weakened in the last twenty years, it is not due a lack of investigative legal authority or the reliance of verification on the cooperation of sovereign states. Instead, the 'crisis' in global nuclear governance stems from the perceived utility of nuclear weapons for regional security, discrimination between states that has become entrenched in the nuclear non-proliferation regime, and lagging expansion of technological verification capabilities associated with the Additional Protocol safeguards. Despite its reliance on the political will of the international community, the far-reaching authority of the IAEA demonstrates that the notion of state sovereignty is evolving to recognise the legitimacy of international security institutions with intrusive powers.

Engaging Dual-Use Technology Manufacturers through Profit-Oriented Export Controls

Andrew Kurzrok, Research Associate, Pacific Northwest National Laboratory

Proliferators' reliance on Western dual-use technology provides a leverage point against the spread of nuclear weapons. Individual companies determine whether or not to sell these parts overseas, and therefore become the critical node in proliferation. A country could make acquiring enrichment and reprocessing technology a national priority, but if no firm sells the necessary equipment the aspiration remains unfulfilled. Instead of asking why a particular state wants nuclear technology, the question posed by non-proliferators should become supply-oriented: "Under what conditions do firms export dual-use nuclear technology?" This presentation will briefly outline the history of dual-use technology in nuclear proliferation before examining motivations behind the sale of dual-use nuclear technology. It will also describe policy options that would encourage non-proliferation through profit-oriented measures, such as stricter enforcement action in some cases, expanded reporting hotlines for those who discover export control non-compliance, export control education, a third party to share denied order requests between firms, and an industry-wide code of conduct.

Assessing the Effectiveness of Covert action in Counter-proliferation: The case of Iran
David Vielhaber, M.A. Candidate, Nonproliferation and Terrorism Studies, Monterey Institute of International Studies

Ever since the public disclosure of Iran's clandestine nuclear program in 2002, and particularly since the spectacular attacks against Iranian nuclear scientists in Tehran in 2010 and the discovery of the Stuxnet computer virus later that same year, there have been reports and speculations regarding efforts by some states to disrupt the Iranian program by means of covert action, including sabotage and paramilitary operations. This presentation examines the advantages and risks associated with three types of covert action that have been used against Iran. Drawing upon the historical track record of covert action in counter-proliferation, one can deduce several generalizations regarding their effectiveness and apply those to the Iranian case, as well as factors whichi affect the effectiveness and limitations of covert action in counter-proliferation.

Assessing Legislative Politics and Ways Forward for Nuclear Policy

How to Avoid a Dialogue of the Deaf on Nuclear Deterrence Policy
Zachary Zwald, Assistant Professor, U.S. Air War College and the USAF Counter-proliferation Center

The prevalence of inflexible thinking is a persistent challenge to formulating an effective nuclear deterrent that remains woefully under-examined. As a result of such thinking, most nuclear deterrence policy debates turn into a dialogue of the deaf wherein those on both sides not only ignore each other's particular concerns but also speak past each other on issues of shared concern. Moreover, existing scholarship on the process of deterrence preference formation actually reifies, and consequently perpetuates, such a dialogue by incorrectly assuming there is one set of preferences that accurately reflects the Nuclear Revolution and another that does not. This presentation will explain how one determines the effect of potential nuclear doctrine and force structure policies on credibility. It contends that the necessary first step toward minimizing the dialogue of the deaf is explicit and widespread recognition that all deterrence preferences are belief-based. Policy-makers must acknowledge, from the outset, that there is no "right" or "wrong" on how best to enhance the credibility of a state's nuclear deterrent. Repeatedly acknowledging the limits of what can be known about nuclear deterrence will make policy-makers more prone to examine the role of cognitive limitations and motivated reasoning. Moreover, doing so will diminish, if not wholly eliminate, the reputation and material costs of engaging in flexible thinking.

