



Technical Challenges Associated With the New U.S. Nuclear Agenda

Summary of a Joint SNL-LLNL-CSIS Workshop
Proceedings, Briefings & Key Takeaways

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EXECUTIVE SUMMARY

At the 3 November 2009 SNL-LLNL-CSIS workshop, participants identified a number of key technical challenges and opportunities associated with Congress and the Obama Administration's new U.S. nuclear agenda. These key judgments can be distributed into four principal issue areas: 1) broad policy considerations; 2) challenges and opportunities facing the U.S. nuclear weapons enterprise; 3) challenges and opportunities facing monitoring and verification; and 4) challenges and opportunities in cooperative threat and risk reduction. Within each sub-set, participants identified challenges that are common to nuclear futures ranging from a world without nuclear weapons to a highly proliferated world, as well as those challenges that are unique to a particular future.

BROAD POLICY CHALLENGES AND OPPORTUNITIES

The Administration and the Congress must agree on an integrated, coordinated national strategy that spans all the elements of nuclear weapons issues: U.S. weapons programs, non- and counter-proliferation, preventing nuclear terrorism, arms control, disarmament, and defense against nuclear use. Without such a strategy, single elements will be difficult, if not impossible, to sustain.

- Whatever strategy is adopted, leadership should proceed along the path with care, defining stages or milestones tied to interim goals that allow assessment of stability along the way. The complexities of regional stresses and a multi-polar world that has emerged since the end of the Cold War are dynamic and difficult to predict in their evolution.
- In the development and advocacy of nuclear policy, the importance of the lexicon – and the associated definitions of commonly used terms – cannot be overstated. Congress appears to have an allergy to the term ‘modernization’ and, to a lesser degree, ‘reliable,’ but could perhaps agree on an alternative expression that captures the need for maintaining safe, secure, and effective deterrent capabilities. One proposed alternative is ‘deterrence management.’ Other terms, such as ‘zero,’ ‘threat reduction,’ and ‘new military capability,’ require clarification.
- The global spread of increasing but variable levels of nuclear latency is a challenge common to all possible alternative nuclear futures. The nuclear weapons laboratories will play a crucial role in managing the risks posed by latency (monitoring, dissuading, and hedging).

CHALLENGES & OPPORTUNITIES FACING THE NUCLEAR WEAPONS ENTERPRISE

At any force or stockpile level, America and its allies must have confidence in U.S. weapon systems, system surety, and the nuclear enterprise. Systemic uncertainty in the 21st century security environment underscores the indefinite requirement for capabilities and infrastructure sufficient to hedge against geopolitical surprise.

- The national debate should broaden from a focus on the Department of Energy's (DoE) weapons program and complex to address full system considerations. Platforms, the enterprise beyond DoE, command and control, and surety (security, safety, and use control) are as important as the weapons themselves when considering declarations, inspections, transparency, and whatever we decide to call ‘modernization.’
- Competing visions of the future of the nuclear weapons complex must be debated and resolved. Continued ‘dithering’ undermines the credibility of U.S. deterrence, extended deterrence, and assurance commitments.
- The most important element in maintaining a hedge against uncertainty is a robust complex with top notch expertise, including the DoE, the Department of Defense (DoD) and the Intelligence Community (IC). As the size of the stockpile declines, the importance of the infrastructure grows.

- If labs are limited by restrictions on new military capabilities or by commitments associated with the long-term pursuit of a world without nuclear weapons, they must find other ways to continue to design ‘outside the box’ in order to prevent technological surprise and maintain the non-weapons capabilities (e.g., technical nuclear forensics) that are built upon design expertise.
- To meet the demands of an integrated nuclear agenda, the nuclear weapons enterprise writ large should expand the portion of its mission space that supports the technologies associated with other key national priorities – e.g., preventing nuclear terrorism, further stockpile reductions, surveillance verification, use control, and registration of facilities. Across the enterprise, top talent will only be attracted and retained if they are engaged in challenging and meaningful work, which is visibly valued by the nation’s leadership.
- The nuclear weapons complex must regain the trust and support of key stakeholders outside of the enterprise (Congress, the Washington policy community, the American public, etc.). The transition to the current laboratory contract arrangements appears to be placing the laboratories into ‘just another contractor’ status instead of the independent, trusted national service role they were intended to serve. Messages from each element of the complex must be aligned and communicated clearly.

CHALLENGES & OPPORTUNITIES IN MONITORING AND VERIFICATION

The United States must develop a coherent interagency plan, properly resourced, for monitoring and verification in support of nonproliferation initiatives and new arms control regimes. Major new challenges – particularly finding and monitoring small numbers of weapons and monitoring rapidly growing nuclear power generation capacity – must be addressed.

- As limitations on stockpile levels increase, monitoring and verification will become increasingly complex and technically demanding, likely requiring a support complex that is equivalent in size to the nuclear weapons laboratories. However, the technical community in this area has been moribund for many years. Reinvigorating the monitoring and verification community should not only improve traditional tools, but also introduce new capabilities that build on advancements in intelligence, surveillance, and reconnaissance (ISR) related to conventional warfighting, management/fusion of massive data files, and use of non-traditional data sources.
- On-site inspections will only be useful if treaties establish effective verification standards. Practical and acceptable approaches to tagging and inspection of facilities and weapon systems should be investigated long before we enter into discussions that expand existing, or create new, treaty inspection regimes. Regardless, as international monitoring and verification regimes expand, the National Nuclear Security Administration (NNSA) must be prepared to make its facilities observable to other countries.
- A renewed investment in ‘strategic intelligence’ (e.g., indications and warning, denial and deception) is needed, and the development of tailored deterrence concepts must be wedded to the social sciences and psychology. New technologies and communication mediums have opened new forums for intelligence gathering, but have also created more opportunities for noise.

CHALLENGES & OPPORTUNITIES IN COOPERATIVE THREAT AND RISK REDUCTION

There are many ideas for Cooperative Threat and Risk Reduction (CTRR), or whatever the Administration decides to call it, beyond the program initiated under the Nunn-Lugar legislation. A piecemeal approach will not serve the country well. The next stage of CTRR must be a coordinated, interagency effort driven by the White House that integrates and harnesses numerous resources – a process which will require a disciplined, strategic approach. Guidelines for crafting such a program include the following:

- The program should focus on global nuclear security – it should be distinct from past, and ongoing, efforts to dismantle biological weapons or Russian nuclear weapons. A new name could help clarify the distinction and eliminate confusion with past or ongoing programs.
- Success requires that the United States takes time to build discrete partnerships, tailored to each partner’s culture and threat perceptions. Metrics for success must also be tailored, based on the partner’s particular situation and goals and on the partnership’s contribution to shared security concerns. The United States should avoid creating universal metrics that are not measurable, not meaningful, and/or overly burdensome in specific contexts.
- Cooperative research and development programs can be valuable confidence building measures and can also support development of the indigenous nuclear security capabilities of our international partners. However, initiatives that provide technology, information, and possibly access to U.S. facilities must not compromise American national security.

INTRODUCTION

As President Obama leads the campaign for a “revitalized commitment to work toward a world without nuclear weapons,”¹ ongoing activities in Iran and North Korea suggest that, despite those laudable efforts, the world may be headed in the opposite direction. On November 3, 2009, Sandia National Laboratories (SNL), Lawrence Livermore National Laboratory (LLNL) and the Center for Strategic and International Studies (CSIS) co-hosted a one-day workshop in Washington, D.C., to explore the technical challenges associated with those competing visions of global nuclear weapons futures.

