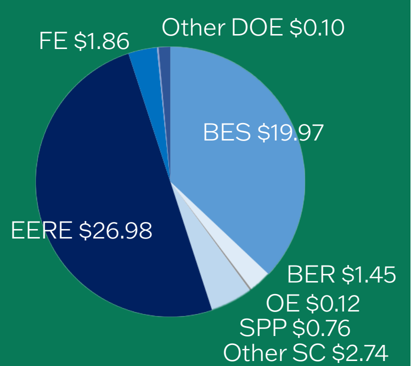
AT A GLANCE: AMES LABORATORY

Ames Laboratory delivers critical-materials solutions to the United States. For more than 73 years, Ames has successfully partnered with Iowa State University of Science and Technology to lead in the discovery, synthesis, analysis, and use of new materials, novel chemistries, and transformational analytical tools. Building upon its core strengths in the science of interfaces, science of synthesis, science of quantum materials, and science of rare earths—plus a proven track record of transitioning basic energy science through early-stage research to licensed technologies and commercialization—Ames leads the nation in translating foundational science for energy and chemical conversion into critical-technology innovation.

FUNDING BY SOURCE

FY 2019 Costs (in $M)
Total Laboratory Operating Costs: $53.99
DOE/NNSA Costs: $53.23
SPP (Non-DOE/Non-DHS) Costs: $0.76
SPP as % of Total Laboratory Operating Costs: 1.4%
DHS Costs: $0.0



FACTS

Location: Ames, Iowa
Type: Single-program Laboratory
Contractor: Iowa State University of Science and Technology
Site Office: Ames Site Office
Website: ameslab.gov

PHYSICAL ASSETS

10 acres and 13 buildings
340,968 gross square feet (GSF) in buildings
Replacement Plant Value: $105M
0 GSF in 0 Excess Facilities
0 GSF in 0 Leased Facilities

HUMAN CAPITAL

300 full-time equivalent (FTE) employees
47 joint faculty
38 postdoctoral researchers
88 undergraduate students
98 graduate students
104 visiting scientists

CORE CAPABILITIES

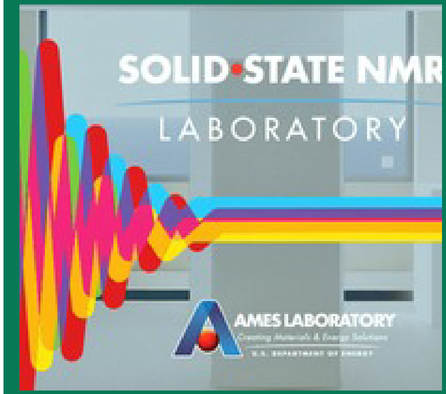
Applied Materials Science and Engineering
Chemical and Molecular Science
Condensed Matter Physics and Materials Science

MISSION UNIQUE FACILITIES

Critical Materials Intitute
Materials Preparation Center
Sensitive Instrument Facility
Powder Synthesis and Development
Dynamic Nuclear Polarization and Nuclear Magnetic Resonance (NMR)
Institute for the Cooperative Upcycling of Plastics (iCOUP)
Center for the Advancement of Topological Semi-metals (CATS)

AT A GLANCE: AMES LABORATORY

ACCOMPLISHMENTS



Unique Facility: Solid-State NMR Laboratory In FY 2020, Ames Laboratory cut the ribbon on a newly remodeled and expanded space to house its state-of-the-art NMR capabilities. Among the instruments is the dynamic nuclear polarization (DNP) solid-state NMR spectrometer endowed with fast magic angle spinning capabilities – the first instrument of its kind in the United States dedicated exclusively to chemical and materials sciences. Conventional and DNP-enhanced solid-state NMR spectroscopy are used in multiple Ames research projects that develop heterogeneous catalysts, semiconductor nanomaterials, polymer recycling strategies, and address other energy-related challenges.

Tech-to-Market Highlight: Recycling Rare Earth Metals from Electronic Waste TdVib, LLC, an Iowa manufacturing company, was awarded a Department of Energy Phase I Small Business Technology Transfer (STTR) grant for $200,000 from the Office of Energy Efficiency and Renewable Energy (EERE) in 2020. The funding supports a goal to demonstrate the feasibility and proof-of-concept for commercially viable and environment-friendly approaches to reclaiming rare earth elements and cobalt from magnets in electronic waste generated in the United States. This Research and Development (R&D) 100 award-winning technology was developed and patented at the Critical Materials Institute; an Energy Innovation Hub led by Ames Laboratory.

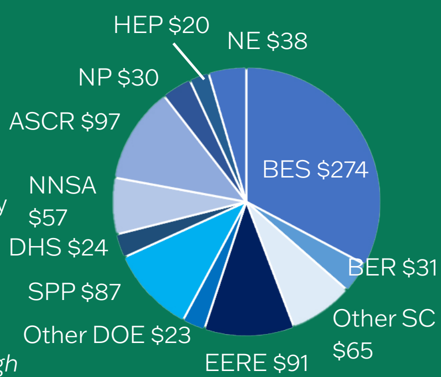
Research Highlight: iCOUP Plastic waste is everywhere in the United States, rapidly piling up in our landfills and leaching into and clogging our waterways. The nearly 27 million tons of plastic waste generated annually in the U.S are full of energy and carbon value, which is currently lost. Ames Laboratory is leading the multi-institutional Energy Research Frontier Center, which is developing methods to selectively "chop" long polymer chains into smaller pieces that will transform them into upcycled products—providing new raw materials for the chemical industry to manufacture useful chemicals, such as lubricants, detergents, and fuels.

AT A GLANCE: ARGONNE NATIONAL LABORATORY

Argonne National Laboratory accelerates science and technology (S&T) to drive U.S. prosperity and security. The laboratory is recognized for seminal discoveries in fundamental science, innovations in energy technologies, leadership in scientific computing and analysis, and excellence in stewardship of national scientific user facilities. Argonne's basic research drives advances in materials science, chemistry, physics, biology, and environmental science. In applied science and engineering, the laboratory overcomes critical technological challenges in energy and national security. The laboratory's user facilities propel breakthroughs in fields ranging from supercomputing and AI applications for science, to materials characterization and nuclear physics, and climate science. The laboratory also leads nationwide collaborations spanning the research spectrum from discovery to application, including the Q-NEXT quantum information science center, Joint Center for Energy Storage Research, and ReCell advanced battery recycling center. To take laboratory discoveries to market, Argonne collaborates actively with regional universities and companies and expands the impact of its research through innovative partnerships.

