Nuclear weapons engineering

The B61-12 Life Extension Program (LEP) implemented an Earned Value Management System (EVMS) to manage cost and schedule performance. At the cornerstone of the EVMS is a fully integrated, resource-loaded master schedule detailing all Sandia work scope through 2024. Sandia nuclear weapon design, business, and IT organizations partnered to design and implement the system. More than 100 technical leads, schedulers, and project controls analysts across the B61-12 LEP were trained to work within the EVMS and ultimately strengthened their skills and knowledge of rigorous project management. The LEP is realizing early benefits from critical-path analysis and cost and schedule integration. (2000, 1000, 5000, 6000, 8000, 9000, 10000) NW [NW]

With wide participation of reliability, system, surveillance, and component engineers, the B61-12 Reliability Review Panel completed its peer review of the B61-12 reliability model in July 2014. The review included validation and identification of improvement opportunities of the system model and of Sandia and Los Alamos national laboratories subsystem and component failure events — a critical part of ensuring the B61-12 system design is capable of achieving its required reliability. The validated model will be used going forward over the life of the program for reliability assessment. (400, 2100, 2500, 2600, 2700, 2900, 8200, LANL, NNSA) NW [NW]

Daily we hear of national security threats involving insider threat, information technologies/cyber threats, and supply chain attacks. The Nuclear Enterprise Assurance Center led work on strategies and capabilities on how best to address these threats in the context of the Nuclear Security Enterprise. This work was the basis for an Enterprisewide program established this year by Don Cook, NNSA's deputy administrator for Defense Programs. His memorandum stated, "The underlying requirement is to design, develop, and produce all future weapons with enhanced trust features that are resilient to subversion attempts." (500) NW [NW]

Sandia and Honeywell FM&T completed the relocation of the production capabilities for all W76-1 Life Extension Project components produced at the Bannister facility to the new National Security Campus (NSC) in Kansas City. To maintain W76-1 production capability, the move necessitated a twofold approach of build-ahead and dualbuild.

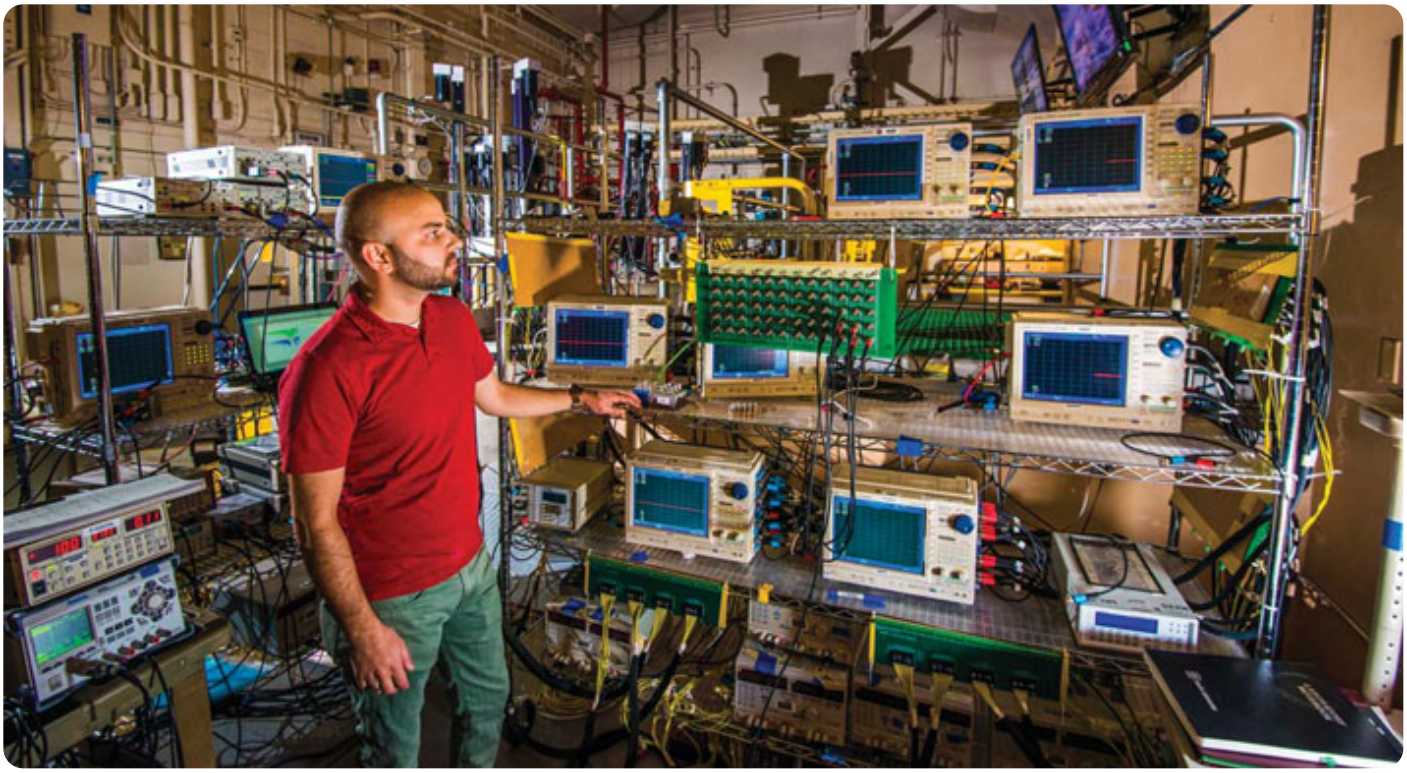
After the NSC production capability was fully established, the Bannister production was shut down. The teams

