Lawrence Livermore National Laboratory

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Predictive Science Panel Unclassified Report

LLNL Meeting

August 20–22, 2013

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Predictive Science Panel

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Unclassified Report

The Predictive Science Panel (PSP) met at LLNL on August 20–22, 2013. The Panel appreciated the frank discussions of the four deep-dive topics:

- Primary Physics Certification Issues with Remanufacture and Reuse
- Statistical Filtering Approaches to UQ Science
- Theoretical and Experimental Considerations for Accessing Low-Z EOS
- Advanced Hydrodynamics Methods Development

Significant progress was demonstrated in each area. Panel suggestions of fruitful directions for further work are described in our classified report. In this unclassified report we offer the following summaries.

Primary Physics Certification Issues. The new metric that was described holds promise for providing insight into primary performance. The Panel is looking forward to seeing its further development and application. The W78/88 LEP team has highly capable designers from LLNL and LANL, and the primary-design work that we saw was of high quality. We remark the overhead of managing such a bi-lab team for such a project is likely to be substantial.

UQ Science. The Panel saw two new methods for developing uncertainty quantification, one in the primary-certification session and one in the UQ-science section. Both methods show promise for addressing issues that cause difficulties for established UQ methods. In our classified report we offer detailed suggestions for connecting these new ideas to established methods and perhaps improving them by merging them with established methods.

Low-Z EOS. Significant progress has been made in developing a low-Z EOS. The theoretical efforts are nearing completion and an experimental program is in progress, with the promise of collecting data that should substantially reduce key uncertainties. Further effort will be needed to reduce experimental uncertainties and to take advantage of all available data, as we outline in the classified report, but this effort is on track to answer many long-standing questions.

Hydro Methods. LLNL and LANL are developing a number of new hydrodynamic simulation methods, with one goal being to take advantage of the specialized computing architectures that are anticipated for the future. The Panel finds this work to be exemplary and thinks these directions are appropriate.

Other Observations. The Panel saw support for basic (open) science by the current weapons program. This was particularly noted in the EOS and hydro work. This has a positive impact that is difficult to quantify but that we believe is substantial. It helps attract and retain talent, promotes documentation of the efforts, and leverages the scientific community to review methodology and provide feedback.

There is an apparent high level of cooperation in the low-Z EOS work among experimentalists and theorists across the three NNSA labs, with substantial cooperation from the University of Rochester and AWE (UK). This level of cooperation is an exceptional asset to the weapons program, and we applaud those responsible, including both managers and staff members.

We heard that there is a sense of increased stress and reduced morale among LLNL technical employees in the weapons program, stemming from a (perceived, at least) combination of reduced resources and increased work requirements. We recommend attention to the potential danger that activities that are important for long-term stockpile stewardship may be dropped in favor of seemingly urgent near-term requirements.