FUNDING BY SOURCE

FY 2019 Costs (in $M)
Total Laboratory Operating Costs: $837*
DOE/NNSA Costs: $727
SPP (Non-DOE/Non-DHS) Costs: $87
SPP as % of Total Laboratory Operating Costs: 13%
DHS Costs: $24
**Excludes expenditures of monies received from other DOE contractors and through joint appointments of research staff.*



HUMAN CAPITAL

3,448 FTE employees
379 joint faculty
317 postdoctoral researchers
297 undergraduate students
224 graduate students
8,035 facility users
809 visiting scientists

CORE CAPABILITIES

Accelerator S&T
Advanced Computer Science, Visualization, and Data
Applied Materials Science and Engineering
Applied Mathematics
Biological and Bioprocess Engineering
Chemical and Molecular Science
Chemical Engineering
Climate Change Science and Atmospheric Science
Computational Science
Condensed Matter Physics and Materials Science
Cyber and Information Sciences
Decision Science and Analysis
Large-Scale User Facilities/Advanced Instrumentation
Nuclear Engineering
Nuclear Physics
Nuclear and Radio Chemistry
Particle Physics
Systems Engineering and Integration

FACTS

Location: Lemont, Illinois, near Chicago
Type: Multiprogram Laboratory
Contractor:UChicago Argonne, LLC
Site Office: Argonne Site Office
Website: anl.gov

PHYSICAL ASSETS

1,517 acres
156 buildings
$3.9 billion replacement plant value
5.1 million GSF in buildings
0.3 million GSF in leased facilities
0.02 million GSF in 16 exess facilities

MISSION UNIQUE FACILITIES

Advanced Photon Source
Argonne Leadership Computing Facility
Argonne Tandem Linear Accelerator System
Atmospheric Radiation Measurement Southern Great Plains Site
Center for Nanoscale Materials
Materials Engineering Research Facility

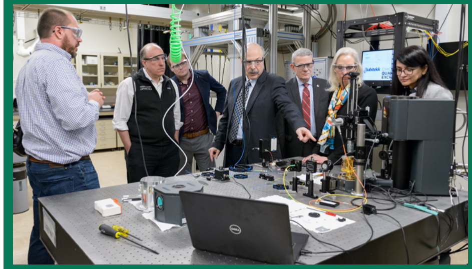
AT A GLANCE: ARGONNE NATIONAL LABORATORY

Argonne NATIONAL LABORATORY

ACCOMPLISHMENTS

Unique Facility: X-rays for Discovery The Advanced Photon Source (APS) is the Nation's highest-energy light source and is used for studies in nearly every scientific discipline. More than 5,000 researchers use the APS annually, making it one of the world's most productive X-ray light source facilities. It has paved the way for better batteries, numerous new therapeutic drugs, more-efficient vehicles, stronger infrastructure materials, and more powerful electronics. Research at the APS has directly led to two Nobel Prizes and contributed to a third. The APS has also made significant contributions in the fight against COVID-19 by supporting research to both identify the protein structures of the virus and find potential pharmaceutical treatments and/or vaccines. The APS upgrade project now underway will make it up to 500 times brighter and vastly expand available research opportunities.

Tech-to-Market Highlight: Argonne Cathode Technology "Game Changer" in Battery Industry The battery that helps power General Motors' plug-in hybrid Chevy Bolt, the 2017 Motor Trend Car of the Year, is based in part on a chemistry breakthrough by Argonne scientists. The researchers used the Advanced Photon Source as part of their toolkit to better understand in real time the reactions that occur inside a battery. The nickel manganese cobalt (NMC) blended cathode structure developed at Argonne offers the longest-lasting energy available in the smallest, lightest package—a 50 to 100 percent increase in energy storage capacity over conventional cathode material. The NMC technology has been licensed to General Motors (Detroit, M.I.), BASF Corporation (Florham Park, N.J.), TODA America, Inc. (Battle Creek, M.I.), and LG Chem.



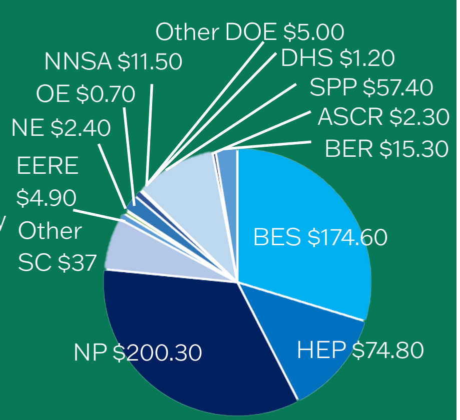
Research Highlight: The Birth of the Quantum Internet Building systems to communicate using quantum mechanics represents one of the most important technological frontiers of the 21st century. Argonne scientists took an important step toward achieving this goal in 2020 when they demonstrated entanglement of photons across a 52-mile "Quantum Loop" in the Chicago suburbs. To ultimately make a national quantum internet a reality, Argonne is leading efforts to develop quantum technologies. Those technologies include quantum repeaters enabling development of "unhackable" networks for information transfer, sensors with unprecedented sensitivities for transformational applications in the physical and life sciences, and "test beds" for both quantum simulators and quantum computers. Argonne's multi-partner Q-NEXT quantum information science center, established in 2020, is accelerating the development of quantum technology.

AT A GLANCE: BROOKHAVEN NATIONAL LABORATORY

With seven Nobel Prize-winning discoveries and more than 70 years of pioneering research, Brookhaven National Laboratory (BNL) delivers discovery science and transformative technology to power and secure the Nation's future. The laboratory leads and supports diverse research teams including other National Laboratories, academia, and industry, by designing, building, and operating major scientific user facilities in support of its DOE mission. These facilities reflect BNL/DOE stewardship of national research infrastructure critical for researchers—such as response to national emergencies (e.g., COVID-19 research). Energy and data science, nuclear science and particle physics, accelerator S&T, quantitative plant science, and quantum information science are Brookhaven's current initiatives. Managed by a partnership between Stony Brook University (SBU) and Battelle plus six universities—Columbia, Cornell, Harvard, MIT, Princeton, and Yale—Brookhaven manages programs that also help prevent the spread of nuclear weapons, protect astronauts on future space missions, and produce medical isotopes to diagnose and treat disease.