The workshop, entitled *Technical Challenges Associated with the New U.S. Nuclear Agenda*, had two primary goals. The first was to describe and motivate the competing visions of the future roles for the United States and other nuclear weapons stockpiles, and the associated global security challenges resulting from each. The second was to identify challenges and opportunities that will face the U.S. technical community as a result of potential policy futures. The purpose was to develop an actionable set of options and prospective technological initiatives that might address these challenges. The workshop served to bridge the September 2008 conference on *Pathways for Nuclear Energy and Nuclear Weapons* to the January 2010 conference on *Strategic Weapons in the 21st Century*.

The morning session, *New Visions for Global Nuclear Security*, chaired by Ron Lehman, explored three alternative nuclear weapons futures: 1) a world free of nuclear weapons; 2) a proliferated nuclear world; and 3) a multilateral, integrated nuclear security framework. At the conclusion of this session, John Hamre, CSIS President and CEO, led a working lunch discussion on the *Policy Implications of Alternative Nuclear Futures*. Those sessions provided the foundation for the three concurrent afternoon ‘breakout sessions’ that assessed the technical challenges across each of those futures in three principal policy areas: 1) monitoring and verification; 2) the U.S. nuclear weapons enterprise; 3) cooperative threat and risk reduction initiatives. Mim John led the final, plenary session in which the key findings of each breakout session were presented and summary findings from the day-long workshop were identified.

¹ The White House: Office of the Press Secretary, “Fact Sheet on the United Nations Security Council Summit on Nuclear Nonproliferation and Nuclear Disarmament UNSC Resolution 1887” (September 24, 2009), http://www.nuclearsecurityproject.org/atf/cf/%7B1FCE2821-C31C-4560-BEC1-BB4BB58B54D9%7D/UNSC_FACT_SHEET_WHITE_HOUSE_92409.PDF.

NEW VISIONS FOR GLOBAL NUCLEAR SECURITY

SUMMARY OF THE MORNING SESSION, SNL-LLNL-CSIS WORKSHOP, 3 NOVEMBER 2009

CHAIR: RON LEHMAN; PRESENTERS: RAYMOND JEANLOZ, KEITH PAYNE, GARRY GEORGE

In the morning session, three alternative global nuclear weapons futures were identified as possible outcomes of current trends in the United States and global nuclear weapons environment. The discussion focused on the challenges and opportunities associated with each future, as presented to the workshop by three subject-matter-experts (SMEs): 1) a world free of nuclear weapons, presented by Raymond Jeanloz; 2) a proliferated nuclear future, presented by Keith Payne; and 3) a multilateral, integrated approach to multiple nuclear initiatives, presented by Garry George.² The presentations and discussion focused on the technical challenges associated with each of these futures in order to lay a common foundation for the breakout sessions that convened in the afternoon.

PERSPECTIVE #1: A WORLD FREE OF NUCLEAR WEAPONS

In addressing the technical challenges associated with a world free of nuclear weapons, Raymond Jeanloz³ answered the following three questions:

1. How do monitoring and verification challenges change as global inventories of nuclear weapons are sharply reduced? How difficult, from a technical perspective, will it be to verify that all nuclear weapons have been eliminated?
2. What are the capability requirements for the U.S. nuclear complex, as stockpiles decline (down to and including zero nuclear weapons)? Are there ‘cliffs’ along the way; that is, minimum levels of capability below which we simply lose the capability altogether?
3. What threat and risk reduction technologies can be developed and implemented for coping in a zero-nuclear-weapon world given that knowledge cannot be ‘uninvented’?

In order to evaluate the capabilities required in a world approaching zero nuclear weapons, Jeanloz described a scenario for 2030 as a baseline from which aggressive implementation steps would be initiated. Assuming current trends (reductions of Cold War arsenals, expanded use of nuclear power globally, developments beyond the Non-Proliferation Treaty (NPT) regime), the best-case 2030 scenario would include: 1) significant reductions in the United States and Russian nuclear stockpile; 2) United States and Russian strategic forces taken off high-alert; 3) ratification of the Comprehensive Test Ban Treaty (CTBT); 4) some form of control over fissionable material; 5) constraints on uranium enrichment and fuel reprocessing facilities; and 6) preclusion of a nuclear weapons program in both Iran and North Korea. Jeanloz acknowledged that four and six are least amenable to technical approaches, but instead depend on political solutions.

While political factors are ultimately determinative, Jeanloz encouraged an initial focus on the technical issues involved in implementing a world free of nuclear weapons. From a technical perspective, the five ‘implementation steps’ Jeanloz identified were: 1) define the end state more explicitly; 2) identify any potential “stages” as assessment points; 3) compare with the prohibition of biological weapons; 4) determine the impact of cooperative research; and 5) specify the roles of the nuclear weapons laboratories.

² Each of the three SMEs presented modified versions - in some cases, significant updates - of the work they had prepared for the September 2008 Workshop, *Pathways for Nuclear Energy and Nuclear Weapons*, sponsored by Sandia National Laboratories and held at the University of California, Berkeley. The complete background papers can be accessed at: http://sandia.gov/nuclear_pathways.

³ Dr. Raymond Jeanloz is a Professor of Earth and Planetary Science, and Astronomy at the University of California, Berkeley.

Jeanloz proposed that the 'end state' be evaluated "from above" – i.e., the range of facilities and materials that would be allowed in current nuclear weapons states (NWS) – as well as "from below" – i.e., the latency and capabilities that would be allowed in current non-nuclear weapons states (NNWS). According to Jeanloz, the global nuclear security environment would be characterized by highly variable degrees of latency, depending on the size of the state and the state's perception of its own security. The concept of 'virtual arsenals' requires elaboration.

Some states will retain or acquire the ability to rapidly develop nuclear capabilities. In order to dissuade states with a strong disposition to proliferate, Jeanloz believes it essential to reach end states which are stable and verifiable. Consequently, the United States will have to confront the challenge of obtaining and sustaining a monitoring and verification ability sufficient to dissuade any potential proliferating state.

While envisioning the end state is important, Jeanloz emphasized that each step along the path towards a world free of nuclear weapons will present unique technical challenges, subject to volatility in the international security environment. It is therefore important to identify whether there are natural 'waypoints' along the path towards zero to reassess and evaluate which next steps will be stabilizing and verifiable. What are the political and technical factors that could limit progress or force a re-assessment? Political factors could include a breakdown in deterrence and increasing risks of conventional war. Technical factors could include failures of monitoring capabilities at low levels (limit of resolution), loss of confidence in existing capabilities, and increasing salience of conventional warfare as nuclear arsenals are reduced.

Jeanloz suggested further inquiry into the lessons learned from biological weapons (BW) restrictions and international norms. While an imperfect case study, Jeanloz argues that the BW experience is useful when assessing latency and dual-use concerns. From a technical perspective, BW represent a deadly technology far more proliferated (in knowledge as well as materials) and multi-use than nuclear weapons. Participants disagreed about how useful this comparison would be.

Jeanloz encouraged the expansion of cooperative research to build confidence and stabilize the verification and monitoring process. Cooperation could take a variety of forms and would occur at different levels (peer-to-peer NWS, non-peer NWS, NNWS-NWS). Ongoing cooperation at the labs in nonproliferation and treaty monitoring provide good measures for the future. Cooperation topics could include: test site transparency; stewardship science; plutonium management; nuclear forensics' warning; command and control systems; and ballistic missile defense. The nature of cooperation must be tailored to each partnership to avoid creating new routes to proliferation.

In discussing the role of the labs in a world without nuclear weapons, Jeanloz stressed that nuclear knowledge cannot be 'forgotten' and highlighted the crucial role that the labs would play in sustaining and monitoring 'virtual nuclear arsenals.' Technical knowhow would be required to verify and prevent potential breakout, or respond rapidly and effectively if a breakout occurred. In a world approaching zero, the labs' expertise would make them natural leaders in technical aspects including identifying technical hurdles in the disarmament process and formulating effective verification regimes. It is important that the complex be viewed as honest brokers with the required technical competence.

