

Reliable Replace Warhead Executive Summary

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1.4 Findings and Recommendations for the WR1

The WR1 design is pursued with the above principles in mind, but certification is not yet assured. The certification plan presented needs further development. For example, additional experiments and analyses are needed that explore failure modes, and assess the impact on performance of new manufacturing processes. Substantial work remains on the physical understanding of the surety mechanisms that are of high priority to the RRW program.

Our findings and recommendations are as follows:

1. Certification for WR1 will require new experiments, enhanced computational tools, and improved scientific understanding of the connection of the results from such experiments and simulations to the existing nuclear explosive test data. We recommend
 - continued investigation and development of quantitative measures that assess the connection of WR1 with the legacy nuclear test data,
 - additional hydrodynamic and other (non-nuclear explosive) experiments beyond those indicated in the certification plan presented. Such experiments are intended to extend modeling and simulation capabilities so that future computational tools are predictive not only of device performance, but also of device failure and the limits of validity of the computer simulations. This effort will require the continued availability of hydrodynamic test facilities;
 - that an improved understanding of materials aging and interactions over the proposed multi-decade lifetime of RRW systems be developed.

2. The physical understanding of the enhanced surety features, which address a top requirement for WRI, is still under development. We recommend
 - that substantial effort be placed into surety science, including modeling, materials properties and experimentation (beyond that proposed in the reviewed certification plan),
 - once an improved physical understanding is in hand, a QMU-based assessment of the surety features must be performed.

3. New fabrication processes are proposed for WRI with the intent of simplifying manufacturing and achieving cost savings. To ensure that the new manufacturing processes do not have a deleterious effect on WRI performance we recommend that
 - their impact on performance be understood. This will require additional experiments and computer simulations beyond those presented in the certification plan;
 - proven manufacturing processes be maintained as contingency.

4. In the absence of new nuclear-explosive testing, the challenges to certification must be met in a peer review regime that establishes confidence in the WRI design. Peer review is essential to establishing the technical credibility of new designs. Peer review for RRW certification must play a larger role than provided for by current NNSA guidelines or envisaged in the LLNL plans presented to us. We recommend that NNSA establish a RRW peer review mechanism with the following elements:
 - the process must be visible, funded, and administered to assure the nation that all expertise available has been applied to a rigorous evaluation of the new design;
 - it is imperative that its effectiveness be examined periodically by an independent organization;

- the peer review team should be broadly constituted and have authority to pose formal tests of a computational or experimental nature to the design team;
- issues identified through peer review must be documented, tracked and follow a formal process of closure with participation by the peer review team;
- responsibility for conducting peer review should be assigned to the weapons design laboratory not leading the design effort.

1.5 Transformation of the Complex

The WR1 design is intended to meet the transformational objectives for the nuclear weapons complex. The early engagement and cooperative working relationship between the design laboratories and production plants during the feasibility phase has led to fewer hazardous materials in the design and a likely reduction of steps in the manufacturing processes. However, JASON was not presented with any cost or schedule information for WR1, so we cannot assess the impact of WR1 or the RRW concept on transforming the production complex at this stage.