FUNDING BY SOURCE

FY 2019 Costs (in $M)
Total Laboratory Operating Costs: $587.5
DOECosts: $528.9
SPP (Non-DOE/Non-DHS) Costs: $57.4
SPP as % of Total Laboratory Operating Costs: 10%
DHS Costs: $1.2



FACTS

Location: Upton, NY
Type: Multiprogram Laboratory
Contractor: Brookhaven Science Associates
Site Office: Brookhaven Site Office
Website: bnl.gov

PHYSICAL ASSETS

5,322 acres and 314 buildings
4.83M GSF in buildings
Replacement plant value: $5.8 B
159,912 GSF in 27 excess facilities
0 GSF in leased facilities

HUMAN CAPITAL

2,421 FTE employees
139 joint faculty
159 postdoctoral researchers
286 undergraduate students
200 graduate students
3,555 facility users
1,523 visiting scientists

CORE CAPABILITIES

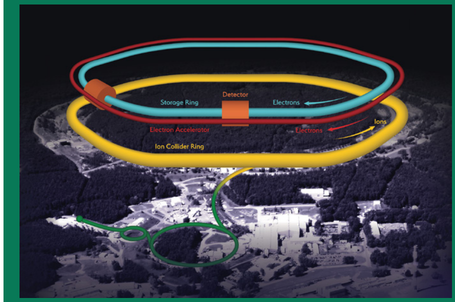
Accelerator S&T
Advanced Computer Science, Visualization, and Data
Applied Materials Science and Engineering
Applied Mathematics
Biological System Science
Chemical and Molecular Science
Chemical Engineering
Climate Change Science and Atmospheric Science
Computational Science
Condensed Matter Physics and Materials Science
Large-Scale User Facilities/R&D Facilities/Advanced Instrumentation
Nuclear and Radio Chemistry
Nuclear Physics
Particle Physics
Systems Engineering and Integration

MISSION UNIQUE FACILITIES

Accelerator Test Facility
Center for Functional Nanomaterials
National Synchrotron Light Source II
Relativistic Heavy Ion Collider

AT A GLANCE: BROOKHAVEN NATIONAL LABORATORY

ACCOMPLISHMENTS



Unique Facility: Electron-Ion Collider In January 2020, DOE named Brookhaven Laboratory as the site for a future Electron-Ion Collider (EIC), a one-of-a-kind nuclear physics research facility to be built in partnership with Thomas Jefferson National Accelerator Facility and New York State. The EIC will reuse key infrastructure from Brookhaven Laboratory's Relativistic Heavy Ion Collider (RHIC) and will serve as a 3D "microscope" for studying quarks and gluons—the building blocks of the protons, neutrons, and atomic nuclei that make up all visible matter in the universe. Scientists from across the Nation and around the world will use the EIC to study the properties of these building blocks of matter and unlock the secrets of the strongest force in nature. Technological advances being developed for the EIC will have widespread benefits for science and society.

Tech-to-Market Highlight: Application-Specific Integrated Circuits Several companies have licensed Brookhaven Laboratory intellectual properties that cover application-specific integrated circuits (ASICs) that were originally conceived by laboratory scientists for detectors in nuclear and particle physics experiments. These physics experiments generally require hundreds of integrated circuits produced within specified constraints of low noise, high precision, and high speed while maintaining low power consumption and low cost—attributes attractive to many industrial applications. Licensees of Brookhaven's intellectual properties are incorporating such ASICs in products designed for imaging and monitoring applications in the security, nuclear power, and medical industries.

Research Highlight: Going the Distance for Quantum Networking Scientists from Brookhaven Laboratory and SBU recently demonstrated a three-node quantum network prototype, extending the reach and potential of future quantum communication systems. Such networks are based on the extraordinary phenomena of quantum physics, including quantum entanglement—where the properties of photons are intertwined even when those particles are separated by vast distances. The team recently transmitted single-photon level polarized quantum bits ("qubits") in a looping configuration for approximately 87 miles, using commercially available telecommunications fiber connecting the SBU and Brookhaven campuses. The achievement marks the longest successful quantum communication link experiment in the United States and is a significant step toward achieving a secure quantum network that could revolutionize the way people communicate.

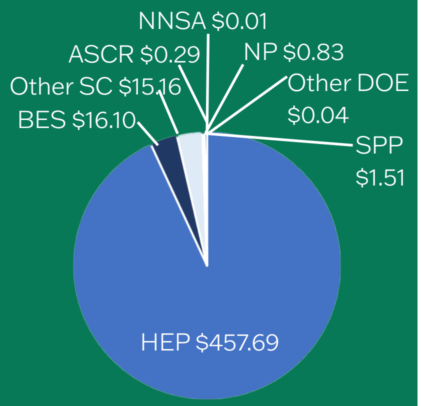
AT A GLANCE: FERMI NATIONAL ACCELERATOR LABORATORY

Fermilab

Fermilab's mission is to be the frontier laboratory for particle physics discovery. The accelerator complex powers research into the fundamental nature of the universe and is the only one in the world to produce both low- and high-energy neutrino beams for science and also enable precision science experiments. The construction of the Long-Baseline Neutrino Facility (LBNF) and Deep Underground Neutrino Experiment (DUNE), along with the world's most intense neutrino beams made possible by the Proton Improvement Plan II (PIP-II) project, will be the first international mega-science project based at a DOE National Laboratory. Fermilab integrates U.S. researchers into the global particle physics enterprise through its experiments and programs in neutrino, collider, precision, and cosmic science. The laboratory's scientific R&D advances accelerator, detector, computing, and quantum technology for use in science and society.

