



Department of Energy
 National Nuclear Security Administration
 Washington DC 20585
 November 28, 2016

MEMORANDUM FOR JEFFREY P. HARRELL
 MANAGER
 SANDIA FIELD OFFICE

OFFICE OF THE ADMINISTRATOR

FROM: MADELYN R. CREEDON, [REDACTED]
 PRINCIPAL DEPUTY AD

SUBJECT: Sandia Corporation, DE-AC04-94AL85000
 Fiscal Year 2016 Award Fee Determination

The National Nuclear Security Administration (NNSA) has completed its assessment of Sandia Corporation's performance of the contract requirements for the period of October 1, 2015, through September 30, 2016, as evaluated against the Goals defined in the Performance Evaluation and Measurement Plan (PEMP). Based on assessments provided in the NNSA Performance Evaluation Report, award fee amounts are as follows:

	<u>At Risk</u>	<u>Available</u>	<u>Final</u>	<u>Percent</u>
Goal-1: Manage the Nuclear Weapons Mission	25%	\$700,000	\$637,000	91%
Goal-2: Reduce Nuclear Security Threats	15%	\$420,000	\$399,000	95%
Goal-3: DOE & Strategic Partnership Projects Mission Objectives	20%	\$560,000	\$537,600	96%
Goal-4: Science, Technology & Engineering (ST&E)	10%	\$280,000	\$266,000	95%
Goal-5: Operations & Infrastructure	20%	\$560,000	\$459,200	82%
Goal-6: Leadership	10%	\$280,000	\$252,000	90%
Total		\$2,800,000	\$2,550,800	91%

In addition, the fixed fee and total fee summaries are provided below for your information:

Fixed Fee	\$15,000,000	\$15,000,000
SPP (Fixed Fee)	\$10,000,000	\$10,000,000
Total Fixed Fee	\$25,000,000	\$25,000,000
Total Summary	\$27,800,000	\$27,550,800





National Nuclear Security
Administration

Sandia Corporation

Fiscal Year 2016
Performance Evaluation
Report (PER)

NNSA Sandia Field Office

Performance Period:
October 1, 2015 –
September 30, 2016

November 15, 2016

Executive Summary

This Performance Evaluation Report (PER) provides the assessment of Sandia Corporation's (Sandia) performance for the period of October 1, 2015 through September 30, 2016, as evaluated against the objectives defined in the Fiscal Year 2016 (FY16) Department of Energy (DOE)/National Nuclear Security Administration (NNSA) Strategic Performance Evaluation and Measurement Plan (PEMP). The NNSA considered all input provided (e.g., Contractor Assurance System (CAS), Program Reviews, peer reviews, external reviews, and customer reviews) from NNSA Program and Functional Offices both at Headquarters and in the field. Sandia's self-assessment report, the FY16 Performance Evaluation and Assurance Report (PEAR), was also considered for this evaluation.

For each goal in the PEMP, NNSA assessed the objectives and key outcomes in the aggregate to determine an adjectival performance rating. NNSA determined the performance ratings (Excellent, Very Good, Good, Satisfactory, and Unsatisfactory) in accordance with the criteria defined in the Federal Acquisition Regulation (FAR) 16.401(e) (3).

Sandia earned an overall Excellent rating during this performance period. Sandia earned Excellent performance ratings in Goal 1 (Nuclear Weapons Mission), Goal 2 (Reducing Nuclear Security Threats), Goal 3 (DOE and Strategic Partnership Projects Mission), and Goal 4 (Science, Technology, and Engineering). Sandia predominately exceeded expectations in these four critical mission areas.

Sandia earned Very Good ratings in Goal 5 (Operations and Infrastructure) and Goal 6 (Leadership). The Very Good rating for infrastructure and operations and leadership acknowledges Sandia's positive progress in these areas, and considers the ongoing challenge of reducing incidents of security concern.

In Goal 1, Sandia earned an Excellent rating by successfully executing the \$1.6 billion Nuclear Weapons (NW) Mission work in a safe and secure manner in accordance with DOE/NNSA priorities, Program Control Document and deliverables, program implementation plans, and weapon quality assurance requirements (25% at risk fee). While maintaining a Nuclear Security Enterprise (NSE)-wide focus, Sandia proactively integrated a historically large NW workload across Sandia National Laboratories (SNL) to achieve strategic national security priorities.

Sandia exceeded expectations in many areas of the NW mission work. Sandia successfully performed the work within scope, cost, schedule, and technical requirements to ensure mission critical deliverables were met. Sandia provided a broad range of capabilities for the NW program, including surveillance of all legacy systems, systems engineering for modernization of several weapons systems, supplying the Limited Life Components, and conducting research to strengthen the NW Science and Technology base. Sandia's key achievements in the NW program include: B61-12 Life Extension Program (LEP) execution and reviews leading to the authorization to proceed from the Development Engineering Phase to the Production Engineering Phase (6.4); W88 Alteration (Alt) 370 reviews in preparation for 6.4 authorization; Z Pulsed Power Facility (Z Machine) experiments that obtained stockpile material property and radiation effects data for code validation; high performance computing capability improvements; surveillance testing to enable the certification of the stockpile; and multiple neutron generator (NG) product lines that exceeded production requirements. Sandia met 130 of 131 NNSA Level 2 milestones, with only one delayed milestone for the W80 Alt 369 critical path work authorization activities.

In Goal 2, Sandia earned an Excellent rating by successfully completing global nuclear security mission work in a safe and secure manner to include the Defense Nuclear Nonproliferation, Nuclear Counterterrorism, and Counter Proliferation and Incident Response missions (15% at risk fee).

Sandia exceeded expectations in many areas of the global security mission. Sandia provided critical subject matter expertise to secure, account for, and interdict the illicit movement of nuclear weapons, weapons-usable nuclear materials, and radiological materials. Sandia successfully established international partnerships and supported international partners in the development of internal plans to prioritize export control implementation for the International Nonproliferation Export Control Program (INECP). Sandia effectively sustained and improved nuclear counterterrorism and counterproliferation science, technology, and expertise.

In Goal 3, Sandia earned an Excellent rating by successfully executing high-impact work for DOE and Strategic Partnership Projects (SPP) safely and securely (20% at risk fee). Sandia demonstrated the value of the work in addressing strategic national security needs.

Sandia exceeded expectations in many areas of the DOE and SPP mission work. Sandia successfully performed the work within scope, cost, and schedule to ensure mission critical deliverables were met. Sandia strategically integrated science and energy technology programs to address the most demanding energy challenges. Sandia effectively leveraged its nuclear weapons (NW) science and engineering capabilities in conducting SPP work in support of current and future national security requirements.

In Goal 4, Sandia earned an Excellent rating by successfully advancing the national security missions and frontiers of Science, Technology, and Engineering (10% at risk fee).

Sandia exceeded expectations in many areas of Science, Technology, and Engineering (ST&E). Sandia successfully achieved numerous science and engineering breakthroughs and developed several technology advancements that supported nuclear security mission execution and the broader national security missions of DOE and other federal agencies. Sandia advanced the state of technical readiness levels and overall ST&E through its strong Laboratory Directed Research and Development (LDRD) and Technology Transfer programs. Sandia effectively managed these programs within scope, cost, and schedule.

In Goal 5, Sandia earned a Very Good rating by effectively and efficiently managing the laboratories while maintaining an NNSA enterprise-wide focus (20% at risk fee). Sandia demonstrated accountability for mission performance and management controls, assured mission commitments were met with high-quality products and services, and maintained excellence as a 21st century government-owned, contractor-operated facility.

Sandia met or exceeded expectations in many areas, including: environment, safety, and health; capital projects; safeguards and security program management; facilities, infrastructure, and equipment; business operations; legal management; cyber security; and information technology. Sandia's safety, security, and business operations enabled the laboratories to meet and exceed many mission deliverables. Sandia addressed key challenges to maintain and sustain its aging infrastructure and improve operations to support the nuclear security enterprise.

In Goal 6, Sandia earned a Very Good rating by demonstrating leadership in supporting the direction of the overall DOE/NNSA mission (10% at risk fee). Sandia strengthened its leadership role with NNSA, exhibiting professional excellence and working selflessly across the enterprise to support the NNSA's strategic vision and mission. Sandia's leadership team demonstrated commitment to improving self-assessments, engaging in continuous improvement, and implementing innovative and cost-effective solutions.

Sandia demonstrated leadership in stockpile stewardship, nonproliferation, counterterrorism and countering weapons of mass destruction, cyber security, energy security, defense, homeland security, and space innovation mission areas. Sandia's collaboration and integration efforts effectively supported the NSE. Sandia led or participated in multiple enterprise-wide continuous improvement efforts, resulting in a number of DOE-recognized strategic best practices in veteran hiring, talent pipelines, and supply chain management.

Sandia did not meet expectations in arresting the rate of Incidents of Security Concern. Sandia successfully implemented a number of initiatives intended to increase security awareness and assist organizations with the highest incident rates. Sandia's leadership also increased its attention on security-focused work planning and controls to improve information protection.

Goal 1: Manage the Nuclear Weapons Mission

Sandia earned an Excellent rating by successfully executing the \$1.6 billion Nuclear Weapons (NW) Mission work in a safe and secure manner in accordance with DOE/NNSA priorities, Program Control Document and deliverables, program implementation plans, and weapon quality assurance requirements (25% at risk fee). While maintaining a Nuclear Security Enterprise (NSE)-wide focus, Sandia proactively integrated a historically large NW workload across SNL to achieve greater impact on strategic national security priorities.

Sandia exceeded expectations in many areas of the NW mission work. Sandia successfully performed the work within scope, cost, schedule, and technical requirements to ensure mission critical deliverables were met. Sandia provided a broad range of capabilities for the NW program, including surveillance of all legacy systems, systems engineering for modernization of several weapons systems, supplying the Limited Life Components, and conducting research to strengthen the NW Science and Technology base. Sandia's key achievements in the NW program include: B61-12 Life Extension Program (LEP) execution and reviews leading to the authorization to proceed from the Development Engineering Phase to the Production Engineering Phase (6.4); W88 Alteration (Alt) 370 reviews in preparation for 6.4 authorization; Z Pulsed Power Facility (Z Machine) experiments that obtained stockpile material property and radiation effects data for code validation; high performance computing capability improvements; surveillance testing to enable the certification of the stockpile; and multiple neutron generator (NG) product lines that exceeded production requirements. Sandia met 130 of 131 NNSA Level 2 milestones, with only one delayed milestone for the W80 Alt 369 critical path work authorization activities.

Objective 1.1: Sandia met expectations in accomplishing negotiated program work and integrating quality requirements. Sandia designed, produced, and delivered safe, secure, and reliable weapon products meeting performance and transportation requirements in a cost effective manner.

Sandia met or exceeded NNSA expectations for almost all mission critical performance areas (i.e., 130 of 131 (99%) NNSA Level 2 Milestones). Sandia effectively managed risks and issues for NW mission work and increased transparency. Sandia proactively managed funding to preclude any mission impact from the Continuing Resolution. Sandia's Weapons Quality Assurance (WQA) program met performance expectations. Sandia's assurance processes were acceptable based on the NNSA's evaluation of product acceptance activities, periodic resolution of WQA issues with Sandia's Chief Engineer for Nuclear Weapons, Sandia External Production (SEP) supplier assessments, and Sandia's execution of the Annual Improvement Plan. Sandia met expectations for executing DOE/NNSA Nuclear Enterprise Assurance (NEA) related program activities, consistent with the NEA Implementation Plan. Sandia identified concerns with flow-down of temperature requirements for the W80 NGs and overexposure to Electro-Static Discharge (ESD) during Lot 2 acceptance testing of the detonators, which necessitated the reallocation of resources to support resolution.