The rationale and motivation for seeking a world free of nuclear weapons is fundamentally different from the classic 'war containment' justification for arms control. It has more to do with containing the potential misapplication of science – a danger that will only grow with time – than it does with ending warfare. Jeanloz closed his presentation by encouraging a persistent focus on the concrete and visible benefits a major NWS would get from disarming its nuclear arsenal (namely international nonproliferation cooperation and preventing nuclear terrorism). One particularly important development that could motivate NWS disarmament is the establishment of more reliable and credible means for enforcing international prohibitions. Possible enforcement mechanisms could be built within existing multilateral frameworks (e.g., International Atomic Energy Agency (IAEA)) or outside of them (e.g., U.S.-Russia bilateral mechanisms).

PERSPECTIVE #2: IMPLICATIONS OF A PROLIFERATED WORLD

In addressing the technical challenges associated with a proliferated world, Keith Payne⁴ answered the following three questions:

1. What are the challenges for monitoring and verification in a proliferated world?
2. How does the United States sustain an ability to develop and produce added nuclear capabilities as a hedge against the risk of a proliferated nuclear world? What non-nuclear capabilities can address the security challenges of a proliferated world in order to support the current trend toward the reduced reliance on nuclear weapons in U.S. security strategy?
3. Are there threat and risk reductions initiatives that can shape the evolving security environment to help ensure that the current trend towards a reduced role for nuclear weapons continues?

Payne suggested that a more proliferated world could include the following new nuclear-weapon states: Iran, Japan, South Korea, Egypt, Saudi Arabia, Turkey, Brazil, and potentially Ukraine. There also could be a modest increase in the French and British nuclear arsenals along with more dramatic increases in those of China, Pakistan, India, North Korea, and Russia.

Payne began by addressing whether and how the United States could continue the current trend towards reduced reliance on nuclear weapons in a more proliferated world. Payne suggested that in the context of a proliferated world, such continued efforts would be difficult to justify. As he put it, if the United States reduced the role of nuclear weapons only to see nonproliferation efforts fail famously, would it be sensible to continue to place priority on a U.S. policy to further a non-nuclear norm?

Paine identified, however, that such efforts might continue if American policymakers determined that nuclear weapons had declining value, even in a proliferated world. Therefore, reducing reliance might eliminate the risks and costs associated with sustaining the arsenal. According to one commentator, even in a proliferated world, the norm against nuclear use might remain, and the United States should act to preserve it. Payne agreed but noted that in the past, even some well-established international norms collapsed under the pressure of war and crisis.

If policymakers concluded that nuclear weapons had limited value in a proliferated world, what measures and initiatives might follow? Payne suggested that the answer is in five overarching, enduring U.S. security goals and their relative prioritization: 1) protection of U.S. society against an attack with weapons of mass destruction (WMD) (Payne emphasized the role of damage limitation in a proliferated world); 2) deterrence; 3) assurance of U.S. allies; 4) dissuasion of potential challengers; and 5) mitigation of security threats through diplomatic and international institutions. Payne identified two parallel approaches: 1) measures and initiatives to support the five goals with declining reliance on nuclear weapons; and 2) the preservation of U.S. nuclear capabilities as a hedge in case those measures fail.

Payne emphasized that the most helpful measure would be a global security regime that provides the United States and its allies confidence in their security with few or no nuclear weapons, even in a proliferated environment, and therefore eases U.S. deterrence and extended deterrence commitments. It would also help to prevent flashpoints from erupting in the Middle East, South Asia, East Asia, and elsewhere. However, Payne described a potential path towards such a security architecture, but added that he considers its successful establishment to be extremely unlikely because of the “profound and enduring” difficulties and political obstacles. As he put it, such a development would “turn international relations on its head.”

⁴ Dr. Keith Payne is President of the National Institute for Public Policy (NIPP) and head of the Graduate Department of Defense and Strategic Studies at Missouri State University (Washington Campus).

If the United States remained committed to reducing its reliance on nuclear weapons in a proliferated world, it might consider restricting the role of nuclear weapons to a single purpose – responding to a nuclear attack on the United States, while relying on conventional capabilities for extended deterrence and deterrence against chemical and biological threats. Since many current NNWS allies will have developed independent nuclear deterrents in this world, withdrawing those U.S. nuclear commitments “wouldn’t break the bank in the way that it would in the current context.” The United States could continue to offer non-nuclear extended deterrence commitments to allies, though it would face the continuing potential for a ‘commitment trap’ and credibility challenges (especially in response to WMD threats).

Payne said the United States also might consider changing the targeting requirements of its arsenal, increasing investment in defense and consequence management (including active and passive actions against chemical and biological attacks), and/or increasing focus on dissuasion of further proliferation by demonstrating that there is no advantage to further developing nuclear arsenals.

The force structure implications of these policy shifts would include: 1) increased emphasis on survivability of U.S. nuclear forces to eliminate any thought that a potential aggressor could have of eliminating U.S. capabilities; 2) greater value placed on non-nuclear capabilities to fight and win against nuclear, chemical, or biological attacks; 3) greater value placed on non-nuclear weapons for deterrence, counterforce, and preemption (requires survivability, effectiveness, exquisite accuracy and high reliability); and 4) an agile and adaptable hedge and/or reconstitution capability.

Even with an increased reliance on conventional capabilities and a new global security regime, the United States would still need to retain a hedge to respond to emerging and unsuspected challenges. Although many assert that U.S. conventional superiority is sufficient for deterrence, Payne remarked that “as a generic comment it doesn’t really offer anything [because] deterrence is not a generic function...what force is sufficient for deterrence will change over time and be different depending on the opponent.” There are a variety of requirements that can come along if deterrence is the goal, and thus, U.S. forces and planning for deterrence need to be sufficiently flexible to accommodate the wide spectrum of opponents, stakes, and contingencies in which the United States will want deterrence to function.

A proliferated world would also have a profound impact on intelligence. The United States would need: improved nuclear and BW forensics capabilities (for tailored deterrence), a detailed understanding of the decision-making of potential adversaries (to formulate effective deterrence), and improved verification and monitoring of the transfer of nuclear materials (to prevent potential transfers to terrorist organizations). According to one commentator, this is an area where the labs would be essential in providing the nuclear expertise needed to know what to look for in monitoring and verification.

Payne concluded that there is a sweeping list of measures and initiatives that might, in principle, allow the United States to decrease the salience of nuclear weapons in a proliferated world – many are unfeasible, others are highly expensive, and some are mutually exclusive (e.g., withdrawing from potentially dangerous ‘commitment traps’ and the establishment of a reliable global security regime). And there are other, less obvious, points of tension that policymakers ought to consider when deciding upon the appropriate path. For example, more robust U.S. non-nuclear capabilities would make it more difficult to elicit cooperation from Russia (and others) in reducing their nuclear arms.

PERSPECTIVE #3: MULTILATERAL, INTEGRATED NUCLEAR SECURITY FRAMEWORK

In addressing the technical challenges associated with a multilateral, integrated nuclear security framework, Garry George⁵ answered the following three questions:

⁵ Mr. Garry George is on assignment to the Lawrence Livermore National Laboratory from the U.K. Atomic Weapons Establishment.

1. What are the next steps for the nuclear powers to pursue in their use of stockpile latency as the key element of NPT Article VI actions? What technical challenges do they pose?
2. What are the next steps in global risk reduction for nuclear weapons and materials? How should they be implemented and what are the technical challenges involved?
3. What are the highest priority elements of a multilateral toolbox that can provide a foundation for progress, and the accompanying near-term steps to initiate for populating the toolbox?