FUNDING BY SOURCE

FY 2019 Costs (in $M)
Total Laboratory Operating Costs: $491.64*
DOE Costs: $490.12
SPP (Non-DOE/Non-DHS) Costs: $1.51
SPP as % of Total Laboratory Operating Costs: 0.3%
DHS Costs: $0.0
**Reflects funding of $15.537M provided by SLAC for LCLS-II work.*



HUMAN CAPITAL

1,810 full-time equivalent (FTE) employees
22 joint faculty
95 postdoctoral researchers
65 undergraduate students
30 graduate students
2,610 Fermilab accelerator complex users
1,162 other Fermilab users (including US-CMS)
27 visiting scientists

CORE CAPABILITIES

Accelerator S&T
Advanced Computer Science, Visualization, and Data
Large-Scale User Facilities/Advanced Instrumentation
Particle Physics

MISSION UNIQUE FACILITIES

Fermilab Accelerator Complex

FACTS

Location: Batavia, Illinois (40 miles west of Chicago)
Type: Single-program Laboratory
Contractor: Fermi Research Alliance, LLC
Site Office: Fermi Site Office
Website: fnal.gov

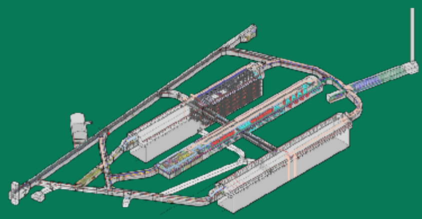
PHYSICAL ASSETS

6,800 acres and 365 buildings
2.4 million GSF in buildings
Replacement plant value: $2.44 billion
28,913 GSF in 10 excess facilities
22,155 GSF in leased facilities

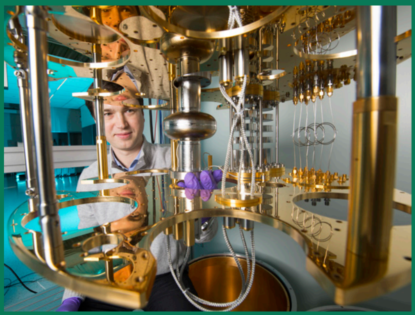
AT A GLANCE: FERMI NATIONAL ACCELERATOR LABORATORY

Fermilab

ACCOMPLISHMENTS



Unique Facility: Long-Baseline Neutrino Facility Construction for two major projects with international contributions is underway at Fermilab to advance the DOE High Energy Physics program: the LBNF, which will host DUNE, and the PIP-II project. More than 1,000 scientists from over 30 countries are working on the DUNE experiment to explore the mysteries of neutrinos. They are seeking to answer some of the biggest questions regarding our understanding of the universe, such as the origin of matter and the nature of subatomic particles. The PIP-II project will upgrade the Fermilab Accelerator Complex facility with a 700-foot-long, state-of-the-art superconducting particle accelerator. PIP-II will also enable the world's most intense neutrino beam for DUNE, plus a broad physics research program that will power new discoveries for many decades to come.



Tech-to-Market Highlight: From Particle Physics Technologies to Quantum Computers and the Quantum Internet Fermilab scientists have demonstrated that superconducting radiofrequency cavities can increase the length of time that a quantum device can maintain information, which is crucial to engineering the next-generation quantum computers and sensors. Building upon this technological breakthrough, together with Rigetti Computing and other partners, Fermilab scientists are using their expertise in superconducting radiofrequency (SRF) cavities and cryogenics to build scalable superconducting quantum computing systems at the DOE-funded Superconducting Quantum Materials and Systems Center. Also, in 2017, Fermilab planted the seeds for a quantum internet by installing the Fermilab Quantum Network (FQNET), a long-term partnership with AT&T, Caltech, and Fermilab. FQNET successfully demonstrated quantum teleportation in 2018. Fermilab and its partners are now expanding the point-to-point network to a multinode system that will crisscross Chicagoland—the third largest metropolitan area in the U.S.

Research Highlight: World Record Magnets for Future Proton Accelerators Powerful niobium-tin superconducting magnets are key components of high-energy proton accelerators and have applications in many other areas, including medical imaging. In a multiyear effort involving Fermilab, Brookhaven, and Berkeley National Laboratories, researchers successfully designed, built, and tested the first of 16 powerful beam-focusing magnets that the laboratories will provide for the High-Luminosity Large Hadron Collider at CERN. The effort set a world record for the highest field strength in a focusing magnet, reaching up to 13 teslas. Also, Fermilab and its partners in the U.S. Magnet Development Program are developing steering magnets for a potential successor to the Large Hadron Collider (which operates with a steering field of 7.8 teslas). In 2020, the program set the world record for the highest field strength for a steering magnet, achieving 14.5 teslas.

U.S. DEPARTMENT OF ENERGY

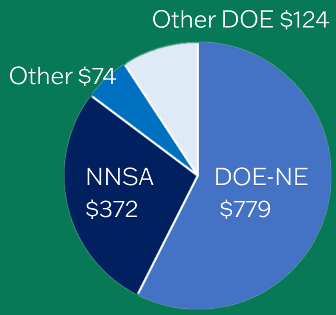
AT A GLANCE: IDAHO NATIONAL LABORATORY

Idaho National Laboratory (INL) serves as the U.S. leader for advanced nuclear energy R&D and is home to an unparalleled combination of nuclear energy test-bed facilities, including those that focus on fuel development and fabrication, steady-state and transient irradiation, and macro- and microscale post-irradiation examination. INL's applied science and engineering discipline and problem-solving approach helps the Departments of Defense and Homeland Security, as well as industry, solve significant national security challenges in critical infrastructure protection, cybersecurity, and nuclear nonproliferation. INL's strategic initiatives include research related to resilient cyber-physical security, integrated energy systems (including clean energy technologies) and advanced manufacturing.

Under the DOE Office of Nuclear Energy (DOE-NE)'s direction, INL leads multipe initiatives to provide the nuclear community with access to the technical, regulatory, and financial expertise necessary to move innovative nuclear energy technologies (e.g., microreactors) toward commercialization while ensuring the continued safe, economical operation of the existing nuclear fleet.