Sandia supported all NNSA and Pantex requests for Nuclear Explosive Safety Studies (NESS) and Nuclear Explosive Safety (NES) Change Evaluations, including reauthorization of the W87 and W84 NESS. Sandia met all Product Realization Integrated Digital Enterprise (PRIDE) milestones and program requirements. Sandia operated and maintained numerous weapon product realization

information systems. The laboratory completed upgrades to the following systems: the enterprise Component Information System to include the capability to track changes in weapon system scheduled dates; the Significant Findings Investigation Data System to allow the simultaneous search of multiple weapon modifications and facilitate identification of common issues and trends; the Weapons Information System to allow for entry of accurate record of assembly dates for components used in a weapon reaccepted as a Modification (Mod) or Alt; the Secure Workflow Enabled Unsatisfactory Report System to include a collaboration feature; and the PDMLink system to consolidate product definition information. Sandia successfully managed the Military Liaison and Nuclear Weapons Training activities and accommodated increased requests from the NNSA associated with stockpile modernization efforts. Sandia conducted training for over 2000 students from across the NSE. All Unsatisfactory Report (UR) and technical publication actions were completed on-time. Sandia successfully completed twelve Office of Secure Transportation (OST) task agreements and met all OST cost, scope, and schedule requirements.

Objective 1.2: Sandia exceeded expectations in maintaining knowledge of the state of the stockpile, demonstrated by the successful execution of the stockpile surveillance program and a robust scientific and engineering understanding of the stockpile. This enabled Sandia's on-time delivery of the critical annual stockpile assessment.

Sandia successfully supported flight tests that included tests at extreme environmental conditions and a test validating the Neutron Generator Assembly (NGA) standoff margin. Sandia exceeded Weapons Evaluation Test Laboratory (WETL) planned testing and significantly reduced the surveillance backlog. Sandia overcame significant technical issues in demonstrating cold testing capability on the new B61/B83 Common Tester, allowing completion of all planned B61/B83 surveillance laboratory tests. Sandia completed a Qualification Evaluation Release (QER) of the new Stronglink Tester and completed all required tests on schedule. Sandia continued work for the qualification of the Joint Test Assembly (JTA) Modernization (JTAM) configurations and supported extensive JTA activities at CNS-PX. Sandia led an NNSA/NSE-endorsed effort to define a new stockpile evaluation framework and strategy. This new paradigm for stockpile surveillance lifetime assessments effectively considers many factors, including evolving risks and evaluation requirements throughout the surveillance life-cycle of weapon systems.

Sandia completed several noteworthy activities in support of stockpile stewardship and modernization. Thirteen gas gun experiments were completed at the Dynamic Integrated Compression Experimental (DICE) facility and the Shock Thermodynamic Applied Research (STAR) facility. These experiments characterized dynamic crush-up and energy absorption for a B61-12 and decreased the need for higher cost sled track tests. Sandia calibrated gauges at the DICE facility to improve diagnostics for B61-12 sled track tests. Data from pre-compressed helium target experiments contributed to predictive equation-of-state (EOS) models. A uranium experiment conducted at the Z Machine produced the highest pressure uranium ramp compression data, which contributed to the validation of models used in predicting hydro tests as well as annual assessment calculations. Sandia also produced validation data for weapon simulation models from a high-precision EOS experiment conducted at the Z Machine.

Sandia successfully closed out Cycle 20 Annual Assessment activities, and completed Cycle 21 deliverables consistent with the Annual Stockpile Assessment Cycle 21 Execution Plan, culminating in the Laboratory Director Annual Assessment letter to the Secretary of Energy, Secretary of Defense, and

the Chairman of the Nuclear Weapons Council. Sandia also completed Independent Nuclear Weapon Assessment Program evaluations for the W80 and W88 in support of the Annual Assessment activities. Sandia successfully provided early delivery of key documents that supported the Cycle 21 Annual Assessment process, including the Enhanced Surveillance Annual Report and the Weapons Reliability Reports.

Objective 1.3: Sandia met expectations in executing stockpile work that enabled stockpile system maintenance, production, limited-life component exchanges (LLCE), weapon containers, and dismantlements.

Sandia improved communications with the NNSA regarding legacy weapon systems. Sandia continued to remain on track for the W88 Alt 940 activities to meet the scheduled First Production Unit (FPU), including the System Conceptual Design review (CDR). Sandia integrated the programmatic and technical activities for W88 legacy activities (Alt 940 and NG LLCE) with the Alt 370 and Conventional High Explosive (CHE) Refresh to ensure all activities supported the W88 Alt 370 FPU schedule. Sandia completed the normal environment testing for the W88 Alt 370. Sandia met expectations to transition the W88 Documented Safety Analysis into the Collaborative Authorization Safety-basis for Total Life-cycle Environment (CASTLE) format prior to the start of the W88 Alt 370 Seamless-Safety for the 21st Century (SS-21) Project. Sandia overcame technical difficulties associated with the W88 NG development and is on-track to meet the NG FPU; however, reduced schedule margin and higher program costs have increased risk for meeting the W88 Alt 370 FPU. Sandia completed the W80 Alt 369 NG Detonator FPU and Timer FPU several months ahead of schedule and remained on track to meet the NG FPU date. The W87 NGA connector chamfer issue was successfully resolved. Sandia was responsive to questions on disposal strategies for weapon component disposition and completed an updated Weapons Dismantlement & Disposition (WDD) Project Plan for FY16-FY20 WDD activities. Sandia supported the B61 Legacy Upgrade Project by providing planning information for the NESS and transferring B61 weapon response information into CASTLE.

Sandia supported resolution of production issues associated with the W87 Firing Set Assembly (FSA) at the National Security Campus (NSC). Sandia resolved sloped glass vendor issues and completed the qualification activities ahead of schedule. Sandia continued to meet W87 Alt 360 Gas Transfer System (GTS) Program activities in accordance with requirements and contributed to the successful completion of the Final Design Review. All GTS production, fill, and monthly shipments remained on schedule.

Sandia did not meet expectations for the W80 Alt 369 critical path work authorization activities.

Objective 1.4: Sandia exceeded expectations by demonstrating the application of new strategies, technologies, and scientific understanding to support stewardship of the existing stockpile and future stockpile needs.

Sandia provided leadership and key support for several major NNSA-directed Tri-Lab strategic planning efforts, including the National Pulsed Power Science and Technology Strategy, the Warhead Hostile Environments Survivability Plan (WHESP), an updated 10-year Boost Science Plan, and the Stockpile Responsiveness 120-day Study. Sandia was the primary integrator for a Tri-Lab effort to improve understanding of Capabilities and Gaps in Weapons Flight Dynamics Modeling, enabling the development of the Reentry System Predictions and Capabilities Plan. Sandia achieved significant

research results using several new and improved experimental platforms on the Z Machine that resulted in record neutron yields, x-ray yields, stagnation pressures, and Special Nuclear Material (SNM) material pressures. Sandia continued to successfully enhance capabilities for Pu experiments on the Z Machine to reach relevant regimes. Computer models based significantly on Pu data obtained on the Z Machine supported annual assessment simulations. Numerous experiments were conducted on the Z Machine to evaluate relevant materials for most of the stockpile systems. Sandia coordinated with Los Alamos National Laboratory (LANL) and Lawrence Livermore National Laboratory (LLNL) on experimental and analyses requirements. The ensuing material response data obtained from the Z Machine experiments supported technology maturation for future stockpile safety options. A series of boost experiments conducted on the Z Machine contributed to improved modeling and simulation capabilities, and another series of experiments measured the opacity of high-Z (i.e., high atomic number) materials.

Sandia's Inertial Confinement Fusion (ICF) Program closely collaborated with LLNL in the following areas: completed nine Sierra experiments; conducted three Laser Plasma Interaction (LPI) experiments at the National Ignition Facility (NIF); and achieved significant progress on several joint diagnostic development activities. Sandia completed several low-cost upgrades to the laser facilities supporting the Z Machine, including the installation of a booster amplifier which increased the available laser energy by 10%, and the installation of a magnetic field coil system in the laser target bay area to support ICF target development.

Sandia conducted radiation effects experiments at the Z Machine using a new higher energy source and radiation effects test platform that were developed using Laboratory Directed Research and Development (LDRD) funding. This new capability delivered record x-ray energies and fluences and provided data for radiation effects computational models development and code validation. Sandia also verified the utility of the new x-ray sources to provide usable responses. Through this research, Sandia performed the first x-ray source experiments on the Z Machine at an x-ray energy level that is important for experiments and radiation effects response codes validation. Sandia resolved electrical contact degradation issues which enabled closure of a Significant Finding Investigation (SFI), and developed new corrosion protection coatings for stockpile components to replace sunset technologies. Sandia improved ceramic/metal joint characterization techniques, which provided validation data for braze models and improved production processes.

Sandia exceeded expectations in the Enhanced Surety Program. Sandia provided exceptional leadership developing the NNSA Enhanced Surety Strategy Plan and created the Tri-Lab Surety Roadmap to effectively integrate weapon and physical security while initiating new USAF projects. Sandia's design advancements enabled increased manufacturing yield for the Highest Priority Mechanical Component ahead of schedule. Sandia designed and prototyped the Adaptable Surety Tester which supports testing and characterization of future Integrated Surety Architecture venues. Sandia achieved a joint stretch goal with LANL ahead of schedule for the Integrated Surety Solutions Launch Facility/Payload Transport System prototype in a representative USAF configuration. Next Generation (Next Gen) functional testing of full-scale components enabled a down-select decision to a baseline design and allowed for a second set of functional tests ahead of schedule. Sandia also performed above expectations by developing an approach to investigate emerging technical capabilities and their impact on the Joint Integrated Lifecycle Surety (JILS) methodology. Sandia initiated collaboration with Unmanned Aerial Systems (UAS) subject matter experts to develop and refine a

framework incorporating use of UAS into JILS scenarios. JILS results also supported a key NNSA surety decision for the W84.

Objective 1.5: Sandia exceeded expectations in sustaining unique science and engineering capabilities, facilities, and essential skills to ensure that current and future Nuclear Weapons mission requirements will be met.

Sandia significantly contributed to the NNSA out-year planning effort in support of the science-based stockpile stewardship program. Sandia provided Radiation Effects data and analyses, essential for the qualification of the W88 Alt 370, utilizing the Hermes III, Saturn, Annular Core Research Reactor and Qualification Alternatives to Sandia Pulsed Reactor (QASPR) capabilities. With this data, Sandia demonstrated a successful new approach to qualification using new experimental platforms and techniques, experimentally validated modeling and simulation, and new weapon technology insertions to increase radiation hardness of microelectronics. Sandia successfully executed the ICF National Diagnostics Plan including developing and providing two 4-frame high-speed hybrid Complementary Metal Oxide Semiconductor (hCMOS) imagers to LLNL for integration into the single line-of-sight detector. Sandia also fielded a 2-frame hCMOS imager on the Z Machine which recorded an image of a dynamic hohlraum experiment for the first time. Sandia's prototype 2-frame hCMOS imager was fielded for use on NIF experiments during FY16, producing valuable data. Sandia overcame technological challenges with the new diodes of the 4-frame hCMOS imager to provide an imager with ~1/2 million pixels for high resolution, high-speed imaging of low-energy electrons and x-rays. Sandia also designed a new capability for measuring experimental temperatures on the Z Machine.

Sandia effectively managed Infrastructure and Operations (I&O) programs to sustain facility operations and ensure mission requirements were met. Sandia adeptly managed Operations of Facilities funding to respond to changing priorities and supported weapons component production and weapons testing activities. Sandia continued to make steady progress with modernization of the SiFab through installation of newer tools and equipment funded by the Sandia Silicon Fabrication Revitalization (SSiFR) project. Sandia also effectively managed the Building 894 Dehumidifier refurbishment project, saving \$1.7M compared to the cost of replacing the equipment with new units. Sandia met the reporting requirements for the Capabilities Based Investments portfolio in G2.

Sandia proactively identified and accomplished several facility and equipment upgrades to support NW programs. Sandia executed the Tonopah Test Range (TTR) Fiber Network project, where they teamed with the USAF to share equipment and reduce costs in installing 59 miles of optical fiber network to support upcoming weapons testing. Other key upgrades included the Saturn Low Noise Test Fixture System redesign to enable safer and more efficient testing diagnostics, and the accelerated qualification of a second SiFab Photolithography Tool to provide important microprocessor production redundancy.

