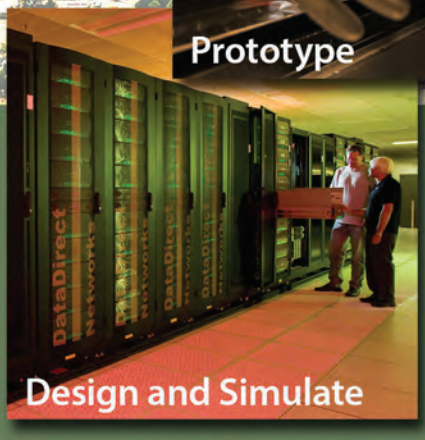
LLNL-TR-670185

Ten Year Site Plan

FY2016



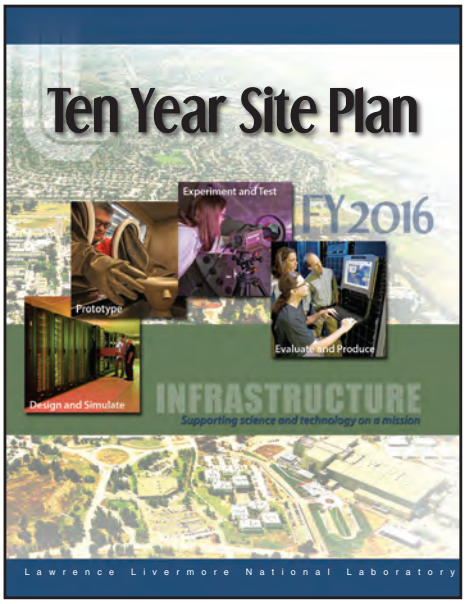
INFRASTRUCTURE

Supporting science and technology on a mission

Lawrence Livermore National Laboratory

About the Cover

The cycles of scientific and technical innovation require a reliable state-of-the-art infrastructure in support of the Laboratory's science and technology mission.



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Lawrence Livermore National Laboratory
FY16 Ten Year Site Plan

April 30, 2015

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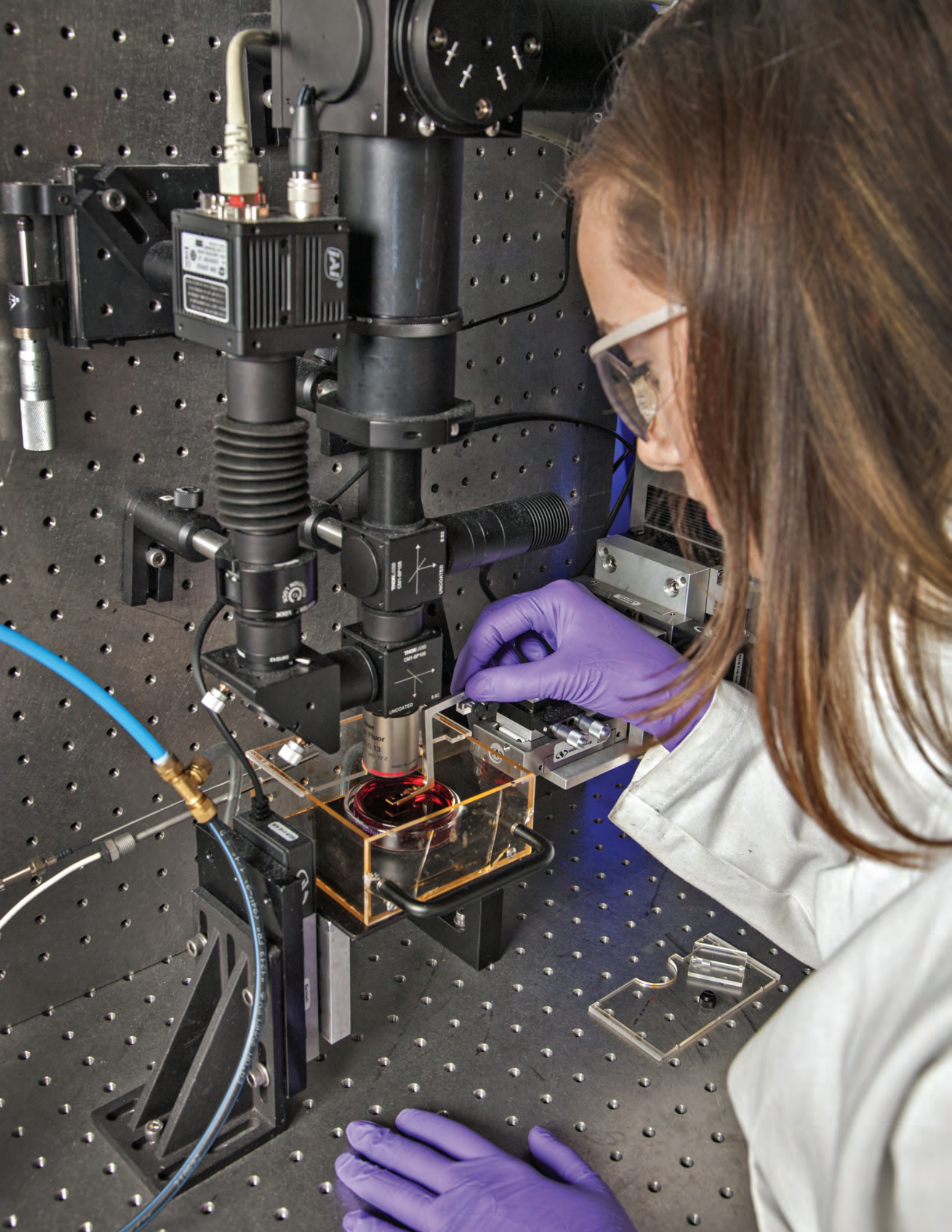

Ten Year Site Plan FY2016

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1 Executive Summary

The Lawrence Livermore National Laboratory (LLNL) is dedicated to deliver on a safe, secure, and effective nuclear weapons stockpile and to address the challenges associated with broader national security missions including nonproliferation and counterterrorism through innovation and excellence in science, technology, and engineering. LLNL is committed to providing the workforce with modern, efficient, and environmentally sustainable facilities with state-of-the-art experimental tools that will ensure LLNL's capability and agility to address the most pressing and longer-term challenges facing our nation.

LLNL's resources and capabilities fully align with the National Nuclear Security Administration (NNSA) missions and programs, but investments are required in facilities and infrastructure to sustain core capabilities and expertise. In addition to LLNL's main mission of certifying the nation's enduring nuclear stockpile, Livermore has been been assigned major program responsibilities over the next 10 years, including warhead Life Extension Programs (LEP) for the U.S. Air Force, increased compartmentalized research and analysis responsibility for deployment of Exascale-class computing for the country by 2023, and major weapons experiments at the National Ignition Facility (NIF) and Nevada. Livermore's infrastructure plan includes strategic investments to sustain core capabilities and expertise that integrates repurposing, consolidation, replacement, modernization, and transition activities commensurate with these national priorities.

LLNL's Main Campus and Site 300 facility infrastructure modernization requirements have been analyzed to ensure continued support for the Stockpile Stewardship Program, broader national security programs within NNSA and other government agencies, and to provide a safe and secure working environment for our employees.

This year's Ten Year Site Plan (TYSP) emphasizes investments to modernize and sustain enduring infrastructure, repurpose quality facilities to optimize utilization, replace buildings when they are well beyond end-of-life, and dispose of legacy facilities to mitigate risk.

> **"We can continue to attract exceptional people to the Laboratory by providing them with opportunities to perform cutting-edge research in world-class facilities. Investments in the Lab's infrastructure are critical to success in meeting vital national needs."**
>
> ***— Bill Goldstein***

Investment Priorities

The implementation of national policy, stakeholder requirements and the program of record contain the following investment priorities:

Modernization and Sustainment Revitalization Priorities
- Upgraded capabilities and facilities focused on infrastructure to support legacy stockpile and modernization (e.g., W80-4, IW-1)
- Replacement and modernization of equipment to support warhead assessment and life extension programs
- High explosives enterprise
- Nuclear/radiochemistry
- Site 300 revitalization to support nuclear security mission
- Precision fabrication and advanced engineering manufacturing
- Special nuclear materials—plutonium and tritium

Construction Priorities
- Engineering and materials replacement building to support stockpile life extension programs
- High performance computing facilities to support Exascale capability deployment
- Compartmentalized (high-side) Research and Development (R&D) office and laboratory space
- Electrical and utility infrastructure rehabilitation
- Emergency operations center replacement

Consolidation and Repurposing Priorities
- Precision targets and diagnostics
- Engineering complex consolidation
- Office and lite laboratory consolidation/utilization

Institutional Priorities
- Livermore Valley Open Campus, including Advanced Manufacturing Laboratory
- Quality office space
- Facilities and infrastructure sustainment
- Information technology upgrades
- Seismic risk mitigation
- Environmental and site stewardship
- Transition and disposition (T&D) of shutdown and legacy space

Addressing these priorities will enable LLNL to continue to lead the nation in nuclear weapons stockpile science, modernization, and sustainment as well as controlling costs in maintaining world-class infrastructure capabilities.

Prior Year Accomplishments

Over the past year, LLNL researchers achieved many accomplishments in support of its nuclear security and broader national security missions. Highlights include:

- NNSA and the U.S. Air Force formally started the long range standoff Life Extension Program (LEP) (W80-4) with Livermore as the lead physics design agency. The LEP team completed the pre-Phase 6.1 studies. The schedule for the first production unit (FPU) advanced by two years to FY2025 to support the Air Force development and deployment of the cruise missile.

- LLNL successfully completed the design and planning effort associated with the Phase 6.2 study following NNSA's decision to postpone the W78/88-1 LEP for five years. As the lead nuclear design lab, LLNL collaborated with Los Alamos National Laboratory (LANL) on aspects pertaining to Navy use of the weapon. A joint design team produced a suite of design concepts that enabled down-selection of the nuclear-explosives package in 2014.

- The Sequoia supercomputer at LLNL became fully operational as a shared stockpile-stewardship resource for the NNSA laboratories. The 20-petaflops machine demonstrated the ability to perform sustained, large-scale, massively parallel simulations that address important materials-performance and predictive capabilities issues. NNSA included Sequoia's accomplishment in its 2014 "Getting the Job Done" list. LLNL is preparing for delivery of a next-generation supercomputer, to be called Sierra, from IBM in 2017. Procurement is part of the Department of Energy (DOE)-sponsored CORAL collaboration with Oak Ridge and Argonne national laboratories to accelerate the development of high-performance computing.

- Experiments at the National Ignition Facility (NIF) clearly demonstrated "self-heating," a mechanism needed to achieve ignition and sustained fusion burn. The accomplishment made the APS list of Top Ten Physics New Stories. Altogether, 156 shots were fired at NIF in support of stockpile stewardship, and operational improvements over the year have dramatically increased the shot rate. Additionally the first plutonium shot was successfully executed, providing significant new data for the Stockpile Stewardship Program.

- LLNL completed technically challenging integrated weapons experiments in FY2014 in support of the national hydrotest program. For example, an innovative pit-reuse concept, with significant cost savings for future LEPs, was successfully tested in October. LLNL technicians also supported a cold-temperature shot to provide a performance baseline of a LANL weapon system.

- LLNL staff members served as task leaders and technical experts at technical Working Group B meetings held by the Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO) in 2014. In addition, LLNL experts co-chaired the On-Site Inspection Workshop 21 held in Yangzhou, China, and a session at the International Noble Gas Experiment Workshop. LLNL experts were also members of the CTBTO Integrated Field Exercise 2014 held in Jordan.

- Livermore researchers are exploring the use of advanced manufacturing (AM) to create materials with novel properties. LLNL developed AM techniques for making polymer cushions and pads for stockpile stewardship applications. Working with MIT researchers, the Laboratory has also developed new ultralight, ultrastiff 3D printed materials that could have very wide industrial applications.

- Researchers from LLNL and four other institutions demonstrated that the Lawrence Livermore Microbial Detection Array (LLMDA) can rapidly and accurately detect bacterial pathogens in the wounds of U.S. soldiers. More effective and timely diagnosis of infections could improve treatment.

- The Laboratory received four R&D 100 Awards, the equivalent of an Academy Award for science and engineering innovation, and two researchers won E. O. Lawrence Awards for work performed at LLNL.

- LLNL is contributing a key technology—a biocompatible neural-interface platform to a variety of projects being pursued as part of the President's Brain Initiative. The platform (with its microprocessor) provides a flexible neural interface with electrodes for recording input from and stimulating neurons.

- An LLNL-developed software tool called Network Mapping Systems (NeMS) provides system owners with a comprehensive view of their computer network environments. Understanding a network's components and structure and their use is the first step for many cyber defense and mission-assurance operations.

Infrastructure supports science and technology mission

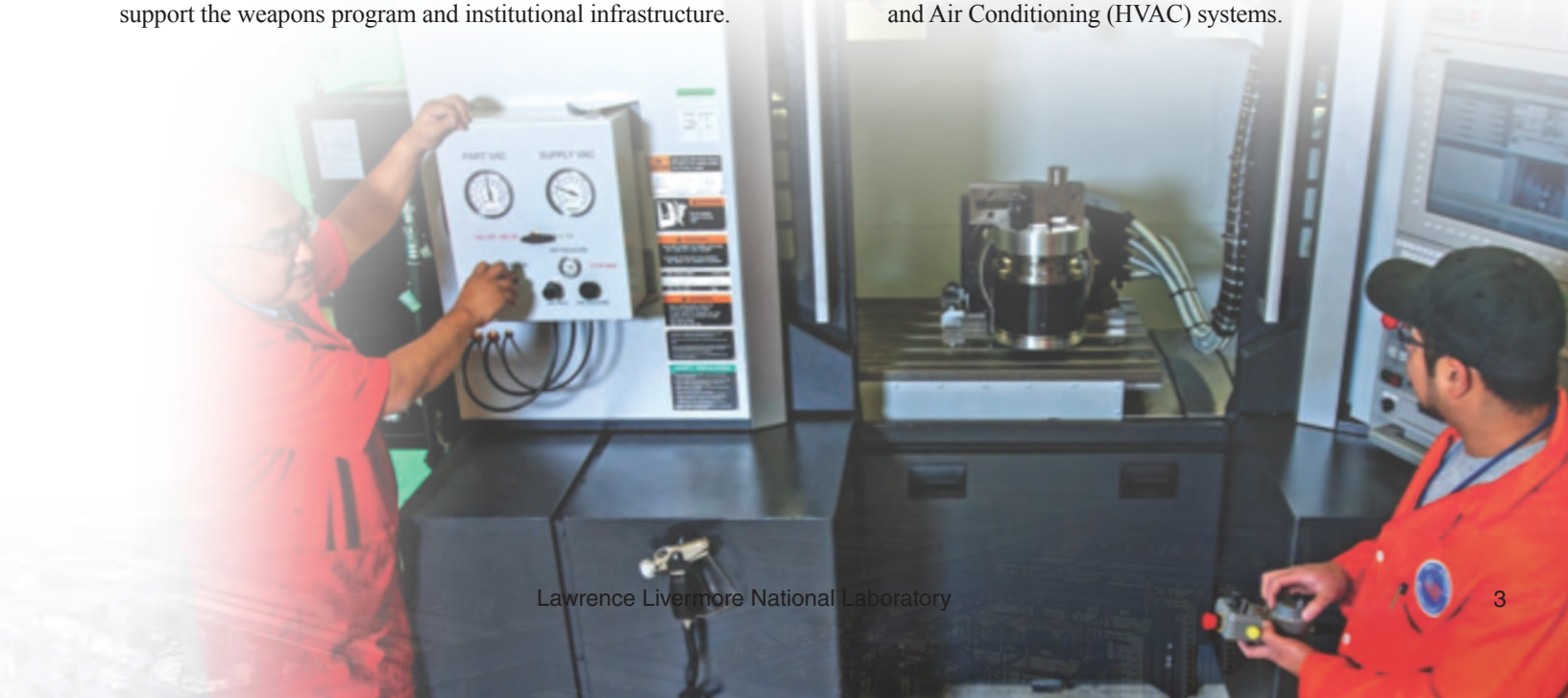
The infrastructure program successfully completed several initiatives and processes to align infrastructure investments with national plans and near-term program requirements:

- Capabilities Based Investments (CBI) continue to be an extremely valuable program to address mission needs for the nation's current and future stockpile and to sustain infrastructure crucial for warhead assessment and certification. Key technical capabilities have been sustained including infrastructure for fabricating warhead components, processing warhead subassemblies, testing and evaluating full-scale devices, characterizing and testing high explosives, and assessing and certifying warhead materials. By the end of FY14, the recapitalization program procured 39 pieces of equipment and performed the associated required facility modifications to support the weapons program and institutional infrastructure.

- The DOE/NNSA has finalized a license agreement for a solar electrical generation system onsite at the Laboratory. A 3-megawatt fixed-tilt solar photovoltaic array is scheduled to be built on 10 acres in the northwest buffer zone through a power purchase agreement. The facility is expected to generate approximately 6,300 megawatt-hours annually. This system will represent the DOE/NNSA's largest purchase of solar power from an onsite facility and the first in the western region.

- LLNL disposed of legacy waste items accumulated over 10 years, substantially reducing risks and liabilities to the government. Of the waste processed, approximately 8,070 cubic feet of radioactive waste and 4,035 cubic feet of California/other waste were shipped to off-site waste repositories. In addition, over 15,000 pounds of scrap metal were recycled.

- The Laboratory's infrastructure organizations supported new enterprise and Laboratory activities:
  - Performed the DOE Laboratory Operations Board uniform condition assessment;
  - Determined Mission Dependency Index importance for each asset at LLNL;
  - Mapped and loaded building system equipment data into U.S. Army Corps of Engineer's BUILDER software;
  - Strengthened the use of an enterprise team to develop infrastructure project priorities consistent with the one Lab concept;
  - Continued to provide new strategies to improve operations and maintenance efficiencies such as implementing "Deployed F&I Teams" and the replacement of various in-house developed maintenance management systems with a commercial Enterprise Asset Management (EAM) system; and
  - Initiated complex-wide Asset Management Program (AMP) analysis, data, and alternatives for Heating, Ventilation, and Air Conditioning (HVAC) systems.



Current State of Site

The current infrastructure at Livermore (Main Campus and Site 300) is operational and continues to meet mission. Most of the resources are focused on sustaining the key core facilities. The Laboratory continues to focus major energies on making the best use of existing facilities by optimizing office assignments and Laboratory utilization.

The infrastructure portfolio at LLNL has widening gaps that constrain the Laboratory's ability to meet rapidly evolving mission demands. Many of the Laboratory's permanent facilities and infrastructure (or utility systems) are reaching their end-of-life cycle, requiring refurbishment, modernization, or replacement. Targeted infrastructure reinvestment continues to be required to meet mission deliverables and sustain mission-supportive Science, Technology, and Engineering (ST&E) excellence and LLNL's special multidisciplinary capabilities.

LLNL's Site 300 remains a critical element of LLNL's infrastructure. The infrastructure at the site is operational but significant portions are rapidly degrading. In support of the LEP requirements, these facilities need to be in a state of readiness to ensure timely programmatic execution in support of the NNSA mission.

With continued investment, LLNL will continue to focus on real property sustainment, major system replacements, required modernization and consolidation and associated shut down of antiquated facilities. LLNL is also aggressively pursuing demolition of legacy facilities and shut-down to reduce potential Environment, Safety, and Health (ES&H) risks and to reclaim valuable redevelopment sites.

Livermore continues to make changes to the Main Campus site and to the infrastructure to accommodate more collaborative interactions. A portion of the site along the south-eastern perimeter is expected to be converted to a General Access Area (GAA) with fence line reconfiguration to accommodate collaboration facilities. In addition, security arrangement is underway for access to the northwest buffer to accommodate the DOE project in collaboration with a private vendor to construct and operate a 10-acre photovoltaic electricity producing facility in support of renewable energy.

Future Plans for the Ten Year Horizon

Livermore has been assigned major program responsibilities over the next 10 years, including a warhead Life Extension Program for the U.S. Air Force, increased compartmentalized research and analysis responsibility for deployment of exascale for the country by 2023, and major weapons experiments at NIF and Nevada. Livermore's infrastructure will implement a vigorous process integrating repurposing, replacement, modernization, and transitioning activities commensurate with these major national priorities.

To meet mission deliverables and sustain LLNL's core capabilities needed to achieve NNSA's strategic goals of stockpile certification and assessment, a prioritized set of projects is proposed to be accomplished in the 10- and 20-year horizons. Both state-of-the-art facilities with advanced capabilities and office space to replace substandard housing are needed to continue to attract and retain top-notch employees and to expand partnerships and collaborations.

The future plan consists of a portfolio of line item constructions, General Plant Projects (GPP)/Institutional General Plant Projects (IGPP) and other expense projects. These priorities comprise a billion dollars of potential investments over 10 years, formulated via NNSA initiatives and planning, programming, budgeting, and evaluation (PPBE) processes across the Laboratory.

Changes, Issues, and Concerns

Delayed Funding for LLNL Line Items
The Electrical Infrastructure Upgrade project supports mission critical facilities at both the LLNL Main Campus and the neighboring Sandia campus. The Emergency Operations Center (EOC) provides a replacement emergency operations facility. Funding for both projects has been delayed to FY17. It is important to maintain funding priority to ensure reliable infrastructure to support mission.

Growing Operational Risk in High Hazard Facilities
There is reduced flexibility at the Laboratory-level to address operational risk among critical skills, programmatic equipment and real property conditions to meet the Stockpile Stewardship mission in high hazard facilities. This limitation inhibits resource flow to where it is most needed.

Timeliness of Infrastructure Investment Funding
Timeliness of core-capability infrastructure investments to support stockpile is important to meet the life extension schedule. Significantly degraded areas of concern include LLNL capabilities in high explosives (HE) operations, device fabrication and inspection, warhead surveillance, integral warhead test and evaluation, and radiochemistry. Timely safety projects are needed for radiochemistry laboratories, high explosives facilities, and seismic safety. Investments in both the physical infrastructure and special facilities and equipment will be required to maintain the robust readiness state of the full capabilities for the Laboratory design and certification activities and ongoing warhead Life Extension Programs. Going forward, the NNSA Readiness in Technical Base and Facilities (RTBF) and Infrastructure and Safety budgets would not adequately support the expected site operation requirements over this time period.

Sustainment of Critical Skills
There needs to be a renewed emphasis on the sustainment of critical skills through re-establishment of a pipeline staff to replace anticipated retirement in high-hazard operations of plutonium, high explosives handling and processing, criticality safety analyses, and warhead fabrication and assembly.

Adequate Quality Space
The Laboratory is anticipating an increase in staffing that requires laboratory and office space to support major stockpile stewardship programs. To address future needs, LLNL will continue to consolidate program activities and optimize the utilization of permanent facilities while targeting vacated temporary and substandard facilities for excess. However, most of the permanent facilities are reaching the end of their lifecycle, requiring refurbishment, modernization, or replacement. The proposed Network Intelligence Research Facility (NIRF) will meet current and forecasted needs for high-side infrastructure to support growing missions in cybersecurity, foreign nuclear weapons analysis, and other threats to international security. Expected future work will depend more heavily on use of Sensitive Compartmented Information (SCI) facilities with an expected need of an approximately 100 or more offices in the next 5 to 10 years.

Balancing Infrastructure Investment Portfolio
The current budget structure produces imbalance in the asset management portfolio of construction, modernization, repurposing and transition and disposition. Stringent Secretarial deferred maintenance goals are not supported by the budget. Developing a balanced funding profile, integrating both RTBF and Infrastructure and Safety activities, is critical for stewardship of the Laboratory infrastructure. Based on current out-year projections, the Laboratory will be unable to carry out facility risk reduction activities.

TRU Processing and Disposition to support Program Operations
Projections have been completed regarding storage capacity for transuranic (TRU) waste within Radiological Hazardous Waste Management (RHWM) storage facilities. It is estimated there will be sufficient storage capacity for TRU waste until 2019 based on current generation rates. If programmatic requirements change and the rate increases, this date will change. The storage capacity for TRU waste is based on the recently implemented and verified Documented Safety Analysis (DSA). Current estimates provided to LLNL regarding Waste Isolation Pilot Plant (WIPP) have it reopening in 2017 and accepting shipments in 2018.

Site Overview and Snapshot

Location: Livermore, California
Type: Multi-Program Site
Contract Operator: Lawrence Livermore National Security, LLC
Responsible Field Office: NNSA Livermore Field Office
Site Manager: Nicole Nelson-Jean
Website: https://www.llnl.gov

LLNL is located about 50 miles east of San Francisco at the outskirts of the City of Livermore in Alameda County. It has been in operation since 1952 on a one-mile-square Main Campus at Livermore (Site 200) and since 1955 at Site 300, a 7,000-acre remote test site 17 miles east of Livermore.

The Laboratory has been operated by Lawrence Livermore National Security, LLC (LLNS) since 2007. LLNS offers a team

of four world-class organizations including Bechtel National, University of California, Babcock and Wilcox, and URS an Aecom Company.

LLNL's workforce, including ~3,800 technical staff and ~2,500 support staff, operate within a matrix framework to foster efficient transfer of knowledge among programs, enable staff members to develop wide-ranging sets of skills, and infuse projects with diverse ideas and solutions.

The Laboratory's current NNSA core capabilities include design, certification, testing, surveillance, and an ST&E base; plutonium research and development (R&D); tritium operations and R&D; high explosives R&D; infrastructure support facilities; nuclear counterterrorism; nuclear nonproliferation; and support to other sites and Work for Others (called Strategic Partners Program). Mission activities take place within a number of core facilities across the Main Campus and Site 300.