FUNDING BY SOURCE

FY 2019 Costs (in $M)
Total Laboratory Operating Costs: $1,349
DOE/NNSA Costs: $980
SPP (Non-DOE/Non-DHS) Costs: $300
SPP as % of Total Laboratory Operating Costs: 22%
CRADA: $9
DHS Costs: $61



HUMAN CAPITAL

4,888 FTE employees
36 joint faculty
68 postdoctoral researchers
20 high school student interns
265 undergraduate students
200 graduate students
691 facility users
12 visiting scientists

CORE CAPABILITIES

Advanced Computer Science, Visualization, and Data
Applied Materials Science and Engineering
Biological and Bioprocess Engineering
Chemical Engineering
Chemical and Molecular Science*
Condensed Matter Physics and Materials Science*
Cyber and Information Sciences
Decision Science
Environmental Subsurface Science and Analysis
Large-Scale User Facilities and Advanced Instrumentation
Mechanical Design and Engineering
Nuclear Engineering
Nuclear and Radiochemistry Power Systems and Electrical Engineering
Systems Engineering and Integration Physics
Emerging Capabilities

FACTS

Location: Idaho Falls, Idaho
Type: Multiprogram Laboratory
Contractor: Battelle Energy Alliance
Site Office: Idaho Operations Office (DOE-ID)
Website: inl.gov

PHYSICAL ASSETS

569,180 acres
540 buildings or real property assets (DOE-owned assets operating or on standby)
$5.6 billion replacement plant value
2.3 million GSF in owned operating buildings; 9,609 GSF in operational standby buildings
1 million GSF in leased facilities
20,363 GSF in three excess facilities

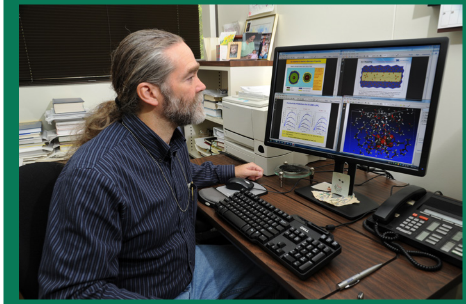
MISSION UNIQUE FACILITIES

Transient Reactor Test Facility
Irradiated Materials Characterization Laboratory
Fuel Manufacturing Facility
Experimental Fuels Facility
Space and Security Power Systems Facility
Critical Infrastructure Test Range Complex
Biomass Feedstock National User Facility
Wireless Security Institute
Cybercore Integration Center
Advanced Test Reactor
Specific Manufacturing Capability

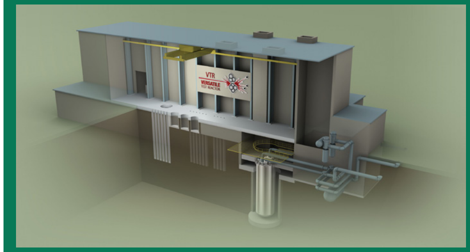
AT A GLANCE: IDAHO NATIONAL LABORATORY

ACCOMPLISHMENTS

Unique Facilities: Nuclear Energy R&D No other place in the nation hosts as many capabilities for assessing the technical and operational feasibility of new types of nuclear fuels and materials as INL. The Advanced Test Reactor is the only research reactor in the country capable of providing large-volume, high-flux neutron irradiation in a prototype environment. Its unique serpentine core allows its corner lobes to be operated at different power levels, meaning it can conduct multiple simultaneous experiments under different testing conditions. The Transient Reactor Test (TREAT) facility is helping to re-establish U.S. leadership in an essential nuclear research field, as TREAT's unique design monitors in real time a fuel or other material's behavior under postulated reactor accident conditions. Resources such as the Hot Fuel Examination Facility and the Irradiated Materials Characterization Laboratory provide state-of-the-art tools for microstructural and thermal characterization of irradiated materials. The results of these examinations are then used to advance fuel or material design and qualification.



Tech-to-Market Highlight: Advanced Electrolyte Model Computer Simulation Program INL is well-known for its Battery Testing Center and research capabilities, which have yielded numerous innovations in battery testing and development. One such technology is INL's R&D 100 Award winning Advanced Electrolyte Model (AEM). This computer simulation program is designed to give fast information on the properties of complex electrolyte formulations and how they can influence battery performance. AEM accelerates the speed at which new cell designs with new electrolytes can be developed. Since its debut in 2010, AEM has been licensed broadly to universities, major consumer product companies and industrial users—including chemical and automotive companies as well as a major lithium-ion cell manufacturer.



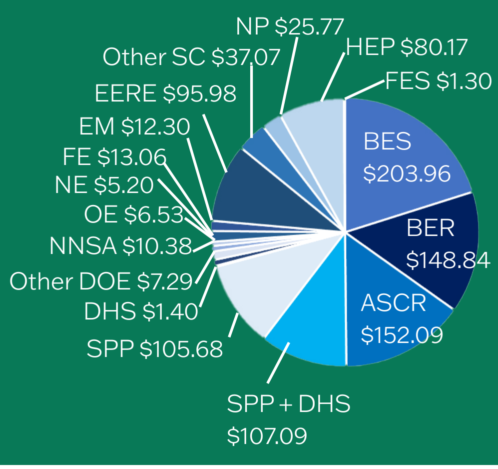
Research Highlight: Digital Engineering As a result of proven benefits in other industries, INL launched a digital engineering program to support new projects such as the Versatile Test Reactor (VTR). Digital engineering (DE) strategies can predict reactor performance and design issues early in the process, minimizing cascading risk. Numerous advances in the VTR design and engineering processes have already been achieved using DE. For example, a 3D model was developed in the first three months of the project—10 times faster than similar past efforts. The VTR is the first DOE nuclear program using cloud computing to reduce technical barriers such as computer performance—reducing latency by a factor of 100 during peak use.

AT A GLANCE: LAWRENCE BERKELEY NATIONAL LABORATORY

Berkeley Laboratory creates useful new materials, advances the frontiers of computing, develops sustainable energy and environmental solutions, and probes the mysteries of life, matter and the universe. Deep integration of basic and applied science, advanced instrumentation, large-scale team science, and collaboration with the international scientific community enhance the laboratory's strengths, which lie in materials, chemistry, physics, biology, Earth and environmental science, mathematics, and computing. Berkeley's five national user facilities provide 14,000 researchers each year with capabilities in high-performance computing and data science, materials synthesis and characterization, and genomic science. Founded in 1931, Berkeley Laboratory's research and its scientists have been recognized with 14 Nobel Prizes.