Objective 1.6: Sandia exceeded expectations in executing Phase 6.X and product realization processes and activities in support of nuclear weapon LEPs, Mods, and Alts.

Despite more challenging entry and exit criteria, Sandia successfully conducted the remaining major component-level baseline design and gate reviews for the W88 Alt 370. Sandia also completed Final Design Reviews for the Magnetically-Coupled Stronglink (MCSL), the Electrical-Contact Stronglink (ECSL), the Launch Accelerometer (LA), and the Lightning Arrestor Connector (LAC). Sandia released component and system design drawings in advance of the Arming, Fuzing, and Firing (AF&F) Baseline

Design Review (BDR). Sandia accomplished a rigorous requirements review using an innovative five-pronged approach to identify deficiencies in the originating customer source requirements. This enabled Sandia's W88 Alt 370 program to ensure that customer source requirements from the USAF (B61 and W87) were integrated within both programs. Sandia exceeded NNSA expectations by producing detailed recovery plans for the customer requirements documents such as the Lockheed Martin Space Systems Company (LMSSC)-owned functional Interface Control Document (ICD) and the Stockpile-to-Target Sequence (STS) documents. Sandia and LANL jointly performed the JTA-8B and JTA-9B concept and cost study and executed all planned system qualification tests on schedule. Sandia completed the W88 Alt 370 required critical testing and major reviews including the system BDR and Independent Peer Review (IPR) and the Preliminary Design Review and Acceptance Group (PDRAAG) review, making significant progress towards entry into Phase 6.4. Sandia also exceeded expectations by leading the effort to complete the Preliminary Addendum to Weapon Development Report (PAWDR).

Sandia exceeded expectations in achieving completion of all major B61-12 6.X milestones, including: B61-12 System, JTA, and Trainer BDRs; System Pre-Production Engineering Gate; Preliminary Weapon Development Report; and the USAF-led PDRAAG. These successful reviews led to the NNSA authorizing Phase 6.4, Production Engineering. Sandia also contributed to the successful USAF Nuclear Weapon Safety Study Group (NWSSG) Preliminary Safety Study. Sandia partnered with LANL to improve system engineering and integration which led to restructuring the System Product Realization Team (PRT). The new System PRT achieved more timely resolution of issues and improved management of system requirements, qualification, and system assembly and disassembly activities at Pantex Plant. Sandia, in conjunction with LANL, successfully executed the B61-12 system's test program in FY16, including the completion of the B61-12 LEP Flight Test Development Unit (FTDU) test at the TTR. Sandia also completed multiple aircraft compatibility flight tests, environmental captive carry tests, and system ground tests to validate the B61-12 safety performance in abnormal environments.

Sandia exceeded expectations in implementing DOE/NNSA Nuclear Enterprise Assurance (NEA) into the 6.X process. Sandia updated the B61-12 Program Protection Plans to incorporate NEA activities at other NSE sites. Sandia provided NEA awareness training across the NSE, completed vulnerability assessments, incorporated NEA review criteria into System and Component Design Reviews, implemented Supply Chain Risk Management measures, and collaborated with the intelligence community. Overall, the Sandia B61-12 Program has performed above expectations in developing a sound NEA implementation approach to increase the confidence that weapon systems are not susceptible to subversion across the life-cycle.

Sandia took the initiative to conduct additional analyses to support the B61-12 LEP Project Officers Group (POG), resolving critical requirements gaps between the NNSA bomb assembly and the USAF Tail Kit Assembly (TKA) and addressing the associated development testing and qualification program schedule issues. Sandia exceeded expectations for its outstanding effort and leadership working with the USAF TKA System Program Office (SPO) to develop a schedule recovery plan for joint test activities. Sandia achieved progress on the aircraft compatibility issue with the ASIC in the Version 2 Weapon Control Unit (WCU) by using a Field Programmable Gate Array (FPGA) in the Version 2 WCUs to facilitate system ground and flight testing. Sandia worked with the NNSA and the USAF to minimize aircraft integration risks by proposing and conducting additional interface testing in Aircraft Simulation Labs and aircraft. Sandia took the initiative to analyze and provide additional information characterizing range safety footprints to address the USAF guided flight test capability that was

projected to exceed the TTR footprint. As a result, Sandia received USAF/NNSA approval to conduct the tests under the current agreements. To assist the USAF TKA SPO, Sandia issued a total dose radiation white paper and hosted a radiation Technical Interchange Meeting (TIM) to facilitate a complete understanding of the radiation requirements. Additionally, Sandia leveraged its efforts in the B61-12 Strategic Partnership Projects (SPP) and Boeing/SNL technical integration support contract to advance the LEP. In partnership with LANL, Sandia significantly contributed to the development of an analytical approach to support emerging requirements for the B61-12's strategic thermal temperature.

The NNSA and other federal stakeholders approved a design change on the Joint Radar Module (JRM), resulting in a significant production increase. The change process to analyze new guidance and potential impacts to all stakeholders does not currently exist for joint weapons components such as DP40/PPI. Sandia has realized the need to communicate with all stakeholders to provide ample time to evaluate production site impacts prior to approval by NNSA and implementation by the sites. The Sandia Production Agency (PA) is preparing Baseline Change Requests to address the increased scope of the Heterojunction Bipolar Transistors (HBT) and the new delivery schedule. The Sandia PA Actuator PRT and the B61-12 GTS PRT jointly developed a delivery schedule that satisfies all next level assembly needs for the Actuator.

Sandia achieved progress in resolving design concerns with the B61-12 LEP Fusilli component and coordinated a NNSA-approved recovery plan that supports the System FPU schedule. This issue increases schedule and cost risks for the NSE. Sandia has also aggressively worked towards the approved recovery plan for the Firing Control Unit (FCU) and continued to monitor the progress as it poses a scheduling risk.

The Offsite Transportation Authorization (OTA) submittals were not always timely, requiring additional coordination of shipments that could have jeopardized OST shipment schedules for the B61-12. Sandia instituted a weekly management assurance review to avoid late submittals.

Sandia met expectations for the Mk21 Fuze Modernization Program as evidenced by Earned Value Management System (EVMS) metrics. Sandia submitted an Integrated Master Schedule to the USAF that detailed critical path activities to FPU and completed Evaluation Status Release 1 and 2. The PRT focused on minimizing schedule impacts to the program by reviewing delivery timelines from suppliers and using innovative approaches to purchase long-lead items that could potentially impact critical path elements. The team continued to progress on common component work, synchronizing USAF and United States Navy (USN) requirements, enabling work to be completed within or under budget. Notable accomplishments include the first Light Initiated High Explosive proof of capability test with better than expected results, eliminating the need for additional tests and resulting in cost savings; and the completion of Lab Test Unit 1/Integrated Test Bed test which demonstrated successful interface of the Arming & Fuzing Assembly (AFA), W87, and Minuteman III.

Sandia met expectations for the W76-1 LEP. The NNSA approved the SEP requested schedule relief to recover the Actuator lost production time. Sandia deployed additional resources to the production vendor's facility to provide stronger production oversight and is on track to yield the first group of Actuators.

Sandia met expectations for the W80-4 LEP. Consistent with Phase 6.2 actions, Sandia continued to refine key aspects of non-nuclear component design options and evaluated trade-offs to meet Department of Defense (DoD) requirements while leveraging components and technologies developed from other LEPs/Alts. Twelve of twelve planned PRTs were stood up this year. Sandia made progress refining program management documents to account for FY17 funding shortfalls and contributed to major program management document revisions, including the NNSA Program Plan, the Phase 6.2/6.2A schedule, the Requirements Management Plan, and the Risk Management Plan. Sandia provided inputs to the POG subgroups and the NNSA. Sandia developed the System Compatibility Definition Document that served as the basis for the Customer Requirements Review (CRR). Sandia completed the CRR and received USAF/NNSA concurrence that the exit criteria were met.

Key Outcome 1.1: Sandia exceeded expectations in the effective application of existing experimental capabilities and made progress toward developing and implementing new capabilities to support stockpile sustainment and stewardship of the existing stockpile.

Sandia achieved record neutron yields, x-ray yields, stagnation pressures, and SNM material pressures utilizing several new and improved experimental platforms on the Z Machine, which improved the NNSA's predictive capabilities for nuclear weapon performance and survivability. Sandia completed 152 shots on the Z Machine, including 51 ICF shots and two plutonium (Pu) shots. Subsequent to the NNSA recertification of the 9977 Shipping Container in May, Sandia, in collaboration with LANL, conducted a Pu aging experiment on the Z Machine in support of the B61-12 LEP, as well as another Pu experiment that provided Pu data at higher pressures than previously achieved. Sandia also collaborated with LANL to conduct a uranium (U) high-pressure ramp EOS experiment on the Z Machine, which shocklessly compressed U to a peak pressure two times greater than previous U experiments conducted on the Z Machine. Sandia safely executed the first experiment on the Z Machine utilizing a trace amount (0.1%) of tritium. The tritium experiment, enabled by a LDRD effort, demonstrated the operational capability to safely use tritium on the Z Machine, and enables future advancements in ICF target development. Another accomplishment resulting from the LDRD effort was the implementation of plasma cleaning on the Z Machine.

Radiation source development experiments on the Z Machine produced greater flux and warmer x-rays than have been previously possible, and enabled improved validation of radiation effects models. Sandia achieved considerable progress on the development of the Next Generation Containment System for future higher pressure hazardous material tests on the Z Machine. Sandia provided expertise and significant technical support for the NNSA Trusted Microsystems Capability (TMC) Mission Need Statement, definition of program requirements, and Analysis of Alternatives (AoA) effort within an extremely compressed timeframe. Sandia exceeded the NNSA's expectations for the Enhanced Capabilities for Subcritical Experiments (ECSE) effort by being flexible and responsive to the project's evolving needs. After only nine months of development efforts, Sandia successfully demonstrated the capability of a four pulse "cable pulser", the prime power source for the next generation Linear Induction Accelerator injector architecture at the U1a Facility. Sandia provided design expertise and diagnostics in support of the national Dense Plasma Focus (DPF) source development for the Neutron Diagnosed Subcritical Experiment (NDSE) capability. Sandia completed evaluations and provided documentation supporting CD-1 project deliverables for the ECSE facility (i.e., U1a Complex Enhancement Project-UCEP) and ECSE technology (e.g., radiography and NDSE). Sandia constructed and commissioned Thor-24, demonstrating the operational capability of the pulsed power technology

intermediate scale pulser, including the development of current adder technology as an MA-class arbitrary waveform generator.

Key Outcome 1.2: Sandia exceeded expectations in effectively executing B61-12 LEP, W80-4, and W88 Alt 370 Phase 6.X programs in accordance with program-specific and NNSA Project Controls System directives, including EVMS implementation and other activities.

The Sandia W88 Alt 370 Design Agency (DA) and Production Agency (PA) are actively managing the site's program risks by maintaining and reporting the NSE-wide risks in accordance with NNSA direction. Sandia displayed leadership in managing the programs' risks by coordinating the Risk Review Board and challenging the quality of risk reporting analysis. In addition, Sandia re-evaluated its entire risk database to ensure data quality. Sandia exceeded expectations in hosting the Quarterly Program Review and Alternative Management Team (AMT) meetings. All PRTs provided an appropriate level of technical and programmatic status.

The Sandia W88 Alt 370 Program used Earned Value (EV) metrics to update the NNSA on project execution and worked to reduce variances. Sandia recognized that adjustments to the baseline are necessary to correct artifacts that cause the non-driving variances. There are a number of schedule variances that Sandia is aggressively working to reduce, resulting in stabilization, and in some cases, reductions in control accounts. Sandia communicated EV metrics with NNSA management and continued to improve its variance reporting by including the details in regularly-prepared monthly submittals. Sandia provided a detailed breakout of its management reserve (MR) for the program, which enabled optimized management of resources and risks across the program and served as a model for soliciting MR data from all of the M&O contractor sites.