completed the extensive relocation while still maintaining shipments of all components from the NSC to the Pantex Plant in Amarillo. (400, 1700, 2200, 2500, 2600, 2700, 2800, 2900, 5300) NW [NW]

A cross-functional team initiated a layered defect prevention (LDP) strategy to improve product quality from design through production and acceptance. Data indicates the majority of defects originate in the requirements phase. Eliminating defects, or minimizing their impact, results in improved end-product quality and reduced life-cycle costs. Center 400 developed a curriculum around the tools of defect prevention along with a general method for implementing layered defect prevention that is available for partners around the Labs to launch their own high-consequence programs for reduction of product defects. (400, 2200, 2700) NW [NW]

The Mk21 Fuze Program is developing a replacement fuze for the Mk21 reentry vehicle that contains the W87 warhead. This Air Force-funded program reached an important milestone in FY14 with approval of the "Acquisition Program Baseline." The APB formally established the program's cost, schedule, and performance requirements against which future progress will be measured. This achievement was enabled by collaboration among Centers 8200 (warhead integration), 2100 (fuze design), and component design groups in Centers 2600, 5300, and 5400. (8200, 2100, 2600, 5300, 5400) NW [NW]

The B61-12 Program is well into the Phase 6.3 Design & Development effort. In collaboration with both internal and external partners, extensive system-level design and development activities were completed in FY14. These activities included a detailed series of electrical tests demonstrating functionality of the design. In addition, a number of thermal, mechanical, electromagnetic, flight, and materials compatibility activities have been completed. These efforts include characterization of both War Reserve (WR) and non-WR designs through physical test and modeling and simulation under relevant normal and abnormal environments. (2000, 1000, 5000, 6000, 8000, 10000, 200, 400, 500) NW [NW]



RESEARCHER Billy Martin (6221) looks over diagnostics that are part of the Qualification Alternative to Sandia Pulsed Reactor program. QASPR combines computer modeling and simulation, experiments, and technology development for stockpile surveillance. (Photo by Randy Montoya)

Under the Qualification Alternatives to the Sandia Pulsed Reactor (QASPR) project, the first tests of a small-scale integrated circuit (SSIC) using ion beams produced by the Ion Beam Laboratory have been done at displacement damage levels comparable to the retired Sandia Pulsed Reactor. The ability of the beam to impart localized damage to single or multiple transistors has improved our understanding of the survivability of such circuits in hostile radiation environments. (1100, 1300) NW [NW]

Sandia released B61-12 LEP Validating Information Processor (VIPr) use control systems software culminating in successful system-level testing. The development software enabled the Systems group to exercise all of the communication channels in the weapon for use control commands, the communication channels for other components linked by the VIPr, and the critical function control switch. The VIPr is the weapon-based portion of multiple use control systems components in the B61. (2600) NW [NW]

Sandia successfully conducted the first flight test in the W88 ALT 370 development program in partnership with Los Alamos National Laboratory, the Kansas City Plant, and Pantex. The Critical Radar Arming and Fuzing Test (CRAFT) flight provided the environment necessary to test the new joint radar in the W88 ALT 370 reentry system. Flight data analysis confirmed success in all test objectives including plasma environment data collection and radar ranging in all radar fuzing modes. Both NNSA and the US Navy publicly recognized the importance of this technical achievement and program milestone. (1500, 2100, 2600, 5300, 8100) NW [NW]

Additive manufacturing capabilities were employed to design and fabricate a full-scale prototype cutaway of the

B61-12. This marks the first time a full-scale cutaway has been available during Phase 6.3 of a life extension program. The unit can be reconfigured to reflect the evolving design. It can also be shown in several unique configurations to accommodate the clearance level of the viewing audience. One unit is housed at Sandia/New Mexico and a second unit was fabricated to support NNSA discussions with stakeholders in Washington, D.C. (2900, 2100) NW [NW]