Real Property

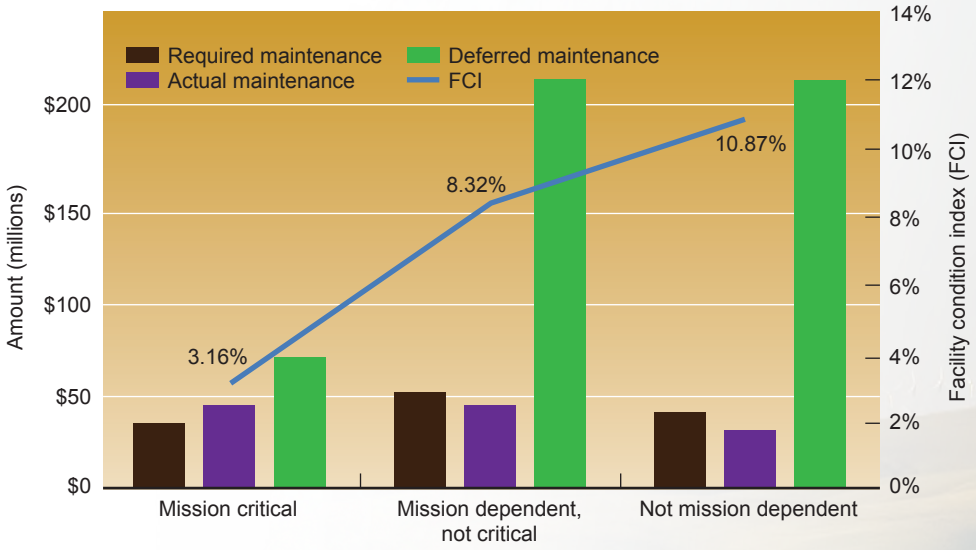
FY14 Facility Information Management System (FIMS) year-end snapshot:

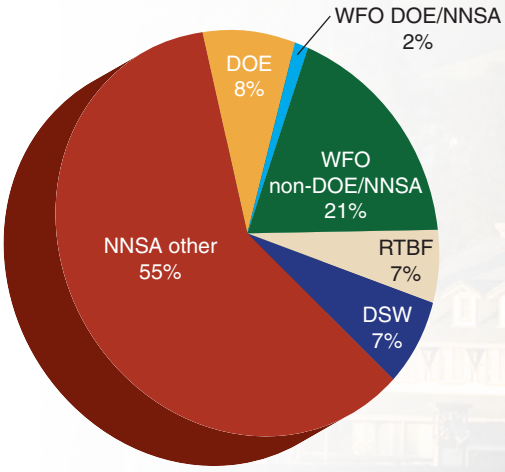
- 7,727 acres (owned)
- 535 buildings/trailers
  - — 6,351,178 gsf active and operational
  - — 611,389 gsf non-operational
  - — 24,250 gsf leased
- Replacement plant value (RPV): $6,752,830,733
- Deferred maintenance: $499,417,713
- Facility condition index (FCI) - overall: 7.40% (adequate)
  - — Mission critical: 3.16% (good)
  - — Mission dependent: 8.32% (adequate)
  - — Asset utilization index (overall): 82.90% (fair)

The numbers provided below are based on the LLNL FY14 *Annual Report*.

FY14 funding by source:

- Total site operating cost: $1,418.5M
- Total NNSA funding: $1,069.9M
- Total DOE (non-NNSA) funding: $118.7M
- Total other funding: $366.4M





3 Assumptions

The *FY16 Stockpile Stewardship Management Plan (SSMP)* specifies the program of record and is consistent with the Nuclear Weapons Council Strategic Baseline. Chapter 4 of the SSMP describes the baseline infrastructure lifecycle management requirement and activities for NNSA's eight Management and Operations sites including LLNL. Key assumptions about the Laboratory's mission and vision for the future that affect F&I planning are as follows:

LLNL will continue to operate as a multiprogram, national security site, with a primary focus on stockpile stewardship as part of the DOE/NNSA integrated program of surveillance, assessment, and life-extension of weapons in the nuclear stockpile. LLNL's mission includes crucial responsibilities to sustain a safe, secure, and effective nuclear deterrent and prevent nuclear proliferation and terrorism.

Livermore will conduct major design, development, and certification activities to meet the stockpile modernization (LEPs) requirements in the next 10 years. In addition, the Laboratory will have major responsibility in deployment of Exascale-class computing for the country by 2023 and major weapons experiments at NIF and Nevada.

As a national security laboratory, LLNL has the mission responsibilities and core competencies to continue to address significant challenges utilizing scientific and technological capabilities bolstered by an agile, modern, and efficient infrastructure. As the Laboratory removes legacy substandard facilities, there will be corresponding investments in space consolidation, recapitalization, and modernization to reduce future maintenance and support costs.

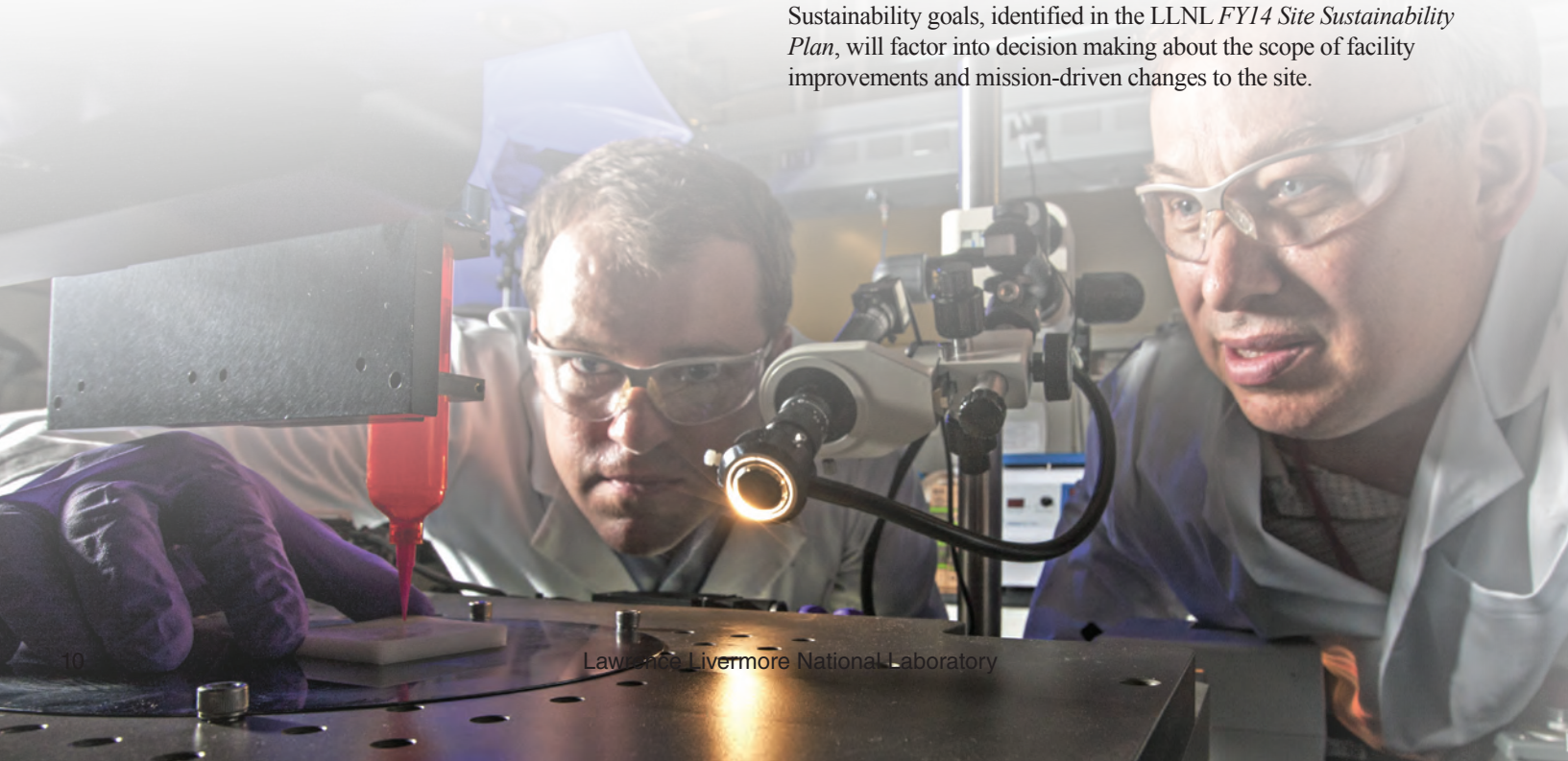
Important national ST&E challenges and LLNL's unique multidisciplinary capabilities together provide expanding opportunities to engage in national security programs for non-NNSA federal sponsors, projects for other-interagency sponsors, and partnerships to enhance the competitiveness of U.S. industry.

F&I investment proposals align with important needs—reaffirmed by the *2010 Nuclear Posture Review*—to modernize the stockpile as well as the nuclear weapons enterprise infrastructure and to sustain the ST&E base at the Laboratory. Proposals are coordinated with the existing Readiness in Technical Base Facilities (RTBF) and Infrastructure and Safety Programs and their associated subprograms and planned construction at LLNL, which are assumed to be funded as scheduled.

The physical site and its security posture will continue to evolve as LLNL adapts to a continuing role for the Superblock to support LEPs and plutonium science, the expansion of national user facilities, expansion of high-performance computing capabilities, the information technology (IT) needs of next-generation employees, 24/7 operational support in several mission areas, and general access for the Livermore Valley Open Campus (LVOC).

The development of anchor facilities for LVOC will greatly enhance the means for LLNL/Sandia to broaden R&D partnerships to help meet national security mission objectives, stay at the forefront of ST&E, and attract and retain a high-quality workforce. A variety of financing options will be explored for the development of LVOC.

Sustainability goals, identified in the LLNL *FY14 Site Sustainability Plan*, will factor into decision making about the scope of facility improvements and mission-driven changes to the site.



Changes from Prior Year TYSP

Asset Management Program (AMP) Expansion
The NNSA is expanding its Asset Management Programs (AMPs) into other building systems beyond roofing systems. Livermore has been selected as the lead Laboratory for a complex-wide heating, ventilation, and air conditioning (HVAC) AMP. This initiative should allow efficient use of infrastructure capitalization dollars to improve both facility conditions and the quality of employee working environments.

Infrastructure Recapitalization
General Plant Project (GPP)-sized projects are included in this TYSP to capitalize on the increase in the NNSA recapitalization budget. Livermore worked with stakeholders and NNSA to establish priority and phasing for these projects.

Insensitive High Explosives (IHE) Qualification Facility Recapitalization
In FY15 the Laboratory initiated the Insensitive High Explosives (IHE) project. Currently in the design phase, this investment recapitalizes core high explosives facilities required to mature several high explosives materials for the weapons Life Extension Programs.

Livermore Computing (LC)
Since the Livermore's Computing (LC) Complex Modernization and Sustainable Computing Center line items were submitted in FY13, LLNL has concluded that it would be optimal to combine these into one line item. This combination clearly establishes that the LC Complex will prepare both for the most demanding systems as well as for a sustainable complex environmentally and technologically suited to the demands of post 2022 computing infrastructure. The line item will be referred to as the Livermore Advanced Computing Complex Line Item. Building 654, a new facility to house future unclassified systems, will begin construction in May 2015 and be completed in FY16.

Electrical Infrastructure Upgrade (Name Change)
This project supports mission critical facilities at both the LLNL Main Campus and the neighboring Sandia campus. The project name has been changed from Electrical Capacity and Reliability Project. Project funding has been delayed, and Critical Decision (CD) CD-2/3 approval is targeted for FY17. It is important to maintain funding priority to ensure reliable infrastructure to support mission at both NNSA sites.

Utility Distribution Systems (Name Change)
This project supports LLNL's utility infrastructure, upgrading electrical, critical building services, and civil distribution infrastructure. This project has been renamed from Electrical Distribution and Reliability in the Integrated Priority List (IPL) contained in the *FY16 Stockpile Stewardship Management Plan*, Chapter 4.

Emergency Operations Center (EOC)
The Emergency Operations Center Line Item has received CD-0 approval. Project funding has been delayed to FY17. CD-1 will be complete and ready for approval in the fourth quarter of FY15. It is critical to receive project authorization to move the emergency operations center from the current temporary location, which has several noted weaknesses, to a permanent facility with full-range capabilities required to effectively manage LLNL's emergency response oganization during emergencies and off-normal situations.

Livermore Valley Open Campus (LVOC)
LVOC provides a venue "just outside the fence" of LLNL and Sandia-CA to expand and accelerate multidisciplinary research partnerships with academia, small business, and industry. There is now over 200,000 square feet of occupied office and lab space in the Open Campus with tailored operations, including customized access controls and streamlined visitor processes.

The next step in development is the construction of two modern, efficient facilities, the High Performance Computing Innovations Center (HPCIC) at LLNL and the Collaboration in Research and Engineering for Advanced Technology and Education (CREATE) at Sandia-CA. The labs recently submitted a revised CD-1 for the development of these new facilities and are currently working with NNSA, DOE, and independent contractors to develop an Analysis of Alternatives as a part of the new DOE approval process.

A third facility at LLNL will focus on advanced manufacturing (AM). The AM facility will augment current lab-industry collaborations to develop and apply the manufacturing process. Building on our base of capabilities developed within the Stockpile Stewardship Program, the AM facility in partnership with the HPCIC will enhance efforts to use modeling structure, material properties, and component performance. Operating a facility that is more accessible to collaborators will facilitate and broaden the Laboratory's ability to partner with industry and academia.

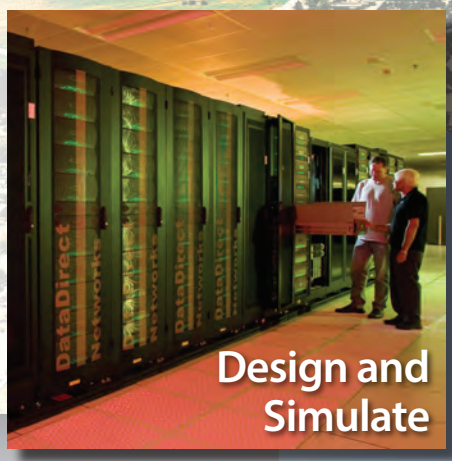
Network Communications Data Center Replacement
Highlighted by the Mission Dependency Index analysis performed last year, LLNL identified needed funding for the Laboratory's networking and telecommunications hub, and developed a new line item proposal. The facility is insufficient to properly support a robust and reliable network and telecommunications capability necessary for the national security missions. A replacement facility will leverage high performance computing architectural, structural, and systems designs and emphasize sustainability features such as free cooling.

Future Vision and Core Capabilities

NNSA Capability Code	NNSA Capability
C1.1	Design and Certification
C1.2	Experiments
C1.3	Simulation
C1.4	Testing
C1.5	Surveillance
C2	Plutonium
C3	Uranium
C4	Tritium
C5	High Explosives
C6	Non-nuclear
C7	Weapons Assembly/ Disassembly
C8	Transportation
C9	Special Nuclear Material Accountability, Storage, Protection, and Handling
C10	Enabling Infrastructure
C11	Counterterrorism and Counter-Proliferation
C12	Support of Other Mission / Program Capability
C13	Federal Management and Oversight
C14	Nonproliferation
C15	Security
C16	Emergency Response
C17	Work for Others

Livermore's defining purpose is to sustain confidence in and to maintain the U.S. strategic deterrent as well as enhance national defense—reducing the global threat from terrorism, weapons of mass destruction, and nuclear proliferation; and more broadly, responding to scientific issues of national importance. With a talented and dedicated workforce and world-class research capabilities, the Laboratory continues its tradition of scientific and technical innovation—anticipating, developing, and delivering solutions for the nation's most challenging problems.

These missions represent an unprecedented challenge, requiring rigorous application of the scientific method to extend our understanding of weapons phenomena, assess the condition of weapons, and, when necessary, pursue programs to extend the stockpile life of aging systems. To illustrate this academic process, four integrated steps are shown below, the backbone of which is the infrastructure—enabling cycles of scientific and technical innovation necessary to support national security missions.



- High-performance computing
- Materials analysis
- Radiochemistry data
- Secure space

Infrastructure
Enables cycles of scientific and technical innovation

The process of scientific and technical innovation must be supported by a viable infrastructure. The design and simulation is conducted using high-performance computing, radiochemistry laboratories, and materials analysis, which in many cases requires secure space. The results are then prototyped by processing, manufacturing, and fabrication. Experiments and tests are then performed on prototypes in state-of-the-art facilities, which leads to the final step to evaluate for performance and accuracy, results of which are iterated back to the beginning of the cycle.

Sustaining these cycles of scientific and technical innovation requires a reliable mission infrastructure—as well as institutional support facilities, site-wide electrical, mechanical, and civil utilities and high-tech communications.

Section 5 uses the NNSA core capabilities to outline the infrastructure needs and future vision required to meet mission commitments that enable world-class science and innovation.

Prototype

- Assembly fabrication
- HE processing
- Target manufacture
- Tritium fill

Experiment and Test

- Environmental testing
- Hydrodynamic testing
- HE characterization testing
- Ignition testing

Evaluate and Produce

- Material characterization
- Radiography diagnostics
- Chemical analysis
- Mechanical property evaluation
- HE qualification
- High performance computing
- Radiochemistry forensics

Products

C1.1 Design and Certification

This mission capability is central to LLNL's historical, current, and future missions to provide the nation with safe, secure, and reliable nuclear weapon systems as it supports the NNSA mission. As a design agency, LLNL ensures stockpile confidence without nuclear testing. The infrastructure that supports this overarching capability includes the workspace for employees, general programmatic equipment, and multi-capability infrastructure at both sites, the Main Campus and Site 300.

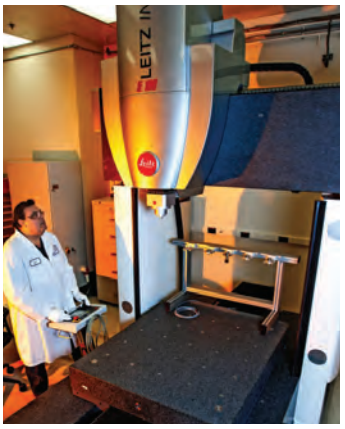
Tactical Planning Horizon (FYNSP of President's Budget +5 years)

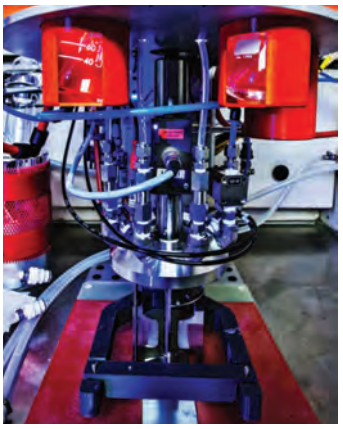
Stockpile stewardship supports ongoing activities for annual assessments for three of the seven active weapon systems and the W80-4 LEP, which will extend the life of the warhead for another 30 years. This LEP is a high-priority stockpile stewardship activity for the Laboratory. It has been over 20 years since LLNL's last LEP, and it is the first time since the end of nuclear testing where a device will be integrated into a new Department of Defense (DOD) delivery vehicle. This project will require over 100 integrated experiments across the Laboratory, starting in FY15 during the LEP's Phase 6.2 activities. Warhead development and certification will require a full spectrum of laboratory capabilities, personnel and facilities to avoid program delays. The LEP will exercise many engineering, science and technology, and other testing facilities and equipment across LLNL, at both the Main Campus and Site 300.

Based on the LEP requirements, new infrastructure needed to support successful program execution is estimated to be over $400M. The infrastructure is being planned and programmed now in anticipation of the LEP. Project execution must begin as soon as possible, as DOD has accelerated its requirements by two years. These modernized and upgraded capabilities and facilities must be in place and fully operational for seamless integration into the LEP schedule:

- **LEP and Warhead Assessment Revitalization Project**
- **Advanced Manufacturing Laboratory**
- **Nuclear Explosives Package (NEP) Engineering and Materials Complex Modernization**
- **Radiochemistry Laboratories Recapitalization**
- **Radiochemistry Data and Analysis Center Upgrade**
- **Site 300 Nuclear Security Infrastructure Stabilization**

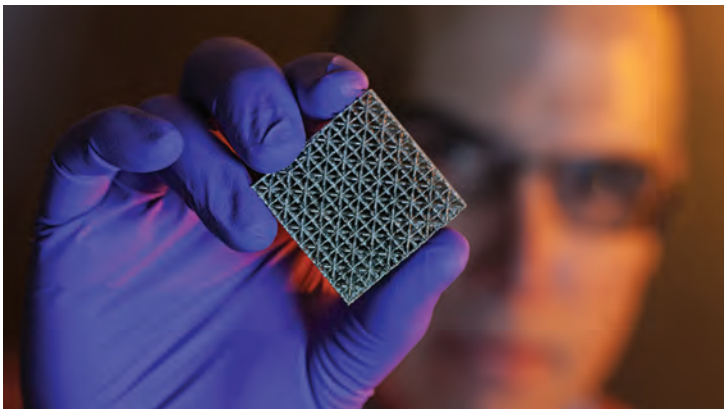
LEP and Warhead Assessment Revitalization Project





The LEP and Warhead Assessment Revitalization Project is an important step in improving the underlying infrastructure associated with DOE and NNSA mission-critical programs, supporting design physics and weapons engineering capabilities. Started in FY2013, and continuing into the Future Year Nuclear Security Plan (FYNSP), this project revitalizes and replaces foundational and obsolete equipment required for the Weapons Program. In FY2013-14, 39 pieces of equipment were procured, over half of which have been commissioned thus far.

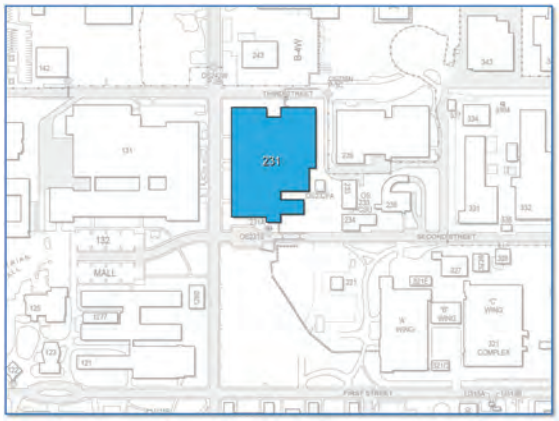
Advanced Manufacturing Laboratory



A key element of the Engineering and Materials modernization effort includes addressing a shortage of laboratory space for additive manufacturing capabilities. In additive manufacturing, parts are fabricated by adding successive thin layers of material. This technology will revolutionize component manufacturing throughout the NNSA complex for Stockpile Stewardship, LEPs, and National Security Programs. LLNL has prioritized an Institutional General Plant Project (IGPP) to expand existing laboratory space to supplement this growing technology.

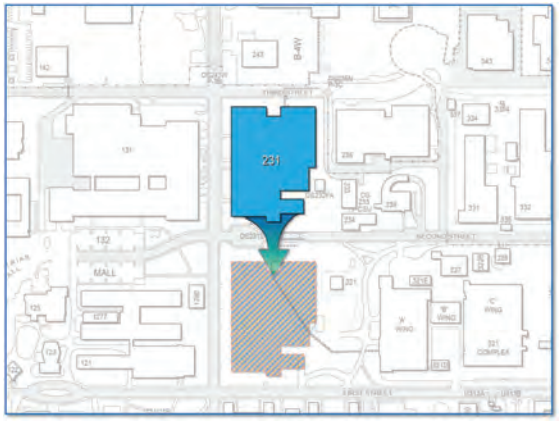
Nuclear Explosives Package (NEP) Engineering and Materials Complex Modernization

Alternative 1: Renovate B231

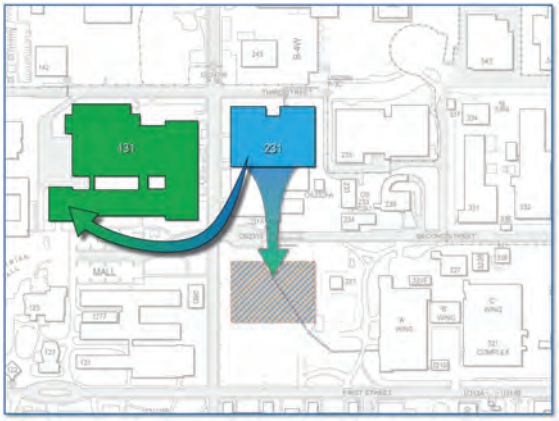


Alternative 2: Consolidate capabilities into other facilities

Alternative 3: Construct “like-for-like” replacement



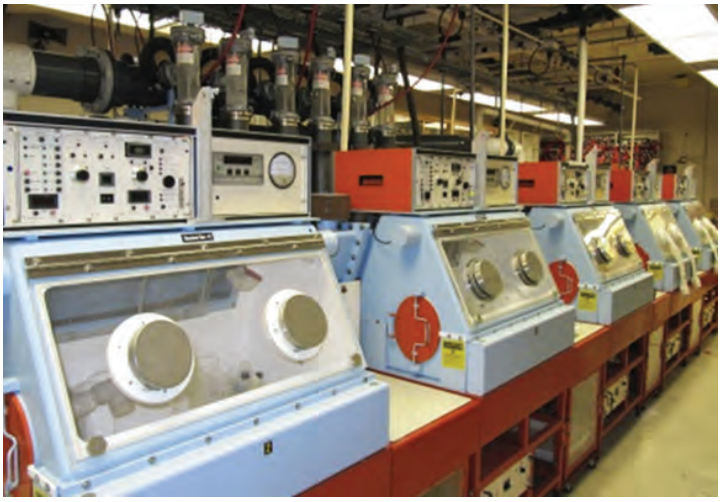
Alternative 4: Construct smaller replacement and consolidate some capabilities



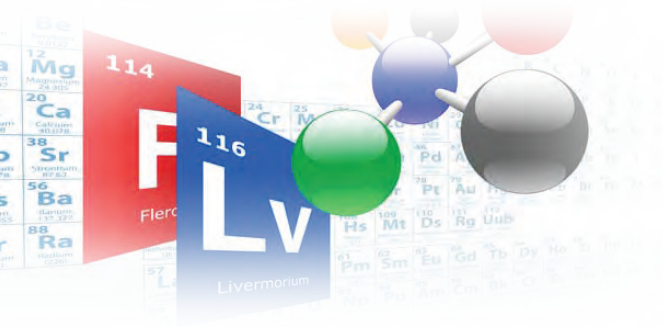
The current facility houses capabilities to support NEP development for the nuclear weapons program. The modernized complex will have a smaller and more efficient footprint by consolidating technologies and leveraging other facilities. The complex will consolidate foundational technologies including metallurgy, material mechanics, material deposition and joining, polymer processing, and material characterization. Research at this facility will strengthen weapons engineering expertise and ensure S&T expertise remains current and technologically advanced. This project was added to the NNSA Integrated Priority List (IPL) in the FY2015 SSMP. A team has been formed to study the project requirements and analyze alternatives for a CD-0 package. Independent of the chosen alternative, some capability consolidation has already been identified. A GPP project has been proposed to start the out-year-migration of these capabilities into other LLNL facilities.