FUNDING BY SOURCE

FY 2019 Costs (in $M)
Total Laboratory Operating Costs: $907.07
DOE/NNSA Costs: $800
SPP (Non-DOE/Non-DHS) Costs: $105.68
SPP as % of Total Laboratory Operating Costs: 11.7%
DHS Costs: $1.4



FACTS

Location: Berkeley, CA
Type: Multiprogram Laboratory
Contractor: University of California
Site Office: Bay Area Site Office
Website: lbl.gov

PHYSICAL ASSETS

202 acres and 97 buildings
1.7M GSF in DOE-owned and operated buildings
Replacement plant value: $1.49B
16,449 GSF in excess buildings
315,471 GSF in leased facilities
20,363 GSF in three excess facilities

HUMAN CAPITAL

3,398 FTE employees
1,699 scientists and engineers
245 joint faculty
513 postdoctoral researchers
332 graduate students
159 undergraduates
13,990 facility users
1,611 visiting scientists and engineers

CORE CAPABILITIES

Accelerator S&T
Advanced Computer Science, Visualization, and Data
Applied Materials Science and Engineering
Applied Mathematics
Biological and Bioprocess Engineering
Biological Systems Science
Chemical Engineering
Chemical and Molecular Science
Climate Change Science and Atmospheric Science
Computational Science
Condensed Matter Physics and Materials Science
Cyber and Information Sciences
Decision Science and Analysis
Earth Systems Science and Engineering
Environmental Subsurface Science
Large-Scale User Facilities/Advanced Instrumentation
Mechanical Design and Engineering
Nuclear and Radio Chemistry
Nuclear Physics
Particle Physics
Power Systems and Electrical Engineering

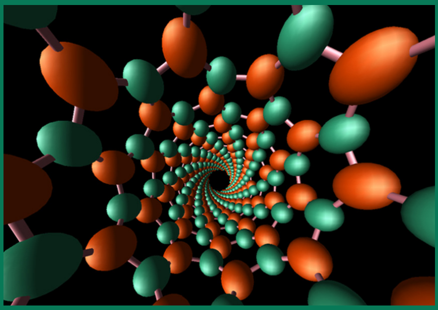
MISSION UNIQUE FACILITIES

Advanced Biofuels Process Demonstration Unit
Advanced Light Source (ALS)
BELLA (Berkeley Laboratory Laser Accelerator)
Joint Genome Institute (JGI)
Energy Sciences Network (ESnet)
FLEXLAB (Integrated Building and Grid Technologies Testbed)
Joint BioEnergy Institute (JBEI)
The Molecular Foundry
National Energy Research Scientific Computing Center (NERSC)
88-Inch Cyclotron

AT A GLANCE: LAWRENCE BERKELEY NATIONAL LABORATORY

ACCOMPLISHMENTS

Unique Facility: Integrative Genomics Building The Integrative Genomics Building (IGB) at Lawrence Berkeley National Laboratory is a four-story research and office building that accommodates three DOE research programs: the Joint Genome Institute (JGI), the Systems Biology Knowledgebase (KBase), and the National Microbiome Data Collaborative (NMDC). JGI provides integrated high-throughput sequencing, DNA design and synthesis, metabolomics, and computational analysis that enable systems-based scientific approaches to these challenges. KBase, a collaboration with laboratories including Argonne, Oak Ridge, and Brookhaven, gives users data and tools designed to help build increasingly realistic models for biological function. The NMDC empowers the research community to harness microbiome data exploration and discovery through a collaborative integrative data science ecosystem. By uniting experts and world-class technologies under one roof—to increase resource efficiencies and scientific synergies for these programs—the IGB will help transform plant and microbial genomics research into solutions for today's most pressing environmental and energy issues. or material design and qualification.



Tech-to-Market Highlight: Next-generation Boron Nitride Nanotubes The boron nitride nanotube (BNNT) is a breakthrough material for energy, aerospace, electronics, and medicine applications. Invented by Lawrence Berkeley National Laboratory, the technology allows the quality scale-up of a material that is 100 times stronger than steel, heat resistant to 900°C, radiation-absorbing, hydrophobic, and capable of hydrogen storage. Additional advantages of BNNTs include high functionalization and thermal conductivity as well as band gap tunability, lending them as superior to carbon nanotubes. The patented technology is now being manufactured by EPIC Advanced Materials. Notably, one potential application is a breathalyzer to detect the COVID-19 virus.

Research Highlight: PDK: The First Truly Recyclable Plastic Even the most recyclable plastic, PET, or polyethylene terephthalate is only recycled at a rate of 20 to 30 percent, with the rest typically going to incinerators or landfills, where the carbon-rich material takes centuries to decompose. Lawrence Berkeley National Laboratory has designed a recyclable plastic that, like a Lego playset, can be disassembled into its constituent parts at the molecular level, and then reassembled into a different shape, texture, and color again and again, without loss of performance or quality. The new material, called polydiketoenamine (PDK) was reported in the journal Nature Chemistry.

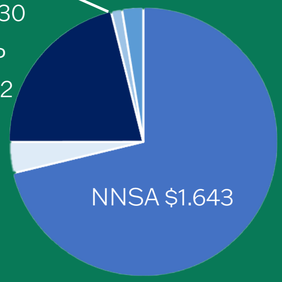
U.S. DEPARTMENT OF ENERGY

AT A GLANCE: LAWRENCE LIVERMORE NATIONAL LABORATORY

S&T on a mission—this is the hallmark of Lawrence Livermore National Laboratory (LLNL). In service to DOE/National Nuclear Security Administration (NNSA) and other federal agencies, LLNL develops and applies world-class S&T to ensure the safety, security, and reliability of the nation's nuclear deterrent. Founded in 1952, LLNL also applies S&T to confront dangers ranging from nuclear proliferation and terrorism to energy shortages and climate change that threaten national security and global stability. Using a multidisciplinary approach that encompasses all disciplines of science and engineering—and that utilizes unmatched facilities—the laboratory pushes the boundaries to provide breakthroughs for counterterrorism and nonproliferation, defense and intelligence, and energy and environmental security.