Sandia continued to effectively coordinate with the USN and LMSSC to complete the difficult task of obtaining approval of flight test bodies for use in missile tests. Sandia's effective ground test activities were instrumental in identifying technical issues before scheduled flight tests, thereby reducing risk of flight test failures. Sandia issued all W88 Alt 370 test plans and obtained NNSA and USN approval prior to test execution. Sandia coordinated closely with LANL to ensure complete integration of the leveraged system qualification program between the original scope of the Alt 370 and the CHE Refresh addition. Sandia's W88 Alt 370 Systems Engineering proactively conducted a Nuclear Weapon Competency Mentoring series taught by the Systems Manager. This recurring eight-session course covers the core functions of the Phase 6.X process and transfers institutional knowledge to new Sandia employees and other federal and contractor personnel associated with the weapon program.

The Sandia B61-12 DA prepared and submitted the Baseline Cost Report and the basis of estimate which supported the NNSA risk analysis for the Baseline Cost Report. Sandia released the New Materials Stockpile Evaluation Plan (NMSEP) Issue B in support of the Baseline Cost Report and conducted a peer review of its Shelf Life Program to refine the estimate and validate the shelf life requirements. This activity ensured a proper balance between costs and long-term surveillance benefits. The Sandia B61-12 DA established processes to formalize handoffs between design and applicable production agencies in the Sandia site schedule to reduce the risk of future schedule disconnects. Sandia is continuing to work on alignment of all lower level milestones to better understand the schedule impacts. The Sandia DA met expectations for submittal of monthly EV and status reports for the B61-12 LEP.

Sandia delivered the W80-4 Technology Maturation Rough Order of Magnitude cost estimate to the NNSA as part of the pilot DP Cost Improvement Initiative. Sandia made exceptional progress on component trade studies implementing an Engineering Review Board process for design decisions that included formalized evaluation criteria. Sandia delivered a detailed cost estimate briefing to NA-143 and NA-191 that provided analysis to better inform scope, schedule, and cost of design options. This information is critical to a successful down-selection process. Sandia completed analysis of funding profiles for 1 and 2 year FPU extensions. Sandia proactively participated in Warhead Arming Working Group meetings with missile vendors in preparation for the CRR and submitted high-quality updated environmental and electrical requirements for the missile-to-warhead ICD in support of the Long Range Stand-Off (LRSO) missile Request for Proposal (RFP) release to contractors. Sandia conducted a comprehensive Foundation Bus course for LRSO missile contractors and held a series of technical workshops. Sandia initiated an ASIC life-of-program buy and an actuator procurement to mitigate future risk. Sandia continued to refine program management planning documents including the Phase 6.2/6.2A schedule in an effort to improve fidelity in order to effectively support future EVMS implementation and continued to work with the NNSA on a new Work Breakdown Structure.

Sandia met expectations for the W88 Alt 370 DA and PA monthly status reporting, the monthly unclassified detailed schedules, and the Integrated M&O Summary Schedule (IMOSS). The Sandia W88 Alt 370 DA and PA participated in Quarterly Program Review and Alteration Management Team meetings. The Sandia W88 Alt 370 provided PRT data to the NSC for publication of the Pilot Production Program Definition (PPPD). Sandia delivered all W88 Alt 370 component test hardware in accordance with the Material Requirements Schedule (MRS). Sandia executed W88 Alt 370 component and system-level development and qualification tests as scheduled.

The Sandia PA met expectations for submittal of monthly EV and status reports for the B61-12 LEP and W88 Alt 370. The Sandia PA proactively coordinated and managed hand-off activities with next level assemblies and communicated the hand-off activities to the NNSA through integrated master schedules. The Sandia PA effectively collaborated on recovery plans when disconnects occurred with the DAs and has negotiated new handoff dates to ensure there is no impact to the FPU. Sandia ensured that the NNSA and all affected parties were informed of the status of these recovery plans. The Sandia PA managed changes through the NNSA change control process to maintain an accurate performance management baseline, which the Sandia PA used to measure Earned Value, identify areas of scope growth, minimize risk, and control cost.

Key Outcome 1.3: Sandia exceeded expectations in demonstrating the effective application of existing capabilities and the development of new capabilities, including codes and models for predictive simulations on next-generation computing platforms.

Sandia made significant progress in the code and algorithm infrastructure required to provide simulation capabilities on next-generation platforms. Sandia demonstrated performance portability abstractions and the coupled multi-physics and template infrastructure for embedded sensitivity analysis on multiple hardware types, utilizing the Computational Systems and Software Environment advanced architecture test beds. Sandia completed several performance improvements to the Structural Simulation Toolkit (SST) to enable increased performance of next-generation memory system architectures for Advanced Simulation and Computing (ASC) applications. To improve the fidelity of models, Sandia developed a multi-physics capability to track the evolution of material states

and evaluate residual stresses in support of GTS reservoir lifecycle simulations. Sandia made enhancements to the QASPR program using Xyce HBT models that evaluate the response of war reserve (WR) circuits in neutron environments. In addition, Sandia completed a blind validation of the HBT stochastic effects, which provided increased confidence in W88 Alt 370 AF&F device predictions with quantified uncertainty. Sandia's Plato modeling environment provided topology design optimization in support of additive manufacturing. Sandia used the computational power of the Sequoia system to extend the range of electromagnetics frequencies being modeled. Sandia supported the Trinity Phase I system delivery and integration readiness, and participated in the management of Exascale Computing Project (ECP), a project jointly managed by DOE/NNSA and DOE/Science.

Key Outcome 1.4: Sandia exceeded expectations in demonstrating the effective application of existing capabilities to meet the build plan specified in the approved NG Implementation Program Plan (NIPP).

Sandia successfully accomplished FY16 NG production at record production rates, with higher product diversity and well controlled costs. Sandia met all NG production and shipping requirements and produced extra units for the W80, W87, B61-12, and B83 programs. Sandia improved the NG infrastructure by replacing a significant amount of aging equipment, completing an important NG tester upgrade, and reducing the average mean-time to repair production equipment which increased equipment operational availability to greater than 90%.

Goal 2: Reduce Nuclear Security Threats

Sandia earned an Excellent rating by successfully completing global nuclear security mission work in a safe and secure manner to include the Defense Nuclear Nonproliferation, Nuclear Counterterrorism, and Counter Proliferation and Incident Response missions (15% at risk fee).

Sandia exceeded expectations in many areas of the global security mission. Sandia provided critical subject matter expertise to secure, account for, and interdict the illicit movement of nuclear weapons, weapons-usable nuclear materials, and radiological materials. Sandia successfully established international partnerships and supported international partners in the development of internal plans to prioritize export control implementation for the International Nonproliferation Export Control Program (INECP). Sandia effectively sustained and improved nuclear counterterrorism and counterproliferation science, technology, and expertise.

Objective 2.1: Sandia exceeded expectations in support of Global Material Security (GMS). Sandia provided consistently high quality subject matter expertise to international partner training and project support for international engagements. Sandia provided significant support in the opening of the China Center of Excellence (COE), as well as nuclear security engagement with the International Atomic Energy Agency (IAEA), Gulf Nuclear Energy Infrastructure Institute (GNEII), Indonesia, Mexico, United Arab Emirates (UAE), Ukraine, Taiwan, Japan, and Republic of Korea (ROK). Sandia provided high quality support on project activities, providing timely and comprehensive input on sensitive technical issues and successfully negotiating mission critical equipment contracts with Chinese entities in time for the opening of the China COE. Sandia consulted with the Chinese State Nuclear Security Technology Center (SNSTC) on the design, operation, and testing of a physical protection system at a material processing facility at the COE for the proper handling and storage of special nuclear material. Sandia enhanced security through these strategic partnerships by building a global capability to prevent the misuse of nuclear, chemical, biological, and radiological materials. Leaders of DOE, NNSA, Sandia, and China and other international guests participated in the startup of the COE, highlighting NNSA's interest in China's commitment to nuclear security.

Through enhanced project management, Sandia provided advanced physical protection and comprehensive radiological security upgrades at sites worldwide. Sandia expanded efforts to assess international radiological risk statements and provided high quality experimental results that enabled NNSA to focus its efforts on the highest risk elements. Sandia's expertise and well planned data-driven analyses of high activity radiological sources allowed NNSA to prioritize and expand internationally the Security By Device Design and In-Device Delay technology.

Sandia provided significant support to the Nuclear Smuggling Detection and Deterrence (NSDD) sustainability efforts by revising the training curriculum. Sandia also provided SME support to a field exercise tutorial for NSDD partner countries, which assisted the partner countries in learning how to perform tests of their radiation detection systems. Sandia supported NSDD's small vessel pilot program to assess the feasibility of scanning small vessel traffic for radiation. Sandia continued to manage a contract with the University of Maryland's Strategic Arms Reduction Treaty (START) center, which supports the efforts of NSDD's newly-formed threat working group.

Objective 2.2: Sandia exceeded expectations in meeting most of the cost, schedule, and technical requirements for the Defense Nuclear Nonproliferation (DNN) Research and Development (R&D) activities under continuing resolution budget restrictions. Sandia successfully led a multi-laboratory effort that identified alternative nonproliferation areas of concern, resulting in the initiation of novel R&D activities. For example, Sandia, in collaboration with LANL, successfully completed the development of an algorithm to calculate the travel time of bottom-side reflected phases in a three-dimensional model of the earth. This enabled further refinement and improvements in the calculation of seismic travel-times, more accurate location of events, and an understanding of associated uncertainties. Sandia also continued development of a new approach for searching data archives at speeds several orders of magnitude faster than current methods. Sandia hosted and performed quality nuclear forensics research that was presented at the DNN R&D nuclear forensics program review.

Sandia played a critical leadership role in the Low Yield Nuclear Monitoring (LYNM) campaign, exceeding all expectations in its R&D of the dynamic networks for detecting low-yield and underground tests. Sandia also led a multi-lab team to conduct a “Hyper Active Trial” series of tests of prompt diagnostics using the HERMES-III facility in a joint campaign with Defense Programs, earning a Defense Programs Award of Excellence.

Objective 2.3: Sandia met expectations in supporting efforts to achieve permanent threat reduction by managing and minimizing excess weapons-useable nuclear materials and providing nuclear materials for peaceful uses. Sandia reviewed domestic conversion programs to prioritize technical and manufacturing work under various FY17 budget scenarios. Sandia also participated in risk assessment and reduction activities for both Transient Reactor Test Facility (TREAT) and U.S. High Performance Research Reactor (USHPRR) projects to determine how to best mitigate cost and schedule risks. Sandia continued the development and implementation of a Quality Assurance (QA) program to support the NNSA Reactor Conversion Program’s effort to convert five U.S. High Performance Research Reactors (USHPRR) from Highly Enriched Uranium to Low Enriched Uranium fuel. Sandia successfully led the QA for the Reactor Conversion Program, performing audits and surveillance visits to ensure that R&D work performed at LANL, Argonne National Laboratory (ANL), and Y-12 meets the Nuclear Quality Assurance (NQA)-1 QA standards required by the Nuclear Regulatory Commission (NRC) for licensing.

Objective 2.4: Sandia exceeded expectations in support of Nonproliferation and Arms Control (N&AC) activities. Examples include the following:

Sandia’s technical support in the use of radiation detection equipment under the New START was outstanding, enabling NNSA to respond to interagency actions. Sandia provided real-time support to the new START Bilateral Consultative Commission Radiation Detection Equipment (RDE) Working Group during the course of several meetings by answering questions and providing essential technical input to support working group proceedings. Sandia’s experts also provided key contributions to NNSA’s Comprehensive Nuclear-Test-Ban Treaty (CTBT) work. Examples include visiting the Nevada site with CTBT on-site inspectors (OSI), developing OSI training material, and assisting in the International Data Centre (IDC) Re-engineering project.

Sandia exceeded expectations in leading the Procedures Development and Prototyping (PDP) Team under the U.S. – United Kingdom (U.K.) Portal Monitor for Authentication and Certification (PMAC) project, coordinating extensively with team members at LANL and Pantex, and ensuring completion of materials for the Design Review Team. Sandia undertook additional responsibilities by providing a

SME to serve as the Deputy Chair of the PDP Team as well as a SME with dedicated responsibilities for procedures development.

