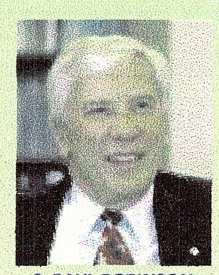
To all Sandians:

Each year we at Sandia National Laboratories take great pride in cataloguing significant accomplishments achieved during the past year by the men and women who make up this great laboratory. The past year, 2001, was extraordinary for the diversity and richness of the achievements and for the one day, September 11, that so deeply affected and changed our laboratory and our nation.

Sandia's staff have rapidly shifted gears to turn up the rate of progress in our national security work, suddenly rendered even more important by the instantaneous change in the free world's security situation that occurred that day. All across the Labs, individuals and teams have all made heroic efforts to extend our technology contributions to both better protect our troops and to help win the war against terrorism. The deep patriotism that inspires all of our laboratory's work took on monumental importance in the days following the terrorist attacks, and we are today operating at an unprecedented intensity in increasing the rate of development and deployment of our unique technologies.



C. PAUL ROBINSON

While the many hardware products we have delivered to the Afghanistan front give us special pride that we are fulfilling our highest goal **" to become the Laboratory that the nation turns to first for technology solutions to the problems that threaten peace and freedom,"** I am delighted with the richness of the many accomplishments, large and small, that we report this year. Sandia has achieved pioneering accomplishments in so many important areas of science and technology, from new software tools that revolutionize the design process, to software systems that vastly improve our financial management; and from creation of classified networks within Sandia to creation of the world's most powerful network that is now furthering the work of all of the NNSA labs. I invite you to judge for yourself: Have this year's accomplishments been the best ever in rendering *exceptional service to our nation?*

C. Paul Robinson
President and Director
Sandia National Laboratories

A Note to Readers

Shortly after the beginning of each calendar year the *Lab News* sums up Sandia National Laboratories' principal achievements during the previous fiscal year. This issue of Labs Accomplishments continues that tradition.

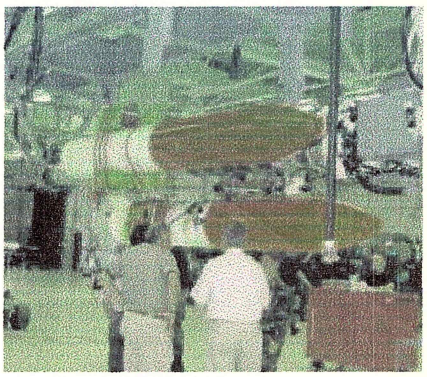
All Sandia divisions — from both the technical and administrative sides of the house — were invited to identify some of their key accomplishments from the period of Oct. 1, 2000, through Sept. 30, 2001. Submissions selected by the VPs' offices are presented on the following pages.

In reading through the accomplishments, you'll notice some numbers in parentheses at the end of each entry. Those represent the Sandia center (or centers) in which most of the work on a particular accomplishment was done. Also, you'll note that many of the technical accomplishments include a key contact name and e-mail address.

The work is presented here by category. We've found over time that this organizational approach is helpful, but it is important to recognize that such categorization, particularly in a multiprogram, multidisciplinary laboratory such as Sandia, is to some extent arbitrary. Much of the work listed in the category "Nuclear Weapons," for example, could very appropriately have been listed under "Computing," "Engineering Science," or any one of a number of other categories. And the converse is certainly true. Indeed, much of the work done across all the Labs' technical divisions supports Sandia's fundamental mission-related nuclear weapons work.

Nuclear weapons

The B83 Systems Engineering group has **completed development of Alt 355 for the B83 Modern Strategic Bomb.** Alt 355 is a near-term field retrofit kit that incorporates design modifications to the present B83-0/1 Gas Transfer System (GTS) hardware. It is the first Alt to complete the stringent Phase 6.X process. Also, a series of field tests were conducted, in conjunction with Alt 355, using two B83 Transportation Environmental Sampling Units (TESU). Both TESU test units were equipped with a data acquisition system and used to collect vibration and shock data during a variety of transportation scenarios. The data were used to compare Stockpile-to-Target Sequence specified levels for these environments. The Stockpile-To-Target-Sequence specified environments were shown to govern and remain unchanged. (2200, 8400, 8700) Thomas Gaffney, tmgaffn@sandia.gov



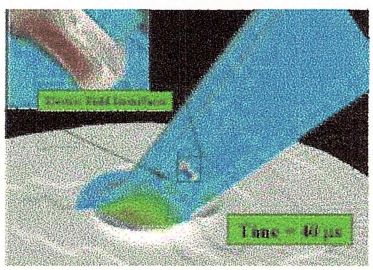
TRANSPORTATION Environment Sampling Units loaded on B-2A Rotary Launcher Assembly.