FUNDING BY SOURCE

FY 2019 Costs (in $M)
Total Laboratory Operating Costs: $2.21 billion
DOE/NNSA Costs: $1.9 billion
SPP (Non-DOE/Non-DHS) Costs: $306 million
SPP as % of Total Laboratory Operating Costs: 13.9%
DHS Costs: $23 million



FACTS

Location: Livermore, California
Type: Multidisciplinary National Security Laboratory
Contractor: Lawrence Livermore National Security, LLC
Site Office: Livermore Field Office
Website: llnl.gov

PHYSICAL ASSETS

7,700 acres
517 buildings
$20.2 billion replacement plant value*
6.4 million GSF in active buildings
0.6 million GSF in 88 non-operational buildings
24,000 GSF in leased facilities

**In FY 2019 NNSA implemented a new tool (BUILDER) to calculate the replacement plant value (RPV) for buildings and trailers. The change in modeling platforms produced new values and we are in the process of validating the updated figures with NNSA. In FY20+, the utility and other structures and facilities (OSF) assets will start migrating into BUILDER.*

HUMAN CAPITAL

7,378 FTE employees
18 joint faculty
253 postdoctoral researchers
184 undergraduate students
138 graduate students
531 contractors (non-LLNS employees)

CORE CAPABILITIES

Advanced Materials and Manufacturing
All-Source Intelligence Analysis
Bioscience and Bioengineering
Earth and Atmospheric Sciences
High-Energy-Density Science
High-Performance Computing, Simulation and Data Science
Lasers and Optical S&T
Nuclear, Chemical and Isotopic S&T
Nuclear Weapons Design and Engineering

MISSION UNIQUE FACILITIES

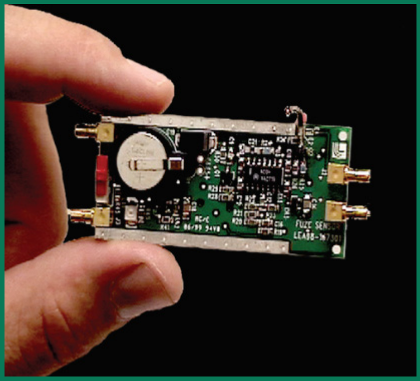
Advanced Manufacturing Laboratory
Center for Accelerator Mass Spectrometry
Center for Bioengineering
Center for Micro and Nanotechnology
Contained Firing Facility
Forensic Science Center
High-Explosives Applications Facility
Livermore Computing Complex
National Atmospheric Release Advisory Center
National Ignition Facility

AT A GLANCE: LAWRENCE LIVERMORE NATIONAL LABORATORY

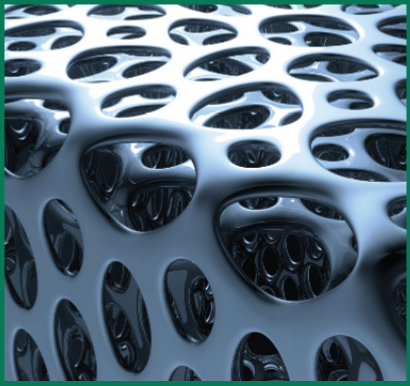
Lawrence Livermore National Laboratory

ACCOMPLISHMENTS

Unique Facility: One of the World's Premier High-Performance Computing (HPC) Facilities LLNL is home to Livermore Computing (LC), one of the world's premier HPC facilities. LC boasts more than 188 petaflops of computing power and numerous TOP500 systems, including the 125-petaflop Sierra. Continuing the long lineage of world-class LLNL supercomputers, Sierra represents the penultimate step on the road to exascale computing, expected to be achieved by 2023 with an LLNL system called El Capitan. These flagship systems are GPU-enabled and produce multi-physics simulations in 3D at never-before-seen resolutions for a variety of mission-critical needs. In 2020, LLNL and Cerebras Systems integrated the world's largest computer chip into the Lassen system, upgrading the top-tier supercomputer with cutting-edge AI technology. This combination creates a radically new type of computing solution, enabling researchers to investigate novel approaches to predictive modeling.



Tech-to-Market Highlight: Micropower Impulse Radar (MIR) The laboratory's compact, lightweight MIR uses very short electromagnetic pulses and can detect objects at a much shorter range than conventional radar can. MIR has been used in, among other applications, fluid-level sensing, medical applications, nondestructive evaluation, motion detection, and devices to detect breathing through walls or rubble to assist in rescue after disasters. The portable radar system was the first that SWAT and land-mine detection teams were able to use in the field. Search and rescue missions, including those on 9/11, have used MIR devices to detect lung or heart movements of people buried under rubble. Since 1994, MIR has held 197 patents and 44 licenses—more than any other technology in LLNL history. It was developed using $10 worth of off-the-shelf materials.



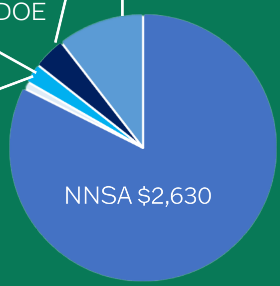
Research Highlight: Advanced Materials and Manufacturing In support of national security applications and to meet broader national needs, LLNL is making significant advances in capabilities to develop specialized materials together with processes and systems for product manufacturing and qualification. LLNL researchers are approaching advanced manufacturing as a fully integrated process from discovery and development of optimized materials to manufactured product. The goal is to achieve better products at reduced cost, infrastructure footprint, and development times. Successes include printed glass, aerospace-grade carbon fiber composite, and marine-grade stainless steel, as well as micro-structured materials with unprecedented properties (e.g., graphene aerogels for supercapacitors). In addition, advances in underlying science, experimentation and high-performance computing with machine learning are being combined to develop innovative means for improving fabrication, printing speeds, and product quality. Partnerships with industry and academia make vital contributions to these efforts.