George began his presentation by criticizing the tendency to “talk about zero as if it exists in an absolute sense” and emphasizing the importance of language and agreed upon definitions when discussing these issues in a multilateral context. As he explained, “zero can mean a lot of things...are we talking about zero knowledge of nuclear weapons? Zero deployment? Zero ownership? Zero intent?” Without a common understanding of words and concepts – as well as a shared view of the nuclear weapons ‘value proposition’ – it will be difficult to formulate global strategies to move toward compliance with NPT Article VI or secure nuclear inventories.

In assessing the global progression towards a world free of nuclear weapons, George proposed a “multiple-zero” approach with emphasis on the linkages to the broader collective security environment (see the workshop briefings in Appendix A for a visual representation of this construct). George tied the progression through each ‘zero’ to three drivers of the collective security environment (energy, sustenance, and political-military relationships). He identified three ‘zeros,’ focusing mainly on the first two. Zero-1 is the ‘spirit’ of NPT Article VI, defined as no operationally deployed nuclear weapons and low stockpile levels, which he also characterized as the medium-term future goal. Zero-2 is a ‘long-term future’ goal at which all nuclear weapons (deployed and in stored ‘stockpiles’) have been multilaterally eliminated. Zero-3 is the ‘letter’ of NPT Article VI, defined as global, complete, and general disarmament – a world where global energy, sustenance, and political-military securities are universal.

George believes that a shared, structured understanding of goals and progress can help focus the international agenda in order to make risk-informed, multilateral implementation plans. His presentation made it clear that no zero is associated with any particular date. Instead, George presented a roadmap that would allow countries to assess their individual and collective security as they progress towards an agreed, multilateral ‘way point’ along the way. The approach makes it clear that associated improvements in world stability – in terms of resources, sustenance, and relationships – will be needed at each stage.

As part of this process, George proposes the development of a nuclear warhead security regime (NWSR). The regime would be designed to expand over time, increasing confidence along the way. George argues that without a regime that matures over time, treaties and verification regimes would have to be constantly reinvented, stunting progress. George’s proposed NWSR would have multiple stages, for example: 0) nuclear complex and stockpile (NWC/S) declarations; 1) nuclear complex and stockpile (NWC/S) registration; 2) NWC/S material and material movement monitoring; 3) nuclear weapons (NW) material and material counting; 4) NW material and material reductions; and 5) NW material and material elimination. One participant noted that the regime would also need to include monitoring of latent nuclear production capacity (even after Zero-2 or Zero-3, latency has been reached), as there would be an enduring proliferation threat.

A number of different progression scenarios could emerge, depending on the evolution of the collective security environment. Each scenario, however, begins with and is dependent upon successful U.S.-Russian arms control and a ‘reset’ of relations. Following that, the NPT-recognized nuclear weapon states (N5) must agree to negotiated reductions as a pre-requisite to engaging the N8 (all states possessing nuclear weapons) and the Iran and North Korea situations must be resolved (though not necessarily in that order).

In response to a comment by a workshop participant, George acknowledged that Stage 0 could be one of the most difficult, especially for states like Pakistan, Russia, and China. However, he reiterated that any plan for getting to ‘zero’ must involve a system that matures over time with recognized way points to assess individual and collective securities, before multilaterally moving to the next step.

MORNING SESSION CONCLUDING DISCUSSION

The plenary discussion following the presentations was centered on three topics: 1) the importance of how nuclear policy issues are framed, described, and marketed; 2) the ability of norms to regulate a state's nuclear decision-making; and 3) the relevance of the experience with biological weapons to nuclear weapons arms control.

The importance of how nuclear policy issues are framed, described, and marketed. Building on an issue that was touched on in the presentations by Jeanloz and George, a number of participants expressed concern with the lexicon that is used to describe the various nuclear worlds and the need for arms control. Two participants argued that policymakers should stop using the phrase 'nuclear danger' because it has no set meaning and can lead to the wrong perceptions.

One participant argued that policymakers might do better to shift the discussion from elimination of nuclear weapons to prevention of use. The participant argued that the real danger is not the existence of nuclear weapons, but their explosion and use. Moreover, this shift in focus might give the needed attention to avoiding mistaken or accidental launch and to preventing cyber attacks on nuclear command and control (C2). The participant emphasized the critical role of survivability and C2 and noted that the knowledge base necessary to maintain them is at more risk than that required for warhead design.

The ability of norms to regulate a state's nuclear decision-making. Some participants argued that norms could continue to play an important – and perhaps increasing – role in reducing the risk posed by nuclear weapons even in a more proliferated world. As one participant explained, in such a world, the “highest priority” would be to strengthen the taboo against nuclear use.

Others were less optimistic. While acknowledging that norms against use could have some effect and should be strengthened as much as possible, one participant argued that the United States should be more realistic in its expectations, citing empirical evidence about human decision-making. 'Rational' decision-making varies based on cultural, religious, ideological, and personality factors, and cognitive studies have shown that individual minds deal with judgment about risk very differently. For example, the nuclear taboo would likely be ineffective in restraining terrorist organizations.

The relevance of the experience with biological weapons (BW) to nuclear weapons arms control. Participants debated the potential to draw lessons-learned from the BW 'taboo.' One participant pointed out that with BW “almost all the investment is in consequence management,” which is an “important distinction because it assumes that someone will use one of these devices.” Another responded that BW is a useful comparison because of the similar dual-use and latency challenges, thought he included the caveat that he sought to avoid the “trap of making easy metaphors.”

Moreover, the experience with BW might offer lessons for how the United States could invest in its nuclear complex even as the arsenal is reduced. The participant noted that while the United States has been out of the offensive BW business for forty years, it still maintains the competent people working on those issues to generate effective consequence management, verification procedures, and disposal methods. In the same way that the United States has “pretty sophisticated” research for BW, even without any intention of creating or using them, the United States should maintain advanced research about nuclear weapons, even if exclusively for defensive purposes.

POLICY IMPLICATIONS OF ALTERNATIVE NUCLEAR FUTURES

SUMMARY OF THE WORKING LUNCH, SNL-LLNL-CSIS WORKSHOP, 3 NOVEMBER 2009

CHAIR: JOHN HAMRE

During the working lunch, CSIS President and CEO John Hamre chaired a discussion concerning the policy implications of alternative nuclear futures. The lunch discussion focused on Washington's "twin objectives" of 1) the long-term vision of a world without nuclear weapons, while ensuring that 2) the United States maintains a safe, secure, and effective deterrent as long as those weapons exist.

Specifically, the group focused on the political realities of balancing these 'twin objectives.' As one participant put it, "there will be no arms control agreement without a modernization program, and there will be no modernization program without an arms control agreement." The critical questions therefore become: How do we make these compatible? Where is the maneuvering room? What constitutes a 'modernization program' (or whatever word is decided upon to describe it)?

Participants agreed that stockpile management – or, 'deterrence management' – is an urgent priority. Although the discussion focused on the stockpile, some participants criticized the tendency to reduce the debate to the warhead and proposed that the debate be expanded to address full system considerations, since aspects of overall capability – platforms; the enterprise; command and control; and surety – are as important as the weapons themselves when considering declarations, inspections, transparency, and stockpile management. Broadening the scope of the initiative could also generate buy-in from Congress members with 'pet projects' taking place outside of the laboratories.

The way that the initiative is packaged and marketed to Congress and the international community will be vitally important. As one participant advised, "you can't use the words 'modernization' or 'reliable'...you need a sales pitch and a salesperson who address the concerns of a few key members...98% of the discussion at this workshop is over their heads." A component of the 'repackaging' should include a greater emphasis on the symbiotic relationships between threat reduction programs at the laboratories (e.g., nuclear forensics) and weapons design expertise.

