

**Department of Energy National Nuclear Security Administration
FY02 Appraisal of
The University of California and Los Alamos National Laboratory**

FUNCTIONAL AREA: SCIENCE AND TECHNOLOGY

Selected notable laboratory accomplishments included:

- Regarding the Dynamic Materials Campaign, the successful demonstration of the utility of neutron resonance spectroscopy for thermal characterization in detonating explosive was a notable accomplishment;
- Regarding the Enhanced Surety Campaign, since certification issues must be resolved prior to implementing a new technology feature, LANL planned and executed component tests intended as steps toward certification;
- Regarding the Enhanced Surveillance Campaign, a notable accomplishment was the successful preparation of Plutonium (Pu) 238 alloys that meet the material specifications for the pit lifetimes project;
- Regarding the Advanced Design and Production Technology Campaign, LANL notable accomplishments were their excellent participation and contributions, reflected in the high quality of the Integrated Priority Lists, 90-Day Study recommendations, and the NNSA Applied Science and Technology Roadmap;
- Regarding the Advanced Simulation and Computing Initiative Campaign, the secondary code projects are the best in the nation and deserve special recognition based on their highly successful simulation;
- Regarding Readiness in Technical Base and Facilities, LANL's Ten-Year Comprehensive Site Plan was a substantial improvement over previous plans, and features a noteworthy representation of the various linkages between mission drivers and facility requirements;
- The performance and planning by LANL for the fusion diagnostics program was outstanding. The LANL theory group made outstanding contributions in the area of computational plasma physics, particularly Magnetohydrodynamics; and
- LANL was included as a joint entrant on an R&D 100 Award submission by industry for a near-commercial fuel cell based on technology licensed from LANL.

Selected notable laboratory deficiencies included:

- Regarding Stockpile R&D, the W76 Stockpile Life Extension Program hydrodynamic test incurred test set errors that compromised data. Regarding the W88 hydrodynamic test (Significant Findings Investigation resolution), problems with production of test unit and delays due to fire hazard precluded test;
- Regarding Stockpile Evaluation, LANL's programmatic performance, management, and planning for Significant Findings Investigations (SFIs) deserves a rating of Good. This element was rated Good because the mechanisms to ensure that SFIs are raised and addressed strategically and given appropriate priority are still being put in place at LANL. The fact that LANL redirected funding from SFIs to other work in FY02 demonstrates that the mechanisms are not yet in place;
- Regarding the Spallation Neutron Source (SNS) Program, the LANL SNS technology and engineering was very good, but requires a definite improvement in the quality assurance area and vendor acceptance requirements. The linac quality assurance program needs improvement, especially on vendor oversight, specifications, and testing. DOE also sees a need for LANL to strengthen its response to satisfying ORNL requests. It is important that LANL management continues to carry out its mission to completion, and not hand-off the responsibility for the equipment before it has been proven technically;
- Regarding the Pit Manufacturing and Certification Campaign, the unexpected cost increment (~\$6.7 Million) that occurred during the final two weeks of FY02 indicates that management must work to ensure tighter control over spend plans relative to budget; and
- Regarding the Advanced Scientific Computing Initiative Campaign, LANL did not demonstrate a common focus and a long-term, integrated, coherent ASCI program strategy. This lack of a coherent primary strategy was twice pointed out by external review panels. The Q supercomputer procurement is suffering at least a six-month delay causing part of one ASCI milestone to be delayed and two more are in jeopardy.

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The following is the DOE evaluation of LANL's S&T performance by major program. Additional LANL performance information related to the NNSA Stockpile Stewardship Program can be found in the Laboratory Management section under the "Support of NNSA Mission" measure (measure 2.1.a).

DIRECTED STOCKPILE WORK

OVERALL DOE ADJECTIVAL RATING: Excellent

NUMERICAL SCORE: 86

The evaluation of the Directed Stockpile Work area is composed of three sub-areas: Stockpile Research & Development, Stockpile Maintenance, and Stockpile Evaluation/Surveillance. Each of these sub-areas is individually evaluated below.

