Lawrence Livermore National Laboratory

January 7, 2009

The Honorable Michael R. Turner
United States House of Representatives
Washington, DC 20515

Dear Representative Turner:

As you requested in your letter dated December 9, I am pleased to provide my comments regarding the observations, findings, and recommendations put forward by the JASONs based on the FY09 summer study on the National Nuclear Security Administration's Life Extension Program (LEP) and documented in their report JSR-09-334E, dated September 11, 2009.

Before responding specifically to your request for my comments on the JASON report, I would like to start with a few overarching perspectives on the general subject of sustaining and managing the country's nuclear weapons stockpile:

Managing the nuclear weapons stockpile to ensure its continued safety, security and effectiveness is a very active endeavor that requires deep and broad scientific, technical and engineering expertise. The nation's nuclear stockpile has always, and will continue to require, a vigorous program of stockpile stewardship. That program is currently at risk.

There are significant scientific and technical certification challenges to maintaining the stockpile. For a well-designed life extension program, the level of technical challenge is comparable for all potential approaches, independent of whether the approach is based on refurbishment of the existing warhead, reuse of previously manufactured components or replacement of the warhead. Most life extensions will actually involve a mix of all three approaches. The same level of technical rigor is required to annually assess the health of the stockpile.

For any potential life extension program, all potential approaches should be examined because the areas of the most significant risks vary, and often times, have to do with costs, manufacturing, the importance of improvements in margins, safety and security, and long-term maintenance and surveillance. These factors differ from system to system.

I continue to believe that there are viable technical approaches to manage and sustain an effective, smaller, safer, and more secure stockpile consistent with national policy goals through a vigorous program of stockpile stewardship.

In responding to your request, the key observations, findings, and recommendations provided in the JASON's unclassified Executive Summary are provided along with my comments on each, as required.

Findings - JASON Life Extension Program (LEP) Executive Summary

1. **JASON finds no evidence that accumulation of changes incurred from aging and LEPs have increased risk to certification of today's deployed nuclear warheads**
2. **Lifetimes of today's nuclear warheads could be extended for decades, with no anticipated loss in confidence, by using approaches similar to those employed in LEPs to date.**

In the absence of the more complete discussion provided in the classified report, the first two findings understate, in my view, the challenges and risks encountered in ensuring a safe and reliable nuclear force. These findings also understate the future risks that we must anticipate in sustaining the high-yield, low-margin designs of the Cold War stockpile. In particular, I believe that the risks associated with manufacturing difficulties, continued erosion of intellectual capital, the impact of funding limitations, and capability to address potential future issues are all understated. While the executive summary understates the risks and challenges, the full classified report does address some of the risks and therefore, in my view, provides a more accurate description of the challenges facing the Stockpile Stewardship Program (SSP).

Considerable discussion occurred during this study that identified the extreme difficulty (Fogbank being the latest example) in recreating Cold War materials and/or production processes. As discussed in the full classified report, continuing to use approaches similar to those employed in LEPs to date would result in the need to re-establish several other highly complex manufacturing processes that have been out of use for decades. While it is theoretically possible to re-establish these arcane processes, the time and cost to do so are daunting and so result in major risk.

Funding reductions over the past five years have impacted the scientific and technological foundation of the SSP. The current LEP approach exercises only that portion of the intellectual base required to make the LEP repair. It does not fully exercise the overall intellectual base required to maintain the nuclear force.

Funding reductions impacting the science, engineering, and technology programs within the SSP, and changing national priorities and

requirements also enter into our assessments of the risks to life extending the current stockpile warheads through techniques similar to those employed to date.

The accumulation over time of small changes that are inherent in component aging, material compatibility issues, and refurbishment of aging components, take our warheads away from the designs whose safety and reliability were certified in the era when nuclear tests were conducted. Recently identified warhead problems (that were not identified when certain warheads were first introduced into the stockpile) further complicate certification. These factors introduce increased uncertainty in the performance of existing warheads. Experience has shown that at least one major new and unanticipated issue is discovered about every five years.

Thus far we have been able to retain confidence in warhead safety and reliability by offsetting these increased uncertainties with corresponding increases in performance margins obtained by changes external to the nuclear explosive package, or by relaxing and eliminating (in coordination with the Department of Defense) military requirements. Options to further improve these margins using techniques similar to those employed to date have largely been exhausted. Perhaps most importantly, the current LEP approach cannot provide modern safety and security features across the stockpile. It is for this broad range of issues, not simply technical concerns, that we have cited increasing risk in our ability to certify the safety and reliability of our Cold War stockpile into the indefinite future.

3. **Further scientific research and engineering development is required for some proposed surety systems.**

While it is true that some more advanced surety systems require further scientific research and engineering, there are many important surety systems that are ready for deployment now. These have been deployed in some stockpile systems for years. More complete deployment of these mature systems, along with further development of the other less mature systems, would result in significant gains in surety when compared to current warhead standards.