Sandia exceeded expectations by effectively building international partnerships and supporting international partners in the development of internal plans to prioritize export control implementation for International Nonproliferation Export Control Program (INECP) activities. Sandia served as the lead for challenging engagements with Afghanistan, Burma, India, Lebanon, Oman, Pakistan, and Sri Lanka. Sandia effectively established partnerships that strengthened global efforts to detect and prevent the illicit transfer of Weapons of Mass Destruction (WMD)-related materials, equipment, and technology. Specifically, Sandia planned and led multi-laboratory SME teams in providing Regional Chemical-Biological-Radiological-Nuclear-Explosive (CBRNE) WMD Commodity Identification Training (CIT) for India, Lebanon, United Arab Emirates (UAE), Afghanistan, Egypt, and Panama. Sandia planned and led a multi-laboratory and international governmental organization team to deliver regional WMD CIT to the United Nations Office of Drugs and Crime and the customs staffs of Pakistan, Sri Lanka, Nepal, and Maldives. This effort continued to deepen the relationship between the U.S. and Pakistan, despite travel restrictions and programmatic challenges that have frustrated other U.S. Government engagements.

Sandia exceeded expectations in providing technical and logistical support for the seven DOE/NNSA-led U.S. Bilateral Physical Protection Assessment visits to foreign sites holding U.S. obligated nuclear material. Sandia supported the nuclear safeguards engagement activities with bilateral partners in France, Germany, the European Atomic Energy Community (Euratom), and the Middle East. Sandia also supported efforts to enhance the effectiveness and sustainability of regional centers including the Middle East Science Institute for Security (MESIS) and GNEII. Sandia participated in multiple nuclear safeguards studies for the disposition of nuclear waste to include investigating geological repositories and deep borehole technologies.

Sandia hosted the Second Nuclear Nonproliferation Treaty Transparency Visit for diplomatic partners, NNSA, and the U.S. Department of State. Sandia showcased its Life Extension Programs and work to prevent, counter, and respond to nuclear dangers worldwide, allowing NNSA to demonstrate transparency with its international partners.

Sandia formed a cadre of technical experts and developed an advanced curriculum, often partnering with other interagency members (e.g. Homeland Security Investigations) and international organizations (e.g., United Nations Office on Drugs and Crime), to support the INECP team on bilateral and regional efforts. Sandia conducted timely export control technical reviews in support of the Department of Commerce (DOC) export license applications and missile proliferation seminars, and provided significant contributions in support of WMD interdiction activities.

Objective 2.5: Sandia exceeded expectations in sustaining and improving nuclear counterterrorism and counterproliferation science, technology, and expertise. Sandia continued to be a key leader in the assessment of open source nuclear threat device information supporting the national security mission. Sandia effectively supported bi-lateral and tri-lateral Nuclear Threat Reduction exchanges by providing strong technical expertise in addressing outcomes from international meetings.

Sandia provided exceptional depth and breadth of technical knowledge and expertise to support the Joint Disablement Campaign (JDC) for Render Safe activities. Sandia successfully led the Lincoln Blue

exercise coordination efforts and mission analysis and organized and hosted a large-scale Capability Exercise (CAPEX) that involved many other organizations, showcasing current capabilities. This work directly contributed to strengthening relationships with the DoD and significantly enhanced disablement capabilities. Sandia provided excellent instructors for the RAPTER courses as evidenced by the highly positive student feedback.

Sandia met schedule and budget requirements for maintaining operational readiness in support of the Disposition and Forensic Evidence Analysis Team (DFEAT). Sandia effectively performed counterterrorism and counter proliferation tasks on schedule and within budget. Sandia participated in instructor teams that conducted international emergency management training, provided expert information to international partners, and contributed to the development of documents for the IAEA. Sandia completed 95% of the Technology Integration deliverables, with the majority delivered on time. Sandia also supported stabilization activities to include Home Team, mobile and international training efforts, and training aid design, construction, and management.

Key Outcome 2.1: Sandia exceeded expectations by delivering all Global Burst Detector (GBD) payloads ahead of schedule to NNSA, and ultimately on time to the USAF in accordance with performance requirements for Space Nuclear Detonation Detection mission-related capabilities. In February, the USAF successfully launched the last Global Positioning Satellite from the IIF block of satellites. Sandia provided the GBD, on behalf of NNSA, to the USAF for meeting the nation's nuclear detonation detection capabilities from space. Sandia participated in Early On-orbit Testing (EOT) by successfully turning-on the GBD IIF payload and verifying its functionality. Sandia propagated a laser from the ground into space to the payload aperture, generated in-flight calibration coefficients, and verified sensor performance. This was the twelfth and final payload to complete the GBD on the IIF constellation of satellites. Sandia led a successful Preliminary Design Review (PDR) for the next generation of payloads, the Global Burst Detector (GBD) Prime III, which is a requirement before proceeding into the critical design phase.

Key Outcome 2.2: Sandia exceeded expectations in the assessment and installation of physical security upgrades in the U.S. and overseas. Sandia provided strong analysis support, diligently working to overcome many challenges to meet its FY16 metric goal. Sandia continued to provide impressive studies support. For example, Sandia effectively supported the Threat and Prioritization and the Material Attractiveness working groups which enabled NNSA to revise its action thresholds and more efficiently allocate resources. Sandia exceeded the radiological security upgrade goal by completing upgrades in 54 domestic buildings (goal of 50), and also completed upgrades in 12 international buildings. This work supported NNSA's mission in securing high-priority sites that contain nuclear and radiological materials.

Key Outcome 2.3: Sandia met expectations in fully supporting counterterrorism, counterproliferation, and incident response. Sandia was a key leader in ensuring continued enhancements to NNSA emergency response capabilities. Sandia engaged with DoD partners while executing all standoff disablement activities, including completion of an interagency Standoff Disablement Roadmap and timely delivery of critical assessments requested by DoD. Sandia provided strong technical support in the Directed Energy development and testing efforts. Sandia adequately supported current Level V Tool testing efforts. Sandia maintained readiness of Radiological Assistance Program (RAP) equipment and personnel and supported several high profile special events.

Goal 3: DOE and Strategic Partnership Projects Mission Objective

Sandia earned an Excellent rating by successfully executing high-impact work for DOE and Strategic Partnership Projects (SPP) safely and securely (20% at risk fee). Sandia demonstrated the value of the work in addressing strategic national security needs.

Sandia exceeded expectations in many areas of the DOE and SPP mission work. Sandia successfully performed the work within scope, cost, and schedule to ensure mission critical deliverables were met. Sandia strategically integrated science and energy technology programs to address the most demanding energy challenges. Sandia effectively leveraged its nuclear weapons (NW) science and engineering capabilities in conducting SPP work in support of current and future national security requirements.

Objective 3.1: Sandia exceeded expectations in various DOE-sponsored science and energy program areas, which directly support DOE strategic goals and objectives to help create and sustain leadership in the transition to a global clean energy economy. Sandia strategically integrated science and energy technology research in a number of cross-cutting technology areas to address the most demanding energy challenges. Integration of basic research, applied energy research and development, and technology commercialization ensured continued economic competitiveness for our nation. Sandia demonstrated leadership in various program areas that help to further strengthen our nation's energy security posture as evidenced by the following:

Sandia demonstrated national leadership in various science and energy mission areas, and was selected as the lead laboratory to support the DOE's strategic efforts at the seventh international Clean Energy Ministerial (CEM7). As a prestigious member of the organizing committee, Sandia exhibited technical displays at DOE's CEM7 Showcase that demonstrated Sandia's world-class leadership in addressing climate change, clean energy, and energy security within the DOE National Laboratory Enterprise.

Sandia led a national endeavor with DOE, Department of Transportation (DOT), Transport Canada, and industry which focused on safety issues associated with train derailment-based spills and fires of crude oil. Sandia provided important technical analysis for DOT regulations, train size, and rail car safety to reduce the risk of life-threatening massive explosions and pool fires resulting from derailed crude oil transportation.

Sandia successfully established the Spray Combustion Consortium (SCC), involving three major auto industry partners. The consortium's goal is to develop more fuel efficient engines that reduce petroleum consumption, resulting in greater economic, environmental, and energy security. Sandia used predictive fuel spray nozzle flow models that were experimentally validated to demonstrate optimization of high-efficiency direct injection engines leading to cleaner and more fuel-efficient engines.

Sandia supported DOE/Fossil Energy (FE) by analyzing the Aliso Canyon, California, natural gas storage facility disaster by providing technical counsel and geoscience alternatives related to preserving gas well integrity. Sandia's assessment led to improved emergency regulation, long-term well integrity assessments, and a new regulatory program by the DOT and the State of California focused on 400

similar natural gas facilities across the U.S. Sandia evaluated the science of well integrity, resulting in a summary of the nation's risk and technical basis to help ensure natural gas energy safety and security.

Sandia's expert technical assessments for disposal of down-blended weapons plutonium (Pu) at WIPP proved to be a cost effective alternative to the Mixed Oxide (MOX) plant. Sandia proactively responded to Congressional, DOE, and NNSA requests addressing criticality analysis, as well as the long-term WIPP system performance for disposing of non-weapons and weapon grade Pu inventory. Sandia's active engagement in these assessments provided the basis for new policy decisions and potential cost savings.

Objective 3.2: Sandia exceeded expectations in performing high-impact Strategic Partnership Projects (SPP) work. Sandia's unique science and engineering capabilities attracted a broad-range of non-DOE customers to conduct work to counter current and emerging national security threats. Technologies associated with these projects leverage, sustain, and strengthen the DOE/NNSA capabilities and core competencies to meet DOE/NNSA mission requirements, as well as enhance the U.S. broader national security mission. Through extensive coordination as the project system integrator, Sandia effectively managed and re-baselined several major, high-visibility, multi-million dollar projects to accommodate developing customer programmatic needs.

By leveraging its nuclear weapons (NW) science and engineering legacy, Sandia successfully supported various SPP missions, which sustained and strengthened essential synergistic capabilities to support current and future national security requirements. Several examples of significant activities and accomplishments are discussed below.

Sandia demonstrated unique world-class modeling and simulation capabilities such as the Dante 3D physics-based terrain modeling tool and Sandia's Head-Neck-Torso soldier models. These two projects sustained and enhanced institutional knowledge in computational modeling which is used in the development of NW modeling applications.

Sandia conducted numerous threat and vulnerability risk analyses that achieved significant enhancements to national security. For nuclear related threats, Sandia conducted the most realistic post-detonation nuclear forensics exercise to date, as recognized by the exercise sponsor. Sandia also successfully performed the government acceptance testing of entry barriers at an Outside Continental United States (OCONUS) site. Sandia completed the design, fabrication, and sponsor acceptance testing of the next generation Explosive Destruction System (EDS) to reduce chemical and munition risk.

Sandia made significant contributions to reducing chemical and biological (chem/bio) risks, threats, and vulnerabilities. Sandia conducted a comprehensive OCONUS on-site bio-risk assessment of laboratories involved in livestock production, provided critical support to address the Ebola outbreak in West Africa, and completed an International Chem/Bio Threat Reduction study for the Defense Threat Reduction Agency (DTRA) that assessed chemical safety and security in the Middle East and North Africa. Sandia also developed a prototype "smart trap" for real-time bio-surveillance of mosquitoes that will allow more efficient mapping, modeling, and response to threats posed by mosquito borne pathogens. These projects leveraged numerous Sandia capabilities and skills that support DOE capabilities in the areas of chem/bio defense and safety.

Sandia leveraged its systems engineering capabilities to develop innovative, cost-effective solutions for several national security issues. For example, Sandia improved energy and electrical power distribution and reliability in Pakistan using microgrid technology, conducted system engineering risk-reduction trade studies of the DoD Low Cost Missile Defeat program, and completed analyses and investigations of a USAF flight anomaly involving an innovative low-cost, spin-stabilized rocket motor. These efforts leveraged a number of DOE skills in energy, aerospace, and sensor systems.