Next Steps in Arms Control: Restoring Consensus on Nuclear Policy
Dr. Tom Karako, Assistant Professor of Political Science, Kenyon College

Whatever else is true about the ratification debate over the New START treaty, the experience helped to serve as a catalyst for renewing attention to the U.S. nuclear enterprise writ large, and for helping to recreate a bipartisan awareness in and outside Congress about the importance of U.S. nuclear weapons activities, which have in some ways been neglected since the end of the Cold War. A path to weapons modernization has now been laid out, but much remains to be seen and done, and this will take over a decade. In November 2010, the Obama administration likewise laid out a detailed ten-year budget and plan for nuclear modernization, and in ratifying the treaty in December, the U.S. Senate affirmed the

importance of such steps. As President Obama noted in Prague, the United States will need to maintain a nuclear deterrent for the foreseeable future, probably beyond most of our lifetimes. As our nuclear stockpile becomes both smaller and older, and as the threat environment continues to evolve, however, it becomes all the more important that it remain safe, secure, and effective, and that it will continue to support a credible deterrent. If this were not a sufficient challenge, the coming decades will also see a need to modernize or replace a number of U.S. strategic platforms, including bombers, dual-capable aircraft, ICBMs, SSBNs, and cruise missiles. As we look forward to both potential deeper nuclear reductions and to potential cuts to the defense budget, it will be essential to sustain a sober, public, and bipartisan awareness of what it will take to sustain nuclear deterrence for ourselves and our allies.

The Duma-Senate Logjam Revisited: Actions and Reactions in Russian Treaty Ratification Debates
Anya Loukianova, Ph.D. Candidate, Policy Studies, University of Maryland

With an eye toward future nuclear reductions, this presentation seeks to identify the political dynamics and key themes of arms control debates and deliberations in the Russian legislature during the past twenty years. Russia scholars have observed that legislative politics have become "re-centralized" after Russia's first president, Boris Yeltsin, left office. However, this observation obscures the impact of the internal debates in Russia's legislature on the conditions placed on the implementation of arms control agreements and the paradox of the seemingly enabling security concerns of conservative factions in lawmaking bodies in both Russia and the United States. The presentation begins with an overview of the Russian legislative branch, its role in foreign policy and treaty ratification, and a quick sketch of the changes in political factions over time. A brief discussion of the START II and New START ratification challenges follows suit. The next section offers a taxonomy of recurring themes and an overview of factional politics in the parliamentary discussion of START I, CTBT, START II, SORT, and New START. The presentation concludes by highlighting continuity and change in Russia's lawmakers approach to arms control and the implications of these trends for the future.

Ensuring Full Nuclear Security Budgeting Accountability and Transparency
Stephen Schwartz, Editor, The Nonproliferation Review and WMD Junction, James Martin Center for Nonproliferation Studies, Monterey Institute for International Studies

Notwithstanding the relatively small proportion of the overall defense budget that they are estimated to consume annually (about 10 percent), it is unlikely that nuclear weapons or related nuclear security programs will completely escape the budget axe. Unfortunately, Congress and the public do not have a clear understanding of what it costs to sustain the nuclear arsenal, or of, for example, the annual expenditures required to secure vulnerable nuclear materials in the United States and overseas. This means that rhetoric and assumptions will most likely replace facts when it comes to making important decisions about the future of US nuclear security spending. As we move forward in a fiscally-constrained environment, we cannot afford—literally—to have elected officials making critical national security decisions on the basis of incomplete or faulty budgetary data. But if nothing changes, that's exactly what will happen. This presentation will offer a way to avoid that problem, and reform a nuclear security budgeting system that has been broken for decades. It will propose that Congress pass a law requiring the executive branch to prepare and submit each year, with the annual budget request, an unclassified and classified accounting of all nuclear weapons–related spending for the previous fiscal year, the current fiscal year, and the next fiscal year. Once completed, Congress should ask the Government

Accountability Office and the Congressional Budget Office to audit the nuclear budget for accuracy and completeness, and then ensure that the executive branch incorporates its recommendations for future years. To the maximum extent possible, this accounting should be unclassified, just like the 2010 Nuclear Posture Review. Once a framework for identifying and allocating costs is agreed upon, it will be a simple matter to add the new numbers each year. Soon, trends will emerge, which should lead to more insightful and informed debates and rational decisions. At the very least, government officials, and the people they represent and work for, will have a significantly better understanding of what we are spending—and what we can afford—when it comes to allocating scarce funds for nuclear security programs.