The existing NEP facility is substandard and 60 years old. It has a large maintenance backlog, and has extremely low seismic performance. It lacks hot water and has vintage infrastructure where replacement parts cannot be found, and leaking boiler water lines consistently run into computer network rooms.

Radiochemistry Laboratories Recapitalization



Building 151 was built in 1967 to house radiochemistry activities in support of the Nuclear Testing program. Only limited infrastructure investments have been made in this facility in the past 48 years and the infrastructure has not evolved with novel and challenging mission needs. Building 151 remains one of the cornerstone radiological facilities at LLNL, performing radiochemistry analyses, target fabrication, and the development of new analytical methods and tools in support of the NNSA mission, while pushing the boundaries of fundamental scientific knowledge with the discovery of new heavy elements, including element 116, named after Livermore. The refurbishment of the high level radiochemistry laboratories will increase the number of Type II workstations, create more versatile experimental space, and provide engineering controls adapted to the radiochemistry activities performed, transforming the facility into a recruiting tool for the next generation of stockpile scientists. The existing conventional facilities and infrastructure for radiochemistry activities are aging, obsolete, and limited in capacity. Investment in these laboratories will modernize capabilities housed within the 48-year-old facility.



The International Union of Pure and Applied Chemistry (IUPAC) officially approved new names for elements 114 and 116, as Flerovium for element 114, with the symbol Fl, and Livermorium for element 116, with the symbol Lv.

Radiochemical Data and Analysis Center Upgrade

In addition to investing in Building 151 laboratory space, there is a need to preserve critical data generated during Nuclear Testing for future generations. The goal is to scan radiochemistry archive materials using modern technology to allow access to this information and to enable electronic document searches. This effort would enable NNSA scientists to use radiochemistry results to their full potential, ultimately improving accuracy and precision of the models supporting stockpile certification.

Livermore nuclear chemist with LLNL's automated ion chromatography fraction collection system, which can chemically separate up to 12 samples, simultaneously. While radiochemical data and analyses directly impact the accuracy and precision of our stockpile certification for current and future weapon systems, these laboratories also underpin NIF diagnostics, pre- and post-detonation forensics, and provide unique capability to nonproliferation and treaty verification.

Site 300 Nuclear Security Infrastructure Stabilization

Site 300 provides mission unique assets for NNSA's weapons programs and broad nuclear security missions. The site supports warhead design; technology development; US stockpile systems certification; mature warhead surety technologies for integration into stockpile systems; and experimental evaluation of foreign nuclear weapons technology, capabilities, and means for proliferation.

Limited capital investments over the past decade have resulted in degraded and outdated infrastructure support systems. High-value and complex weapon experiments with long lead times rely upon 20+ year old control and timing systems. In addition, many electrical and remote operation systems are antiquated, and operational failure occurs routinely.

This project will enhance LLNL's mission to test full-scaled mock nuclear weapons through hydrodynamic and environmental tests, which are necessary for weapon assessments and the W80-4 LEP. This is accomplished by testing assemblies with large high explosives quantities using the outdoor firing facility, the indoor Contained Firing Facility, and multiple environmental testing facilities.

This project was re-submitted to NNSA through the FY2015 Construction Working Group (CWG).

Strategic Planning Horizon (FYNSP of President's Budget + 20 years)

LLNL will continue to rely on its core capabilities as a design agency for its nuclear weapons system and ST&E base to fulfill its role as a national asset, meeting and addressing the nation's security challenges in the 10- to 20-year horizon. The same mission areas are expected to continue with changes anticipated to support the focus of each mission.

Efforts will continue to retire legacy facility liabilities; transform Superblock security categorization; and develop, deploy, and exploit future high-performance-computing architectures. In the long term, there are plans to collocate and integrate program physics and engineering staff through the following:

- **Nuclear Weapons R&D Complex**
- **Building 131 Office Space Replacement/Recapitalization**

Nuclear Weapons R&D Complex

E.O. Lawrence and the founders of LLNL recognized the importance of close collaboration and integration of the personnel and facilities within the weapons programs, as close integration has historically facilitated faster and better weapons development for the nation. Having primary designers, secondary designers, experimentalists, and code physicists in the same location enables better communication and collaboration that is essential for innovation and stockpile assurance. This project proposes to consolidate design and weapons engineering into a single facility.

Building 131 Office Space Replacement/Recapitalization

Building 131 is a 60-year-old 280,000 sq ft office space that constitutes Engineering's cornerstone office facility. At 90% occupancy, it houses over 500 engineering personnel who support all major programs at LLNL. It suffers from maintenance issues typical of near end-of-life facilities at LLNL, including inefficient, high-energy consumption and high water usage to support creature comfort, several raw sewage incidents in recent years due to deteriorating waste transport infrastructure, and the outdated and poorly maintained finishes are not attractive to new staff nor encouraging to maintaining critical skill staff.

Improved work spaces and upgraded building systems will reduce facility annual maintenance costs, contribute to sustainability goals, and increase staff morale.

C1.2 Experiments

Dynamic, extreme-condition, physics experimentation takes place at LLNL within two flagship facilities: the National Ignition Facility (NIF) in B581 and the Contained Firing Facility (CFF), National Radiographic User Facility at Site 300's B801A. (See other capability sections for additional experimental facilities.)

The NIF, the world's largest and highest-energy laser, focuses the energy of 192 giant laser beams on a BB-sized target filled with hydrogen fuel. NIF is capable of creating temperatures and pressures similar to those that exist only in the cores of stars and giant planets and inside nuclear weapons. NIF is the only facility that can perform controlled, experimental studies of thermonuclear burn—the phenomenon that gives rise to the immense energy of modern nuclear weapons. It can also provide material property data at extreme conditions of temperature and pressure. This experimental data helps to inform and validate sophisticated, three-dimensional weapons-simulation computer codes and facilitate a broader understanding of important weapon physics.

The CFF, LLNL's principal hydrodynamics experimental facility, is a containment chamber capable of handling large-scale experiments with full containment of hazardous materials—a unique combination of capabilities and diagnostics that are unavailable at other sites. The suite of diagnostics include laser velocimetry, wide-angle flash radiography, pin-dome measurements, and high-speed photography. It is used for testing mock nuclear explosives in support of NNSA's multiple annual stockpile assessments, stockpile modernization (LEPs) requirements, nuclear counterterrorism, and nonproliferation. The main diagnostic at CFF, the flash x-ray (FXR), plays a crucial role in understanding the performance of nuclear weapons. The CFF, combined with the FXR, is a key component of NNSA's national hydrotest strategy.

CFF firing chamber

The National Ignition Facility.

The Contained Firing Facility, National Radiographic User Facility. The firing chamber is shown on the left.

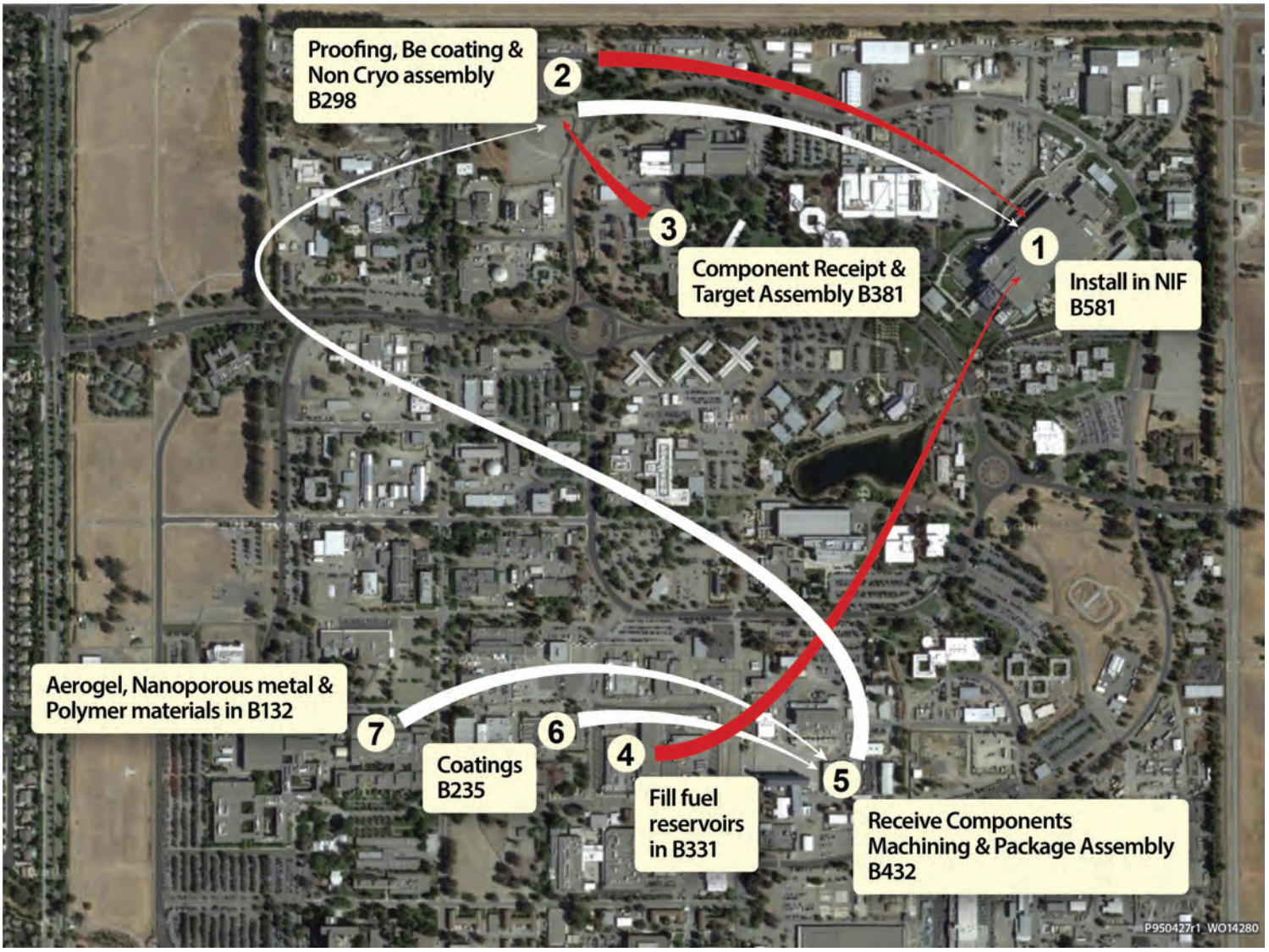
Tactical Planning Horizon (FYNSP of President's Budget +5 years)

High Energy Density (HED) Physics

Laser and photon science has a specialized set of requirements and associated facilities and equipment needed to support the SSMP. Efficient execution of the envisioned experimental program requires enhancements and consolidation to existing NIF infrastructure in the areas of target fabrication and diagnostics. Currently, capabilities are dispersed due to available space resulting in disjointed operations; the current situation requires movement of targets among several facilities during the fabrication process and movement of diagnostics between onsite and offsite facilities. The recent 120 Day Study highlighted the challenge to target fabrication in supporting a higher shot rate and identified the need to increase assembly capacity as well as improve efficiencies in the target fabrication process (Ref: D.W. Larson and L.J. Atherton, *Report to NNSA on the Plan to Increase the Shot Rate at NIF*, LLNL-AR-659514, September 2014).

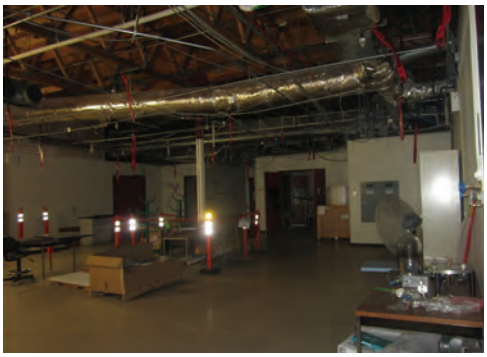
Proposed projects include a mix of refurbishment and upgrades of current facilities:

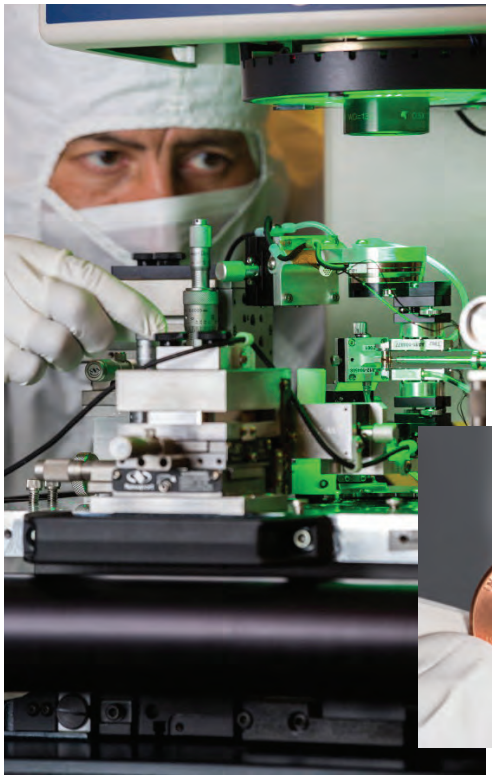
- **Target Fabrication Consolidation**
- **Target Diagnostics Consolidation**



Current operations for NIF target fabrication are disjointed, requiring movement of targets amongst several facilities during the process. The consolidation into B298 would eliminate the need to transfer targets/components to and from B432.

Target Fabrication Consolidation Project/Target Diagnostics Consolidation Projects





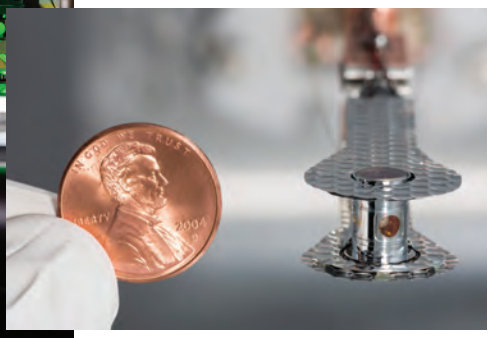
The **Target Fabrication Consolidation project** will significantly enhance HED platform capabilities by providing efficient and reliable precision target manufacturing. Currently, program components are developed in seven different facilities, all near capacity for the number and types of targets needed to meet the weapons physics experimental program. The impacts of continuing without this consolidation include:

- Reduced ability to solve complex platform design, fabrication, maintenance, and calibration problems
- Inability to meet ever-increasing demand for new and more complex platforms and diagnostics
- Potential for damage to delicate targets as they are moved amongst facilities, thereby impacting mission

The project features repurposing an existing mission critical facility, consolidating work performed both on and off site, and vacating a 34,000 sf facility, reducing deferred maintenance costs of over $2M. By incorporating off-site operations, we will respect DOE's existing vendor arrangements and be able to reduce both cost and risk.

The **Target Diagnostic Consolidation project** will significantly enhance HED platform capabilities by providing consolidated diagnostics production in an integrated facility. Currently, program components are developed in several different facilities, both offsite and onsite. The impacts of continuing without this consolidation:

- Reduced shot rate due to limited ability to reconfigure/repair diagnostics instruments
- Reduced experimental capabilities that can be provided to the Program
- Reduced handling and transport of activated/contaminated components



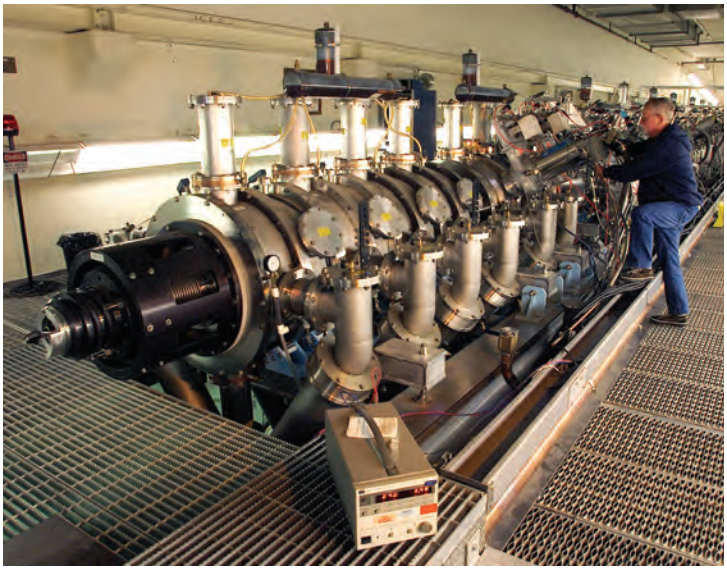
An example of a NIF target containing a polished capsule about two millimeters in diameter, filled with cryogenic (super-cooled) hydrogen fuel.

Contained Firing Facility, a National Radiographic User Facility

CFF's combination of diagnostic and containment capabilities, unique to Livermore, has proven indispensable in experiments conducted by both LLNL and LANL in support of multiple national-security programs and agencies. While the functionality of the CFF meets NNSA's needs into the foreseeable future, the Flash X-Ray radiography capability has begun to deteriorate. Needs will be addressed through the **Flash X-Ray Modernization** project.

LLNL is currently expanding some technical features of FXR as part of the national Advanced Radiography and Transformational Technology strategic plan. Once these capabilities are in place, FXR will be used as a national user development platform, in anticipation of an NNSA enhanced capability for subcritical experiments.

Flash X-Ray Modernization



It has been approximately 20 years since the facility had a major refurbishment of its systems; therefore, it is time for a major maintenance overhaul, as the dwindling supply of custom spare parts cannot be easily reproduced and support systems have technically improved multi-fold in the last decade. This refurbishment project will enable CFF to maintain its overall system reliability and enhance its overall diagnostic capabilities. A significant aspect of this project is the updating of the high-energy radiographic capability at CFF. The Flash X-ray (FXR) system at CFF provides greater than 450 Rad dose at 1 m (18 MeV). This project will provide a double-pulse capability, modernize the pulsed-power systems, and train a new generation of physicists and engineers to carry on the long history of induction linac design excellence. At the conclusion of the project, CFF will be sustainable for at least 10 more years.

Strategic Planning Horizon (FYNSP of President's Budget + 20 years)

LLNL will continue to rely on its core capabilities as a design agency for its nuclear weapons system and ST&E base to fulfill its role as a national asset, meeting and addressing the nation's security challenges in the 10- to 20-year horizon. The same mission areas are expected to continue with changes anticipated to support the focus of each mission through developing an advanced radiography technology facility to support hydrodynamic experiments with the following projects:

- **Enhanced Capability for Subcritical Experiments (ECSE)**
- **Pulsed Power Facility**

Enhanced Capability for Subcritical Experiments (ECSE) previously called Diagnostics X: Next Generation Radiography

NNSA is planning a 10-year, phased investment to enhance the radiographic capabilities for subcritical experiments at the Nevada Nuclear Security Site's (NNSS) underground laboratory, the Ula Complex. The immediate tri-laboratory focus is to address a significant gap in this capability for the NNSA mission. LLNL radiographic designers will provide state-of-the-art numerical simulations of beam transport and beam physics effects in advanced accelerator conceptual designs. This capability was essential to the design, development, and operation of U.S. induction linear accelerators used to support dynamic radiography. In concert, LLNL will add additional capability to the FXR at the CFF, to function as a test bed in anticipation of the ECSE at NNSS.

Pulsed Power Facility

A flexible pulsed power and electromagnetics laboratory is critical for support of hydrodynamic radiography. It supports material characterization at extreme temperatures and pressures, provides critical data incorporated by weapons computer codes, and enables new technologies for national security needs in modern electronic warfare, asset defense, fleet modernization, and counterterrorism. This project would upgrade the existing pulsed power/electromagnetics laboratory with modern special facilities equipment (SFE) and infrastructure.

C1.3 Simulation

A cornerstone of NNSA's Stockpile Stewardship program is nuclear weapons simulations necessary for the Stockpile Stewardship Program. Building 453 in the Livermore Computing (LC) Complex houses the new IBM 20-petaflop supercomputing system, Sequoia, which will help continue to ensure the safety and reliability of the nation's aging nuclear deterrent. Sequoia is one of the most powerful supercomputers in the world and will be focused on strengthening the foundations of predictive simulation by running very large suites of complex simulations for uncertainty quantification (UQ) studies. A number of facilities across the site provide support capabilities to B453.

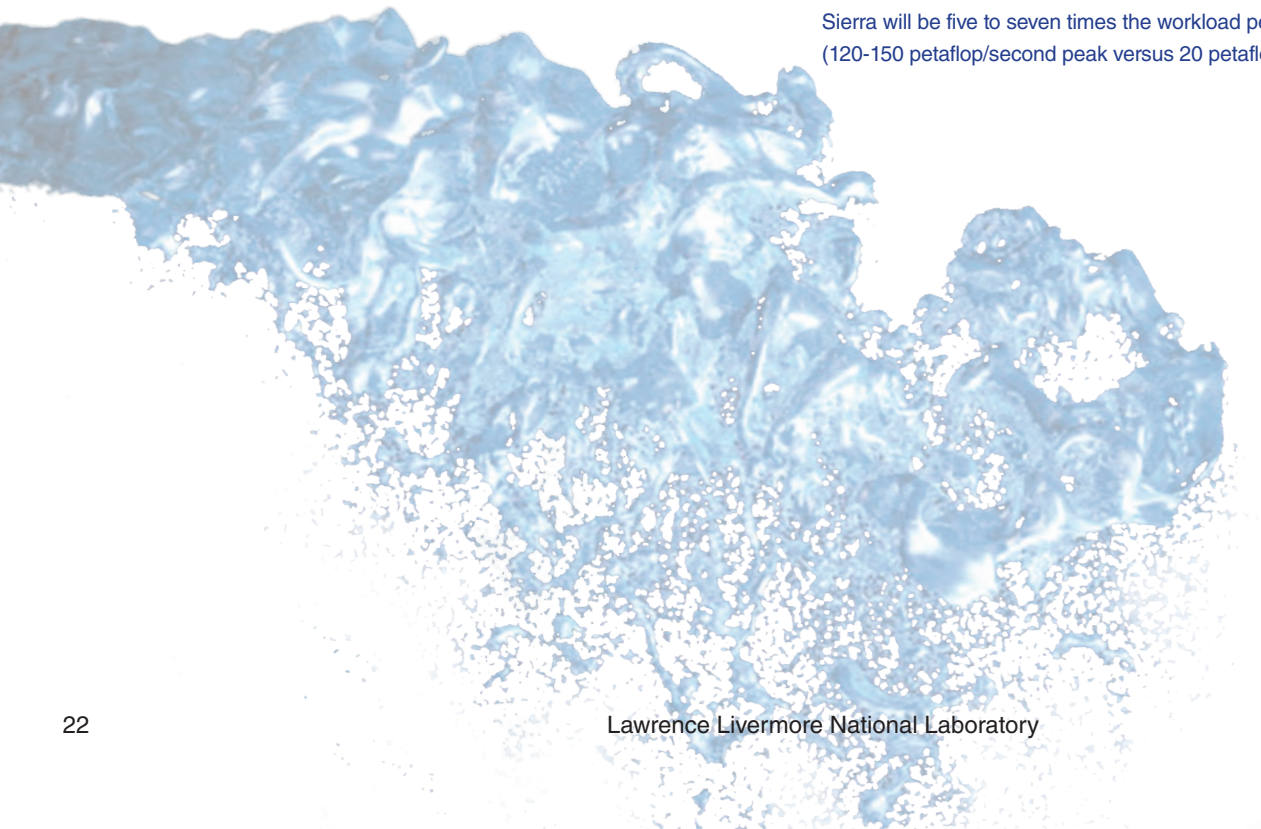
Tactical Planning Horizon (FYNSP of President's Budget +5 years)

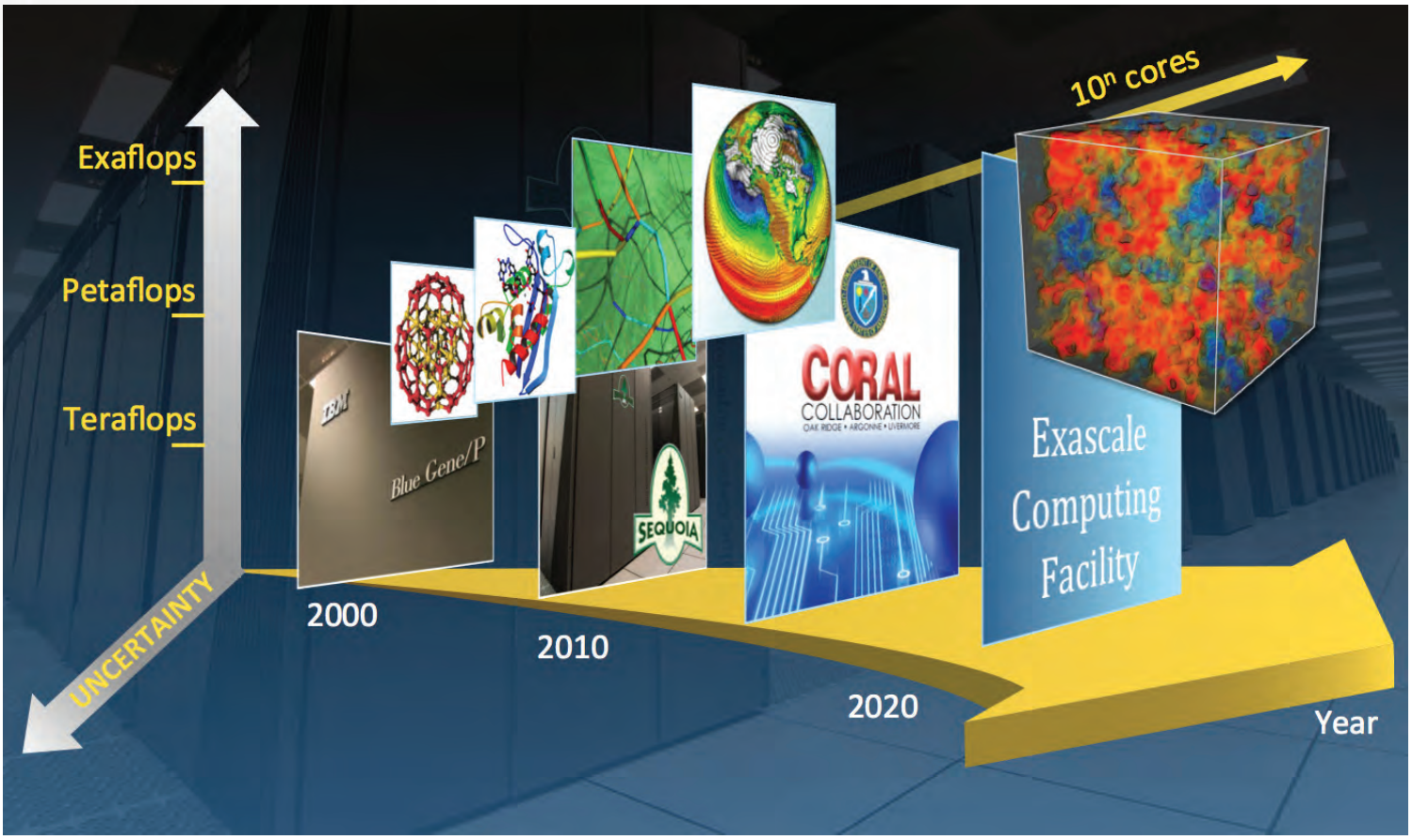
In the tactical planning horizon, LLNL will continue infrastructure support for high-performance computing; deploy capacity and capability computing platforms (e.g. Sierra and CTS-1). In addition, LLNL is slated to take delivery in 2023 of an Exascale-class system. In the ASC platform program plan, this system is designated as "Advanced Technology System – 4" or ATS-4. The architectural direction currently pursued by technology vendors, even with the expected environmental and technological mitigations resulting from Exascale Initiative (EI) R&D investments, will nonetheless drive high density racks that are anticipated to exert extreme floor loads and require substantial power supply and heat dissipation.