Sandia performed above expectations in the area of sensors and sensing systems. Sandia received the DOE Secretarial Achievement Award for the Space Based Infrared System geosynchronous earth orbit staring sensor. Sandia successfully demonstrated the Dionysus radar sensor resulting in image data that did not previously exist. These pathfinder project achievements support key intelligence surveillance reconnaissance activities and nuclear detection capabilities.

Sandia effectively applied world-class cyber security technical expertise to demonstrate WeaselBoard technology for detecting abnormal equipment behavior, which may be indicative of a cyber-attack. The laboratory also deployed the Tamizar network analytic tool to detect network cyber-threats. The technical director of a U.S. partner presented meritorious achievement awards to three Sandia cyber teams. These projects assured U.S. readiness against cyber-attacks, enhanced national security, and strengthened capabilities that are used to protect DOE equipment and networks.

Key Outcome 3.1: Sandia exceeded expectations in its non-Nuclear Weapons Program Management Units (PMUs) communications and transparency with the Sandia Field Office (SFO). There were continued improvements as Sandia involved SFO in operational activities, program development and execution, site tours, and customer reviews. These engagements enabled SFO to conduct meaningful oversight and maintain a high level of operational awareness. Sandia continued to enhance the Management Assurance Tools (MATs) as part of the Contractor Assurance System (CAS). DSA also hosted a Low Cost Missile Defeat (LCMD) project review for several SFO organizations that described some of the unique technologies and features of the system, as well as hazards associated with tests. This was the first all-inclusive review of this type where the LCMD SPP initiated a dialog early in the program with multiple SFO organizations to discuss potential issues and concerns.

Key Outcome 3.2: Sandia exceeded expectations by making substantial contributions to support the DOE cross-cut initiative in Grid Modernization goals and objectives that enhance national grid resiliency and modernization efforts. Major laboratory accomplishments included the successful development and execution of the Grid Modernization Laboratory Consortium (GMLC) that is leading U.S. research endeavors towards the development of a more secure and modern electric grid. Sandia's legacy and leadership in protecting national security assets and enhancing energy security is a unique and essential capability needed for modernizing grid security and resiliency. Sandia led the development of a smart grid testing network and a data model library to facilitate stakeholder collaborations with the national laboratory community. This development accelerated the determination of new technologies and systems that effectively addressed grid vulnerabilities and deficiencies. Sandia presented the grid testing network vision to the DOE Electricity Advisory Council and a stakeholder workshop.

Sandia was acknowledged as a major contributor of the Joint Capability Technology Demonstration (JCTD) and earned a team of the year award for contributions made to Smart Power Infrastructure

Demonstration for the Energy Reliability and Security (SPIDERS) program. The major contribution of SPIDERS was the timely influence on microgrid technology standards and policies that will be applied at DoD bases worldwide. The SPIDERS team developed, demonstrated, and deployed operational microgrids. The JCTD resulted in the reduction of fuel consumption and carbon emissions, increased the use of renewable energy, and increased grid reliability with a significant improvement in cyber security.

Goal 4: Science, Technology, and Engineering (ST&E)

Sandia earned an Excellent rating by successfully advancing the national security missions and frontiers of Science, Technology, and Engineering (10% at risk fee).

Sandia exceeded expectations in many areas of Science, Technology, and Engineering (ST&E). Sandia successfully achieved numerous science and engineering breakthroughs and developed several technology advancements that supported nuclear security mission execution and the broader national security missions of DOE and other federal agencies. Sandia advanced the state of technical readiness levels and overall ST&E through its strong Laboratory Directed Research and Development (LDRD) and Technology Transfer programs. Sandia effectively managed these programs within scope, cost, and schedule.

Objective 4.1: Sandia exceeded expectations by executing strategic plans for seven core research foundation areas that directly align with the DOE/NNSA's mission. The Sandia Research Leadership Team implemented the strategic plans with an increased emphasis on mission impact and transformational results. Significant improvements in the execution of strategic plans were noted by the Sandia Research Advisory Board (SRAB).

The LDRD Grand Challenge External Advisory Boards (EAB) continued to commend Sandia's efforts in emerging multidisciplinary work that is pushing the frontiers of science and engineering. Sandia's Partnerships Program was improved with the implementation of the Academic Alliance program, generating LDRD proposals of new research ideas and leading to projects at five universities that align with the mission of attracting new researchers to Sandia. Sandia established four onsite managers who are developing partnerships and monitoring the projects. Sandia increased the number of full proposals that align with critical NNSA mission areas.

Objective 4.2: Sandia exceeded expectations with mission-enabling research that benefited DOE/NNSA and the nation. Sandia's work in Power Spectrum Analysis (PSA) enabled the detection of electrical differences in devices. This work provided the ability to detect aging effects when devices are subjected to accelerated life tests at elevated temperatures and voltages, which has applications for weapons surveillance. Sandia continued to deploy apatite-based technologies to protect groundwater at sites contaminated by radionuclides and heavy metals, and conducted laboratory tests to evaluate the efficacy of apatite for remediating uranium contamination. Sandia's combustion researchers influenced atmospheric research by proving, with laser-induced incandescence models, how conventional tools used to detect black carbon Single Particle Soot Photometer (SP2) do not sense all of the carbon present in the atmosphere. Sandia demonstrated the first-ever chip-scale quantum receiver to support cyber and physical security applications through the Sandia Enabled Communications and Authentication Network using the Quantum Key Distribution (SECANT QKD) Grand Challenge. Sandia developed three new algorithm enhancements to add to an existing operation spaced-based ground system.

Objective 4.3: Sandia exceeded expectations in conducting transformative, innovative, leading edge, and high quality science that benefited the national security mission.

Sandia's work in modifying molybdenum disulfide (MOS₂) has demonstrated MOS₂ as a viable replacement for expensive platinum in catalyzing hydrogen as a transportation fuel. Sandia earned five R&D 100 awards for transformative research and advancements in technology, including 1) CO₂ Memzyme, an ultra-thin membrane that is the first cost-effective technology for carbon dioxide separation and capture to help reduce the threat of climate change; 2) LED Pulser, a light source that enables use of light-emitting diodes instead of expensive lasers to provide high-brightness, rapidly pulsed, multicolor light for scientific, industrial or commercial applications; 3) Integrated Circuit Identification (IC ID), a revolutionary method that authenticates integrated circuits, detects counterfeit electronics, and verifies individuals' identities and their transactions using a unique device signature and cryptographically secure challenge-response protocol; 4) Lightweight Distributed Metric Service (LDMS), a monitoring software that provides detailed awareness of system-wide performance of high-performance computers and applications in production; and, 5) Silicon Carbide Junction Field-Effect Transistor (JFET) Switch, a novel low-cost junction field-effect transistor that will improve the efficiency of next generation power conversion systems used in energy storage, renewable energy and military applications. Sandia's paper on transformation computing capabilities that addressed combining innovations in nanotechnology computer science and scientists' understanding of the brain, led to the Office of Science and Technology Policy (OSTP) announcement of a new research endeavor, titled Nanotechnology Inspired Grand Challenge for Future Computing.

Objective 4.4: Sandia met expectations in maintaining a healthy and vibrant research environment. Sandia earned several awards and commendations, validating Sandia as a premier laboratory of researchers and capabilities to advance science. A Sandia researcher was awarded the 2015 Institute of Electrical and Electronics Engineers (IEEE) Technical Committee on Scalable Computing Award for Excellence for Early Career Researchers. A Sandia researcher was selected by the SunShot Initiative as an inaugural recipient of the Innovator in Residence Fellowship. A Sandia researcher received an inaugural Thin Film Division Distinguished Technologist Award by the American Vacuum Society. Three Sandia employees were selected as fellows of the American Physical Society. Out of 21 candidates, Sandia attracted three Truman Fellows to conduct national security research. Sandia cultivated internal and external communities of interest in revolutionary approaches to the stockpile by hosting monthly seminars and seven seminars on Power on Demand. Sandia also established communities of practice to engage the technical workforce in additive manufacturing, statistics, agile project management, and shock physics.

Objective 4.5: Sandia exceeded expectations in transitioning high-impact technologies to industry that enabled economic development. Sandia's work on the BaDx anthrax detector was recognized as one of the year's 100 best technology innovations. Sandia is working with Aquila (industrial partner) to transfer this technology into broader commercialization frontiers for detection of various biological agents. Sandia hosted a roundtable on the woman's role in changing the dynamics of innovation, technology transfer, and economic development in New Mexico (NM). Sandia was awarded seven DOE Small Business Vouchers in its pilot program in the areas of solar, wind, water, fuel cells, geothermal, and advanced manufacturing. Sandia received two federal Laboratory Consortium Awards of Excellence in Technology Transfer for a decontamination product. Sandia supported 205 small businesses in New Mexico through the New Mexico Small Business Assistance Program, resulting in \$2.4 million in tax credits from the State of New Mexico. Sandia's increased success in technology transfer during the fiscal year were impressive, as evidenced by over 300 technical advances, 239

patent applications, 164 copyright works, 148 government use notices, 29 commercial licenses, and impactful results using Cooperative Research and Development Agreements.

Sandia exceeded expectations for reporting and publishing requirements for the broad availability of federally funded scientific research. Sandia increased its public publication submissions, as reported by the DOE Office of Scientific Technical Information (OSTI), to more than 60%, a substantial increase from last year's submission rate.

Goal 5: Operations and Infrastructure

Sandia earned a Very Good rating by effectively and efficiently managing the laboratories while maintaining an NNSA enterprise-wide focus (20% at risk fee). Sandia demonstrated accountability for mission performance and management controls, assured mission commitments were met with high-quality products and services, and maintained excellence as a 21st century government-owned, contractor-operated facility.

Sandia met or exceeded expectations in many areas, including: environment, safety, and health; capital projects; safeguards and security program management; facilities, infrastructure, and equipment; business operations; legal management; cyber security; and information technology. Sandia's safety, security, and business operations enabled the laboratories to meet and exceed many mission deliverables. Sandia addressed key challenges to maintain and sustain its aging infrastructure and improve operations to support the nuclear security enterprise.

Objective 5.1: Sandia met expectations for delivering effective, efficient, and responsive environment, safety and health (ES&H) management and processes. Sandia responded to several safety and environmental events in a manner that demonstrated strong management engagement, critical thinking, and a desire to continuously improve. Sandia aggressively investigated a Sulfur Hexafluoride gas leak at the Z Machine and implemented timely corrective measures to prevent future large leaks. Sandia's notifications, activities to assess extent of condition, and conduct of causal analysis have improved. The extent of condition evaluations associated with the wafer off-gas event at the Microsystems Engineering & Sciences Applications (MESA) facility and the pressure safety event at Building 808 were rigorous.

Sandia demonstrated positive management engagement in the causal analysis and corrective actions for two wastewater Notices of Violation, implementation of proactive measures to address inclement weather, and the additional analysis to identify commonalities in electrical safety and battery incidents. In response to multiple Work Planning and Control (WPC)-related incidents at SNL user type facilities involving non-Sandia employees and other locations where Sandia employees performed work, Sandia analyzed work at these facilities and identified specific practices where improvement processes could be implemented to ensure safety. These incidents included the laser injury of a Los Alamos National Laboratory employee at the Center for Integrated Nano-Technologies, an inadvertent rocket motor ignition during a test conducted by United States Air Force (USAF) personnel at Tonopah Test Range, and the incident at an off-site location involving a Sandia employee who was participating in team building activities at a rappelling wall owned and operated by the USAF.

Sandia's Radiation Protection Program exceeded expectations by proactively developing an environmental field monitoring methodology for dynamic tests which was successfully field tested at the sled track, and by increasing usage of Radiological Process Improvement Reports (RPIR) in resolving latent cross-organizational weaknesses. Sandia's Industrial Hygiene Program actively supported the success of the Z Machine mission, teamed with line organizations on Methylene dianiline contamination assessment and control, and was engaged in assessing the potential impacts of the proposed 10 Code of Federal Regulations (CFR) 850 standards.