In Congress, the reliable replacement warhead (RRW) has fallen out of favor, in part because of its semantically-similar predecessor, the robust nuclear earth penetrator (RNEP), and the tendency to associate 'modernization' with more nuclear weapons and a higher likelihood of use. While the administration appears to support a robust stockpile management program, it wants to avoid being perceived as developing any new nuclear capabilities. Some arms control advocates have argued that investments in nuclear modernization would signal a renewed emphasis on nuclear weapons, which would offset the nonproliferation benefits of ratifying a new START and the CTBT.

According to one participant, the Obama administration might have more flexibility in pursuing modernization programs. Under the Bush administration, improved nuclear capabilities were associated with preemption. Under Obama, the United States might be able to sell these capabilities to the international community. For example, the United States might have success emphasizing that new nuclear capabilities are an important step to get to lower numbers in the arsenal.

Many participants expressed the need for more congressional guidance directed at the labs. For example, the authorization for B61 modernization is confusing for the labs – in particular the nuclear/conventional distinction in the authorization. This confusion impacts the lab staff very directly. With direction, the labs will be able to develop specific systems for real functions. A clear message is also important outside the labs where the United States needs to be careful not to send countries like Japan the wrong signal by not investing in a nuclear deterrent.

BREAKOUT SESSIONS: TECHNICAL CHALLENGES AND CAPABILITY GAPS

For the afternoon session on *Technical Challenges and Capability Gaps*, the workshop was divided into three concurrent 'breakout' groups, structured according to three principal policy challenges facing the United States as it copes with a complex and uncertain nuclear future. The topics were: 1) sustaining a U.S. nuclear weapons enterprise capable of meeting an array of challenges across multiple nuclear futures, co-chaired by Don Cook and Donald Kerrick; 2) providing the cooperative threat and risk reduction capabilities needed to address new challenges associated with multiple, changing nuclear futures, co-chaired by Jim Tegnalia and Anne Harrington; and 3) monitoring and verifying global and bilateral regimes for multiple nuclear initiatives, co-chaired by Jay Davis and John Lauder.

Each breakout group identified the technical challenges and associated capability gaps that are common to all of the nuclear futures or unique to a particular future. The goal of the afternoon sessions was to characterize a set of technical program initiatives that might support U.S. nuclear weapons policies in an uncertain world. For each session, a rising young professional served as a rapporteur and prepared the following summaries.

SUSTAINING A U.S. NUCLEAR WEAPONS ENTERPRISE CAPABLE OF MEETING AN ARRAY OF CHALLENGES ACROSS MULTIPLE NUCLEAR FUTURES

SUMMARY OF BREAKOUT SESSION #1, SNL-LLNL-CSIS WORKSHOP, 3 NOVEMBER 2009

CO-CHAIRS: DON COOK & DONALD KERRICK⁶

SUMMARY PREPARED BY LANI SAUNDERS⁷

The breakout group on the U.S. nuclear weapons enterprise focused on the requirements and strategy for a range of possible nuclear futures, with key questions posed up-front by the co-chairs that stirred comment in four major areas: 1) technical capabilities – existing or new – needed to support a variety of futures and the gaps that need to be addressed; 2) stockpile confidence and extended deterrence; 3) a comprehensive strategy for the future and the advice that could be offered to both NNSA and Congress on the future of the enterprise; and 4) issues of governance.

TECHNICAL CAPABILITIES AND SUSTAINING COMPETENCIES

The participants roundly agreed that capabilities cannot continue to exist if they do not get exercised. However, exercising capabilities in a paradigm where doing anything ‘new’ can become a congressional lightning rod is a very real issue. Several participants believe it puts the onus on those within the enterprise to be innovative, albeit politically savvy, in exercising capabilities. Others believe that being crystal clear on definitions of what truly constitutes ‘new’ – in other words, reaching a consensus and socializing that consensus – is absolutely a first step. One participant cited a methodology of working “designs that one would never dream of putting in the stockpile” to exercise capabilities. Many participants thought that out-of-the-box thinking is needed on how to exercise capabilities in an increasingly constrained environment; they think that old thinking will not necessarily solve the challenges of this new age.

Participants also discussed the leveraging of other national security missions in maintaining capabilities. Several believe that there is room to improve synergies between nuclear weapons and other national security missions with the goal of better leveraging flow of personnel and use of physical capabilities to the benefit of both. However, it was also noted that there is no substitute for nuclear weapons design and that these capabilities cannot be purely sustained by exercise that does not include such nuclear weapons design; the kinds of environments and requirements that nuclear weapons must be designed too often have no analogue outside the weapons program.

Another key theme of the discussion was the difficulty of planning for an enterprise and programs that by necessity have extremely long lead times when clearly articulated policy that sets the requirements is absent. The participants cited a need for such “boundary conditions” and “clarity in policy” – in other words, “what the country wants to do with the nuclear deterrent” – to be able to make decisions on “how to staff the enterprise and plan for it.”

There is also a need for an understanding of “what the core jobs are that need to be accomplished.” One participant stated it this way: “a realm where one can plan – this is what is needed – a program that provides the basis for stability.” Not being able to properly plan for the enterprise – both at a strategic and tactical level – is viewed as a significant gap that needs to be addressed.

STOCKPILE CONFIDENCE AND EXTENDED DETERRENCE

The discussion returned several times to the issue of credibility of those within the enterprise to stakeholders outside the enterprise (Congress, etc.) and how fundamental this credibility is to stockpile confidence and the extended deterrent.

⁶ Dr. Donald Cook is the former Managing Director of director of the U.K. Atomic Weapons Establishment and Lieutenant General Donald Kerrick (ret) is the former Deputy National Security Advisor to the President.

⁷ Dr. Lani Miyoshi Sanders is a Senior Member of the Technical Staff at Sandia National Laboratories.

Several participants highlighted the powerful tool that robust surveillance – down to that at the component level – can be in increasing confidence, both of those within the enterprise (of their own judgments in the absence of nuclear testing and meaningful weapons production) and outside the enterprise (to the administration, the public, and to others, such as our allies).

It was also noted that messages that shore up stockpile confidence or strengthen the extended deterrent can be unraveled by competing or contradicting messages. The participants returned several times to the importance of alignment of the right messages and the clarity in communication that is needed in both directions; they agreed that aligning the messages through the right story would do much to restore credibility that has unfortunately waned over the past decades. Several participants postulated that changes such as moves from no-fee contracts to fee-contracts, which have opened the door for criticism of the motives of lab and plant management, have damaged credibility.

COMPREHENSIVE STRATEGY AND ADVICE FOR THE FUTURE

Given the ongoing Nuclear Posture Review (NPR); the Upcoming NPT Review Conference; and the President’s commitment to reducing nuclear arsenals, pursuing the CTBT, and completing a new START, the participants agreed that any comprehensive strategy for the future enterprise must be tailored to have consistency with the Administration’s policies and Congressional prerogatives. All of this must be done in the context of no new military capability.

In other words, any program that is to be ‘survivable’ in any meaningful sense must be put together in a manner that reflects clear stockpile reductions, surveillance and refurbishments, strengthened non-proliferation, verification, declarations/registration of warheads, facilities, etc. (in other words, a move towards unprecedented transparency – and a new wrestling with how to make the enterprise ‘observable’), extended deterrence, and no new military capabilities – all the while retaining a clear focus on improvements to reliability, safety, security, surveillability, and survivability.

As one participant put it, “it is the coupling of weapons and arms control, non-proliferation, nuclear terrorism—it is these that must be wrapped up in a comprehensive strategy for nuclear security.”