Advanced Simulation and Computing (ASC) Program

Sierra is the next advanced technology high performance computing system for NNSA's Advanced Simulation and Computing (ASC) Program, to be sited at Lawrence Livermore in 2017. Sierra is projected to provide four to six times the sustained performance of Sequoia. Sierra will provide computational resources that are essential for nuclear weapon scientists to fulfill the stockpile stewardship mission through simulation in lieu of underground testing. Modern simulations on powerful computing systems are key to supporting the annual assessment of all stockpile systems, accomplishing upcoming Life Extension Programs (LEPs) with computationally taxing advanced safety and surety features, and for supporting qualification of hostile environments, safety calculations of abnormal environments, and gravity and reentry simulations.

Sierra will be five to seven times the workload performance of Sequoia (120-150 petaflop/second peak versus 20 petaflop/second).





Path to Exascale Computing Facility.





Buildings 115 and 117 are 62 years old and have permanent limitations in terms of their electrical and mechanical infrastructure. In addition, they exhibit significant structural deficiencies whose correction are prohibitively costly given their age and limitations. Since these structures are ultimately slated for Deactivation and Decommissioning (D&D), LC moved operations to its enduring LC facilities. No further programmatic or Institutional investments will be made in these two facilities.

Livermore Advanced Computing Complex

The strategy to ensure sufficient classified computer room space suitable for the ASC Program's long-term classified Advanced Technology System (ATS) and Commodity Technology Systems (CTS) is to design and build modern, scalable and efficient infrastructure. LLNL plans to leverage its innovative design used for B654 which is to start construction in May 2015 for long-term unclassified systems as well as modernize the enuring LC complex in the new line item project. This leveraged design and best practices will support the technological advances and challenges of post-2022 machines, including Exascale, across the entire LC complex.

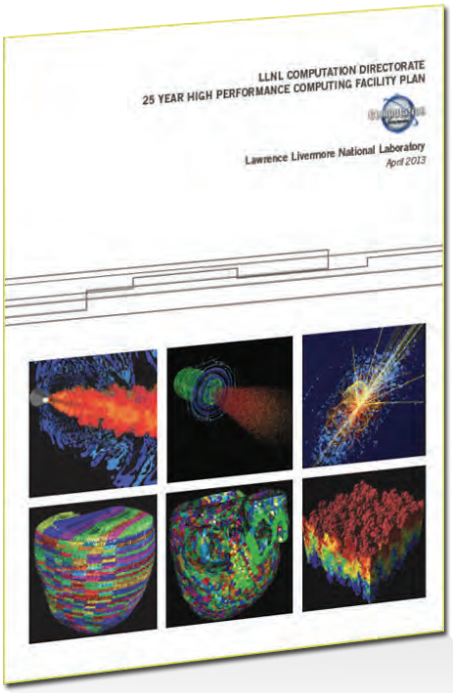
Strategic Planning Horizon (FYNSP of President's Budget + 20 years)

While one key goal of the Exascale Initiative (EI) is a 20 MW computer system draw, it is far from certain that this can be achieved, and prudence dictates that a 50% margin (to circa 30 MW) is a reasonable planning target per system.

In FY13, upon completion of LLNL's *25 Year High Performance Computing (HPC) Facility Plan* (published periodically), two line item requests were submitted during the annual FY13 CWG process. Since then, LLNL has concluded that it would be optimal to combine these into one line item.

This combination makes clear that the Livermore Computing Complex will prepare both for the most demanding systems as well as for a sustainable complex environmentally and technologically suited solution to the demands of post 2022 computing infrastructure. The line item will be referred to as the **Livermore Advanced Computing Complex** Line Item, encompassing the same scope but replacing the FY13 projects shown below:

- The Sustainable Livermore Computing Center will house classified systems whose siting requirements surpass those of any existing facilities. Such a facility, whether it be an upgrade of B453 or a new facility, would deploy free cooling, warm water-cooling, and AC/DC electrical distribution to assure the most efficient and adaptable operations.
- The Livermore Computing Complex Modernization project modernizes and consolidates the Livermore Computing Complex into a number of enduring facilities. Additionally, it would shut down inadequate spaces. The long-term strategy is to make use of sustainable facilities and transition out of and dispose of non-enduring facilities in accordance with the *25 Year HPC Master Plan*.



The *25 Year HPC Facility Plan* provides a comprehensive strategy for assessing the probability (and then assuring) that future computing systems can be sited to sustain mission. Facilities have been evaluated for required infrastructure based on their ability to site various classes of computing systems. LC computational services reside in a range of facilities, from dedicated computer rooms to retrofitted, yet currently inefficient space. Some of the infrastructure is nearly 65 years old, and is not sustainable or efficient for future computational systems without major networking, structural, mechanical, and/or electrical upgrades. In some cases, modernization is impossible. This plan was completed in 2013 and is updated periodically.

C1.4 Testing

A nuclear warhead must maintain satisfactory structural integrity, physical configuration, and functional performance throughout its stockpile life to assure that it performs as required at the target.

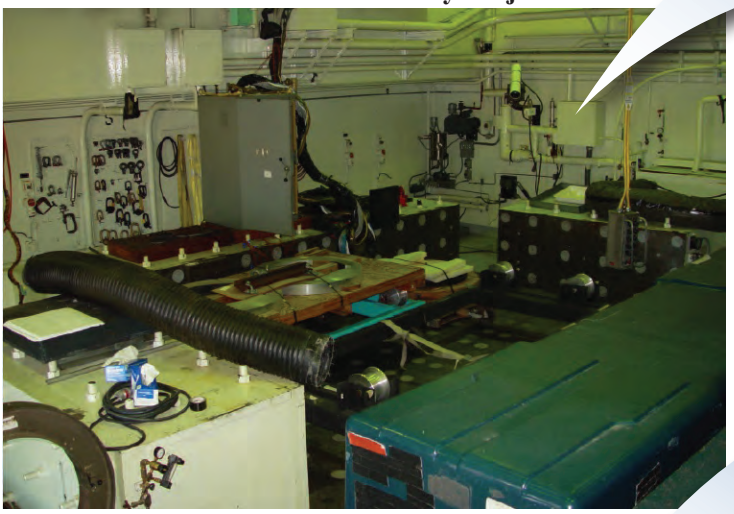
LLNL supports this mission capability through the Stockpile-to-Target Sequence (STS) tests. These tests determine weapon performance characteristics in environments a given weapon type will encounter throughout its life such as temperature excursions and hostile environments. Environmental testing is performed in a number of facilities at Site 300.

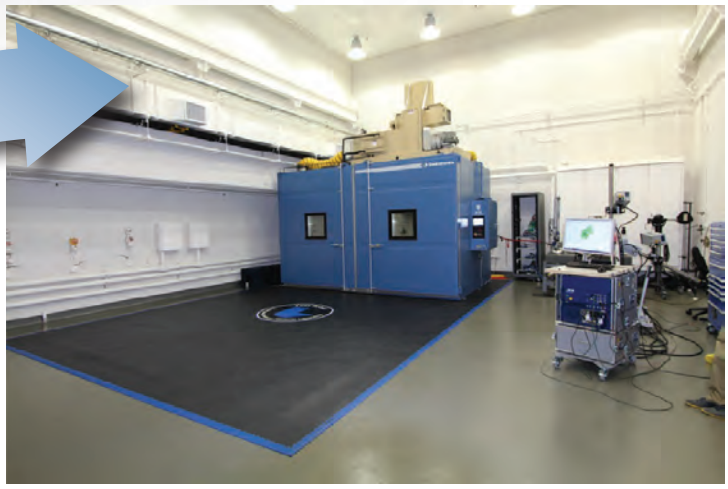
Tactical Planning Horizon (FYNSP of President's Budget +5 years)

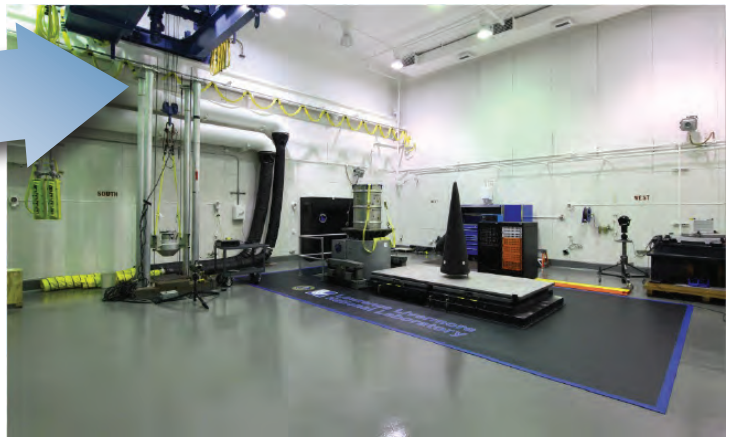
LLNL's environmental testing philosophy is to thoroughly and rigorously test its systems early in development so as to achieve design robustness. The design must meet, at a minimum, the environmental extremes as outlined in the Military Characteristics (MCs) and STS.

Environmental testing is an integral part of the nuclear weapon design and certification process for LLNL systems. Site 300 allows for the largest HE loading (200 lbs per test cell) of all environmental test facilities within the Nuclear Security Enterprise (NSE), and LLNL is the only national laboratory capable of performing environmental tests on Special Nuclear Material (SNM) test articles. These test facilities average 45 years of age and are showing signs of significant atrophy, including loss of some capabilities, therefore revitalization of the infrastructure is needed.

STS Test and Evaluation Laboratory Project







Similar to the successful rehabilitation of the bays in B836 (shown above) the STS Test and Evaluation Laboratory Project will revitalize aging and obsolete infrastructure in other environmental test facilities. These facilities test large capacity HE assemblies in environments encountered in a stockpile to target sequence.

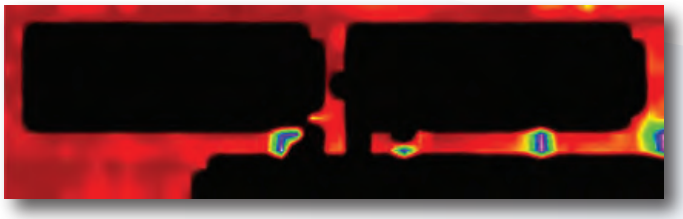
Strategic Planning Horizon (FYNSP of President's Budget + 20 years)

LLNL will continue to rely on its core capabilities as a design agency for its nuclear weapons system and ST&E base to fulfill its role as a national asset, meeting and addressing the nation's security challenges in the 10- to 20-year horizon. The same mission areas are expected to continue with changes anticipated to support the focus of each mission.

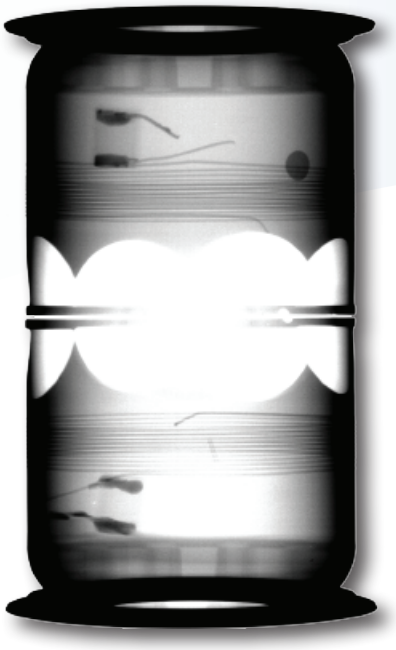
Revitalization of environmental test facilities and infrastructure are needed to ensure the integrity of tests performed.

C1.5 Surveillance

LLNL supports the Surveillance mission capability with its nondestructive evaluation (NDE) infrastructure—a broad spectrum of unique hardware/software systems in 10 facilities across the Laboratory and elsewhere. LLNL develops techniques to characterize the internal structure of a material, component or assembly without causing damage. Modeling and measurement sciences are combined to research, develop, and advance interrogative techniques and procedures. Techniques include 3D measurements of materials (explosives, foams, and metals), and small to large structures (sub-micron to meters) and high-fidelity characterization of materials and assembled targets.



Amplifier plates



Hohlraum

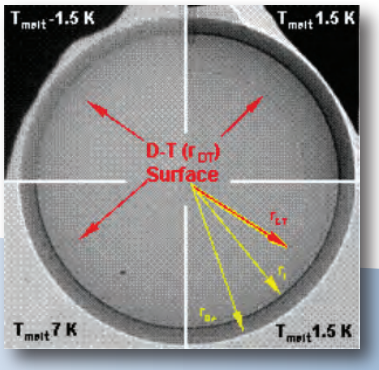
Tactical Planning Horizon (FYNSP of President's Budget +5 years)

Much of the NDE capabilities at LLNL are housed within a 60-year-old facility that needs revitalizing. Relocation is not an option due to the NDE equipment shielding requirements. Current lack of laboratory space and permanent office space prevents modernizing technologies, expanding capabilities, retaining talent, and reaching new sponsors.

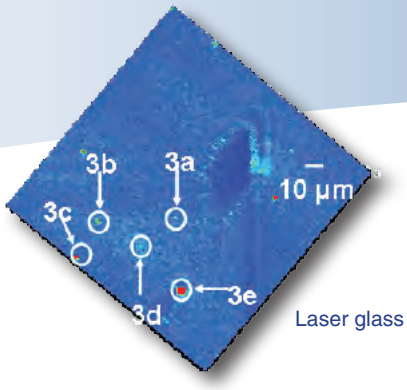
Strategic Planning Horizon (FYNSP of President's Budget + 20 years)

LLNL will continue to rely on its core capabilities as a design agency for its nuclear weapons system and ST&E base to fulfill its role as a national asset, meeting and addressing the nation's security challenges in the 10- to 20-year horizon. The same mission areas are expected to continue with changes anticipated to support the focus of each mission.

Deuterium–Tritium
(DT) ice layer



Nondestructive
Evaluation (NDE)



Laser glass

Building 327 Nondestructive Evaluation Facility Recapitalization

This project will regain valuable, shielded X-ray lab space currently used as computer server and storage rooms. It will replace temporary offices, remove outdated equipment, and create conference and visualization rooms to assess tomographic and radiographic data. The HVAC and electrical systems to support laboratory repurposing will be recapitalized.

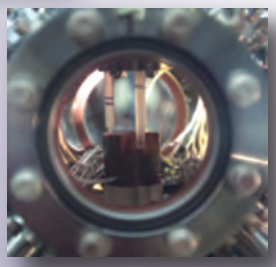
C2 Plutonium

The LLNL mission capability associated with plutonium operations is principally centered within the facility complex referred to as the Superblock, one of two defense plutonium research and development facilities in the U.S. The Superblock supports a wide variety of activities sponsored by NNSA, DOE, and DOD. The Stockpile Stewardship Program (SSP), however, supports the majority of the Superblock programmatic activities. Superblock SSP activities include:

Activity	Purpose
Material characterization (MC) and analytical chemistry of plutonium and highly enriched uranium (HEU) components of U.S. stockpile weapons	Assure current weapons function as designed
Fabrication of plutonium targets	Determine dynamic plutonium properties (to update and refine material property models)
Plutonium aging studies	Determine when current weapons need to be remanufactured
Plutonium science and corrosion studies	Determine when current weapons need to be refreshed
Certification activities for remanufactured pits	Assure remanufactured pits meet design intent
Testing and certification activities for LEP nuclear material components	Assure designs for W80-4 and interoperable warhead (IW-1) meet design requirements
Plutonium processing and fabrication development	Develop technologies that decrease costs

Optical Metallography

Tensile Tester



Dilatometer

Hardness Tester

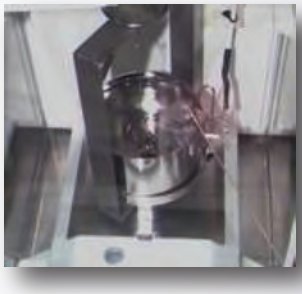
Every year, the Livermore and Los Alamos national laboratories provide the technical basis for certification to the U.S. President that the nuclear components for which they are responsible are safe and reliable. Much of the research in the Superblock contributes to this annual process. The Superblock houses modern equipment for research and engineering testing of nuclear materials. The facility has been continuously upgraded to ensure it meets the latest nuclear safety requirements.

At the end of FY12, LLNL fulfilled the requirement of removing Security Category I/II SNM, however, the plutonium capability within Superblock is still required, operating under Security Category III, for the continuing SSP. With the delays and reconfiguration of the Chemistry and Metallurgy Research Replacement Facility at LANL it is anticipated that replacement capability for Superblock capabilities will be no sooner than 2035. LLNL routinely performs facility upgrades to ensure the Superblock facilities meet the latest nuclear safety requirements. The facility will remain capable and ready to support additional programmatic needs as required.

The other major missions supported with LLNL plutonium capabilities are nuclear counterterrorism (NCT) and nonproliferation (sections C11 and C14). These specific missions rely on the unique capabilities within the Superblock for nuclear forensics (pre- and post-detonation), diagnostic/detector developments, and training associated with nuclear materials.

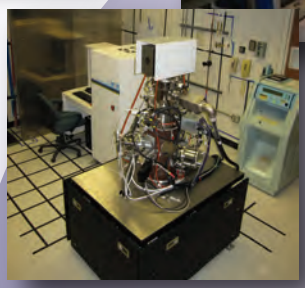
Material Characterization

The Superblock has a very broad array of modern material characterization and analytical chemistry capabilities that are being used to meet SSP needs.



Immersion Density

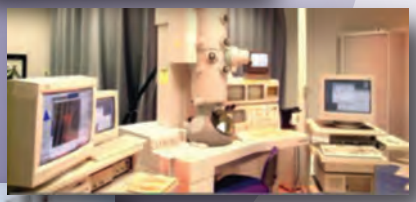
Microprobe



Scanning Auger Nanoprobe

Analytical Chemistry

Oxygen–Nitrogen–Hydrogen Analyzer

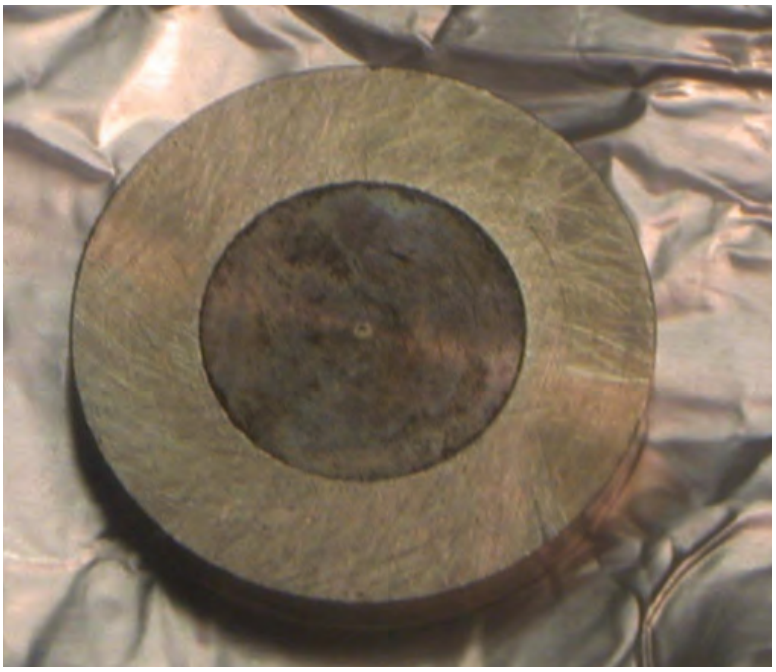


Transmission Electron Microscope (TEM)

Focused Ion Beam Experimental Scanning Electron Microscope (FIB/ESEM)

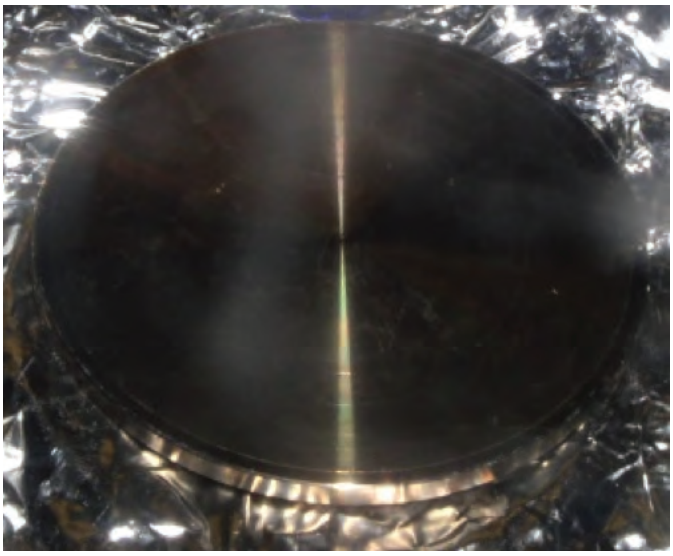
Carbon–Sulfur Analyzer

Inductively Coupled Plasma Mass Spectrometer (ICPMS)

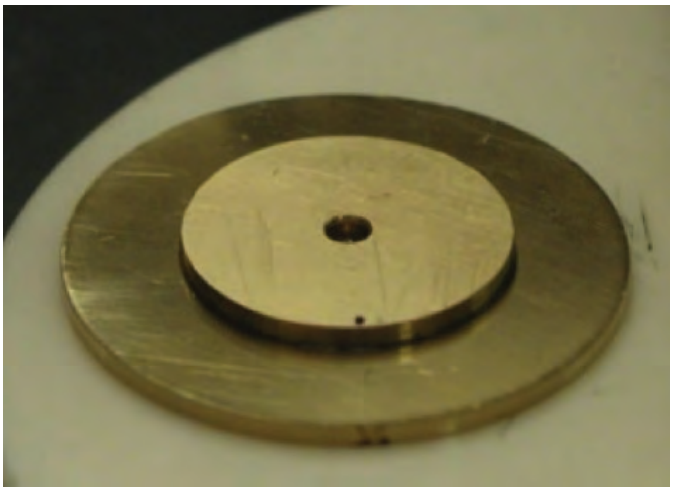


JASPER part with old and new plutonium.

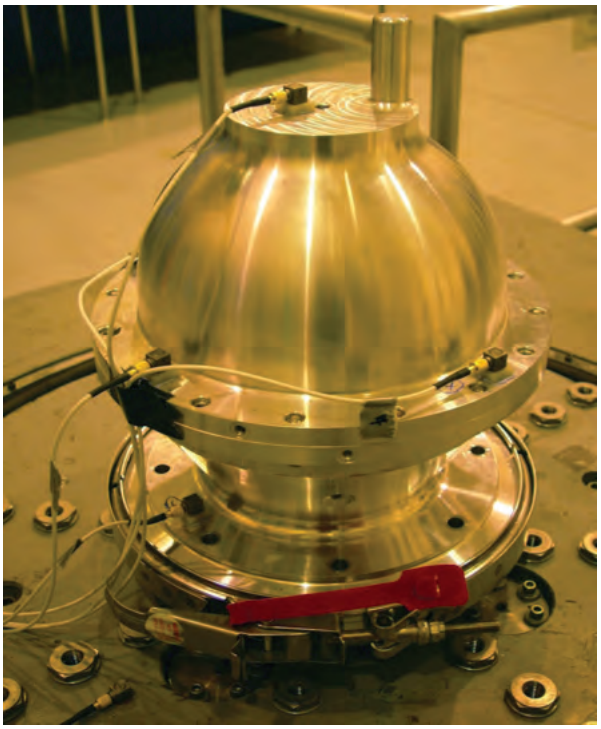
These plutonium JASPER targets, with surfaces lapped to 0.0001” flat and parallel over a 1.3” diameter, were used to achieve the highest quality plutonium data ever accomplished for Stockpile Stewardship. They were machined and assembled at the Superblock.



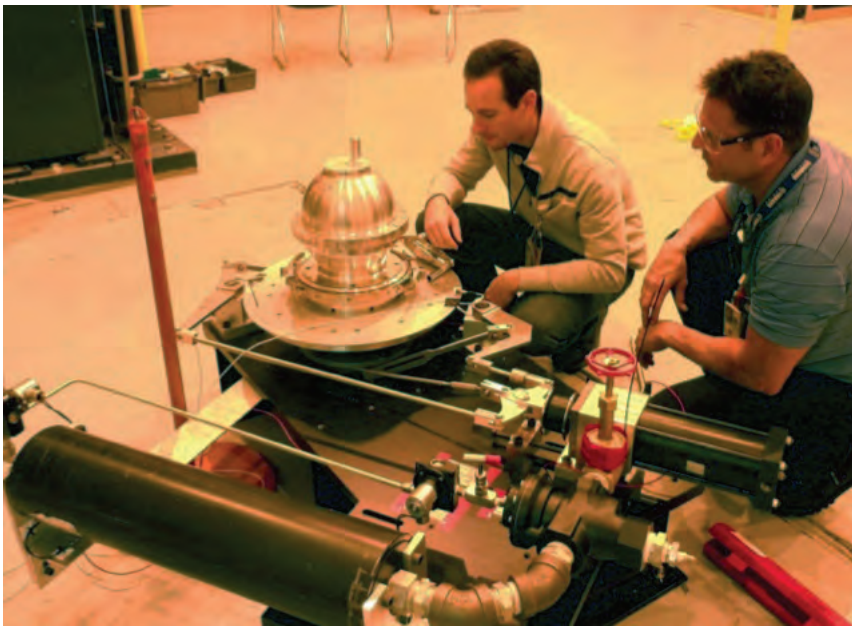
Rough-machined puck for JASPER parts.