Exploring New Dimensions of Nuclear Strategy

Extended Deterrence and a Nuclear Iran: Lessons from the Cold War
Tim McDonnell, Program Associate, Woodrow Wilson International Center for Scholars, and M.A. Candidate, Security Policy Studies, George Washington University

The academic and policy worlds are rife with speculation about what policy courses a nuclear armed Iran might choose, and how the world can and should respond. By exploring the United States and the Soviet Union's long histories of forward deploying nuclear weapons on the territories of their allies, this presentation will advance the literature on Cold War-era extended deterrence theory by explicating the important but under-examined relationships between geography, credibility and survivability, and between promptness and stability. A Pakistani-Saudi extended deterrence relationship involving forward deployed nuclear weapons would be very similar at the regional level to US and Soviet arrangements at the global level, would benefit both nations, and is within the realm of possibility. Given the short missile and aircraft flight times which are a defining characteristic of the regional strategic environment, modest increases in promptness (decreases in warning time) would not impact stability. On the other hand, geography-driven survivability and credibility issues, as well as the rapid and catastrophic deterioration of US attack warning time and the corrosive effects of increased promptness on strategic stability, suggest that Iran and Venezuela would be unwise to attempt to put together a comparable arrangement.

The Strategic Effect of Indigenous Nuclear Fuel Cycle Capabilities on Regional Security
Tristan Volpe, Ph.D. Candidate, Department of Political Science, George Washington University

Contemporary discourse on the Iranian nuclear program underscores how analysis of nuclear proliferation focuses too heavily on time horizons to warhead acquisition and concomitant tactics to thwart progress. Iran took the most important step toward a nuclear weapons arsenal when it developed an indigenous nuclear fuel-cycle with the enrichment technologies necessary to produce weapons usable fissile material. Given the high level of uncertainty over Iranian security motives and the objectives of their nuclear program, the focus of the debate must shift to analyze the implications of the state's nuclear fuel-cycle on regional security dynamics. This presentation therefore develops a novel framework to answer two central research questions. Can a state use nuclear fuel-cycle technology to generate an observable security posture? If so, how does variation in nuclear fuel-cycle postures among states affect the likelihood of a competitive regional arms race? This presentation will discuss how the fuel-cycle is developed, managed, deployed, and linked to the security objectives of the state, and will

identify the characteristics of a nuclear fuel-cycle security posture. Finally, it will posit how the United States can use the extant array of nuclear security institutions to help mitigate regional arms racing when a state adopts an escalatory or hedge nuclear fuel-cycle posture.

French strategic Posture since the last *Livre Blanc*
Emmanuel Nal, Consultant – Junior Lecturer, University of Tours

"It is necessary to have the most powerful weapons of the time, unless, of course, the others stop possessing it", declared General de Gaulle in 1963, while the Cold war was at its height; now, the strategic context changed but nuclear deterrence retains a major role in the French defence policy. "The world is different, more unstable, more changeable, more complex. It does not mean that it is necessarily more dangerous, it means that it is less predictable than before", asserted President Sarkozy in Cherbourg in 2008. The French national security strategy is articulated around five strategic elements, defined by the 2008 Livre Blanc on Defense and Security that the defense and security forces must be in control of: knowledge and anticipation, prevention, deterrence, protection and intervention. The combination of these five functions must be flexible and able to evolve in time, by adapting itself to the modifications of the strategic environment. How did the French nuclear deterrence take into account the evolution of the strategic environment?