The participants noted several times that in terms of science-based stockpile stewardship, the needs are invariant to the size and details of the stockpile. In other words, the complex remains capability-versus capacity-driven. Yet the very infrastructure to complete the mission does not exist today. A comprehensive strategy must address the overall sustainability of the enterprise. Furthermore, the enterprise must be considered as a whole, to include the DoD — particularly when considering the competencies that must be sustained.

At the core of a comprehensive strategy is thinking of and framing the future in ways that reflect the new thinking underway, while acknowledging the lessons learned from experience. This requires a new terminology and sensitivity to the way issues are framed. For example, rather than speaking of ‘stockpile management,’ a participant suggested ‘deterrence management’ to reflect the broader nature of the enterprise and what it is ultimately intended to accomplish.

GOVERNANCE

The participants agreed that the governance of the enterprise remains largely in disrepair. The sheer scale and number of entities giving direction to the Lab Directors was cited as a clear example. The participants seemed to agree that working the margins of the issue of governance will not create real change; as one participant put it, “bold moves are needed to fundamentally change the way we work and get rid of the extended, vested bureaucracy.”

The participants agreed the Secretary of Energy does have the power to effect such change, should he or she choose to exercise it. Fundamental to any change will be a needed restoration of trust – within and across the enterprise and between those inside the enterprise and stakeholders outside. The ongoing work towards reform is necessary and requires courage and commitment from leadership to embrace the real, bold change necessary for a sustainable future for the enterprise.

PARTICIPANTS, “U.S. NUCLEAR WEAPONS ENTERPRISE” BREAKOUT SESSION

Don Cook (Co-Chair), Don Kerrick (Co-Chair), Lani Miyoshi Sanders (Rapporteur), Ev Beckner, John Browne, Fred Celec, Don Cook, William Daitch, Garry George, Steve Guidice, John Harvey, Michael Haertling, Paul Hommert, Mim John, Don Kerrick, Ming Lau, Ron Lehman, Russ Miller, Tony Vidlak, and Jessica Yeats.

COOPERATIVE THREAT AND RISK REDUCTION

SUMMARY OF BREAKOUT SESSION #2, SNL-LLNL-CSIS WORKSHOP, 3 NOVEMBER 2009

CO-CHAIRS: JIM TEGNELIA & ANNE HARRINGTON⁸

RAPPORTEUR: THOMAS VANCE⁹

The Cooperative Threat and Risk Reduction (CTRR) group began with an explanation by the chairpersons of how broad global security cooperation facilitates solutions to problems faced by the partner states. The primary example used to illustrate the cascading effect of cooperation between states was the U.S-Pakistan science cooperation program. Instituted by the United States Agency for International Development (USAID), this program focused predominantly on health-related technologies that benefitted Pakistan. While Pakistan provided a majority of the funding for the program, the United States benefitted from information it collected through the partnership. However, while the United States gained useful information about biological weapon proliferation, it lost focus on chemical and nuclear technologies. This science and technology cooperative could provide a useful model for similar partnerships between the United States and Middle Eastern and Central Asian states with a focus on nuclear technologies and programs.

Three keys to building and sustaining successful partnerships were discussed by the CTRR group members: determining and defining a clear problem or issue that the partners are trying to solve, determining the correct partners for the problem or issue, and ensuring that the agency representing the U.S. government in the endeavor is provided the requisite tools to succeed. As an example of the third point, U.S. procurement laws constrain the actions of cooperative nations. This can lead to circumstances whereby actions will be based upon internal partner-state rules that may contradict the goals of the cooperative. Patience is critical for developing a successful cooperative effort among states; it takes substantial time and effort (as long as five years, or more) to build mutual trust and understanding.

While the goals U.S. partners in a global security cooperative do not need to be the same as U.S. goals, they do need to be complementary. Self-serving goals are only a concern when they contradict those of another partner state or the cooperative effort. On the U.S. side, the lead government agency determines whether a cooperative is net-positive for U.S. national security interests. The former Soviet Union had different goals when it agreed to the Cooperative Threat Reduction Program (Nunn-Lugar), but they did not contradict U.S. goals. Russian leaders were less concerned with nonproliferation efforts and more concerned with regaining control of weapons and returning them to Russian territory. Understanding the culture and priorities of partner states is an important step in this endeavor.

Specific issues and goals need to be carefully tailored to each cooperative in order to provide meaningful statistics that can indicate true progress towards achieving goals. Careful attention needs to be paid to avoid the creation of metrics that are immeasurable, non-meaningful, and/or overly burdensome to the point that they become detrimental to the cooperative mission.

It will be important for the United States to sustain strong cooperatives that are not viewed as U.S.-dominant. The United States should periodically cede leadership power to partner states. By empowering others, the United States might be able to leverage another state's unique capabilities and influence to help and encourage additional partner states. Each partner state brings something unique to the cooperative and it is important to maximize each contribution to the fullest extent possible.

However, participants did have one common concern with CTRR. While the goal of these efforts is threat reduction – which improves overall security – giving information to partner states must be carefully controlled so the United States can support the collective effort without harming its national

⁸ Dr. James A. Tegnelia is the former director of the Defense Threat Reduction Agency (DTRA) and Ms. Harrington is the Director of the U.S. National Academy of Sciences Committee on International Security and Arms Control (CISAC).

⁹ Major Thomas Vance (USAF) is an Air Force Fellow at Lawrence Livermore National Laboratory.

security. Participants were concerned with providing technology and information to partner states as well as granting reciprocal access to facilities on U.S. soil. Careful attention is required and those who participate in these U.S.-based visits should only be provided a general-level awareness and understanding of counter-intelligence efforts.

PARTICIPANTS, “COOPERATIVE THREAT AND RISK REDUCTION” BREAKOUT SESSION

Jim Tegnalia (Co-Chair), Anne Harrington (Co-Chair), Thomas Vance (Rapporteur), Larry Brandt, Paul Bernstein, Mike Dunning, Ronnie Faircloth, Howard Hirano, Carol Kuntz, Tom Neary, and Michael Sjulín.

VERIFICATION AND MONITORING

SUMMARY OF BREAKOUT SESSION #3, SNL-LLNL-CSIS WORKSHOP, 3 NOVEMBER 2009

CO-CHAIRS: JAY DAVIS & JOHN LAUDER¹⁰

SUMMARY PREPARED BY VERONICA HUTFLES¹¹

The breakout session began with a brief presentation on technical challenges and capability gaps in monitoring and verification. Participants looked at factors from ten or more years ago in order to assess the factors that contributed to previous successes in monitoring and verification. An important distinction was highlighted between monitoring and verification. Monitoring involves surveillance and determining the existence of sites via satellite imagery or on-site inspection; verification involves higher levels of confidence that can only be achieved once monitoring activities have already isolated a suspected site. A lengthy discussion ensued noting that onsite inspections are not very valuable if you don't know what you're looking for.

In future scenarios of significantly reduced arsenals, monitoring and verification would need to evolve. Inspection regimes would be near global, putting significant stress on the system. Resolution limits on monitoring capabilities would make it more difficult to account for fissile material than it has been to count tanks or missiles. Another concern is how to handle sensitive programs or a company's proprietary information. This led to discussion about the purpose of monitoring and verification. Suggested purposes included: to provide warning (allowing one to take action), to provide deterrence, to ensure entities are fulfilling their stated obligations, to enhance transparency and confidence by seeing that signatories are abiding by the rules of a treaty, and to get assurance. One participant noted that we are moving toward more dynamic monitoring. For example, before by counting silos one could infer other numbers and capabilities. This tactic will be harder to accomplish with new monitoring activities and technologies.