Sandia met expectations in the performance of assurance activities at the moderate hazard facilities and facilities of programmatic importance. Sandia successfully completed all corrective actions to restart the Scaled Wind Farm Technology (SWiFT) facility in a safe manner. Sandia developed a thorough corrective action plan to address issues identified in an incident at the Tonopah Test Range (TTR), to include establishing a strengthened partnership with the USAF 96th Test Wing. Sandia's Rocket Sled Track personnel displayed a good questioning attitude during preparations for a test. While examining the current rocket motor inventory, Sandia discovered that specific rocket motors might contain a banned substance. Sandia paused operations, secured the affected areas, and worked vigorously to reach back to the vendor to characterize the actual constituents in the propellant.

Sandia's Explosive Centers of Excellence (COE) concept continued to mature. Sandia established a process to include more check points during the development or revision of an explosive site plan (ESP) which will improve timeliness of approval. Sandia's COE were engaged in investigating a TTR explosive incident and in resolving WETL issues that could have impacted the mission.

Sandia continued to make progress in addressing corrective actions. For example, Sandia's Division 5000 conducted a rigorous Independent Validation Review to confirm the effectiveness and sustainability of 36 of 40 conclusions from the 9920 Accident Investigation Board (AIB) Report.

Sandia implemented and improved its Quality Assurance (QA) program by raising awareness of the corporate documents and records program, communicating the Suspect/Counterfeit Items program requirements, enhancing current assessment processes, and upgrading Sandia QA corporate documentation.

Sandia personnel provided professional and technically sound testimony and evidence supporting DOE/NNSA and Sandia's permit modification request during a New Mexico Environmental Department (NMED) hearing. Because of this support, NMED was able to issue a Corrective Action Complete (CAC) decision and no appeal was filed to challenge the Hearing Officer's decision. Sandia held a public meeting for the CAC status for six Solid Waste Management Units under the Environmental Restoration Program.

Sandia exceeded expectations in the quality and continuous improvement of the Annual Site Environmental Reports (ASERs) for SNL/CA, SNL/NM, and SNL/Tonopah Test Range & Kauai Test Facility. Of particular note, Sandia added a new and very informative chapter on Ecology in the SNL/NM ASER that provided detailed information for DOE and the general public.

Sandia met all compliance deliverables for three new and important storm water permits, avoiding potential fines and violations. This is the first time that the compliance deliverables required for these permits were available for public review and comment.

Sandia met expectations in Technical Area-V (TA-V) for nuclear operations through the effective implementation of its management system. While maintaining a high level of transparency with NNSA, Sandia scheduled and performed self-assessments, conducted analyses of its operations, instituted a Condition Review Board to identify and track issues and actions, and tracked its progress against performance metrics.

Sandia made progress executing its Nuclear Criticality Safety (NCS) improvement plan by establishing a resource-loaded schedule that included all criticality safety activities (e.g., procedures, assessments), NCS qualification for new trainees, and the stand-up/shut-down of the criticality safety program in specific facilities. This resulted in a more complete understanding of resource constraints and schedule limitations. Sandia successfully led two efforts that benefited the DOE/NNSA NCS community.

Objective 5.2: Sandia met expectations managing the minor construction project portfolio. Sandia delivered performance reports that tracked project health, issues, and risks. Sandia met expectations reporting monthly progress on interim milestones for the Collaboration in Research and Engineering for Advanced Technology and Education (CREATE) Alternative Finance Proposal (AFP). Sandia participated in the lessons learned and business case review sessions on the Pantex and Lawrence Livermore AFPs, respectively.

Objective 5.3: Sandia's Safeguards and Security program largely exceeded expectations with the exception of information protection which is addressed in Key Outcome 6.2. The DOE Office of Enterprise Assessments (EA) conducted a full-scope assessment of the Sandia New Mexico Safeguards and Security program this fiscal year, the first in nearly seven years. EA inspection results reflect a program that consistently met, and in many instances, exceeded expectations in every formal topical and sub-topical area. Notably, EA lauded Sandia's security assurance program as best in class and noted Sandia had "broken the code to an effective assurance program", exceeding expectations for transparency, rigor, and formality. Sandia's security assurance system enabled an effective security program and an environment for continuous improvement. Sandia's Operational Security (OPSEC) program also significantly exceeded expectations and was noted by Enterprise Assessments and the Interagency OPSEC (Operations Security) Support Staff (IOSS) as best in class in protecting sensitive information.

Although Sandia's corporate security program was effectively managed, the program is not being consistently administered across all Sandia locations.

Sandia made progress in addressing NNSA concerns related to transparency and collaboration of the classification program. NNSA acknowledges it will take time for substantive improvements in transparency and communication to be implemented.

Sandia met expectations in the area of Emergency Management regarding planning, preparedness, and response, in accordance with DOE Order 151.1C. Increased integration with the security assurance system continues to improve the overall effectiveness of the Emergency Management program. Sandia is not consistently analyzing emergency management assurance data to identify and address issues.

Objective 5.4: Sandia met expectations to maintain, operate, and modernize DOE/NNSA facilities, infrastructure, and equipment. Sandia met expectations in managing the Roof Asset Management Program (RAMP) and Cooling and Heating Asset Management Program (CHAMP) in alignment with respective program plans. Sandia collaborated with the CHAMP stakeholders to resolve schedule and cost approaches on the Building 869 pilot. Sandia exceeded expectations in maintaining real property assets (RPAs), ensuring a greater than 99 percent availability of key mission facilities and reducing maintenance backlog from over 8 weeks to below 5 weeks by the end of the fiscal year. Sandia did not correctly record maintenance costs from two remote locations in the SNL Facilities Information

Management System, as identified in the FY16 Validation Report. In response, Sandia developed a corrective action plan to capture Annual Actual Maintenance costs for all RPAs.

Sandia consistently focused on recapitalization priorities and provided thorough reports. Sandia's recapitalization planning for future projects is a potential model for other sites. Sandia executed projects according to plan and met expectations in providing indirect-funded project data in G2.

Sandia supported the NNSA goal to implement a more robust infrastructure planning process with the Master Asset Plan (MAP) Deep Dives. Sandia Organization 4800 utilized division-level Facilities and Infrastructure Plans, up-to-date Facilities Information Management System data, and Mission Dependency Index information to create an integrated view for Sandia leadership to present during the MAP Deep Dive.

Sandia exceeded DOE/NNSA sustainability expectations by setting and achieving challenging goals in areas such as Sustainable Buildings, Clean and Renewable Energy, and Water Use Efficiency and Management. Sandia is continuing work on the proprietary Facilities Analytics database which will collect data from facilities and incorporate weather data to optimize energy systems and enhance its Transformation IX determinations. Sandia is working closely with NNSA and the local USAF installation to determine the feasibility of a joint renewable energy project. Sandia is working with NNSA to investigate the potential for an energy savings performance contract at SNL.

Despite resource commitments to improve real estate management, Sandia has not met the Preliminary Real Estate Plan documentation and lease management quality requirements. In addition, Sandia is working to improve the coordination of facility planning and NEPA requirements, but acknowledges that it will take time before the benefits of these improvements are realized.

Objective 5.5: Sandia met expectations in delivering effective and efficient business operations. Sandia received the highest rating possible from NNSA's financial performance measurement assessment. Sandia was proactive in keeping NNSA informed of financial issues and initiating efforts to improve operations. Sandia worked collaboratively with NNSA to improve processes for managing service centers and suspense accounts, as well as providing prompt and detailed responses in support of reviews. Sandia is commended for its response time and detailed explanations in addressing questions that arose during the FY15 Final Actual Costs and Rates Review meeting. Sandia completed its Internal Controls Program Review, providing assurance that Sandia's program is adequate. Sandia improved its Disclosure Statement by adding clarifying language that identifies all rate exemptions. With respect to Program Management Unit indirect costs, Sandia significantly increased the transparency of the general process for sizing the costs, while also identifying additional opportunities to further improve transparency and standardization for developing and managing costs.

Sandia is addressing concerns relating to cost accounting standards, specifically areas pertaining to labor charging practices and the need to improve monitoring and quantification of service center variances. In the area of labor charging, Sandia conducted multiple self-assessments to better pinpoint problem areas and develop a communication strategy to address them. For service center variances, Sandia's improvement efforts included rate compression and creating a standardized work breakdown structure to enable automated solutions for variance reporting and redistribution. NNSA recognizes

that Sandia is implementing corrective actions in these areas and that addressing the service center deficiencies will take several years.

Sandia received the highest rating from the NNSA Personal Property Branch system review and personal property validations. Sandia improved its wage determination request documentation, enabling NNSA to make faster determination decisions and significantly reducing the number of questioned and rescinded actions. Sandia did not meet expectations in the quality of subcontract packages. In collaboration with NNSA, Sandia is planning a structured improvement activity to improve the subcontract consent process and package quality.

Sandia met expectations in the areas of human resources and communications. Sandia's on-site health services achieved full reaccreditation through 2019 and was awarded an Honorable Mention for the C. Everett Koop National Health Award based on both health improvement and cost savings. Sandia completed four of the eleven structured improvement recruitment-based activities intended to solicit and retain the most highly sought-out applicants to ensure Sandia remains competitive with industry. Sandia proposed strategic solutions to the DOE Benefits Value Study task force created by the Secretary of Energy to enhance the value of this reporting requirement. Sandia is participating in the Geographic Differential working group to ensure its compensation in the Northern California bay area is competitive to attract and retain employees. Sandia received two coveted Awards for Publication Excellence in Social Media and Writing. There has been a concerted effort to improve communication and increase transparency to ensure NNSA is informed of upcoming initiatives, achievements, and areas of concern. Sandia is improving the quality of deliverables and is developing a centralized tracking system to ensure deliverables are submitted in accordance with contract requirements.

Objective 5.6: Sandia met expectations by delivering efficient and effective management of legal risk and incorporation of best legal practices. Sandia's increasingly strategic use of in-house counsel continued to improve its effective legal representation and appropriately control legal costs. Sandia is also taking steps to improve its performance in areas such as export control. Sandia is fostering a positive and cooperative relationship with DOE/NNSA counsel by increasing interactions and transparency to reduce overall legal risk to the enterprise.

Sandia leadership implemented a comprehensive suite of meaningful corrective actions related to compliance with lobbying restrictions, which demonstrated Sandia's commitment to avoid recurrence of similar issues.

Sandia acknowledged issues with its management of outside counsel under 10 CFR Part 719, performed an extent of condition analysis, conducted additional training, and began revising its Legal Management Plan to ensure compliance with the regulation.

Sandia undertook extraordinary efforts early in this performance period to support a timely NNSA response to court-ordered deadlines in one particular FOIA matter, but experienced a growing number of pending FOIA requests. In response, Sandia initiated a comprehensive FOIA process improvement activity that demonstrated a commitment to improving both the cycle time and accuracy of FOIA responses.

Objective 5.7: Overall, Sandia exceeded expectations to deliver effective and responsive cyber security and information technology systems. Sandia conducted multiple cyber security self-assessments to prepare for the NNSA Command Cyber Readiness Inspection (CCRI) of the Sandia Partnering Network. The methodology employed for interviews and system assessments was robust and effectively prepared Sandia for the inspection, as evidenced by the outstanding rating (99.5 out of 100 possible points).

Sandia continues to be a national leader in cyber security forensics, analysis, and incident remediation and response, providing valuable information and direct assistance to DOE and numerous federal agencies concerning indicators of compromise and attack methodologies. Because of these advanced capabilities, the NNSA Chief Information Officer (CIO) designated Sandia as the Center of Excellence (COE) for cyber threat intelligence, responsible for leading the effort to share developed technologies and practices with other NNSA sites.

Sandia added a new capability to its high performance computing cluster designed to spin up hundreds of vulnerability scanners on demand, reducing scanning time of the entire unclassified environment from 3 days to less than 3 hours. Sandia remediated 83% of the original four obsolete and vulnerable software products on the Sandia Restricted Network in its effort to meet the NNSA requirement.