Benefits of ICBMs to US Nuclear Posture and Global Stability
Aaron Van Noy, Systems Engineer, Northrop Grumman Aerospace Systems

With the ongoing discussion of the implementation of New START as well as budgetary reviews, high-level decisions will be made that will affect the United States' nuclear posture. In particular, decisions regarding the required nuclear force size. These decisions require an understanding of the characteristics and benefits of the ICBM System. This briefing will review ICBM history and benefits, both intended and unintended. Also highlighted will be the ICBM's role in global stability as well as global zero scenarios. Finally, the briefing will touch on potential improvements for future ICBMs.

Looking Ahead to Future Nuclear Force Reductions

The Question of Nuclear Disarmament and the Enforcement Paradox
Dane Swango, Lecturer, Department of Political Science, University of California, Los Angeles

Nuclear disarmament has reemerged as a major issue in international security. Advocates claim nuclear disarmament will provide two benefits: it will reduce the risk of nuclear terrorism, and make it easier to build international political support for measures to prevent nuclear proliferation. The perceived benefits of nuclear disarmament give impetus to efforts to create the conditions necessary to eliminate nuclear weapons. But there is substantial disagreement over which factors are most important in creating the conditions necessary to eliminate nuclear weapons. Insights from the early history of disarmament provide a useful contribution to this debate. Numerous official disarmament studies were conducted by the U.S. government in the 1940s and 1950s. These declassified studies are largely unknown in the policy and scholarly communities that deal with nuclear security. The history these documents reveal suggests that deep reductions in conventional weapons will be required to eliminate nuclear weapons. Monitoring and verifying the elimination of these conventional systems will prove much more difficult than for nuclear weapons, and deep conventional reductions will complicate efforts

to police a nuclear weapons-free world. Therefore, disarmament will lead to an "enforcement paradox." The process of nuclear disarmament will require deep cuts to the conventional weapons required to enforce the rules in a nuclear weapons-free world.

Verifying Multilateral Nuclear Reductions: Balancing Verification, Transparency and Information Security
Sarah Elizabeth Cross, Graduate Research Intern, Brookhaven National Laboratory

In June of this year the five Nuclear Weapons States (NWS) recognized by the NPT met in Paris to continue discussions, which began in London in 2009, on confidence-building measures toward nuclear disarmament and other nonproliferation issues. The need to maintain a crucial balance between verification, transparency and the protection of confidential information is one of the greatest challenges to expanding the process of nuclear disarmament beyond the United States and Russia. Developing a framework for multilateral arms reductions requires that we address this dilemma. This presentation will include a brief discussion of the challenges presented by multilateral verification of future nuclear reductions and the extreme importance of transparency in such a context. The presentation will then shift to explore the procedures and tools, both legal and practical, used by the International Atomic Energy Agency (IAEA) and the Organization for the Prohibition of Chemical Weapons (OPCW) to protect confidential information, information related to national security and that which industry considers proprietary.

HEU Down-blending and Information Barriers: A thought Experiment in South Asia
Jessica Bufford, M.A. Candidate in Nonproliferation and Terrorism Studies, Monterey Institute of International Studies

This presentation develops a model agreement and verification regime between India and Pakistan to down-blend highly enriched uranium (HEU). In the proposed scenario, a year's production of HEU enriched to 70% or higher is down-blended to low enriched uranium (LEU). The process is verified using information barriers and safeguarded with the assistance of the International Atomic Energy Agency (IAEA), starting at the removal of the fissile material from storage through down-blending to storage until use in safeguarded reactors. Because information barriers have not been used before in South Asia, such an agreement both introduces the technology to the region and clarifies its uses and limits. The verification regime also demonstrates that information barriers can be used in different situations but must be adapted to fit the conditions.

Analysis of Nuclear Explosion Debris and Considerations for Verification
Mr. Christopher Ryan, Research Scientist, Lawrence Livermore National Laboratory

A residual and radioactive signature remains in debris or fallout after a nuclear explosion. This signature can be found via radiochemical analysis of the debris – regardless of the age of the debris. Collection and interpretation of this debris, even years later, can provide useful information. This is important to realize as we move forward with treaty agreements where we manage access to various facilities and engage in international training for inspections. We'll demonstrate that even one of the most labor intensive and difficult methods of sample collection can still be accomplished today.