The group discussed how U.S. monitoring capabilities have improved since ten years ago. However, as the capabilities have increased, 'cheaters' have learned how to obfuscate and defeat our surveillance means. One individual noted that the great strength and capabilities inherent in U.S. surveillance equipment has actually had a negative effect on monitoring and verification because key assets have been reallocated to other efforts (e.g., Iraq and Afghanistan). According to one participant, using different approaches during monitoring and verification can create synergy – pieces of information from multiple sources can create a more accurate picture of a country's activities. As traditional intelligence is superseded and augmented by modern technology, verification and monitoring will improve (especially from a deterrence perspective).

The United States can more efficiently analyze and understand information than it could 10 years ago. For example, the United States also has a better ability to model an entire nuclear enterprise, which allows it to do link analysis of known activities or events and extrapolate to unknown or unseen events. However, as someone cautioned, third party data mining or surveillance can make it harder to interpret data because it is separated from the source. Furthermore, despite more widely available commercial imagery, the overall effect can be negative if there is a need to independently establish credibility of intelligence. Problems could also arise if the United States does not want to reveal intelligence sources.

The degree of access is critical, particularly if a country is not deterred by known surveillance capabilities. Even the United States has limits in its ability to gather data; the signal to clutter problem is an issue with massive amounts of data. Also, data gathering is limited by the equipment allowed during on site inspections. One participant pointed out that U.S. inspectors must have a mindset of 'what is the other party's perceived benefit'; they must enter with a theory of what a country believes it

¹⁰ Dr. Jay C. Davis is a National Security Fellow at the Center for Global Security Research at LLNL and served as the founding Director of the Defense Threat Reduction Agency (DTRA) and Mr. John A. Lauder is Vice President of Intelligence & Homeland Security Programs at Areté Associates.

¹¹ Major Veronica Hutfles (USAF) is an Air Force Fellow at Lawrence Livermore National Laboratory.

will gain and not fall into the mirror-imaging trap. The group agreed that a key element is having skilled and experienced practitioners of treaty writing that can write enforceable agreements. Skilled people are also needed to conduct monitoring and verification.

At this point, a second set of slides were presented on a proposed progression for getting global nuclear stockpiles to zero, and the monitoring and verification capabilities that would be required. A number of participants agreed that people need to realize nuclear weapons are not granular because they are tied to systems. The presentation theorized that getting to 1,000 weapons would be the last bilateral treaty, with all further treaties being multilateral. As a transition to multilateral negotiations, the United States and Russia should encourage other nations (China, India, Pakistan, etc.) to watch the final round of negotiations even though they would have no direct role.

One participant questioned whether the Russians care about getting down to 1,000 weapons, and a number exclaimed that non-strategic nuclear weapons must be included in any negotiations. One participant argued that Russia is more concerned about losing its 5,000-10,000 tactical weapons than it is lowering its strategic arsenal to 1,000. This led to further discussion about the perceived benefits for Russia and other states of participating in such negotiations. And, one participant noted at some point arms control agreements must start counting production capabilities, not just weapons and delivery systems.

If stockpiles were reduced down to 500 weapons, a number of additional requirements would emerge. A lot of people would need to understand the technology required to make monitoring and verification work including a number of foreign language speakers. Support from the military and Congress would be necessary for each step of the drawdown.

In a world of zero nuclear weapons, U.S. conventional forces would be even more important. In addition, things like the nuclear fuel cycle, naval propulsion fuel, and plutonium recycling would require special handling. Participants wondered whether a central, worldwide entity would be required to control these materials. A big unknown at zero weapons is whom the United States would be willing to accept parity with – a very emotional issue. The United States would also need to spend a lot of time and money to monitor zero causing a significant amount of money to be spent on research and development with no production as an end result. Participants doubted whether that would be possible in the typical U.S. budget mindset. Personnel numbers would also have to be greatly increased. For example, the START office at the Defense Treat Reduction Agency (DTRA) currently has about 500-600 people and a budget of 250 million dollars. If we reduce the stockpile to 50-100 weapons, that office will likely require thousands of people and billions of dollars.

One individual argued that we will never get lower than about 25 weapons. At this point, the weapons are counter value not counter force weapons. Nations will be really close to each other due to inspections, which will involve significant intrusion into a country's affairs. However, the fewer weapons you have, the less likely you are to share information. One participant worried that people in the United States are still talking like they are in the old Cold War regime. This participant felt that a new regime must get away from asymmetry between tactical and strategic weapons. Another person pointed out that treaties can be written to include positive motivations to go to zero or to significantly reduce arsenals. New mechanisms to achieve greater assurances of better compliance could help ease concerns.

An interesting note in regards to tactical nukes is that use control – the idea of loose nukes – arose as a Democratic Party concern, while greater numbers – which then might threaten the United States – was a Republican Party concern. One person noted that Russian tactical nuclear weapons are not a large concern in Europe because Russia has other means of wielding power (e.g., shutting off the gas supply or launching cyber attacks).

For the last 8-10 years, the United States has not been in a treaty preparation mode, which also means there has been no preparation for monitoring. Many in Congress don't even know we are in treaty negotiations. One individual felt future inspectors need experience in the technical details of nuclear weapon design and worried about where that experience will be found. Others noted that weapons design expertise is not required to be a good inspector, but for rogue states or states trying to avoid

treaty commitments, it's good to have that knowledge and background. Basically, monitoring and verification teams require a mix of skills. The United States must capture lessons learned from START inspectors, treaty negotiators, and others before that expertise and knowledge base is lost. There are two dimensions to expertise: reflecting on the past (lessons learned) and preparing for the future (how to grow or prepare new people). The United States should also consider the breadth of the system. The system is more than just inspectors, but includes laboratory personnel, the military, negotiators, and others.

Finally, the monitoring and verification regime was designed to be managed as a matter of routine; the regime should be robust in the face of crisis. During internal strife in a country, monitoring and verification should continue. If the process is routine, verification and monitoring could contribute to crisis stability and increased confidence in compliance.

PARTICIPANTS, "VERIFICATION AND MONITORING" BREAKOUT SESSION

Jay Davis (Co-Chair), John Lauder (Co-Chair), Veronica Hutfles (Rapporteur), George Anzelon, Henry Abeyta, Chris Chyba, Bryan Fearey, Lindsay Kitay, Matt Knight, John Stenbit, Benn Tannenbaum, Richard Wagner, Derek Wapman, and Amy Woolf.

PLENARY SESSION ON KEY JUDGMENTS FROM THE BREAKOUT & MORNING SESSIONS

SUMMARY OF THE PLENARY SESSION, SNL-LLNL-CSIS WORKSHOP, 3 NOVEMBER 2009

CHAIR: MIM JOHN¹²

Following the afternoon sessions, the full workshop convened for a plenary session to summarize the key judgments from the day-long workshop. This final discussion began with presentations of the key judgments from each of the three breakout group and concluded with Mim John's presentation of key takeaways from the day-long event.