Sandia began implementing continuous monitoring (CM) of cyber security controls on the Sandia Classified Network, but did not meet all milestone objectives for the classified and unclassified environments outlined in the SNL Information Security CM Implementation Plan. Sandia made progress in CM to identify needed changes in its vulnerability management program for the unclassified environment that reduced the overall risk of potential vulnerabilities from a high to moderate level, demonstrating an ability to analyze and apply monitoring data to improve performance. Sandia achieved progress in meeting ARCHER requirements in the NNSA Enterprise CM charter for Windows 7 and 8 end-user systems and current Windows servers. Sandia configured ARCHER to incorporate the results of manual assessments for all security plans, enhancing CM visibility at the corporate level. In addition, Sandia now performs weekly credentialed scanning on all unclassified Windows machines and servers, enabling Sandia to identify significantly more vulnerabilities. During an audit of Sandia's Cyber Security Program, NNSA praised Sandia's extensive use of ARCHER and continuous improvement in CM.

Sandia demonstrated a new Cyber Risk Assessment process for the Enterprise Change Advisory Board that was effective in managing potential risks introduced by proposed system changes. Through this process, Sandia successfully identified and prevented 11 high risks from being introduced into classified/unclassified systems.

Sandia implemented new processes to increase line awareness and accountability for assessment results. These efforts significantly improved the line managers' responsiveness in addressing assigned cyber security issues.

In the area of information technology, Sandia successfully transitioned a Virtual Private Network (VPN) between Sandia and the Kansas City Plant to the OneNNSA Network, leveraging the network's data protection capability and saving circuit costs. Sandia also met very challenging Multifactor Authentication (MFA) goals by achieving 87% compliance for standard users and 100% compliance for privileged users.

Sandia successfully dispositioned over 30,000 boxes of records from 12 bunkers one year ahead of schedule as required by the National Archives and Records Administration (NARA) Plan of Corrective Action (PoCA). Sandia also achieved progress in meeting other major records management milestones in the PoCA.

Key Outcome 5.1: Sandia exceeded expectations for lifecycle management of hazardous and nuclear materials and demonstrated a strong commitment for further improvements. Since the Life Cycle Materials Management Program was initiated in FY14, Sandia achieved a 2 – 5 percent annual reduction in chemical containers. Sandia improved the accountability and accuracy of chemical inventories, with 100 percent of chemical containers receiving a radio frequency identification device (RFID). Sandia developed a streamlined and effective process to safely and securely dispose of waste and unneeded hazardous materials. In FY16, Sandia disposed of 32,000 pounds of unneeded explosives and 95,000 pounds of radiological/mixed waste. Sandia completed its legacy waste campaign, disposing of over 8300 items with a net explosive weight of 1,081 pounds since FY11. Additional life cycle management improvements included prototyping a disposal process for trace explosives in analytical waste. Sandia continued to make progress in preparing for two repackaging campaigns of legacy nuclear material at the Auxiliary Hot Cell Facility to reduce the amount of legacy nuclear material at Sandia.

Key Outcome 5.2: Sandia met expectations in infrastructure management improvements. Sandia improved performance in the management of G2 data, including project baselines, project execution updates, planning module inputs, and timely monthly report corrections. Sandia's G2 financial team was responsive and submitted cost reporting on-time that was current, accurate, and complete, and reconciled with the Standard Accounting Reporting System (STARS). Sandia actively participated in multiple NNSA infrastructure forums, including the NNSA Maintenance Management Conference, Core-infrastructure Risk Informed Strategic Planning (CRISP) Team, and the Sustainment Management System Team (BUILDER Team). Sandia met the deliverables for Phases II and IIIa of the BUILDER Implementation Plan. Sandia accelerated the deliverable for Phase IIIb, months ahead of schedule, and submitted a plan for achieving full BUILDER implementation. Sandia completed the re-calculation of Deferred Maintenance (DM) as required by the PMP. Sandia supported the Mission Dependency Index (MDI) by actively participating in the MDI validation, and completed the review ahead of schedule. Sandia provided valuable recommendations on future development of MDI and network analysis. Sandia supported Enterprise Risk Management (ERM) efforts through its participation in the ERM activity.

Key Outcome 5.3: Sandia met expectations in the implementation and effective execution of the DOE emergency management requirements. Sandia completed technical planning documents, including the Emergency Planning Hazard Assessments for multi-facility, catastrophic events, in accordance with the Technical Planning Basis requirements. In addition, Sandia executed an effective drill and exercise program that challenged and tested the overall response capabilities at both the NM and CA sites. Both sites demonstrated improvement in issues management related to documenting, tracking, and completing corrective action plans in a timely manner.

Goal 6: Leadership

Sandia earned a Very Good rating by demonstrating leadership in supporting the direction of the overall DOE/NNSA mission (10% at risk fee). Sandia strengthened its leadership role with NNSA, exhibiting professional excellence and working selflessly across the enterprise to support the NNSA's strategic vision and mission. Sandia's leadership team demonstrated commitment to improving self-assessments, engaging in continuous improvement, and implementing innovative and cost-effective solutions.

Sandia demonstrated leadership in stockpile stewardship, nonproliferation, counterterrorism and countering weapons of mass destruction, cyber security, energy security, defense, homeland security, and space innovation mission areas. Sandia's collaboration and integration efforts effectively supported the Nuclear Security Enterprise (NSE). Sandia led or participated in multiple enterprise-wide continuous improvement efforts, resulting in a number of DOE-recognized strategic best practices in veteran hiring, talent pipelines, and supply chain management.

Sandia did not meet expectations in fully arresting the rate of major Incidents of Security Concern. Sandia successfully implemented a number of initiatives intended to increase security awareness and assist organizations with the highest incident rates. Sandia's leadership also increased its attention on security-focused work planning and controls to improve information protection.

Objective 6.1: Sandia exceeded expectations in its extensive participation and leadership with multiple DOE and NNSA councils, committees, and boards. Sandia continued to foster the high-level of collaboration and sharing of best practices needed to enhance mission goals. Sandia's President actively participated in the NNSA Council and the DOE National Laboratories Directors Council. Sandia's Executive Vice President for Mission Support co-chaired the NNSA Operations Board and served on the DOE Laboratory Operations Board. In addition, Sandia's investments in relationships with top-tier universities, participation in DOE-wide diversity efforts, and effective implementation of its workforce strategy, exemplified the strategic vision necessary for meeting future challenges.

Sandia demonstrated strong leadership involvement in facilities and infrastructure management during the Master Asset Plan (MAP) Deep Dive, providing NNSA leadership a deeper understanding of real property management at SNL.

Sandia defined and implemented a realistic vision for the Laboratories in alignment with the NNSA strategic vision. Sandia's FY16-FY20 Strategic Plan demonstrated alignment with the Mission Pillars and Crosscuts described in NNSA's Enterprise Strategic Vision. The plan also outlined how Sandia partners with other organizations across the NNSA enterprise, universities, and industry to support the DOE/NNSA mission.

Objective 6.2: Sandia met expectations in the area of contractor assurance. Sandia continued to use its contractor assurance system to engage in critical self-assessment. Sandia used measures and metrics in a number of ways across the Laboratories to assess performance at multiple levels of the organization, further identify strengths and weaknesses, and enhance data trending to manage issues more systemically. Sandia completed multiple key performance baseline activities, such as the three-year

Quality Maturity Assessment, to obtain a much improved and more evidence-based understanding of corporate-level performance using quality principles. Sandia formalized an enterprise-level risk management process using corporate parent input and created a risk management index to measure how well Sandia is addressing risk. Sandia enhanced existing tools to improve performance, such as the addendum to its publication, *Achieving High-Quality Results through Operational Excellence*, which incorporates lessons learned and best practices into day-to-day work guidance. Sandia created and enhanced its quarterly measures and metrics report to analyze data available from its Assurance Information System, and summarized the identified improvement opportunities for creating action plans. Sandia monitored the quality of its planned self-assessments and causal analyses and identified areas for improvement, with the ultimate goal of enhancing the line implementation of assurance processes. Sandia completed the FY16 ISO 9001:2008 Surveillance Audit with no findings and no negative observations. The audit provided a valuable external review of Sandia's continual improvement and management system processes.

Sandia quickly assessed and resolved a potential issue regarding nonconforming material in the production of the small neutron tube. Through elements of its assurance system, Sandia determined the risk was low, and the affected product was formally dispositioned as acceptable for use. The complete analysis and resolution of the issue, combined with clear communications, enabled NNSA to continue production.

Objective 6.3: Sandia exceeded expectations in creating enterprise solutions and efficiencies. Sandia continued to identify cost savings and efficiencies through its operational innovation tool that tracks cost savings driven by innovative solutions. Sandia generated a total of \$132 million of cost efficiencies this year. Sandia led, coordinated, or developed multiple innovative cost saving solutions addressing a broad range of NNSA Complex needs, such as: developing the framework for a new stockpile evaluation program to support NSE stockpile certification; producing model-based deliverables in support of W80-4 LEP scope estimation as part of the Enterprise Modeling and Analysis Consortium; improving Strategic Partnership Projects management through Lean Six Sigma activities; developing the tri-lab National Survivability Strategy and National Pulsed Power Strategy for high-energy density physics; and supporting National computational and information science programs by crafting the National Strategic Computing Initiative vision, and leading the Hardware Technology element of DOE's Exascale Computing Project.

Sandia demonstrated leadership in support of NNSA's SPP Task Force (TF) by chairing a lean event to identify process improvements and leading several TF subgroups. Sandia leveraged the TF initiative to develop an SPP "umbrella" agreement with the Missile Defense Agency that will serve as an example for other NNSA sites to reduce government processing costs.

Using capabilities enhanced through its work with other federal agencies, Sandia provided key expertise and technical solutions to counter various domestic and international threats. Sandia provided timely information to senior decision makers to help stabilize dynamic threat environments.

Objective 6.4: Sandia exceeded expectations in demonstrating professional excellence and continuous learning. Sandia was recognized by the Secretary of Energy for numerous Strategic Best Practices in the April, 2016, DOE Best Practices Report. Sandia was highlighted for best practices in the areas of veteran hiring, creating talent pipelines, and awareness of supply chain issues. In addition, Sandia's

Health Services clinic received an Honorable Mention for the C. Everett Koop National Health Award based on health improvement and cost savings.

Sandia demonstrated leadership across the DOE/NNSA nuclear criticality safety (NCS) community in leading two efforts. Sandia hosted the NNSA NCS Technical Program Review for over 90 NCS engineers from NNSA, DOE laboratories, four foreign countries, and two universities. Sandia orchestrated an orientation and training tour for NCS engineers from NNSA, Los Alamos National Laboratory, and Sandia at the weapons vault and the Defense Threat Reduction Agency weapons school. Sandia completed three, week-long NCS classes at TA-V Sandia Pulsed Reactor (SPR)/Critical Experiment (CX) for managers and staff including foreign nationals (Canada, France, and Greece). In addition, Sandia completed four specialized classes for 56 LANL staff at SPR/CX in support of the restart of the LANL Plutonium Facility-4.

Key Outcome 6.1: Sandia met expectations in continuing its commitment to improve safety through the use of the Site Wide Strategy for Safety Improvement (SWSSI) Plan. The line-led peer review initiatives between Organizations 1000, 2000, 5000, and 6000 were a positive step towards promoting continual improvement. Organizations are collaborating on work processes, integrating safety cases, and reviewing failure modes and analysis. All divisions have individual examples associated with the level of effectiveness against the themes of the SWSSI. Site wide efforts such as the addition of a core safety value in the Employee Recognition Awards and improved safety related communications strengthened safety culture.

Key Outcome 6.2: Sandia did not meet expectations in information security. While Category A incidents dropped slightly from FY15 levels, the number of Category A incidents continued to be high and the overall number of Category A and B incidents has increased. NNSA acknowledges the leadership attention and initiatives introduced by Sandia to reverse the high rates of security incidents, particularly Category A incidents.

Sandia's senior management remains engaged on security-focused work planning and controls to improve information protection. Sandia vastly improved its assessment, trending, and corrective actions for Category A incidents. Although improved management attention and increased emphasis on security incidents is clearly visible, these efforts have not yet yielded positive results in reducing majority security incidents.