JASPER target.



Vibrational test of nuclear material component.



Jerk testing of Nuclear Material Components.

Strategic Planning Horizon (FYNSP of last President's Budget +20 years)

LLNL will continue to rely on its core capabilities as a design agency for its nuclear weapons system and ST&E base to fulfill its role as a national asset, meeting and addressing the nation's security challenges in the 10- to 20-year horizon. The same mission areas are expected to continue with changes anticipated to support the focus of each mission. A future **Superblock Recapitalization** project will address potential changes to LLNL infrastructure to support these missions, including retiring legacy facility liabilities and managing recapitalization of SNM facilities.

C4 Tritium

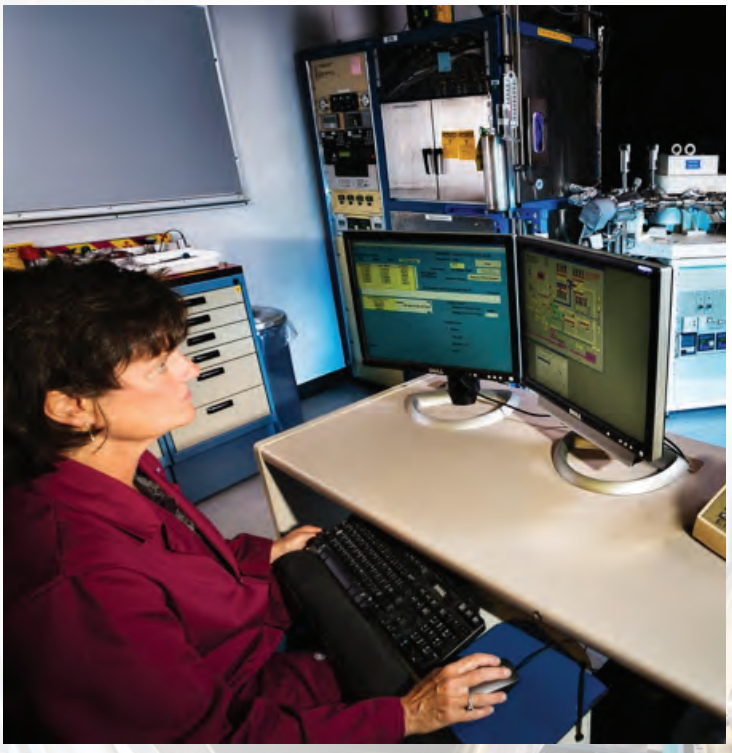
The tritium mission capability at LLNL resides in a Hazard Category 3 nuclear facility, the LLNL Tritium Facility, located within the Superblock complex. Its current primary mission is to support high energy density (HED) stockpile experiments and fusion energy experiments at the NIF and at the Omega facility at the Laboratory for Laser Energetics of the University of Rochester. Tritium R&D work in support of enduring nuclear weapon stockpile activities is conducted in conjunction with Sandia-CA, along with basic research applicable to fusion–energy–tritium issues. Tritiated targets are developed through LLNL's Laboratory Directed Research and Development collaborations and Work for Others (Strategic Partners Program) agreements. The tritium capability also supports the Containers Program with maintenance and recertification of selected containers, as well as tritium recovery operations for the U.S. DOD and other government and private entities.

Tritium processing station and recovery system.

Tactical Planning Horizon (FYNSP of President's Budget +5 years)

The number and complexity of experiments using tritium will continue to increase in support of the HED stockpile, fusion energy, neutron generator, and other R&D activities. To meet these program requirements, existing capabilities and assets provided by the LLNL tritium facility will need to be maintained and remain operational with high reliability. An additional tritium facility capability, the Diffusion Fill System, has been completed and is pending approval to be operated in support of Inertial Confinement Fusion (ICF) experiments on NIF and Omega. LLNL is evaluating the need for additional fumehoods workspace to support expanded tritium services and other recapitalization needs.

Tritium recovery operations from DOD and an expanded list of governmental and private entities are expected to significantly increase while some container maintenance and surveillance activities diminish, due to the expected retirement of the certified shipping containers used for tritium payloads.



Sector Mass Spectrometer optimized for gaseous isotopes.

Strategic Planning Horizon (FYNSP of last President's Budget + 20 years)

With NIF's expected lifetime of 30 years and continued ICF program target needs, LLNL will need to maintain target fill and other tritium support capability. Tritium recovery operations, mostly from obsolete illumination devices, are expected to continue, as are container maintenance and surveillance activities.

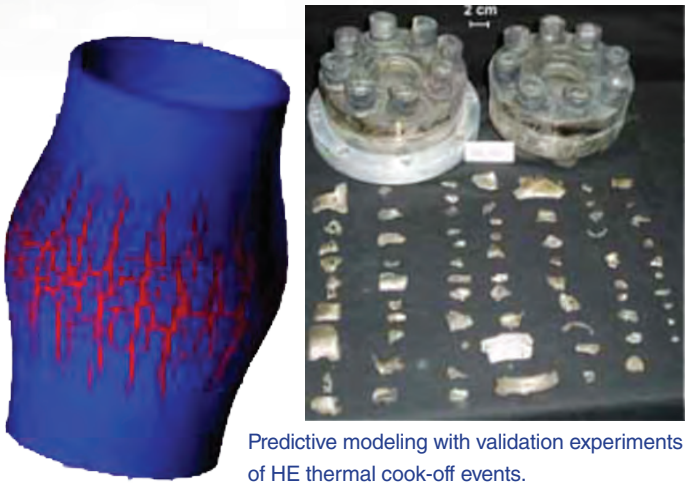
C5 High Explosives

The high explosives (HE) capability is a core competency at LLNL and is an integral element of NNSA's design and development effort supporting the nuclear weapons program. The energetic materials enterprise has a highly skilled workforce and broad experimental and modeling capabilities. The explosives program conducts research, development, test, and evaluation (RDT&E) activities using a multidisciplined approach to synthesis, formulation, characterization, processing, and testing energetic materials, components, and warhead subassemblies. In addition to the core weapons capabilities, the program also conducts work to address broad national and international security needs. These activities include development of conventional, novel, low-collateral-damage, improvised, and re-purposed explosives for DOD's Department of Homeland Security and various other agencies.

LLNL has unique experimental facilities at the Main Campus, Site 300, and also the Nevada National Security Site (NNSS). Its key facility is the High Explosives Applications Facility (HEAF) with capabilities ranging from laboratory-scale efforts to test and evaluation of materials, components and warhead-level subassemblies. The facility includes laboratories, assembly areas, compressed gas guns for detonation and high-rate testing, and firing tanks up to 10 kg capacity.

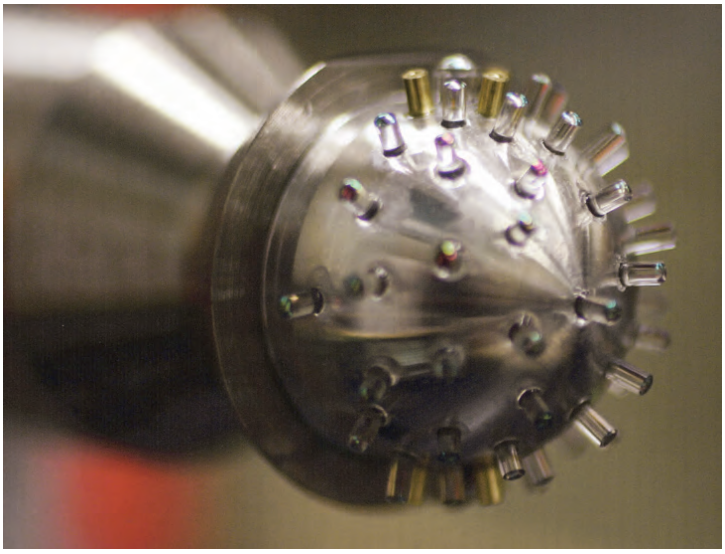
Site 300 infrastructure consists of more than 50 facilities and storage magazines supporting HE work with large charges up to 60 kg. This infrastructure includes pilot-scale synthesis, formulation and casting, HE machining, radiography, assembly, storage, and HE waste disposal facilities. The site also has additional mission-critical facilities to evaluate and test warhead-level subassemblies such as the Environmental Testing Complex, Radiography Facility, and the Contained Firing Facility (CFF). The ability to cast very large, high-precision HE charges is a unique capability for the U.S. that also resides at Site 300.

The High Explosives Applications Facility (HEAF) (bottom left), the Contained Firing Facility (CFF) (top right), and the HEAF spherical firing tank (bottom right).



Predictive modeling with validation experiments of HE thermal cook-off events.

Unique capability in U.S. to make precision large charges.



LLNL developed Photonic Doppler Velocimetry (PDV) technique for HE-driven experiments.

Tactical Planning Horizon (FYNSP of President's Budget +5 years)

LLNL was approved as the lead design agency for the W80-4 long range cruise missile warhead. Replacement of the HE and insensitive high explosives (IHE) detonator, booster, and main charge are included in all design options for this life extension program. The schedule for the first production unit (FPU) was moved up two years to FY2025 to support the Air Force development and deployment of the cruise missile. The HE work for W80-4 and W78/88-1 (FY2030 FPU) LEPs will require synthesis, formulation, processing, test and evaluation of newly manufactured IHE main charges materials and new insensitive HE. To support the timely execution of these activities, Livermore is implementing a range of investments to sustain and modernize the equipment and facilities at HEAF and Site 300 facilities. These recapitalized capabilities also provide core competencies for the weapons program annual assessment of the energetic materials, components, and subassemblies.

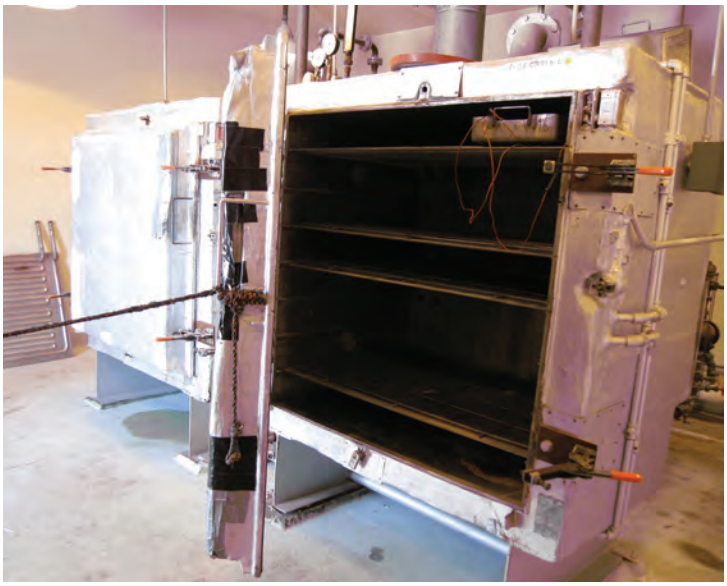
LLNL will maintain and revitalize existing HE facilities to meet current missions and objectives, while also being strategically positioned to address future needs. The investments include:

- **HE equipment modernization in the LEP and Warhead Assessment Recapitalization Project** (discussed in section C1.1 Design and Certification). This project recapitalizes and modernizes foundational equipment and capabilities across the weapons program. HE is one of five technical areas within the scope of this effort.
- **Insensitive High Explosives (IHE) Qualification Capabilities Recapitalization.** This project recapitalizes facilities and experimental capabilities that support explosives technology maturation and weaponization activities associated with the development and qualification of IHEs.

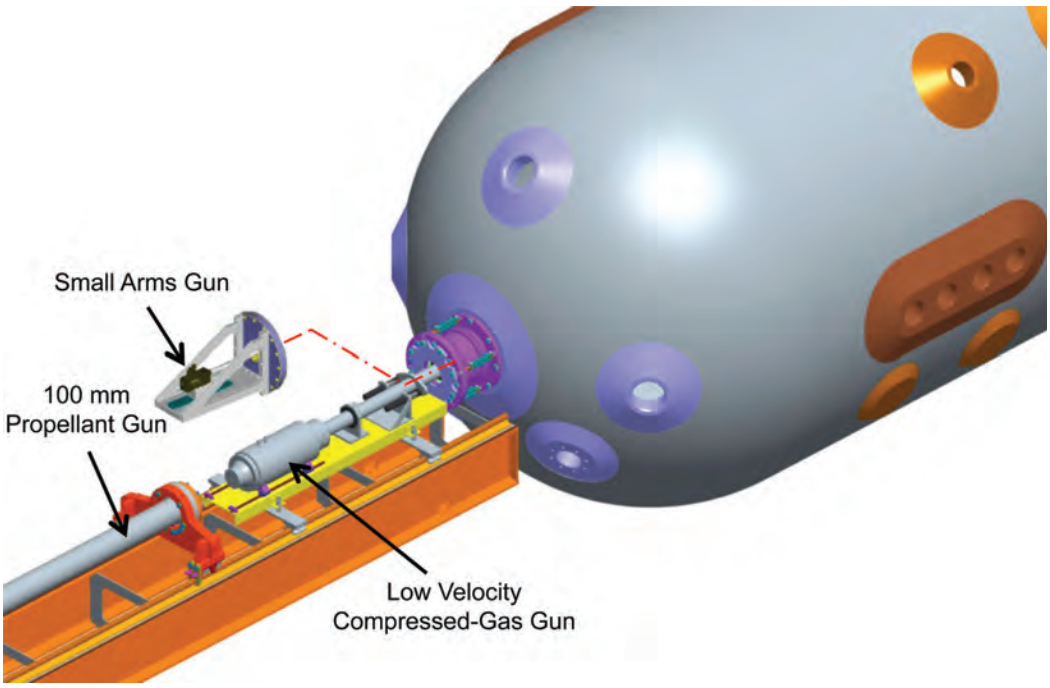
Insensitive High Explosives Qualification Capabilities Recapitalization

Many of the capabilities and supporting infrastructure required to qualify IHEs (eg., LX-17 and UFTATB) for the U.S. stockpile were last exercised over 30 years ago. The infrastructure needed to perform these activities is severely degraded and beyond its service life. Stockpile Stewardship activities and planned LEPs both require qualification and certification of newly manufactured main charge and booster IHEs and detonators. This project, funded in FY2015 and continuing through the FYNSP, will sustain, recapitalize and modernize the explosives facilities and experimental tools at HEAF and several buildings at Site 300. The scope covers four thrust areas:

- Consolidation and recapitalization of the IHE qualification test capabilities in the HEAF detonation/firing tanks and their supporting electrical and mechanical systems.
- Refurbishment of the large-charge isostatic press.
- Renovation of the explosives pilot synthesis facility.
- Stabilization of enabling infrastructure such as firing tank hydraulic systems, HEAF's air handling system for tank ventilation and integrated control systems for arming, firing, safety interlocks, and diagnostics control for several firing tanks.



HE oven (top) and antiquated HE press (bottom).



Rendering of the 100-mm-gun firing tank showing the planned consolidation of legacy and modern IHE qualification capabilities into a single firing tank.

- **Site 300 Nuclear Security Infrastructure Stabilization** (discussed in section C1.1). This project consists of a series of investments to stabilize aging HE facilities and degraded general infrastructure at Site 300 to support the weapons program.
- **HE Process Area Revitalization.** This project addresses sustainment and recapitalization of mechanical building systems, electrical, safety, and control systems for several HE processing buildings at Site 300 (formulation/synthesis complex and HE machining facility).
- **HEAF Infrastructure Upgrades.** This project upgrades air handling equipment to balance hood and tank controls.

Strategic Planning Horizon (FYNSP + 20 years)

With the enduring missions at LLNL as a center for HE RDT&E, revitalization and modernization of existing facilities will continue. Continued growth in the mission areas of nonproliferation, nuclear counterterrorism (NCT), and homeland security will require additional capabilities. The long-term investment plan will include a portfolio of activities centered around two major Line Item construction projects. These investments will leverage direct and indirect resources with the emphasis on consolidation and modernization. This strategy will result in a modern and enhanced capability with a reduced footprint, improved safety, and efficiency. Projects include:

- **High Explosives Research and Development Recapitalization and Consolidation**
- **Energetic Materials Processing Complex (EMPC)**

C10 Enabling Infrastructure

The Laboratory's utility systems and enabling infrastructure and facilities are the backbone to all mission facilities. Starting in 1952, the utility systems were modified and retrofitted as the Laboratory grew to keep pace with growing program mission with some thought to the future. On-site utilities at both sites include electrical power, domestic cold water (CW), sewer, and life-safety alarm systems. At the Livermore Main Campus, there are four additional site-wide utilities including natural gas, low-conductivity water (LCW), demineralized water, and compressed air. Roads, pathways, parking lots, and storm drainage service both sites. The site is supported by cafeterias, maintenance shops, and business functions. Today's mission cannot be accomplished without modern communication and information technology infrastructure. This infrastructure is expected to perform with little or no hindrance to ongoing and future programmatic missions.

Tactical Planning Horizon (FYNSP of President's Budget +5 years)

Combined investments in site-wide infrastructure projects are necessary to enable the accomplishment of programmatic deliverables. Modern, efficient, and sustainable utility systems; enabling infrastructure; and support facilities help ensure that the Laboratory can meet mission goals cost-effectively, safely, and securely. Much of this infrastructure is past its useful life, increasing maintenance costs and reliability risks.

Utilities

Investments must be made to ensure the reliability of electrical, mechanical, civil, and life safety utilities, allowing for preventive maintenance without major planned outages and interruptions to mission important facilities, and replacing aging equipment with site-wide infrastructure projects. Needs include:

- Electrical Infrastructure Upgrades
- LLNL CW System Rehabilitation
- Gas, Water, and Air Valve Replacement
- LCW System Rehabilitation
- Alarms/Supervisory Control and Data Acquisition (SCADA) Infrastructure Reliability
- Fire Alarms/Life Safety Modernizations
- Civil Infrastructure Improvements
- Site 300 Storm Drain Rehabilitation

Electrical Infrastructure Upgrade Project

Western Livermore substation

This project will increase the reliability and capability of the existing electrical distribution system on the east site of the Livermore Site and to neighboring Sandia-CA. The scope includes new electrical duct bank, new load grid switchgear and sectionalizing switches. CD-1 was approved February 2012. This project is a high priority for LLNL and is critical to infrastructure, however it has currently been delayed until FY2017.

Utility Distribution Systems Project

This project supports LLNL's utility infrastructure, providing electrical, critical building services and civil infrastructure. This project has been renamed to Utility Distribution Systems from Electrical Distribution and Reliability in the Integrated Priority List (IPL) contained in the *FY16 Stockpile Stewardship Management Plan* (SSMP). It will address many of the needs identified in the tactical planning horizon (typical utility system needs are shown on the following pages).

Aged High-Voltage Unit Substation Transformers

Typical high-voltage unit substation transformer more than 40-years-old and beyond its expected lifetime. The air-insulated high-voltage switch is not rated high enough for system fault conditions and the switch compartment is subject to water and animal intrusion. Replacement of all aged high-voltage unit substation transformers will reduce the risk of failure and increase personnel safety and energy savings with the installation of energy efficient transformers.

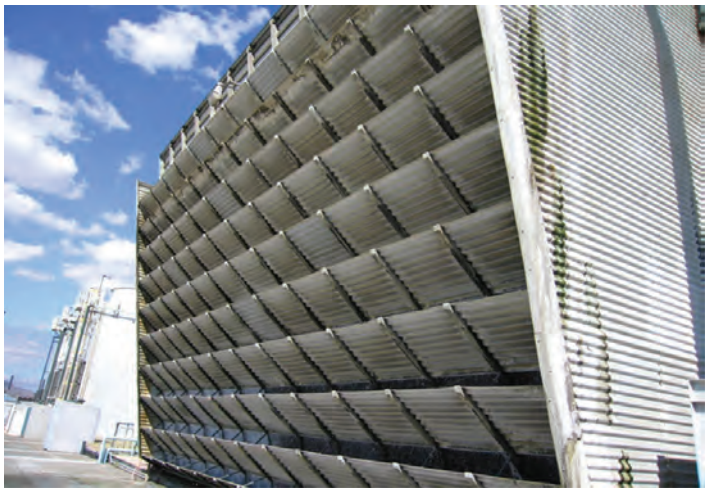
CW System Rehabilitation

Three of Site 300's 11 CW tanks installed in 1957 are out of service due to leaking gaskets containing asbestos. None of the tanks meet seismic standards.

Site 300's CW tanks have lost interior galvanized protection.

Site 300's CW transfer pump piping is in poor condition.

LCW System Refurbishment

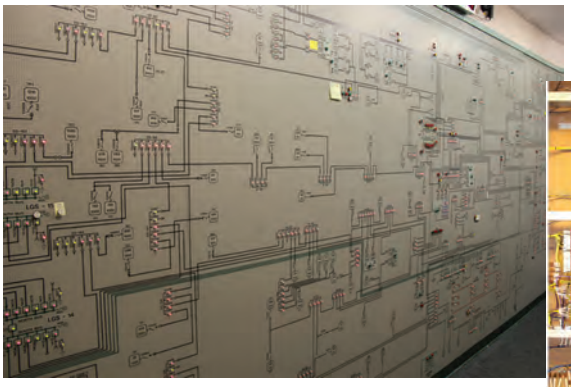


At the LCW stations, some components are over 50 years old. The wooden cooling towers require replacement or refurbishment and seismic bracing. The cooling towers are in poor condition and have lost up to 20% of their structural surface due to erosion.

Horizontal fill support ties have almost completely washed away at the exterior faces of the tower.

Cooling tower heat exchanger full of algae (Contained Firing Facility, explosives testing).

SCADA Infrastructure Reliability

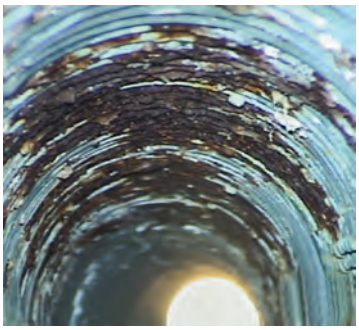


The LLNL Electric Utility SCADA system display board is comprised of vinyl tape representing distribution/feeder conductors and LED lights indicating an open or closed switch position. When changes are made to the configuration of the utility through routine maintenance work or planned construction activities, the display board is manually updated. These manual updates include deleting or adding vinyl tape and modifying the hundreds of feet of wiring providing indication to the LED lights leading to potential personnel error.

Fire Alarms/Life Safety Modernizations

LLNL's fire and emergency voice alarm utility systems are over 30 years old and no longer supported by the vendors.

Site 300 Storm Drain/Erosion/Roads Rehabilitation



Interior photos of this Site 300 55-year-old metal storm drainpipe shows corrosion at the flowline and a "band of corrosion" around the upper surface of the pipe. It is believed this situation combined with significant soil erosion resulted in a section of pipe collapse in 2010. Interior photos of multiple pipes have shown this condition.

The drainage outfall and holes from corrosion in the bottom of the pipes eventually erode the soil beneath the pipe and road, creating voids under the road and erosion on the hillside. These conditions are threatening the integrity of Site 300 roads that transport high explosives. With over 450 aging drain pipes under Site 300 roads, this situation is very common at Site 300 today.

Asset Management Programs (AMPs)

Using AMPs, LLNL will group similar building system replacements together to cost effectively arrest the growth of deferred maintenance. Similar to the Roof AMP, the NNSA is beginning reinvestment programs for other aged building system areas. Benefits include centralized and simplified procurement, tradeoffs evaluated at a site and enterprise level by key stakeholders, and development of expertise in building system assessment, design, and installation. As this effort gets underway, LLNL is identifying its top priorities based on the importance of the building system and the criticality of the building to the mission. Near term projects include:

- **Mission Critical HVAC Revitalization projects**
- **Mission Critical Electrical Revitalization projects**

Mission Critical HVAC Revitalization Project

The average age of LLNL's mission critical HVAC systems is 29 years old. These systems suffer from frequent breakdowns, are energy inefficient, have hard-to-find replacement parts, and do not consistently provide proper temperature and humidity controls for the mission critical activities being performed. Current direct digital control (DDC) systems are aging, energy inefficient, and not integrated with existing facility infrastructure, such as ventilation and fume hoods.

Replacement Space

LLNL will need to replace substandard WWII era buildings with Leadership in Energy and Environmental Design (LEED)-certified General Plant Project (GPP)-sized replacement facilities. These projects will provide a dual benefit by eliminating maintenance backlog and providing quality space to accommodate the need for laboratory and office housing. Office modules will collocate dispersed groups to improve operational cost, efficiency, and collaboration. Laboratory units will be designed and configured for shared limited-term use rather than a multitude of single-use dedicated facilities. The highest needs are:

- **Replacement Office Building**
- **Shared-Use General Purpose Laboratory**
- **Maintenance Operations Center**

Replacement Office Building

As an example, an Institutional General Plant Project (IGPP) building could replace offices in the southwest quadrant of the Laboratory allowing LLNL to stand up a business office to support the modernization of stockpile systems. This classified office building could house project controls, supply chain, and quality assurance personnel and be shared with ST&E personnel who are navigating the future of additive manufacturing and be collocated near the LEP design and test engineers.

Transition and Demolition

There is a need to demolish legacy facilities to clear the site for redevelopment; eliminate maintenance backlog and environment, safety, health, and security risks; reduce surveillance and maintenance costs; support sustainability goals by eliminating the energy and water usage of excess facilities; and improve the site's appearance to attract and retain the next-generation workforce. Transition and Demolition Projects are discussed in Section 6.

Emergency Operations

LLNL must coordinate operations to comply with DOE and all state and federal regulatory requirements, provide interface with NNSA/Livermore Field Office on emergency program issues, plan and execute on-site emergency exercises, and liaise with local community emergency response. Coordinated operations are to take place in a new Emergency Operations Center (EOC) (formerly known as Emergency Management Facility).