U.S. NUCLEAR WEAPONS ENTERPRISE

Ev Becker and Lani Sanders presented the following summary judgments from the breakout session on the "U.S. Nuclear Weapons Enterprise:"

- Congress and the White House must formulate a strategy to sustain the nuclear labs for the long run. If knowledge and capability fades, it will take years to reconstitute.
- NNSA strategy should focus on reductions, surveillance, refurbishments, verification, and use control. The weapons program should flow from these ideas.
- It's time to get serious about how to make U.S. facilities observable to other countries.
- NNSA management of the labs comes from too many offices – NNSA and DOE need to simplify the management of the labs.
- The nuclear labs are facing increasing questions of trust – lab directions are no longer called upon to give their opinions because they're perceived as contractors. It could be useful to revisit no-fee contracting strategies for the labs.
- The size of the nuclear weapons enterprise should have little connectivity with the size of the nuclear weapons stockpile – it's a capability driven complex, not a capacity driven complex.
- Even without introducing new military capabilities into the stockpile, the labs must design outside the box to avoid technological surprise and to ensure the robustness of U.S. weapons.
- Words matter – 'deterrence management' has more currency than 'modernization' or 'stockpile management'

COOPERATIVE THREAT AND RISK REDUCTION (CTRR)

Paul Bernstein and Thomas Vance presented the following summary judgments from the breakout session on the "Cooperative Threat and Risk Reduction:"

- For effective CTRR, you have to address three critical questions: 1) what is the problem? 2) who is the partner? and 3) what toolkit (technology, but also inventory and business processes) are you using?
- The next stage of CTRR must be a coordinated, interagency effort – tons of resources need to be integrated and harnessed, which will require a disciplined, strategic approach.
- CTRR policy formation must reflect the President's priorities.

¹² Dr. Mim John is Vice President Emeritus at Sandia National Laboratories.

- Whatever we call the next phrase of CTRR, it needs to have more explicit focus on global nuclear security – it should be distinct from past efforts to dismantle BW or Russian nuclear weapons.
- However, CTRR can only be effective if the United States takes time to build discrete partnerships and understanding that will take time – each partner and situation will be unique.
- CTRR should be associated with different waypoints toward reduced reliance on nuclear weapons – when planning for the future, it’s important to think about the role that technology can play in assuring data exchanges, monitoring capabilities to deter cheating, and providing early warning.
- The United States tends to focus on national technical means – the discussion should be expanded to international technical means.
- Multilateral requirements can help target U.S. investment and capacity building to increase indigenous nuclear skills suitable to international requirements.
- Cooperative research and development between the United States and partners can be an important confidence building measure.

VERIFICATION AND MONITORING

John Lauder and Veronica Hutfles presented the following summary judgments from the breakout session on the “Verification and Monitoring:”

- Begin detailed planning now – infrastructure, personnel skills, treaty writers
- Learn from previous arms control activities
- Synergy matters – important to use many means together
- Monitoring and verification need to be a matter of routine, which can provide stability
- Reconstitution ability, production capability, and tactical systems require monitoring
- Monitoring methods have positive effects in crisis situation
- Treaty language can be written to craft positive incentives
- Impact of globalization strengthens connections between countries
- Need to be conscious of goals of monitoring regime: 1) warning; 2) are obligations being fulfilled? 3) deterrence; and 4) confidence in each step on the way to zero.
- Important to remember the resolution limits on our monitoring ability

WORKSHOP WRAP-UP DISCUSSION

Mim John led the final workshop discussion that laid the foundation for the key takeaways identified in the executive summary of this report. Key themes included:

- The United States must develop a consensus national strategy for the roles that nuclear weapons will serve including ultimate goals and interim weigh-stations along the way.
- Language is important – some terms have vague definitions that can lead to confusion (e.g., ‘nuclear danger’) and others are politically charged and must be replaced (e.g., ‘modernization’ and ‘reliability’). Alternate phrases like ‘deterrence management’ might be useful to get beyond the language barrier and start talking about the real issues.
- No matter what language is chosen – real work needs to be done to refurbish and maintain the arsenal.
- The United States won’t get arms control without sustainment and life extension and vis-a-versa.

- The discussion should be expanded from eliminating weapons to preventing use.
- Regardless of what path the United States chooses, it should proceed with care – this means defining not just the endpoint, but the steps along the way. There should be assessments of each waypoint to determine if the world is safer and if adjustments need to be made.
- While maintaining an effective hedge with U.S. offensive capabilities remains an essential mission of the nuclear labs, the entire nuclear enterprise must increase investment and planning for monitoring and verification.
- The United States needs to reinvigorate investments in monitoring and verification. The rapid growth of nuclear power will present new challenges that will require new tools and new ways of thinking about the problem – new technology will make denial and deception a more prominent problem.
- In developing monitoring and verification, the United States must consider what transparency mechanisms should be included in inspection regimes.
- The United States is moving in the direction of agreement to restrict strategic nuclear weapons, but must also plan for future ways to deal with conventional superiority and non-strategic nuclear weapons.

APPENDIX: WORKSHOP PARTICIPANTS

Mr. Henry Abeyta	<i>Sandia National Laboratories</i>
Dr. George Anzelon	<i>Lawrence Livermore National Laboratory</i>
Alex B.	<i>WINPAC</i>
Dr. Everet Beckner	<i>National Nuclear Security Administration (fmr)</i>
Mr. Paul Bernstein	<i>Science Applications International Corporation</i>
Dr. Larry Brandt	<i>Sandia National Laboratories</i>
Dr. John Browne	<i>Los Alamos National Laboratory (fmr)</i>
The Honorable Fred Celec	<i>Office of the Secretary of Defense (fmr)</i>
Admiral Henry G. Chiles, Jr.	<i>U.S. Strategic Command (fmr)</i>
Dr. Christopher Chyba	<i>Princeton University</i>
Dr. Donald Cook	<i>Atomic Weapons Establishment (fmr)</i>
Mr. William Daitch	<i>Domestic Nuclear Detection Office</i>
Dr. Jay Davis	<i>Defense Threat Reduction Agency (fmr)</i>
Dr. Michael J. Dunning	<i>Lawrence Livermore National Laboratory</i>
Mr. Ronnie Faircloth	<i>Defense Threat Reduction Agency</i>
Dr. Patricia K. Falcone	<i>Office of Science & Technology Policy</i>
Dr. Bryan Fearey	<i>Los Alamos National Laboratories</i>
Mr. Garry George	<i>Atomic Weapons Establishment</i>
Mr. Stephen J. Guidice	<i>Independent Consultant</i>
Mr. Michael Haertling	<i>Los Alamos National Laboratory</i>
The Honorable John Hamre	<i>Center for Strategic & International Studies</i>
Ms. Anne Harrington	<i>National Academy of Science</i>
Dr. Carolyn M. Hart	<i>Sandia National Laboratories</i>
Dr. John Harvey	<i>Office of the Secretary of Defense (AT&L)</i>
Mr. Steve Henry	<i>Office of the Secretary of Defense (AT&L)</i>
Mr. Howard Hirano	<i>Sandia National Laboratories</i>
Dr. Paul J. Hommert	<i>Sandia National Laboratories</i>
Major Veronica Hutfles	<i>Lawrence Livermore National Laboratory</i>
Dr. Raymond Jeanloz	<i>University of California at Berkeley</i>
Dr. Miriam E. John	<i>Sandia National Laboratories</i>
Dr. Kerry Kartchner	<i>U.S. Department of State</i>

Lt. General Donald Kerrick	<i>Independent Consultant</i>
Ms. Linsay Kitay	<i>Defense Threat Reduction Agency</i>
Dr. Matt Knight	<i>Nuclear Strategic Deterrent Office, MOD</i>
Dr. Carol Kuntz	<i>Office of the Secretary of Defense</i>
Dr. Ming Lau	<i>Sandia National Laboratories</i>
Mr. John Lauder	<i>Areté Associates</i>
The Honorable Ronald F. Lehman, II	<i>Lawrence Livermore National Laboratory</i>
Dr. Russell Miller	<i>Sandia National Laboratories</i>
Dr. Clark Murdock	<i>Center for Strategic & International Studies</i>
Maj. General Thomas H. Neary	<i>Science Applications International Corporation</i>
Dr. Keith Payne	<i>National Institute for Public Policy</i>
Dr. Lani M. Sanders	<i>Sandia National Laboratories</i>
Mr. Michael R. Sjulín	<i>Sandia National Laboratories</i>
Dr. Francis Slakey	<i>Georgetown University</i>
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