Sandia's Enterprise Modeling & Analysis Consortium team (Org. 280) delivered the Scope and Complexity Model methodology white paper (release 2) four months ahead of plan, enabling support of the W78/88 120-Day Study and delivering all modeling and analysis products on or ahead of schedule. Using the Sandia-developed "Stockpile Optimization under a Resource-Constrained Enterprise" model, Sandia is providing primary Nuclear Security Enterprise stockpile analyses for the Production and Planning Directive 2014-1. (200) NW [NW]

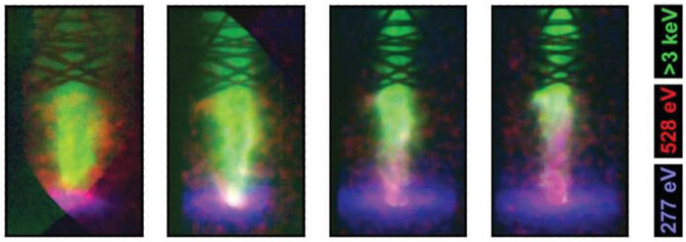
Sandia developed a new flight recorder/telemetry for collection of critical weapon performance data in support of the B61 stockpile surveillance flight test program. The Joint Test Assembly Modernization flight recorder collects 4,000 times more data per flight than the system it replaces, allowing improved weapon assessment during surveillance missions. As a result, Sandia can collect enhanced fidelity data while testing at the edges of the aircraft's release envelope. Telemetered data at 5 Mb/sec permits real-time access to pre- and post-release data. (2200, 8100, 0400, 2600, 2700, 5300) NW [NW]

Sandia's Aircraft Compatibility Team and B61-12 Life Extension Program System Engineering completed Vibration Fly-Around/Instrumented Measurement Vehicle testing on the F-15E and F-16 airframes. Six flights were flown in July and August 2014. Five weapon configurations — three on the F-15E and two on the F-16 — were represented in the six flights. These tests were the first successful flights of Sandia-furnished test units on US Air Force carrier platforms. (2900, 2100) NW [NW]

The Test Operations Center at Tonopah Test Range underwent a modernization initiative from November 2013 to March 2014, integrating scalable/configurable flight test suites, a touchscreen VOIP communications system, new situational awareness displays for increased flight safety, and LED energyefficient lighting. Flight test personnel now have enhanced collaboration and communications capabilities, and information flow is faster and archived more efficiently. This exponential upgrade in the Test Operations Center expands the operational capability and flexibility of this vital node for Sandia's stockpile surveillance mission and postures TTR for upcoming flight test missions. (2900) NW [NW]

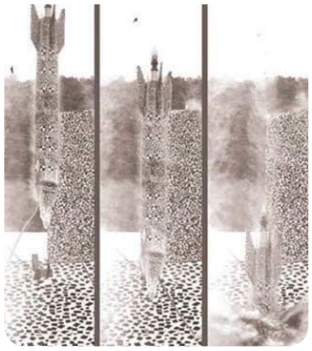
Centers 1700 and 2600 completed the qualification of a critical new supplier to complete the final production lots for a Gel Mylar Capacitor. As a result of early production issues, a team was formed to develop a new supplier to finish capacitor production. The Product Realization Team built and delivered more than 100 Mark Quality capacitors to the Kansas City Plant in August 2014. This accomplishment was three-plus years in the making and resulted in four development builds and two Process Prove-In builds prior to the successful, reject-free lot submittal in August 2014. (400, 1700, 1800, 2100, 2200, 2600, 2700, 2900, NNSA, SFO) NW [NW]

Sandia scientists have used the Z Machine to create the world's brightest bursts of cold X-rays in a laboratory setting to simulate the effects of nuclear countermeasures. By imploding puffs of argon gas at high velocities, three shots in October achieved record exposures and data collection under the Radiation Effects Sciences (RES) Z campaign — a program aimed at validating physics models and engineering codes used for assessing the survivability of strategic weapons in hostile nuclear environments. (1300, 1500, 1600, 1800).



ONLY 2.5-CENTIMETERS TALL and lasting just tens of nanoseconds, argon implosions at Z are the world's brightest laboratory source of cold X-rays, shown in these false-color

NW [NW] frames calibrated to the emitted X-ray energies.



Sandia executed a B61-11 Cable Pull Down stockpile surveillance test at the Sandia Aerial Cable Facility. The test unit was pre-conditioned to the Stockpile-to-Target Sequence cold temperature extreme. Impact conditions were consistent with a low-altitude delivery. Surveillance data were interrogated from the on-board flight recorder, and post-test evaluation indicated the unit functioned normally. NW (1500, 2200, 2900) NW [NW]