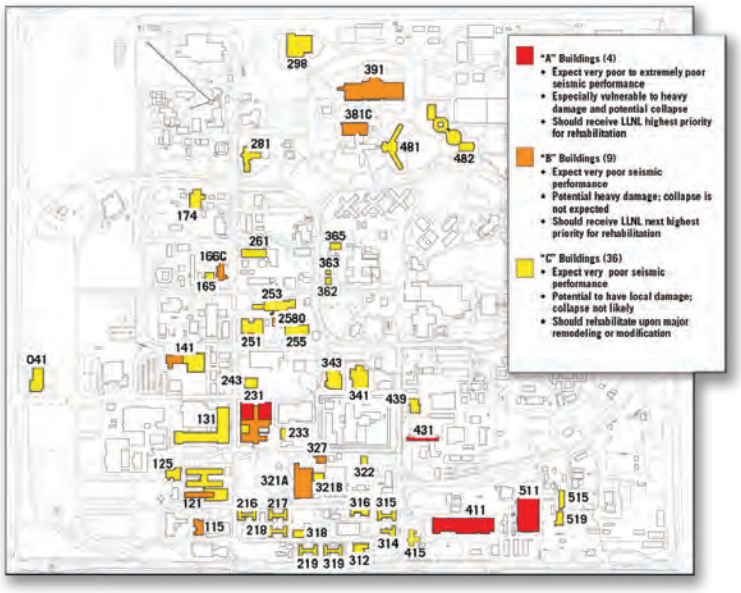
Emergency Operations Center

The Emergency Operations Center Line Item has received CD-0 approval. Project funding has been delayed to FY17. CD-1 will be complete and ready for approval in the fourth quarter of FY15. It is critical to receive project authorization to move the emergency operations center from the current temporary location, which has several noted weaknesses (i.e., limited accessability and usable space, habitability during extended activations), to a permanent facility with full-range capabilities (e.g., seismic survivability, sustainable operations, interoperable communications) required to effectively manage LLNL's emergency response oganization during emergencies and off-normal situations.

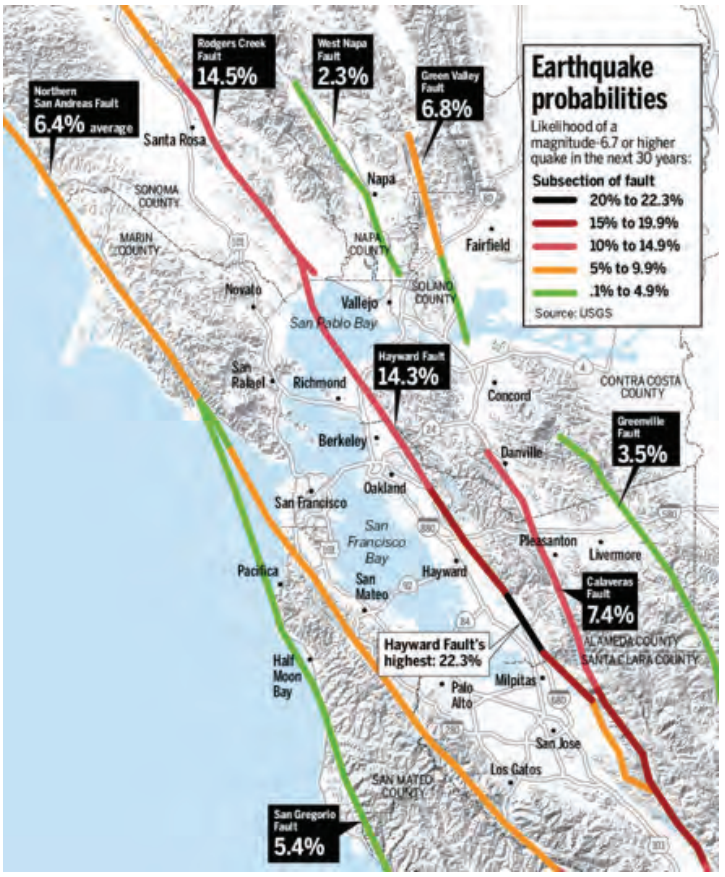
Seismic Safety

It is important that LLNL provide safety compliance retrofits of enduring facilities. LLNL is located in a seismically active region and there is a 72% probability that one or more earthquakes of magnitude 6.7 or greater will occur over a 30 year period. As highlighted in the map, LLNL has many enduring facilities that are in need of seismic retrofit that would be accomplished through the Seismic Risk Mitigation Project.

Seismic Risk Mitigation Project



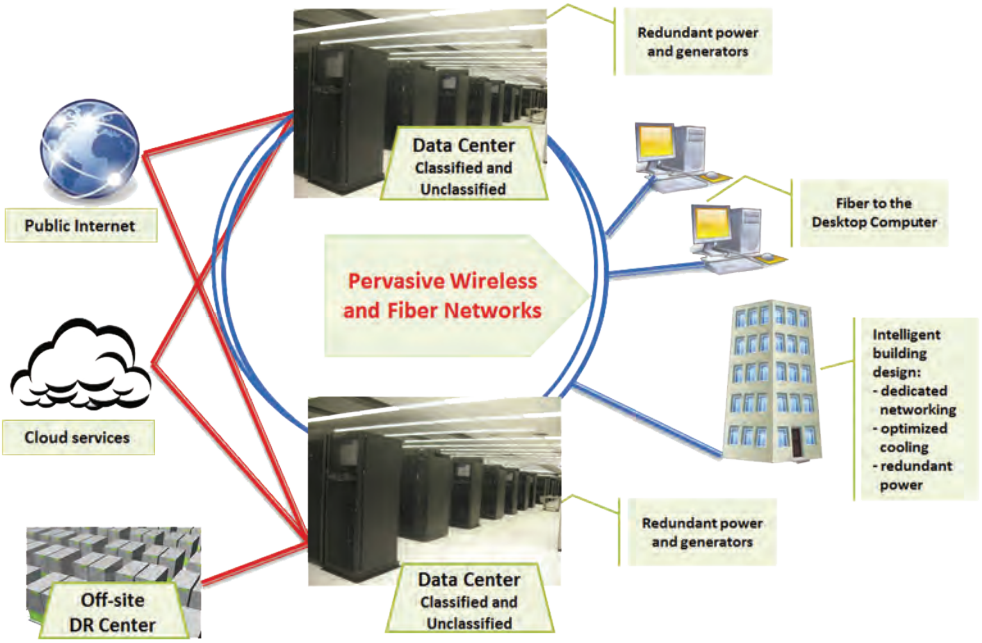
Map identifies all buildings at the LLNL Site 200 campus that have been shown by structural evaluation to have an expected seismic performance of poor to very poor. These buildings require various levels of seismic rehabilitation to mitigate life-safety hazards for their occupants during earthquakes. The proposed project addresses 10–15 of the approximately 68 buildings that require immediate attention as they are the most seriously deficient. This initial listing is based on a seismic safety study performed in 2006 with an update in 2008 and is subject to change based on a Probabilistic Seismic Hazard Analysis currently underway.



Considering all possible faults, the San Francisco Bay Area has a nearly 3-in-4 chance of experiencing a potentially deadly earthquake in the next 30 years, as reported in a new study by scientists from the U.S. Geological Survey. The largest risk is from the Hayward Fault that is within 30 miles of LLNL.

Information Technology

Provide mission-enhancing IT-scale computing and networking capabilities that are robust and reliable. Computing capabilities will emphasize on-demand services that will make cost-effective IT computing available to programs and business units. Networking capabilities include first-in-class core and distribution layers and pervasive indoor and outdoor wireless access. Projects involve communications systems upgrades and a **Network Communications Data Center Replacement**.



Distributed networking featuring modern, pervasive fiber, and wireless networks with fault tolerant, distributed network nodes. Particular strategic emphasis is placed on pervasive wireless access for employees, collaborators, and guests throughout the campus.

Network Communications Data Center Replacement

As the networking and telecommunications hub for the Laboratory, this facility is insufficient to properly support a robust and reliable network and telecommunications capability necessary for the national security missions. The building lacks basic, modern data center features such as a raised floor for cable and power management and a dimensional layout that allows efficient siting of modern computer racks. The existing conduits that run into the facility, allowing network circuit expansion to support the Lab's missions, are near capacity. The replacement 6,000 sq. ft. facility will leverage high performance computing architectural, structural, and systems designs and emphasize sustainability such as free cooling and modern HVAC equipment for operational cost savings. It will also ensure fire and other alarms are reliable for safety and emergency response capabilities, including nuclear facility alarms and will allow consolidation of ComSec facilities and other communications data centers.

Strategic Planning Horizon (FYNSP of President's Budget + 20 years)

LLNL has the goal of constructing one general-purpose facility per year until personnel are no longer housed in substandard trailers and WWII barracks buildings. It will continue to rely on its infrastructure support and facilities to meet the long-term challenges facing the nation and the world. It is anticipated that, as resources are further constrained, the threats to national and global stability will increase, resulting in both state and non-state organizations seeking preeminence. The same mission areas are expected to endure; however, changes anticipated in the specific mission focus within these areas are based upon an evolving social and political landscape.

C11 Counterterrorism/Counterproliferation

LLNL has an integrated nuclear counterterrorism and counterproliferation program, part of a national program to address the threat posed by nuclear and radiological devices. LLNL applies its expertise in nuclear weapons design to enable assessments related to all types of nuclear technologies. In keeping with the vision of One NNSA, this program is critically dependent on the infrastructure investments and capability stewardship provided by Defense Programs (NA-10) supporting the programmatic requirements of the Nuclear Counterterrorism Incident Response Program and other related programs.

LLNL maintains key science and technology infrastructure to anticipate, innovate, and deliver responsive solutions to complex global security needs. The International Security Research Facility, B140, and the Forensic Science Center in B132N are two such examples.

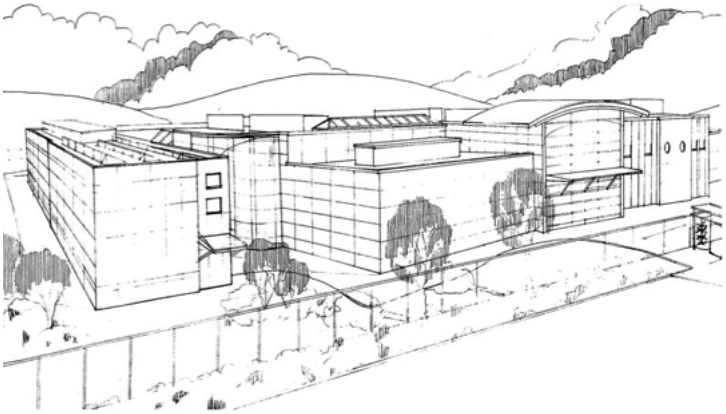
Building 140 brings together the broad spectrum of Laboratory disciplines, from bioscience and chemistry to nuclear science and engineering, that is vital to the nation's effort to assess and counter threats to international security.

The Forensic Science Center (FSC) in B132N is one of the two U.S. laboratories to be internationally certified for identifying chemical-warfare agents. The FSC combines state-of-the-art science and technology with expertise in chemical, nuclear, biological, and high-explosives forensic science to support these national security missions. The FSC also collaborates with federal agencies by applying forensic technology to help defeat terrorists or interdict dangerous materials. While serving the immediate, short-term needs in these areas, the center also conducts basic research in the areas of analytical science and instrument development, nuclear forensic analysis, and the synthesis of new molecular and tailored nanostructured materials.

Tactical Planning Horizon (FYNSP of President's Budget +5 years)

LLNL will develop, enhance, and apply the expertise and capabilities to analyze nuclear technologies; develop nuclear detection and countermeasures strategies and hardware; provide expertise, analysis, and disablement technologies in support of emergency response; and perform the full range of nuclear materials analysis and pre- and post-detonation nuclear forensics to support attribution and consequence management. Secure high-side space will be needed to support the growing mission. A GPP-sized project to create space and the **Network Intelligence Research Facility (NIRF)** will address current and forecasted needs.

Network Intelligence Research Facility



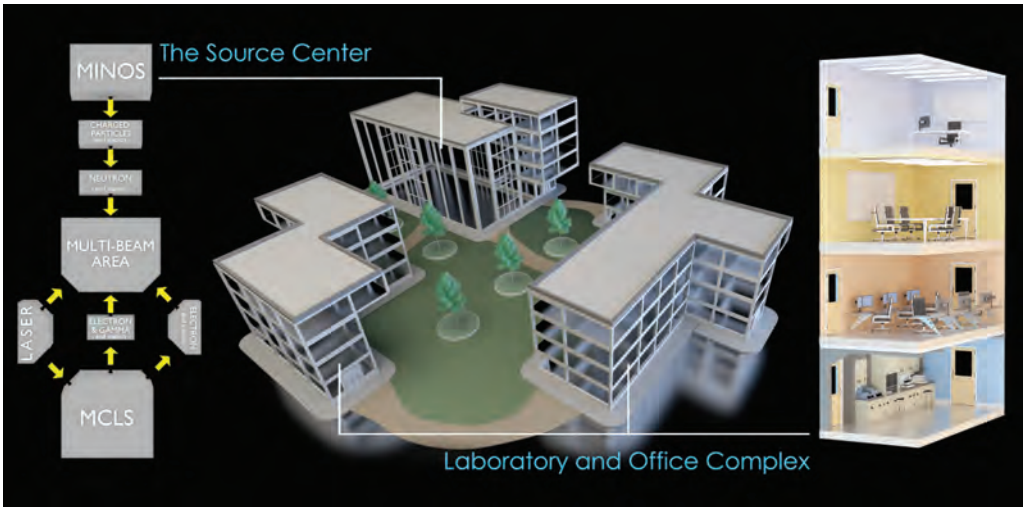
The proposed NIRF will meet current and forecasted needs for high-side infrastructure to support growing missions in cybersecurity, foreign nuclear weapons analysis, and other threats to international security. Expected future work will depend more heavily on use of Sensitive Compartmented Information (SCI) facilities with an expected need of approximately 100 or more offices in the next 5 to 10 years.

Strategic Planning Horizon (FYNSP of President's Budget + 20 years)

Nuclear counterterrorism is only one part of the overall mission of the national program to address the threat—both domestic and international—posed by nuclear technologies in the hands of terrorists. LLNL uses its significant multidisciplinary science and engineering expertise and nuclear weapons design knowledge to create an integrated approach to the broad spectrum of nuclear security challenges. In the long term, a **Nuclear Security Science Center** is proposed that would integrate diverse teams (e.g., academia, sponsors, end users) to anticipate threats and to innovate solutions.

Nuclear Counterterrorism and Counterproliferation are only a portion of the overall Global Security mission, including countering both domestic and international threats. LLNL utilizes its significant systems engineering expertise to create integrated countermeasures to varied and, at times, coupled threats. In the long term, an **Integrated Global Security Center (IGSC)** would bring together diverse teams to anticipate threats, innovate solutions, and create deployable systems of countermeasures.

Nuclear Security Science Center (NSSC)



The proposed project will create a facility for state-of-the-art capabilities to work with nuclear materials, radioactive samples, and intense particle and photon sources. A 300,000 sq ft facility will be constructed to encompass offices, laboratories, meeting rooms and other support space. The facility will be used to establish new, transformational experimental capabilities to drive innovative research and development, and foster communication and collaboration across the nuclear security community. The NSSC would bring together signature experimental capabilities in support of actinide science, nuclear detection, forensics, and diagnostics.

C12 Support of Other Mission/ Program Capability

LLNL has a mission of strengthening the United States' security through development and application of world-class science, technology, and engineering that position the Laboratory to anticipate and respond to national security challenges and minimize technological surprise. It is therefore of paramount importance that the Laboratory sustain a vibrant ST&E base and continue to invest in enabling infrastructure that provide scientists and engineers a suite of tools to deliver on multi-programmatic missions for NNSA and DOE in the areas of: Stockpile Stewardship Science, Cyber Security, Space, Intelligence, Energy and Climate Security, Chemical and Biological Security, Inertial Fusion Science and Technology.

Research areas that support these missions include: computational science, high energy physics, advanced materials, manufacturing, design and synthesis, radiochemistry, intelligence and counterintellligence, basic energy, energy security, earth and environment, atmospheric sciences, and biosciences. Investing in infrastructure that advance the science and engineering in these research areas serves to deepen the Lab's core capabilities and expertise—and ultimately strengthens our nation's security posture.

Tactical Planning Horizon (FYNSP of President's Budget +5 years)

Livermore Valley Open Campus (LVOC)

The DOE/NNSA national laboratories have long provided exemplary science, technology, and engineering to address the most pressing national security challenges. Recognizing the need for enhanced collaboration, NNSA authorized LLNL and Sandia-CA in 2010 to co-develop the Livermore Valley Open Campus (LVOC)—a more open national security laboratory environment to enhance the flow of innovation that results from deep connections with diverse partners.

LVOC is currently thriving in a General Access Area campus that stretches across the eastern side of LLNL and Sandia-CA sites and is convenient to the innovation of the vibrant San Francisco Bay Area and Silicon Valley. It houses more than 200 laboratory researchers who work with visiting collaborators from industry and academia on projects in areas that include high-performance computing, advanced manufacturing, nonproliferation, cyber/bio/energy-security, transportation and big data.

LVOC partnerships are already producing value. The High Performance Computing Innovation Center (HPCIC) at LLNL is applying laboratory supercomputer expertise to wider challenges and encourages partnerships to develop robust tools and codes in areas of mutual interest. Industry is already utilizing HPCIC resources through CRADA's and Strategic Partnership Agreements. These strategic projects are providing direct benefits to the Nuclear Security Enterprise.

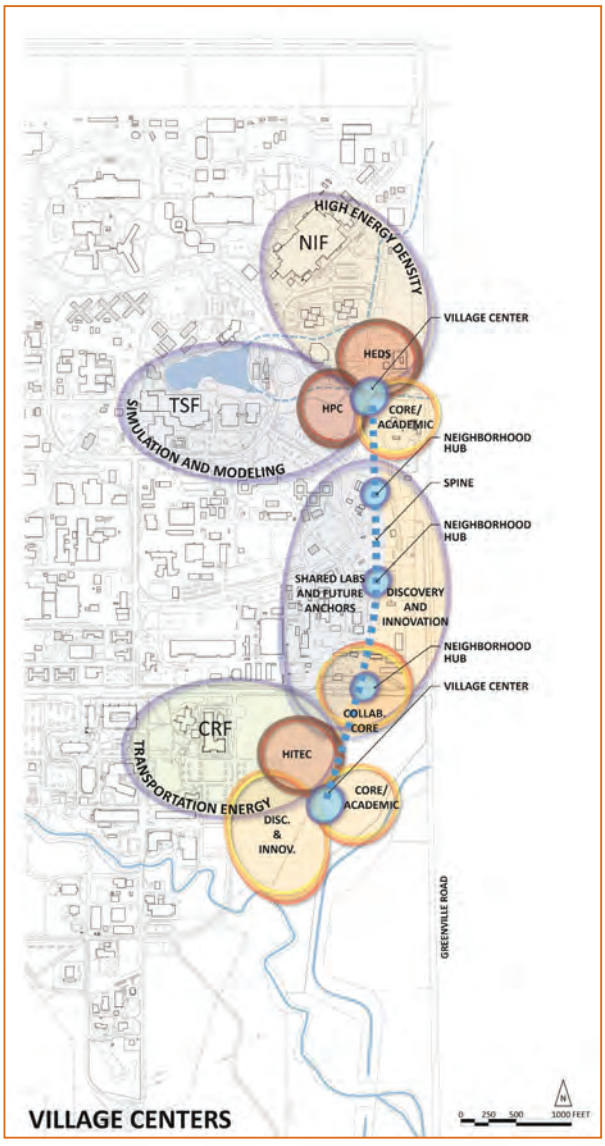
The HPCIC is currently housed in temporary rented trailers and requires a new facility to grow programs and partnerships. To address this need, LLNL submitted a CD-1 for the development of a replacement facility and is currently working with NNSA through the approval process.

A separate but parallel planning effort is ongoing to establish an advancing manufacturing (AM) facility in the Open Campus near the HPCIC. The AM facility will augment current lab-industry collaborations to develop and apply manufacturing process–including modeling, simulation, and data analysis related to direct digital manufacturing technologies, such as additive manufacturing, and new characterization technologies. Building on our base of capabilities developed within the Stockpile Stewardship Program, the AM facility in partnership with the HPCIC would enhance and validate multiple physics and engineering packages as well as improve our UQ methodology and our ability to scale these packages. Successfully executing CRADA's would deliver real improvements to mission relevant codes and enhance our capability with AM technology, while enabling a US AM manufacturer to be more competitive.

Such synergistic collaborations are the purpose of the HPCIC and the LVOC. A fully established HPCIC will enable us to continue growing a robust portfolio of these projects to accelerate the delivery of advances to the NNSA while transferring HPC expertise into the private sector and strengthening our pipeline of HPC-trained candidates.

Infrastructure projects being considered for the Open Campus include:

- **High-Performance Computing Innovation Center Replacement Office Buildings**
- **Collaboration Center**
- **Livermore Advanced Computing Complex (see Section C1.3 Simulations)**
- **Advanced Manufacturing Laboratory**
- **Hertz Hall Revitalization**
- **Office and Light Laboratory Incubator**
- **Institute for Translational Biomedicine**
- **Southeast Campus Revitalization**



The campus development concept is a series of science-related villages based on functional relationships to existing research facilities at LLNL and Sandia; a center at each village shares core functions and amenities. The villages are linked with intermediate neighborhoods of other facilities along a circulation spine to facilitate an interactive community environment.

LVOC is a joint initiative between LLNL and Sandia that will promote greater collaboration between the world-class scientists at the nuclear security labs and their partners in industry and academia. The LVOC leverages and facilitates ready access to the expertise and capital investments already made by NNSA and DOE while providing a dynamic and exciting work environment for scientists and engineers. The LVOC is located on DOE property managed by Sandia and LLNL, with approximately 110 acres of that property in a designated General Access Area (GAA). Since its opening in 2010, the LVOC has welcomed more than 30,000 visitors at the High Performance Computing Innovation Center engaged in research, development, and education.

The High Performance Computing Innovation Center's (HPCIC's) unique ability to allow partnering with industry and academia is important to achieving the goals of the Advanced Simulation and Computing program. Replacing the current leased modular facility with an expanded, modern, collaborative workplace will allow the new HPCIC facility to house more staff and enable broader strategic partnering arrangements—thus positively impacting programmatic work and creating a work experience attractive to next generation scientists and engineers.

Plans are under discussion with the University of California to renovate Hertz Hall, formerly home to the Department of Applied Science at the University of California at Davis to include UC-wide programs in emerging areas of mutual interest that enable broader interactions with UC and local communities.

Strategic Planning Horizon (FYNSP of President's Budget + 20 years)

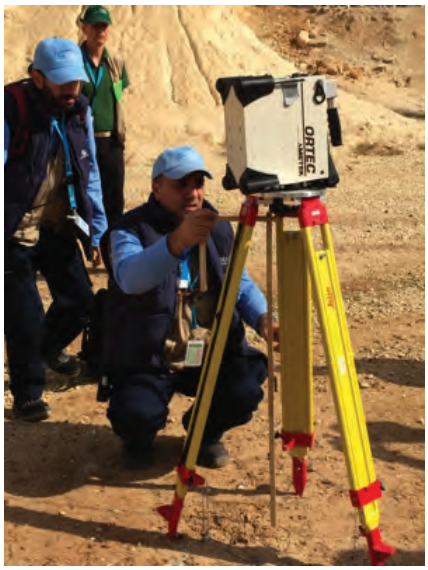
Fundamental Science and Engineering R&D

LLNL must maintain expertise in fields ranging from materials science and detector and diagnostic development to focused aspects of the fundamental supporting disciplines in physics, chemistry, biology, and earth sciences. Strategic planning initiatives emphasize a science and technology corridor, or "hub," having multidisciplinary infrastructure with coordinated facilities investment that would support the widest swath of ST&E and programs at LLNL. This collection of ST&E facilities, along with the **NEP Engineering and Materials Complex** (Section C1.1), **Nuclear Security Science Center**, and a stand-alone **Forensic Science Center** (Section C11), will provide the science and engineering capabilities needed by LLNL to meet the demanding needs as well as have the ability to adeptly respond to changing programmatic mission space. The collection of ST&E facilities included in the hub follows:

- **Biosecurity and Biosciences Research Facility**
- **Earth Science Facility**
- **Energy and Climate Complex**

C14 Nonproliferation

The Nonproliferation Program at LLNL supports NNSA's nonproliferation mission by providing technical leadership to advance technologies to monitor, detect, and limit or prevent the proliferation of materials, technology, and expertise relating to weapons of mass destruction (WMD) worldwide. The program also provides technical leadership to eliminate or secure inventories of surplus materials and infrastructure usable for nuclear weapons. It also covers a broad spectrum of activities from weapons dismantlement to physical protection upgrades, both with the goal of preventing proliferation and reducing the global risk posed by inadequately secured nuclear and radiological materials.



A number of LLNL staff participated in the planning and execution of the Comprehensive Test Ban Treaty (CTBT) Integrated Field Exercise (IFE), which took place on the eastern shore of the Dead Sea in Jordan along with LLNL developed detection technology.

The overall goal of the program is to open channels of communication among organizational structures, coordinate, and focus efforts to enhance LLNL's role in nonproliferation and threat reduction. In keeping with the vision of One NNSA, this program is critically dependent upon the infrastructure investments and capability stewardship provided by Defense Programs (NA-10), supporting the programmatic requirements of Defense Nuclear Nonproliferation. LLNL uses unique capabilities in computing, materials development, and sensor technologies as well as its nuclear weapons expertise to support the nonproliferation mission.

Tactical Planning Horizon (FYNSP of President's Budget +5 years)

LLNL's Nonproliferation Program relies heavily on the capabilities provided from throughout NNSA funded activities at LLNL and other sites. Specifically the projects listed below directly support the activities conducted in support of nonproliferation:

- **Radiochemistry Laboratories Recapitalization (C1.1)**
- **Livermore Advanced Computing Complex (C1.3)**
- **Forensic Science Center (C11)**
- **Network Intelligence Research Facility (NIRF) (C11)**
- **Nuclear Security Science Center (NSSC) (C11)**

Strategic Planning Horizon (FYNSP of President's Budget + 20 years)

Longer-term capabilities would include those contained within the following: **Integrated Global Security Center (IGSC).**

C15 Security

LLNL maintains security expertise and guidance in support of the LLNL mission and provides a secure environment that protects personnel, information, property, and nuclear material while complying with laws, policies, and procedures in a cost-effective manner.