DIRECTED STOCKPILE WORK - STOCKPILE RESEARCH & DEVELOPMENT

OVERALL DOE ADJECTIVAL RATING: Excellent

NUMERICAL SCORE: 84

Quality of Science: LANL did not complete the W76 Stockpile Life-Extension Program (SLEP) hydrodynamic test, but did complete the baseline hydrotest. However, the test incurred test set errors that compromised data. LANL will need to conduct a second hydrotest in this series to develop the data set needed to establish a baseline against which validated models for predicting W76-1 performance can be compared. Measurement and instrumentation quality issues will need to be overcome to maximize the prospects for success in future tests. Regarding the W80 baselining hydrodynamic test, LANL completed and returned high quality data that was the cornerstone of the LANL W80 Baselining Report. This information was transferred to LLNL following assignment of the W80-3 to LLNL. Regarding archiving, LANL was an active member of Defense Programs Archiving Working Group (DPAWG) and participated in the development of the Nuclear Weapons Information Management (NWIM) Program Plan. LANL is successfully surveying all of LANL's NWIM holdings and assets, and is beginning to prioritize which holdings will be processed based on program needs or migration requirements. LANL completed cost analysis of LANL's NWIM activities and supported briefings to NNSA Administrator on NWIM's strategic approach. Regarding Acorn-2 design and options for future Terrazo replacement, rebuild or refurbishment, LANL successfully performed design review, and analysis to support down select of gas transfer system (GTS) options for the W88. The crosscutting team of LANL experts considered a range of options for application to the W88 and selected the Terrazo as the preferred GTS. Regarding B61 Baselining activity, LANL completed baselining activities in support of B61 Alteration (ALT) 357. LANL completed 61 worst-case condition baselining activities, which included developing new two-dimensional computer models and performing analyses. LANL completed other B61 baselining activities in support of the Stockpile Stewardship Program (SSP). Regarding the B61 hydrodynamic test, LANL did not complete these tests due to the potential for fire hazard on site. Regarding the W88 hydrodynamic test (Significant Findings Investigation resolution), problems with production of test unit and delays due to fire hazard precluded test.

Programmatic Performance: For B61 ALT357, LANL completed necessary activities to develop cost data for completing the Phase 6.2/2A report, Weapons Development Cost Report, and input to the Joint Integrated Program Plan. LANL also completed a draft NNSA project plan and supported the inter-laboratory peer review per the 6.X process. LANL developed technical details sufficient to allow proceeding to Phase 6.3, including re-make/re-use decisions.

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Relevance: LANL conducts general R&D activities to support future non-nuclear testing, computer modeling and simulation technologies, flight test programs, refurbishment programs, certification methods, and future stockpile scenarios. A specific objective is supporting the development of production and certification technologies for gas-transfer systems. Consequently, the Stockpile R&D Program is of significant relevance to the Stockpile Stewardship Program.

Operation of Major Facilities: As indicated above, the W76 SLEP hydrodynamic test incurred test set errors that compromised data. LANL will need to conduct a second hydrotest in this series to develop the data set needed to establish a baseline against which validated models for predicting W76-1 performance can be compared. Measurement and instrumentation quality issues will need to be overcome to maximize the prospects for success in future tests.

Notable Laboratory Accomplishments and/or Recommendations:

LANL completed the B61 Phase 6.2/6.2A activity on schedule.

Notable Laboratory Deficiencies and/or Recommendations:

The W76 SLEP hydrodynamic test incurred test set errors that compromised data. received. Regarding the W88 hydrodynamic test (Significant Findings Investigation resolution), problems with production of test unit and delays due to fire hazard precluded test.

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Operation of Major Facilities: The ESC personnel utilized facilities to accomplish program objectives while meeting safety and security requirements. Facility operations generally met delivery commitments and program schedules. The operation of facilities was without any significant delays or incident.

Notable Laboratory Accomplishments and/or Recommendations:

Regarding the Enhanced Surety Campaign, since certification issues must be resolved prior to implementing a new technology feature, LANL planned and executed component tests intended as steps toward certification. LANL successfully fired a series of heavily monitored Flat Plate Tests conducted with baseline and alternative detonators. Additional Flat Plate Test Assemblies are being built to fire in FY03. These tests are critical to confirming certifiability of advanced detonation systems by weapons designers. Regarding the Enhanced Surveillance Campaign, an example of notable accomplishments was the successful preparation of Pu 238 alloys that meet the material specifications for the pit lifetimes project. Regarding the ADAPT Campaign, LANL notable accomplishments were their excellent participation and contributions, reflected in the high quality of the IPLs, 90-Day Study recommendations, and the NNSA AS&T Roadmap. Also, LANL demonstrated proactive management by beginning a follow-on LANL technology roadmap without asking NNSA for additional funding.

Notable Laboratory Deficiencies and/or Recommendations:

The Enhanced Surety Campaign at LANL relies on two key areas to address certification concerns. It must work very closely with Campaign 2, Dynamic Materials Properties, to obtain experimentally validated models of materials properties that are essential to understanding the performance of the weapons. They must also tie into the Advanced Simulation & Computing Initiative (ASCI) project, which will calculate a three-dimensional nuclear safety simulation of a complex abnormal initiation of the high explosive in a nuclear weapon using an advanced high-explosives model. The simulation will produce information that will be compared with relevant nuclear and non-nuclear test data. An open recommendation for prior years is the need for high-level agreement between the HQ NNSA and LANL concerning the future of surety in the campaign. Specifically, LANL's top goals, and therefore priorities, do not include surety.