4. **Implementation of intrinsic (inside the nuclear explosive package) surety features in today's re-entry systems, using the technologies proposed to date would require reuse or replacement LEP options.**

We agree that implementing surety features inside the nuclear explosive package would require life extension approaches based on reuse and/or replacement.

5. **All proposed surety features for today's air-carried systems could be implemented through reuse LEP options.**

   We agree with this finding. However, the same finding holds that all proposed surety features for today's air-carried systems could also be implemented through replacement LEP options.

6. **Implementation of intrinsic surety features across the entire stockpile would require more than a decade to complete.**

   Based on current and anticipated future production capacity, it will take more than a decade to complete any life extension programs for the stockpile. This is independent of whether or not they include intrinsic surety improvements. Recognizing this, we are investigating multiple options to improve the safety and security (surety) of stockpile warheads in a layered or spiral approach. Options are available today that, if pursued, could enable substantially improved surety for certain LEPs over the next decade. We are developing approaches to incorporate intrinsic surety into warheads as they undergo full life extensions. For warheads that have previously undergone life extensions or are not scheduled for life extension for some period of time, there are additional approaches that while not providing as complete benefit as intrinsic surety, offer improvements over the current situation. Intrinsic surety would be implemented into these warheads as they in turn undergo their full life extension.

7. **The basis for assessment and certification is linkage to underground test data, scientific understanding, and results from experiment.**

   Certification of the stockpile progressively relies on increasing scientific understanding and advanced experimental and simulation capabilities. But more importantly, it is the quality of our people, their experience and judgment in assessment and certification that we rely on the most. It will become increasingly more difficult to preserve this base of human capital if their skills are not exercised routinely.

8. **Quantification of Margins and Uncertainties (QMU) provides a suitable framework for assessment and certification.**

   We agree that Quantification of Margins and Uncertainties provides a suitable framework for assessment and certification and continue to devote considerable effort to further maturing the scientific, computational, and experimental underpinnings that supports the QMU methodology.

9. **Increased scientific understanding enables reduced reliance on calibration, enhanced predictive capability, and improved quantification of margins and uncertainties.**

   We agree. The SSP's science, technology, and engineering (ST&E) underpin the current and any future nuclear deterrent. ST&E within the SSP is currently under considerable funding stress and impacts our ability to increase scientific understanding.

10. **Assessment and certification challenges depend on design details and associated margins and uncertainties, not simply on whether the LEP is primarily based on refurbishment, reuse, or replacement.**

    We agree. Warhead assessments and certification must encompass and address the entire nuclear warhead. Therefore while the focus and/or intensity of effort on a particular aspect to the warhead might be influenced by the specific LEP approach, all aspects of the warhead must be analyzed independent of the life extension approach.

11. **Certification of certain reuse or replacement options would require improved understanding of boost.**

    Improved understanding of boost is essential for predicting and assessing weapon performance for all systems as they age including those currently undergoing life extension, not just for reuse or replacement life extensions. This is especially true for current, low-margin Cold War systems. Reuse or replacement options enable increased margin and so reduce risk. In addition, there are many other areas of weapons physics that require improved understanding if we are to be fully confident of our ability to carry the full range of potential certification tasks without resorting to nuclear testing.

12. **Continued success of stockpile stewardship is threatened by lack of program stability, placing any LEP strategy at risk.**

    We agree with this finding.

13. **The surveillance program is becoming inadequate. Continued success of stockpile stewardship requires implementation of a revised surveillance program.**

    We agree with this finding. Issues surrounding the growing inadequacies associated with the surveillance program have been raised over the past years in the Director's Annual Assessment Letter. We are working with

NNSA to identify a new/modified surveillance program that meets current and future program needs.

Recommendations- JASON Life Extension Program (LEP) Executive Summary

1. **Determine the full potential of refurbishment, as exemplified by LEPs executed to date, for maintaining or improving the legacy stockpile.**
2. **Quantify potential benefits and challenges of LEP strategies that may require reuse and replacement, to prepare for the possibility of future requirements such as reduced yield or enhanced surety.**
3. **Strengthen and focus science programs to anticipate and meet potential challenges of future LEP options, including challenges associated with boost and surety science.**
4. **Revise the surveillance program so that it meets immediate and future needs.**
5. **Assess the benefits of surety technologies in the context of the nuclear weapons enterprise as a system, including technologies that can be employed in the near term.**

These recommendations have been provided to NNSA for their review and consideration. Prior to this study, NNSA had directed the NNSA design laboratories to address some of these recommendations. In particular work on recommendations one, two, three, and four have been underway for some time. An initial study of number five began more recently. We are working with NNSA to identify those recommendations that may require additional study and analysis.

I would be happy to meet with you or your staff personally to provide any additional clarifications if that would be helpful.

Sincerely,

George H. Miller

George H. Miller
Director

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