In executing its safeguards and security mission, LLNL operates and maintains a number of site infrastructure facilities and systems. These include several essential training and operations facilities; physical protection elements (fences, gates, access control and intrusion detection systems, video surveillance systems, and barriers); and systems supporting security clearance and badging functions.

Tactical Planning Horizon (FYNSP of President's Budget +5 years)

Security Organization Training and Operations Facilities

There are projects related to Protective Force facilities that will be commenced within the next two years. These are:

- **Security Armory Replacement Facility**
- **Upgrade of the Staffed Entry Kiosks**

There are two additional projects that are proposed and are pending approval:

- **Security Fitness and Training Center Replacement Facility**
- **Security Organization Range Replacement Facility**

Security Armory Replacement Facility

The Security Organization's Protective Force Division has been permitted to construct a permanent facility (approximately 2880 gsf) to replace the existing trailer which functions as an Armory Facility. The trailer has been the primary Armory for over 17 years, and is operated on a daily basis. In April 2015, the SO will commence construction on a $2.5M, 2880 sq ft replacement Armory Facility with a 720 sq ft fenced external storage area.

Upgrade of Staffed Entry Kiosks

Five vehicle entry gates provide entry into the LLNL Main Site Property Protection Area and a large Limited Area. The staffed gate entering the Laboratory on Greenville Road has two traffic lanes but only one Security Police Officer (SPO) kiosk. Construction is proposed for a new Staffed Entry Gate Kiosk at the East Avenue entrance, accompanied by a move of one of the existing East Avenue kiosks to the Greenville Road entry gate. This work is proposed in the FY15-16 timeframe.

Physical Protection Elements

There are several projects related to Physical Protection Elements that will be commenced within the next two years.

- **Argus (Access Control and Intrusion Detection System) Upgrades**
- **Limited Area Fence Repairs**
- **Video Surveillance Upgrades**
- **West Badge Office Security Barriers**

Limited Area Fence Repairs

During FY14-15, LLNL ran a campaign to repair certain Site 200 Limited Area (LA) fences to correct all deficiencies identified during an FY13 inspection. In early FY15, a similar inspection identified a number of deficiencies in Site 300 LA fences. Estimates and schedules are in development for a phased effort to effect repairs on the Site 300 LA fences.

Argus Upgrades

LLNL employs the Argus system to carry out the automated access control and intrusion detection functions required by the DOE Physical Protection order. In October 2014, LLNL upgraded the Argus host software to System Release 28 (the most recent available version), becoming the second NNSA site to do so. Since FY14, LLNL has executed a phased upgrade of the Argus network infrastructure and the front end field processors and badge readers. When completed (anticipated for early FY17), LLNL will be fully compliant with Homeland Security Presidential Directive 12 (HSPD-12) and will make full use of the security features of the HSPD 12 badges. Life-cycle upgrades will be made to 30 Argus portal booths (doors, lights, handles, and other hardware components).

Strategic Planning Horizon (FYNSP of President's Budget +20 years)

LLNL will continue to rely on its core capabilities to fulfill its role as a national asset, meeting and addressing the nation's security challenges in the 10- to 20-year horizon. No significant changes are anticipated to LLNL's infrastructure to support these missions with regard to security infrastructure in the +20 years.


STOP
BADGE
CHECK

C16 Emergency Response

LLNL is a key contributor to DOE/NNSA's emergency operations mission, providing key technical capabilities and scientific expertise during radiological/nuclear incidents in collaboration with the interagency preparedness and response community. LLNL partners with other national laboratories and sites to support DOE/NNSA emergency response capabilities including the nuclear Accident Response Group (ARG), the Joint Technical Operations Team (JTOT), the Radiological Assistance Program (RAP), DOE Radiological Triage, and the nuclear/radiological Consequence Management program. In addition, LLNL maintains the National Atmospheric Release Advisory Center (NARAC), DOE/NNSA's operational plume modeling center.

LLNL enhances NNSA's Emergency Response programs by utilizing qualified subject matter experts, state-of-the-art tools, scientific knowledge, and technical training to provide both pre-event and post-event response and reachback support.

Qualified personnel deploy to emergency locations across the globe, serving in both support and technical leadership roles. These personnel are provisioned with state-of-the-art radiation detection, disablement, and render-safe equipment. LLNL also provides extensive Home Team technical and intelligence support, drawing on unique national laboratory resources and expertise; and advanced communications.

NARAC is a national support and resource center for planning, real-time assessment, emergency response, and detailed studies of incidents involving a wide variety of hazards, including nuclear, radiological, chemical, biological, and natural emissions. The center provides tools and expert services to the Federal Government that map the probable spread of hazardous material accidentally or intentionally released into the atmosphere in order to help protect the public and the environment. The Naval Nuclear Propulsion Program (NNPP), various DOD facilities, and the National Aeronautics and Space Administration (NASA) also use NARAC for emergency preparedness and response.

Tactical Planning Horizon (FYNSP of President's Budget +5 years)

Within the Tactical Planning Horizon, the 15+ year old core NARAC software system requires a significant modernization effort to ensure that NARAC is able to continue to provide cost-effective long-term support and to be responsive to the evolving requirements of DOE (and other sponsor) missions. In addition, upgrades are needed to NARAC's classified capabilities as its roles in JTOT/ARG support expand.

Strategic Planning Horizon (FYNSP of President's Budget + 20 years)

It is anticipated that within the Strategic Planning Horizon a replacement facility for NARAC will be required due to the age of the current facility. This effort will be done in conjunction with an upgrade to LLNL's other Render Safe and Consequence Management home team facilities which support an integrated response to both unclassified and classified incidents. The proposed project will be the **24/7 Joint Operational NARAC and Render Safe Home Team Facility**.

NARAC Operational Facility.

C17 Work for Others

LLNL's Work for Others (called Strategic Partners Program) is a broad National Security portfolio whose primary missions are divided into three main areas: Nuclear Security, National Security, and Energy and Environmental Security. LLNL's main strategic partners reside primarily within the Department of Defense and the Intelligence Community which is a reflection of the Laboratory's focus on Nuclear and National Security. LLNL's core competencies are as follows:

- High-Energy-Density Science
- Advanced Materials and Manufacturing
- Nuclear and Isotopic Science & Technology
- Lasers and Optical Science & Technology
- Earth and Atmospheric Science
- Bioscience and Bioengineering
- High-Performance Computing, Simulation, and Data Science

The core capabilities support five mission focus areas that are of paramount importance to LLNL's DOE/NNSA sponsors as well as its strategic partners. These mission focus areas are:

- Stockpile Stewardship Science
- Cyber Security, Space, and Intelligence
- Chemical and Biological Security
- Energy and Climate Security
- Inertial Fusion Science & Technology
- Laser Science, Technology, and Applications

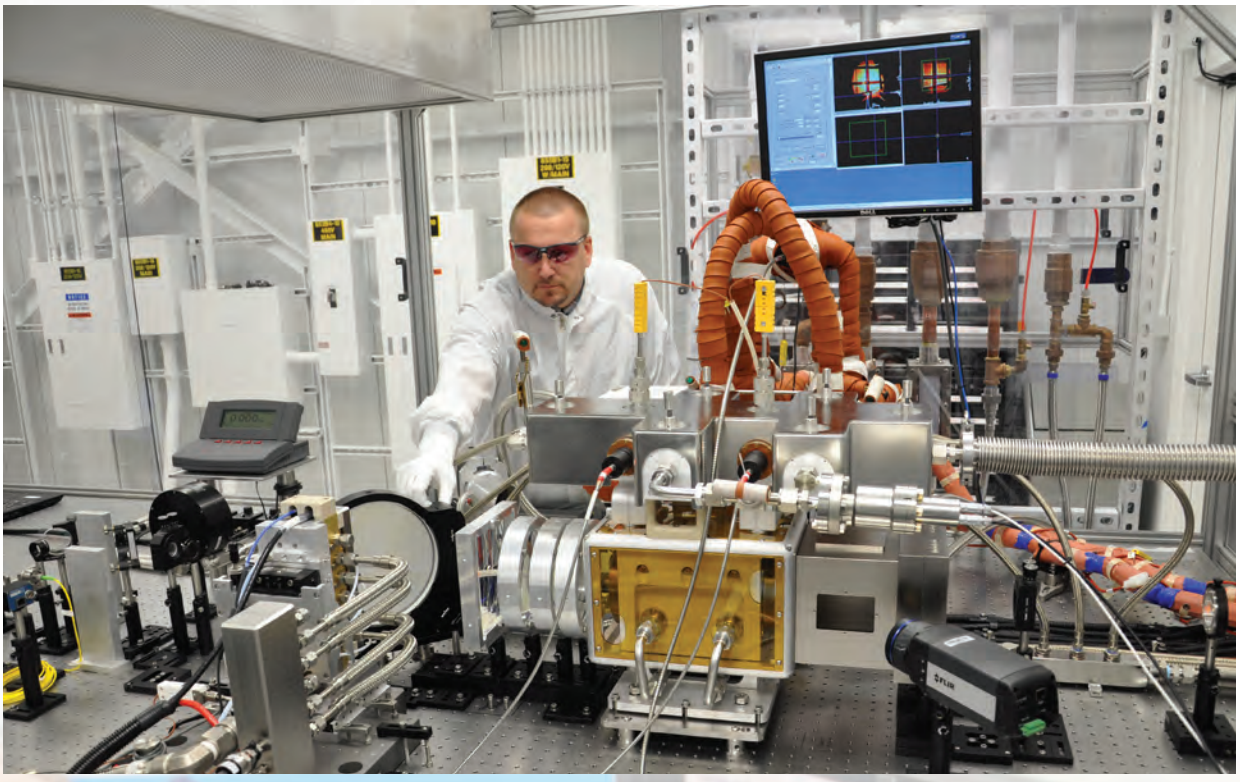
As the Laboratory grows its sponsor base to complement the missions of the nuclear enterprise, the Laboratory will correspondingly expand the program-sponsored investments that sustain and modernize LLNL facilities and infrastructure and keep R&D at the cutting edge.

Tactical Planning Horizon (FYNSP of President's Budget +5 years)

LLNL leverages its interagency work back into the core NNSA programs by using the technologies developed, the enhanced expertise of the staff, or in most cases, both to further the core capabilities of the Laboratory.

Strategic Planning Horizon (FYNSP of President's Budget + 20 years)

For the strategic planning horizon, LLNL will continue to leverage its interagency work back into the core NNSA programs.



A technician adjusts an optical component of an advanced laser system.

Real Property Asset Management

To meet DOE Order 430.1B Real Property Asset Management and to support NNSA real property performance goals, LLNL has established a corporate, holistic, and performance-based real property lifecycle asset management program. The program links real property asset planning, programming, budgeting, and evaluation to program mission projections and performance outcomes. Its process includes the prioritization of all real property related to preventive, corrective, and replacement maintenance activities, and ensures that these activities are performed in a safe, secure, compliant, and cost-effective manner that supports and enables world class science and technology. The Laboratory's facility management organization is responsible for ensuring that operable and well-maintained infrastructure and facilities assets are in place to support site research missions and objectives.

The Laboratory is landlocked and has aged to a point that development of the physical plant today is focused on redevelopment of existing footprint. This is an example redevelopment within existing site footprint.

Replacement Plant Value (RPV)		$ 6,752	Million		
Total Deferred Maintenance (DM)		$ 499	Million		
Site Wide Facility Condition Index (FCI)		7.40%			
		Facility Condition Index (FCI)	Asset Utilization Index (AUI)	# of Assets	Gross Square Feet (GSF) Buildings & Trailers (000's) **
Mission Dependency	Mission Critical	3.16%	94.06%	29	2,409
	Mission Dependent	8.32%	92.29%	250	1,825
	Not Mission Dependent	10.87%	66.17%	401	2,752
Facility Use *	Office	7.05%	81.06%	150	2,079
	Warehouse	7.60%	91.73%	127	355
	Laboratory	4.60%	80.64%	87	3,349
	Housing	0.00%	0.00%	0	0

Real property and asset management. All information in this chart includes both Site 200 and 300. "# of assets" column includes buildings, trailers, and other structures and facilities.
* Not all LLNL facilities are represented by the listed categories.
** Only includes gross square feet for buildings and trailers.

Strategic site planning for redevelopment envisions Program-corridors, linking existing signature core capabilities and future Program project sites; and in the center would be a multi-disciplined science and technology hub of sharable resources to reduce duplicity. The southeast quadrant of the site is reserved for general site support and connects with open collaboration initiatives.

Site Footprint (Current and Future)

The physical development of the Laboratory site has evolved greatly in the 60+ years since it was a U.S. Naval Air Station. The site is now about 90% developed, with mixed facilities in a business-park-like setting. The majority of Laboratory development occurs at the Livermore Main Site, where there are approximately 6.6 million gross square feet (gsf) of diverse facilities—ranging from office and storage to state-of-the-art laboratories and nuclear facilities. There are 23 Mission Unique designated facilities at the Main Site, ranging from the National Ignition Facility to the Center for Accelerator Mass Spectrometry. Early development was concentrated at the southwest quadrant of the site and spread gradually across the square mile. The infrastructure includes about 820 acres of land and a network of roadways, utilities, communication, and security systems to support a variety of scientific, technical, and administrative support activities.

Site 300 covers approximately 7,000 acres (about 11 square miles). It is located 17 miles east of the Livermore Main Site with approximately 370 thousand gsf of facilities from firing chambers to storage magazines, 76 of these are designated as Mission Unique facilities. Primarily grassland with isolated stands of trees or surface water, by design Site 300 is currently only about 5% developed. The majority of the site cannot be developed because of the steep terrain, required explosives safety zones that result in relative isolation of test facilities, and the establishment of wildlife protection areas.

Footprint reduction initiatives have been underway at LLNL since 1994 resulting in 1.7M gsf removed by the site. Aggressive consolidation efforts include moving operations out of underutilized and lower-quality, end-of-lifecycle facilities, thus reducing operating costs while improving work efficiency and safety. Pending demolition of vacated facilities, nonessential maintenance is suspended in these vacated facilities. This effort includes deactivating utilities (electrical, communications, gas, and compressed air) and tailoring surveillance to the lowest cost while maintaining safe conditions and regulatory compliance.

To address future needs, LLNL continues to consolidate program activities and optimize the use of permanent buildings while targeting vacated temporary and substandard facilities for excess. However, most of the permanent facilities are reaching the end of their lifecycle, requiring refurbishment, modernization, or replacement. Given the high cost to repair seismic and technological deficiencies, in addition to the size of the backlog in deferred maintenance, building a new facility is often the most cost-effective solution to providing the needed capabilities while simultaneously reducing the deferred maintenance backlog.

The Laboratory is pursuing new facilities to address programmatic and ST&E strategic priorities. Also important is the need to provide quality office housing to attract and retain staff, to provide for adequate high-side space, and to replace those in substandard conditions beyond the end of the facility lifecycle. The long-term strategy is to vacate all WWII barracks and trailer facilities in conjunction with pursuing line-item projects for seismic upgrades and modernization of permanent enduring facilities.

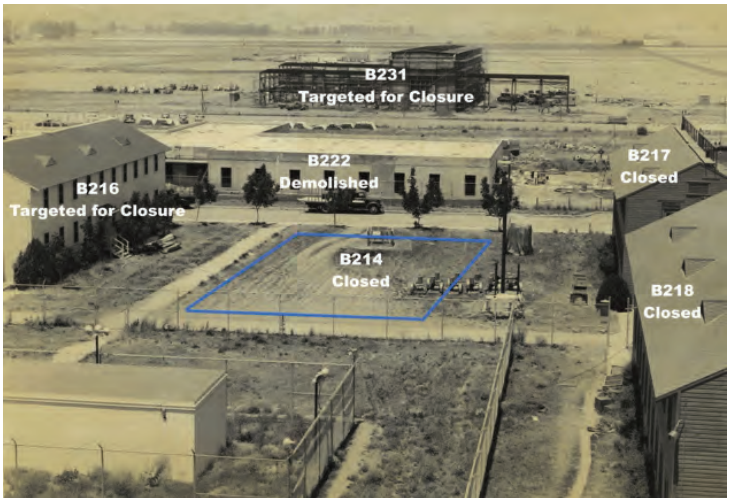
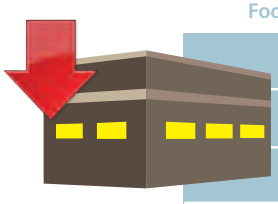
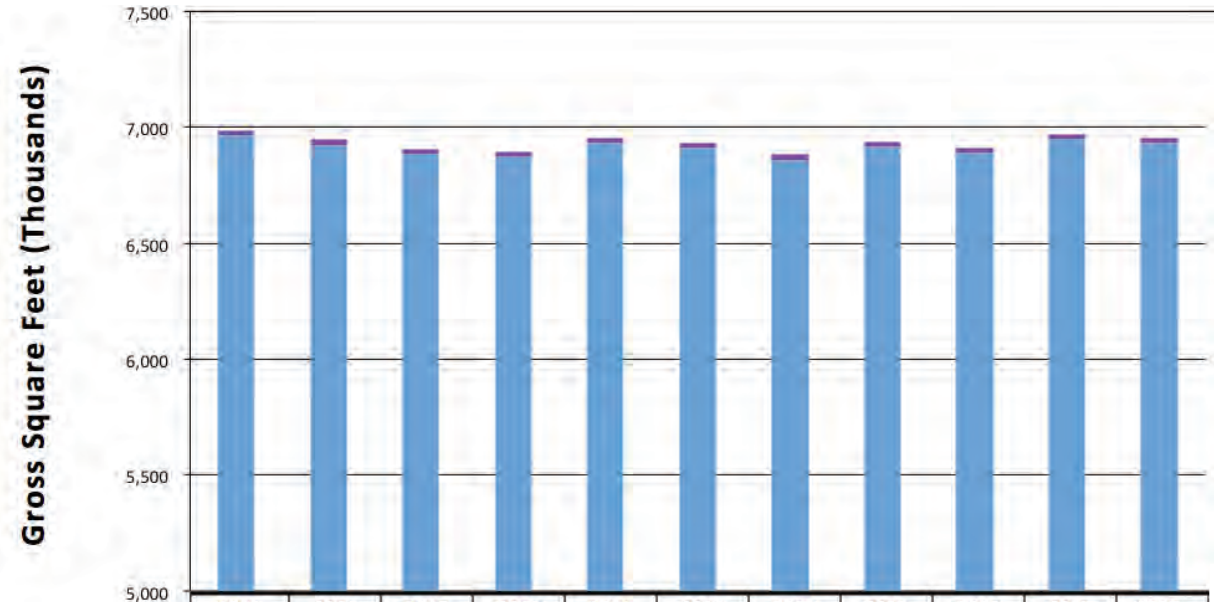


Image from 1953, the early days at LLNL when it was called the Livermore Radiation Laboratory, showing barracks from the original Livermore Naval Air Station and other facilities now vacated, closed, or demolished.

Even with the addition of new footprint such as the National Ignition Facility and the Livermore Computing Facility, the site has experienced a net decrease in gsf since the high in 2004 due to aggressive footprint reduction initiatives. There is an additional 0.8M of gsf currently available to demolish when funding is available.



Footprint reduction history	Million gsf
Highest gsf (FY2004)	7.2
Demolished gsf (FY1994 to FY2014)	1.7
Current gsf enduring facilities (FY2014 year-end)	6.2
Current non-enduring facilities gsf available for demolition (FY2014 year-end)	0.8



	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025-2040
Contractor Leased	-	-	-	-	-	-	-	-	-	-	-
DOE/NNSA Leased	24	24	24	24	24	24	24	24	24	24	24
Outgranted	-	-	-	-	-	-	-	-	-	-	-
DOE/NNSA Owned	6,963	6,922	6,882	6,873	6,930	6,909	6,859	6,914	6,888	6,948	6,931

Site GSF increased in FY 2014 due to building redefinition effort

LLNL Footprint Projection (Buildings and Trailers) under a realistic funding scenario. Assuming modest internal institutional demolition funding of approximately $1M per year for non-process contaminated space and assuming that LLNL's top legacy encumbered facility B251 is funded by DOE for demolition, the projected footprint will not grow in correlation to the probable new construction. If full funding were received for all demolition activities, then LLNL could achieve significant footprint reduction.

Space Utilization and Consolidation

Historical, current, and projected space requirements are analyzed and presented using office space metrics and directorate-specific portfolios. This comparative analysis is made within Laboratory organizations and also with other multiprogram continuing mission sites. Each directorate portfolio is updated on an annual basis. The facilities portfolio and space utilization data are linked directly to LLNL's internal tracking system and DOE's Facilities Information Management System (FIMS) for use in the overall real property management.

The Laboratory organizations review their space needs to reduce underutilized space and returning surplus facilities to the institution for shut-down. The organization-specific space-tracking process assists in strategic space planning, feasibility studies, and migration plans, as well as developing office and workstation guidelines and requirements for space repurposing and consolidation scenarios.

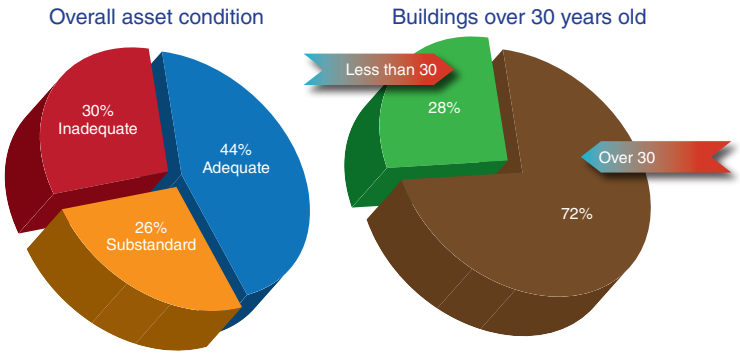
Through the Laboratory Strategic Infrastructure organization, Space Planning and the Transition and Demolition groups facilitate the coordinated effort in the reassignment or reuse of space and the continuing effort in consolidation.

Facility Condition

Best practices developed at LLNL, in conjunction with the Facilities and Infrastructure Recapitalization Program (FIRP), have resulted in LLNL exceeding the NNSA corporate Facility Condition Index (FCI) goals developed early in FY07. The FY14 FCI for Mission Critical facilities is 3.16% (good), for Mission Dependent Not Critical facilities is 8.32% (adequate), and for Not Mission Dependent is 10.87% (fair). It should be noted that with the ending of FIRP in FY13, along with LLNL's limited funding, the ability to reduce and maintain a stabilized deferred maintenance backlog as well as meeting NNSA's FCI goals in the future will be significantly impacted. It is anticipated that an NNSA recapitalization/modernization program would need to contribute resources to achieve sustainment of the current facility conditions.

Last year LLNL participated in the DOE Laboratory Operations Board (LOB) activity to reassess the Overall Asset Condition of buildings by

the new rating criteria. The criteria allowed for a qualitative evaluation to be factored in to the condition assessment process beyond FCI so that a management perspective could consider issues such as environment, safety, and health and/or risk; capability to perform current mission; ability to attract and maintain key staff; and the ability to meet DOE requirements. The results showed that 56% of building and trailers at LLNL are Substandard or Inadequate in their Overall Asset Condition, more accurately representing the infrastructure needs of LLNL's real property than FCI.

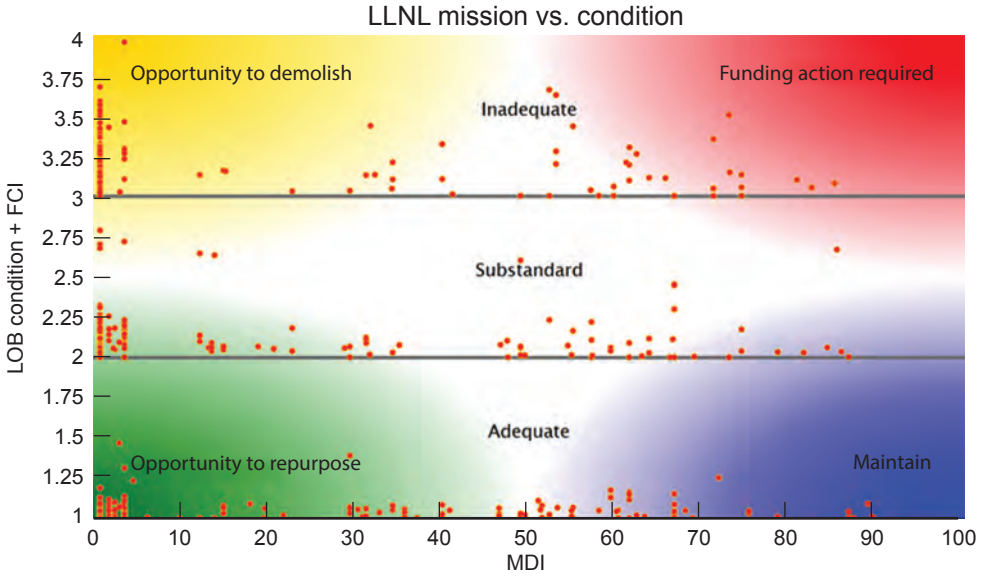


LOB Overall Asset Condition at LLNL reveals that 56% of all assets are Substandard or Inadequate. Results are not surprising since 72% of LLNL's buildings and trailers are over 30 years old.

LOB assessment results identified that the top 5 building systems needs are Heating Ventilation and Air Conditioning (HVAC), life safety, exterior shell, electrical, and computer networks/ communications. HVAC systems have caused programmatic impacts. LLNL's fire alarm systems, emergency voice alarm systems, and direct digital control of HVAC systems are between 10 to 40 years old, and many systems are no longer supported by their vendors. Building sprinkler systems require testing or replacement of sprinkler heads at the 50-year mark [per the National Fire Protection Association (NFPA)] which will impact many facilities in the next 10 years. Many building electrical systems have exceeded their 50+ years service lives posing a risk to the safety and reliability of the building electrical system and are also limited in their electrical capacity and performance to accomplish the Lab's mission. Information technology systems have obsolete network switch infrastructure and mixed cabling. Major investments are required to prevent major system failures. Over the last few years, the number of utility system failures has increased.