Lead zirconate-lead titanate (PZT) is a key ceramic used in the production of Neutron Generator power supplies. With the loss of all external suppliers, **we developed an in-house production-scale process to supply PZT.** Process development spanned the chemical synthesis of the PZT through powder fabrication processes resulting in a fired ceramic. Numerous technical and ES&H hurdles were overcome to scale-up the process from the laboratory size to 10 kg production quantities. MC3422 voltage bars made from the production-scale processes have met the stringent War Reserve specifications. (14100, 1800, 2500, 9200) Steve Lockwood, sjlockw@sandiagov

A simulation-based engineering approach that integrates research, numerical simulations, code validation experiments, wind tunnel data, and flight test data was used to quantify B61 spin rate losses due to vortex-fin interaction and to define optimal fin cant angle for B61-3,4,10 ALT354. TAOS spin rate predictions, confirmed in flight tests, showed that **the new fin cant angle produces improved spin rates** when used in conjunction with the existing spin motor. (2100, 9100, 15400) Carl Peterson, cwpeter@sandia.gov

B61 spin-rate test.

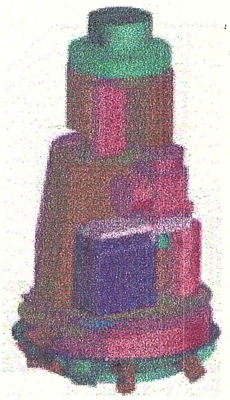
In support of the FY01 Acclerated Strategic Computing Initiative Normal Environment Level 1 Milestone, the ALEGRA code development team successfully completed **calculation of contact fuze electromechanical operation** during target impact at termination of flight for a W76 Reentry Body. This calculation showcased the Adaptive Mesh Refinement (AMR) and Arbitrary Lagrangian-Eulerian (ALE) capabilities of the ALEGRA code. (9200) Edward Boucheron, eabouch@sandia.gov



ALEGRA calculation of pressures and electric fields produced during RB impact and operation of contact fuze.

Code Management System (CMS) delivery provides **a significant security enhancement to weapon code operations** in Europe. The CMS project has completed a four-year full-scale engineering effort with its first full system delivery to its DoD customers. This system enables the recoding of nuclear weapons in a fully encrypted manner and greatly simplifies use and logistics issues for personnel. The complete system consists of 17 NNSA-qualified products, and several commercial computers. (1700, 2100, 2500, 2900, 5900, 6500, 12300, 14100) Doug Clark, jdclark@sandia.gov

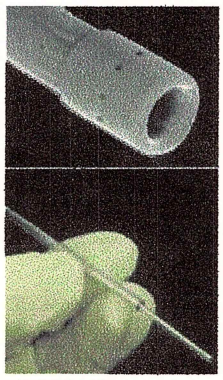
We created **a highly detailed finite element model of the W76/Mk4 Reentry Body** (over 3 million degrees of freedom) using the ASCI code SALINAS. Model improvements have been made using data from validation experiments. Additional experiments provided insight into variability in dynamic response of these components. We have found that as-built differences in weapon components have a significant impact on dynamic response. The variability data enable statistical tests of model validation and may also affect derivation of component environmental requirements used for design certification. (9100, 2100) David Clauss dbclaus@sandia.gov



HIGH-FIDELITY dynamics model of MC2912.

The US Navy W76-0/Mk4 Joint Test Assembly (JTA) redesign achieved First Production Unit status last August, following a successful development flight test in February 2000. The redesign replaced sunset technology components in the existing 20-year-old JTA, which is used to test the continued conformance of a denuclearized version of the War Reserve (WR) warhead. The new JTA collects significantly more state-of-health and critical performance data from onboard the Reentry Body (RB), as part of the core surveillance program. (1700, 2100, 2500, 2900, 8400, 9100, 12300) Bill Tedeschi, wjtedes@sandia.gov

A seemingly impossible fabrication task often leads to enhanced creativity. The Advanced Systems Group 2254, located at Livermore, Calif., expressed the need for a small tube-assembly consisting of very intricate components. A team from center 14100 met the following challenges: **Design and fabricate a tube within a tube** (thin wall-thickness); create features of very high aspect ratios (diameter versus length); manufacture micro-size grooves and angled holes (alignment / assembly); assemble components to provide a high-pressure seal (assembly/welding). Lothar Biegs, lfbieg@sandia.gov



AN IMPOSSIBLE fabrication task? Not at Sandia.

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