To maintain the conditions of facilities and infrastructure to meet current and future mission needs, advancements must be made to clearly identify sustainment requirements. LLNL is working with DOE/NNSA and collaborating with the U.S. Army Corps of Engineers to develop and implement knowledge-based facility sustainment modeling. This type of modeling has the ability to identify, forecast,

A new Mission vs. Condition enterprise model helps LLNL strategically plan the future use and investment needs of its assets. For example, assets that are very important to the LLNL mission but are also in poor condition fall into the red "Funding Action Required" quadrant. Assets in this quadrant have been evaluated for revitalization plans described in this TYSP. Assets in the yellow "Opportunity to Demolish" quadrant are already on LLNL's excess list or are now under consideration for that list. Assets in the green have good-bones and could be repurposed to house important mission infrastructure. Those assets in the blue quadrant are important to LLNL's mission and need to receive adequate funding to maintain them in an adequate state.



and plan preventive, major repair and replacement maintenance requirements. Sustainment modeling holds the key that unlocks the door towards acquiring funding for effective and efficient facility stewardship across the complex. LLNL has also developed a set of time-dependent, full-lifecycle models for real property and programmatic equipment. These computer models are used to project infrastructure resource requirements from acquisition through mission lifecycle (operations, maintenance and repair, recapitalization) and transition and disposition.

LLNL created an additional model this year to expand upon the LOB assessment and the new NNSA real property initiative to rank order the importance of assets by a Mission Dependency Index (MDI). The new enterprise model displays assets on a risk matrix associating MDI to condition. LLNL results are plotted below. To help rationally spread to the condition data, the LOB Overall Asset Condition (qualitative assessment) and the FCI (quantitative assessment) were combined into the score on the vertical axis. The intent of this model is to group assets to quadrants to support strategic planning.

Deferred Maintenance Reduction

Deferred Maintenance (DM) is managed by identifying and maintaining a comprehensive deficiency inventory based on field condition assessments. The Condition Assessment Survey (CAS) process at LLNL—identified as a best practice by the Government Accountability Office and the National Research Council—includes a detailed inspection and evaluation of all facilities on a continuing three-year cycle. Also, nuclear facilities and facilities with special hazards remain on an annual inspection cycle. Each inspected asset is tracked by multidiscipline inspection efforts (i.e., mechanical, electrical, architectural, roofing, and civil surveys).

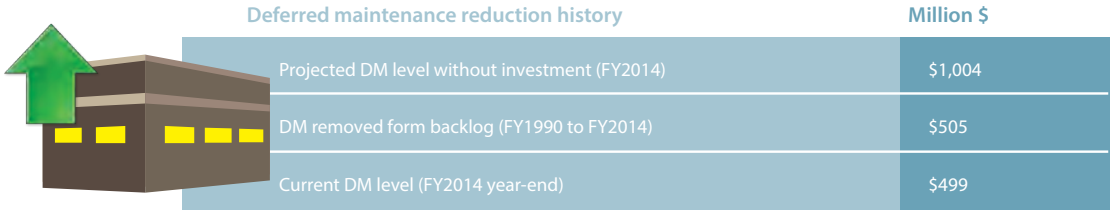
In the past, LLNL could stabilize its DM through effective facility management practices, including an aggressive internal reinvestment program and the externally funded FIRP. Since the mid-1990s, LLNL funded the reduction of over 12,500 items from the DM backlog, totaling $505M. In addition, LLNL held DM stable in the 2003 to 2006 timeframe.

However, current budget of record projections do not allow this level of investment. Currently, major trade-offs relating to 'run to fail' versus replacement maintenance are being made. These trade-offs have longer-term impacts on the capability of many assets to support enduring missions, such as execution of stockpile certification and assessment and broader national security activities. LLNL continues to annually prioritize every deficiency in its total DM using the same mission-owner rating process with maintenance-specific ranking definitions. This prioritization process has become a best practice that allows LLNL to direct its limited funding to its most important maintenance replacements.

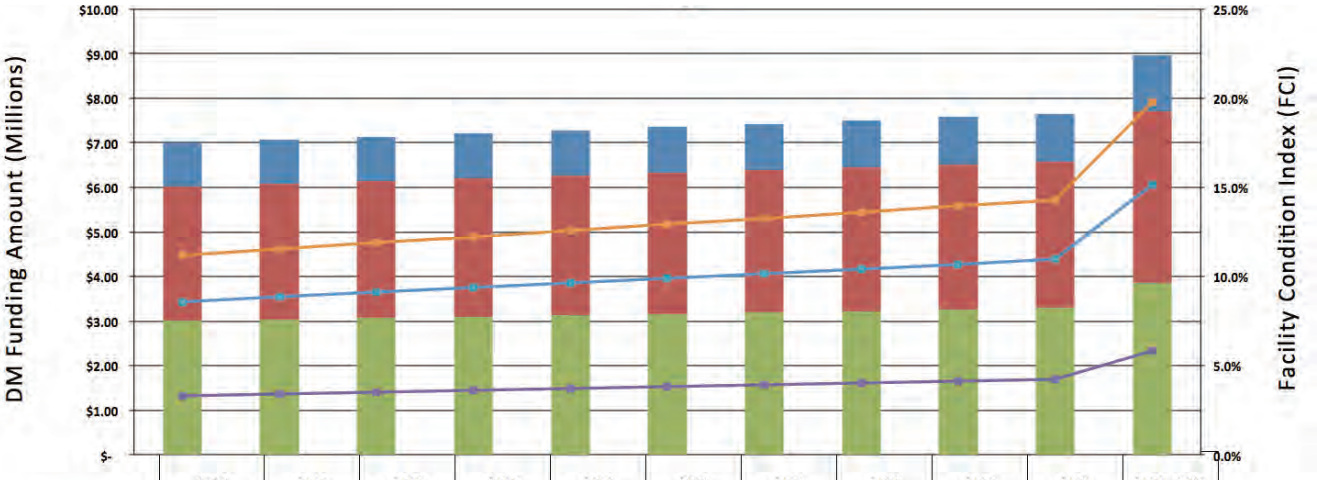
Although current site DM has been significantly reduced compared to what it would have been without investment, it now stands at $499M. Without a new influx of funding, DM growth for the near-term future is expected to be ~$20M per year assuming minimal inflation, but the limited preventive maintenance funding since 2008 may accelerate the growth of DM as the infrastructure ages prematurely.

This year, the Secretary of Energy has issued guidance that programs are to ensure actions are taken to prevent DM growth. In addition, the FY2015 National Defense Authorization Act (NDAA) requires NNSA to submit a 10-year plan to hold DM at FY2014 levels. LLNL has been assigned DM reduction targets based on the share of FY2014 end-of-year DM actuals across the NNSA complex. Given these goals and the annual DM growth, LLNL will need additional investments to address DM.

The projected calculations shown in the graphs on p. 68 compare the scenarios of no new funding and DM reduction funding of approximately $35M per year adjusting for inflation.

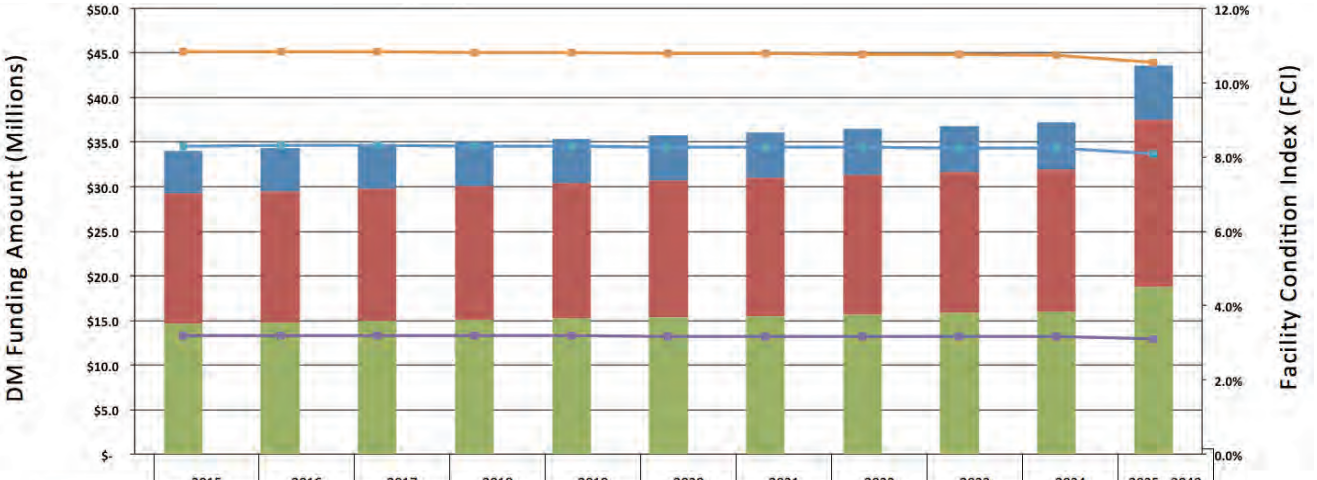


Deferred maintenance reduction history showing that DM would have increased to over $1B had LLNL not invested aggressively in DM reduction since FY2003.



	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025 - 2040
DM NMD	$ 0.98	$ 0.99	$ 1.00	$ 1.01	$ 1.02	$ 1.03	$ 1.04	$ 1.05	$ 1.06	$ 1.07	$ 1.26
DM MD	$ 3.01	$ 3.04	$ 3.07	$ 3.10	$ 3.13	$ 3.16	$ 3.20	$ 3.23	$ 3.26	$ 3.29	$ 3.86
DM MC	$ 3.01	$ 3.04	$ 3.07	$ 3.10	$ 3.13	$ 3.16	$ 3.20	$ 3.23	$ 3.26	$ 3.29	$ 3.86
FCI MC	3.3%	3.4%	3.5%	3.6%	3.7%	3.8%	3.9%	4.0%	4.1%	4.2%	5.8%
FCI MD	8.6%	8.9%	9.1%	9.4%	9.6%	9.9%	10.2%	10.4%	10.7%	11.0%	15.2%
FCI NMD	11.2%	11.6%	11.9%	12.2%	12.6%	12.9%	13.3%	13.6%	14.0%	14.3%	19.8%

Planned DM Real Property Expenditure by Mission Dependency without New Funding.



	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025 - 2040
DM NMD	$ 4.8	$ 4.8	$ 4.9	$ 4.9	$ 5.0	$ 5.0	$ 5.1	$ 5.1	$ 5.2	$ 5.2	$ 6.1
DM MD	$ 14.6	$ 14.8	$ 14.9	$ 15.1	$ 15.2	$ 15.4	$ 15.5	$ 15.7	$ 15.8	$ 16.0	$ 18.7
DM MC	$ 14.6	$ 14.8	$ 14.9	$ 15.1	$ 15.2	$ 15.4	$ 15.5	$ 15.7	$ 15.8	$ 16.0	$ 18.7
FCI MC	3.2%	3.2%	3.2%	3.2%	3.2%	3.2%	3.2%	3.2%	3.2%	3.2%	3.1%
FCI MD	8.3%	8.3%	8.3%	8.3%	8.3%	8.3%	8.3%	8.3%	8.2%	8.2%	8.1%
FCI NMD	10.8%	10.8%	10.8%	10.8%	10.8%	10.8%	10.8%	10.8%	10.8%	10.7%	10.5%

Planned DM Real Property Expenditure by Mission Dependency with $35M of DM Reduction Funding per Year.

Sustainability/Energy

As defined in the LLNL FY15 Site Sustainability Plan, the Laboratory vision for site sustainability is to supply its programs with optimal conditions for success while undergoing continual improvement to existing energy infrastructure; to collaborate with growing mission areas to identify ways to move toward more energy- and water-efficient solutions for energy- and water-intensive facilities; to pursue innovative renewable energy generation both for on-site use and as an ongoing research area; and to incorporate energy and water efficiency improvements into LLNL's on-going energy management and facility operations.

LLNL will continue to identify methods to reduce greenhouse gases (with priority on sulfur hexafluoride [SF6] emissions in utility components) and to develop "green" buildings: four buildings are currently LEED–certified; an additional 14 buildings have met the guiding principles for the federal High Performance Sustainable Buildings requirements.

LLNL will aggressively continue irrigation reduction plans with focus on water-wise landscaping. Further implementation of reverse osmosis technology to replace potable water use at the cooling towers is being evaluated.

Being sensitive to California's current drought conditions, this reverse osmosis unit recycles water for a cooling tower—one of the sustainability measures that has allowed the Laboratory to save more than 10% of the water it consumes annually.

While LLNL's current contracted cost of delivered electricity is very low (~$0.05 per kilowatt hour), LLNL has renewed its efforts to identify funding for renewable projects to provide power and is committed to executing its Site Sustainability Plan. Land use on site has evolved with opportunities to implement sustainability projects such as solar array installations at the site perimeter or on other existing land within the boundaries of the Livermore Site and Site 300.

Existing resources will be leveraged as much as possible to achieve LLNL's sustainability goals. Indirect funding will be used to replace and upgrade aged equipment with the most energy-efficient and cost-effective replacements. Third party financing options are currently being considered, such as a utility energy service contract with the local utility Pacific Gas & Electric (PG&E). The focus of this effort would be the performance of Energy Independence and Security Act (EISA) facility energy and water audits and a selection of short-payback energy conservation measures projects from the audit recommendations, along with some noteworthy sustainability projects from LLNL's master list.

LLNL is facing an on-going energy challenge as the Laboratory is poised to grow in mission areas that are particularly energy-intensive. This is indicative of the Lab's successful efforts in research and technology development. However, LLNL's success will impact its energy intensity and greenhouse-gas emissions.

The above scenario will be the case even as new computing centers and prospective new facilities are designed and built to be as efficient as possible. Another set of challenges are driven by regulatory compliance from local agencies, such as the Bay Area Air Quality Management District, necessitating early replacement of a large portfolio of boilers for heating of buildings.

A 3-megawatt fixed-tilt solar photovoltaic array is scheduled to be built on 10-acres in the northwest buffer zone through a power purchase agreement. The facility is expected to generate approximately 6,300 megawatt-hours annually. This system will represent the DOE/NNSA's largest purchase of solar power from an onsite facility and the first in the western region.

Transition, Disposition, and Long-Term Stewardship

As LLNL carries out its national security missions, the Laboratory strives to assure its facilities portfolio meets the latest technologies and enables infrastructure needs. Past mission objectives have left the Laboratory with many process-contaminated, failing, and obsolete facilities. These facilities were closed through LLNL's strategic consolidation effort in support of NNSA's enterprise-wide footprint reduction directive and in concurrence with the NNSA Livermore Field Office (LFO). A subset of these facilities have been deemed "legacy encumbered" facilities; those requiring significant safety systems and ES&H oversight to ensure containment, monitoring, as well as limited remediation of legacy contamination. Access to these facilities is limited to trained and authorized personnel only.

Because site stewardship is of the highest priority at LLNL, the Laboratory is committed to removing legacy contamination from the workplace and provides a safe and secure work environment for Laboratory employees and visitors. LLNL assures the protection of workers, public, and the environment from existing and future hazards; provides an informed platform from which to develop transition, disposition, and stewardship actions; and aligns the transition, disposition, and long-term stewardship effort with new and evolving mission needs.

While the facilities await final demolition funding, the following transition, disposition, and stewardship actions have been implemented:

- Operating and maintenance costs have been reduced by achieving inactive state;
- Required safety controls are being maintained; and
- Monitoring and surveillance is being performed.

Activities are required to protect workers, the public, and the environment from hazards associated with closed facilities while the following takes place:

- Mission operations are closed out;
- Near-term mitigation and stabilization activities are conducted;
- Baseline characterization is determined; and
- Long-term stewardship is established.

Operational Stewardship Program

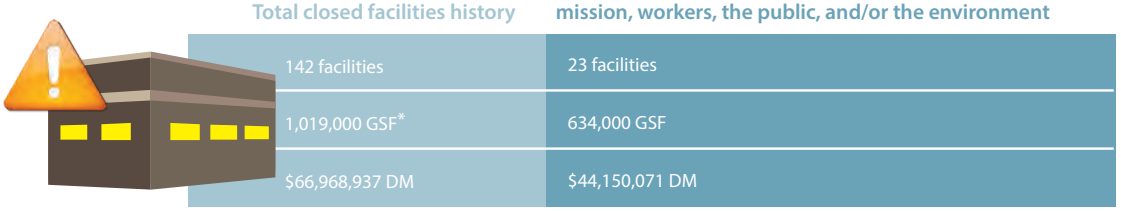
LLNL's Operational Stewardship Program outlines the process, roles, and responsibilities in changing facility status to ensure good stewardship, accountability, management, and utilization of facilities. The program clearly defines life cycle stages along a facility and/or mission, closely aligned with responsibilities and financial obligations.

Headquarters Collaboration

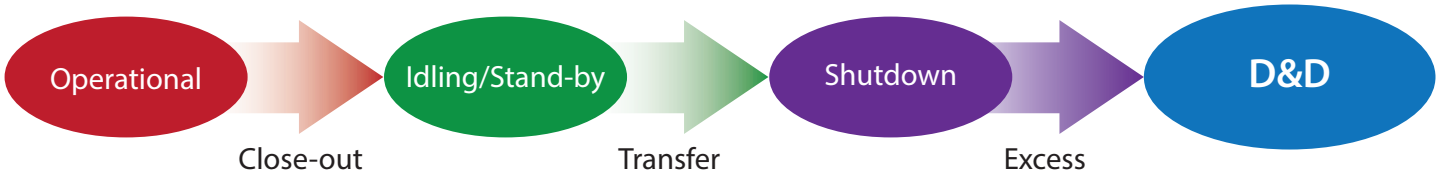
LLNL is an active participant and supporter of the NA-521 Facilities Disposition Prioritization (FDP) Working Group. Great strides have been made in establishing an enterprise-wide legacy facilities risk prioritization process. At the request of NNSA, 2012 efforts established a footprint prioritization process which was updated in 2013 to reflect a risk based prioritization.

LLNL has ranked its legacy facilities using the FDP Working Group criteria, which focuses on risk, cost, and political consequence. The complete list was communicated to NNSA with a focus on the top ten legacy facilities. This list has been consistently presented in the rank order shown in the table at right on p. 71.

Total closed facilities/Facilities and those of the total that pose significant risk to ongoing mission, workers, the public, and/or the environment.



*Includes 200,000 gsf of unusable land with site-aspect encumbrances.



LLNL has processes to meet continually changing facility mission and objectives needs. A framework is in place to move nonenduring facilities from operational status to cool and dim (idling/stand-by) to cold and dark (shutdown) while awaiting decontamination and demolition (D&D).

Top 10 Legacy Facilities

LLNL Rank Order	NNSA Rank Order	Facility	Gross Sq Ft	Net Sq Ft	Federal Owner	Status
1	4	251*	31,128	21,968	NNSA	Legacy Encumbered
4	7	292	20,811	16,886	NNSA	Legacy Encumbered
2	5	280	5,469	5,307	EM	Legacy Encumbered
3	6	175	10,778	9,284	NNSA	Legacy Encumbered
5	–	212	3,770	2,761	NNSA	Legacy Encumbered
10	–	341	44,184	33,091	NNSA	Legacy Encumbered
9	–	865	61,360	54,923	NNSA	Legacy Encumbered
6	–	OS212	71,001	71,001	NNSA	Legacy Site Aspect
8	–	OS222	0	0	EM	Legacy Site Aspect
7	–	OS412	13,700	13,720	NNSA	Legacy Site Aspect

*Recognized by the FDP in the Integrated Project List as a top candidate for action as funds become available.
Legacy Encumbered: Abandoned contaminated programmatic equipment and/or buildings requiring some level of facilities management and/or ES&H monitoring and surveillance.
Legacy Site Aspect: Generally a residual slab or below grade system; managed similarly to Legacy Encumbered.

LLNL invested $1.2M disposing of legacy waste items accumulated over 10 years, substantially reducing risks and liabilities to the government. Of the waste processed, approximately 8,070 cubic feet of radioactive waste and 4,035 cubic feet of California/other waste were shipped to off-site waste repositories. In addition, over 15,000 pounds of scrap metal were diverted to the Donation, Utilization, and Sales (DUS) group.

Constraints and Actions Forward

In response to the government-mandated *Freeze the Footprint* and *Reduce the Footprint* policies, LLNL has developed tighter integration that ties the needs of emerging and innovative science and the constraints posed by closed facilities and legacy aspects. LLNL is exploring partnerships with local vendors to remove excess trailers at a limited cost to LLNL, while the vendor receives salvage value of the trailers for repurposing, further reducing LLNL's excess facility portfolio and adding to reduction levels.

Federal funding for demolition of legacy encumbered facilities is not anticipated until FY16 or beyond. In the interim, risk and consequence data is continually being updated, envelope and contamination control issues are being tightly monitored, and response to system and controls failures are acted upon discovery. Even as closed facilities, process contaminated facilities are a significant financial drain on LLNL's site support budget. The most effective way to bring the ongoing cost to zero is to D&D these facilities.

Building 175 Legacy Encumbered Facility Demolition

Final operations in B175 were relocated this past year due to the building process contamination and failing infrastructure. B175 has been reclassified with NNSA as excess, awaiting D&D funding.

Building 251 Legacy Encumbered Risk Reduction Roof Replacement

Building 251 ceased all operations in 1995 and general maintenance was discontinued in 2009. As such the facility has fallen into disrepair with significant roof leaks over radioactive contaminated areas of the facility. Rainwater capture systems are employed as roof failures are discovered. While B251 is awaiting D&D funding, a roof replacement project is needed to reduce risks.

Trailer and Cold and Dark Facility Transition and Disposition Projects

Continue the footprint reduction efforts through the removal of trailers and other cold and dark facilities including site restoration across both Sites 200 and 300. These projects achieve deferred maintenance reductions as well as footprint reduction. Hazards characterization and service disconnects will be performed by LLNL and required hazards remediation, demolition and disposal will be conducted by a vendor.

List of Acronyms

AM	Advanced Manufacturing
AMP	Asset Management Program
ARG	Accident Response Group
ASC	Advanced Simulation and Computing
ATS	Advanced Technology System
CAS	Condition Assessment Survey
CBI	Capabilities Based Investments
CD-1	Critical Decision-1
CFF	Contained Firing Facility
CREATE	Collaboration in Research and Engineering for Advanced Technology and Education
CTBT	Comprehensive Test Ban Treaty
CTBTO	Comprehensive Nuclear-Test-Ban Treaty Organization
CTS	Commodity Technology System
CW	Domestic Cold Water
CWG	Communications Working Group
D&D	Deactivation and Decommissioning
DDC	Direct Digital Control
DM	Deferred Maintenance
DOD	Department of Defense
DOE	Department of Energy
DSA	Documented Safety Analysis
DUS	Donation, Utilization, and Sales
EAM	Enterprise Asset Management
ECSE	Enhanced Capability for Subcritical Experiments
EI	Exascale Initiative
EISA	Energy Independence and Security Act
EMPC	Energetic Materials Processing Complex
EOC	Emergency Operations Center
ES&H	Environment, Safety, and Health
F&I	Facilities and Infrastructure
FCI	Facility Condition Index
FDP	Facilities Disposition Prioritization
FIB/ESEM	Focused Ion Beam Experimental Scanning Electron Microscope
FIMS	Facilities information Management System
FIRP	Facilities and Infrastructure Recapitalization Program
FPU	First Production Unit
FSC	Forensic Science Center
FXR	Flash X-Ray
FYNSP	Future Year Nuclear Security Plan
GAA	General Access Area
GPP	General Plant Project
gsf	Gross Square Feet
HE	High Explosives
HEAF	High Explosives Application Facility
HED	High Energy Density
HEU	Highly Enriched Uranium
HPC	High Performance Computing
HPCIC	High Performance Computing Innovation Center
HVAC	Heating, Ventilation, and Air Conditioning
ICF	Inertial Confinement Fusion
ICPMS	Inductively Compiled Plasma Mass Spectrometer
IDAC	Infrastructure Data Analysis Center
IFE	Integrated Field Exercise
IGPP	Institutional General Plant Project
IGSC	Integrated Global Security Center
IHE	Insensitive High Explosives
IPL	Integrated Priority List
IT	Information Technology
IW1	Interoperable Warhead
JTOT	Joint Technical Operations Team
LA	Limited Area
LANL	Los Alamos National Laboratory
LC	Livermore Computing
LCW	Low-Conductivity Water
LEED	Leadership in Energy and Envirnomental Design
LEP	Life Extension Programs
LFO	Livermore Field Office

LLMDA	Lawrence Livermore Microbial Detection Array
LLNL	Lawrence Livermore National Laboratory
LLNS	Lawrence Livermore National Security, LLC
LOB	Laboratory Operations Board
LRSO	Long-Range Stand-Off
LVOC	Livemrore Valley Open Campus
MC	Military Characteristics/Material Characterization
MDI	Mission Dependency Index
NARAC	National Atmospheric Release Advisory Center
NASA	National Aeronautics and Space Administration
NCT	Nuclear Counterterrorism
NDAA	National Defense Authorization Act
NDE	Nondestructive Evaluation
NeMS	Network Mapping Systems
NEP	Nuclear Explosives Package
NIF	National Ignition Facility
NIRF	Network Intelligence Research Facility
NFPA	National Fire Protection Association
NNPP	Naval Nuclear Propulsion Program
NNSA	National Nuclear Security Administration
NNSS	Nevada Nuclear Security Site
NSE	Nuclear Security Enterprise
NSSC	Nuclear Security Science Center
OMB	Office of Management and Budget
PDV	Photonic Doppler Velocimetry
PPBE	Planning, Programming, Budgeting, and Evaluation
R&D	Research and Development
RAP	Radiological Assistance Program
RDT&E	Research, Development, Test, and Evaluation
RFI	Request for Information
RHWM	Radiological Hazardous Waste Mangement
RPV	Replacement Plant Value
RTBF	Readiness in Technical Base and Facilities
SCADA	Supervisory Control and Data Acquisition
SCI	Sensitive Compartmented Information
SFE	Special Facilities Equipment
SFI	Significant Finding Investigations
SNL	Sandia National Laboratories
SNM	Special Nuclear Material
SPO	Security Police Officer
SSMP	Stockpile Stewardship Management Plan
SSP	Stockpile Stewardship Program
ST&E	Science, Technology, and Engineering
STS	Stockpile-to-Target Sequence
T&D	Transition and Disposition
TEM	Transmission Electron Microscope
TRU	Transuranic
TYSP	Ten Year Site Plan
UQ	Uncertainty Quantification
WIPP	Waste Isolation Pilot Plant
WMD	Weapons of Mass Destruction