AT A GLANCE: LOS ALAMOS NATIONAL LABORATORY

As a premier national security science laboratory, Los Alamos National Laboratory applies innovative and multidisciplinary science, technology, and engineering to help solve the toughest challenges of the nation—and to protect it as well as the world. In delivering mission solutions, Los Alamos ensures the safety, security, and effectiveness of the U.S. nuclear deterrent and reduces emerging national security and global threats. The multidisciplinary focus of the laboratory's mission extends to nuclear nonproliferation, counterproliferation, energy and infrastructure security, and technology—to counter chemical, biological, radiological, and high-yield explosives threats.

FUNDING BY SOURCE

FY 2019 Costs (in $M)
Total Laboratory Operating Costs: $2,609
DOE/NNSA Costs: $2,361
SPP (Non-DOE/Non-DHS) Costs: $299
SPP as % of Total Laboratory Operating Costs: 9%
DHS Costs: $9



HUMAN CAPITAL

9,831 FTE employees
31 joint faculty
460 postdoctoral researchers
604 graduate students (688 during summer peak)
847 undergraduate students
995 faculty users
855 visiting scientists
1,080 craft employees

CORE CAPABILITIES

Complex Natural and Engineered Systems
Information, Science, and Technology
Materials for the Future
Nuclear and Particle Futures
Science of Signatures
Weapons Systems

FACTS

Location: Los Alamos, NM
Type: Multiprogram Laboratory
Contractor: Triad National Security, LLC
Site Office: NNSA Los Alamos Field Office
Website: lanl.gov

PHYSICAL ASSETS

24,612 acres
896 buildings
8,240,164 GSF in buildings
Replacement Plant Value: $39.1 billion
1 million GSF in leased facilities

MISSION UNIQUE FACILITIES

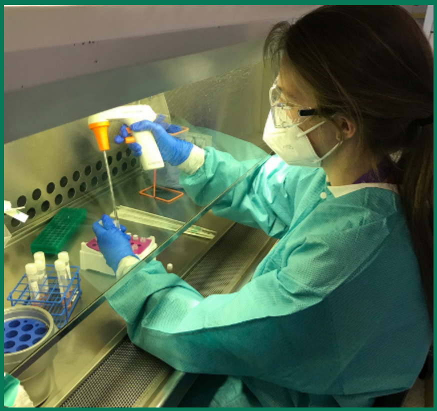
Atmospheric Radiation Measurement (ARM) (user facility)
Center for Explosives Science
Center for Integrated Nanotechnologies (CINT) (user facility)
Chemistry and Metallurgy Research Facility
Dual-Axis Radiographic Hydrodynamic Test Facility (DARHT)
Electron Microscopy Laboratory
Ion Beam Materials Laboratory
Los Alamos Neutron Science Center (LANSCE) (user facility)
National Criticality Experiments Research Center (NCERC), Nevada
Nonproliferation & Internal Security Facility
Plutonium Science & Manufacturing Facility
National High Magnetic Field Laboratory (NHMFL) (user facility)
NNSA's Plutonium Center of Excellence
Proton Radiography (pRad) @ LANSCE
SIGMA Complex for Materials Manufacturing & Machining
Strategic Computing Complex (SCC)
National High Magnetic Field Laboratory (NHMFL)
Weapons Neutron Research Facility @ LANSCE

AT A GLANCE: LOS ALAMOS NATIONAL LABORATORY

ACCOMPLISHMENTS

Unique Facility: Los Alamos Neutron Science Center (LANSCE) LANSCE is a national user facility with one of the nation's most powerful linear accelerators. For more than 30 years, LANSCE has provided the scientific underpinnings in nuclear physics and material science needed to ensure the safety and surety of the nuclear stockpile into the future. In addition to national security research, the LANSCE user facility has a vibrant research program in fundamental science, providing the scientific community with intense sources of neutrons and protons—to perform experiments supporting civilian research as well as the production of medical and research isotopes.

Technology to Market: Next-Generation Fuel Cells To address the high cost of precious metal catalysts used in conventional fuel cells, Los Alamos scientists developed electrocatalysts that use inexpensive, Earth-abundant, and easily sourced precursor materials—instead of precious metals. Los Alamos partnered with Pajarito Powder, LLC, which is taking the lead in commercializing the technology for numerous applications. These clean-energy electrocatalysts without precious metals generate performance quickly approaching that of precious metal catalysts—but at a fraction of the cost, thus reducing the time-to-market for fuel cell technologies that provide clean, reliable, and now affordable energy.



Research Highlight: Biotechnology Los Alamos is advancing biotechnology research that is leading to innovations in energy, health, and sustainability. The Los Alamos expertise in synthetic biology, synthetic organic chemistry, biochemistry, and cell and molecular biology provides the basis for strong biotechnology capabilities. These capabilities address national needs such as producing bio-based alternatives to fossil fuels and petroleum-based products, as well as developing new therapeutics through natural products discovery. Biotechnology at Los Alamos is strengthened by a robust, interdisciplinary approach to science, including access to high performance computing and modeling, machine learning and artificial intelligence, next-generation sequencing, unique bioinformatics, flow cytometry and cell sorting, and customizable affinity reagents.

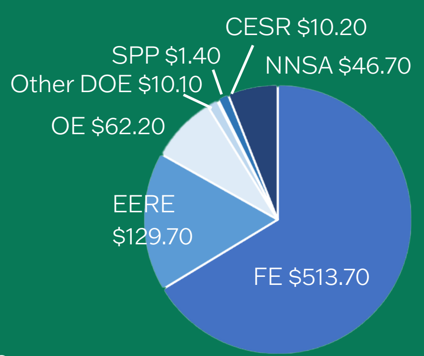
AT A GLANCE: NATIONAL ENERGY TECHNOLOGY LABORATORY

NATIONAL ENERGY TECHNOLOGY LABORATORY

The National Energy Technology Laboratory's (NETL) mission is to discover, integrate and mature technology solutions to enhance the Nation's energy foundation and protect the environment for future generations. NETL's advanced technology development is crucial to U.S. energy innovation. Through R&D, partnerships, and initiatives, NETL enables production of the clean, reliable, and affordable energy required to increase domestic manufacturing, improves our nation's energy infrastructure, enhances electrical grid reliability and resilience, expands domestic energy production, educates future scientists and engineers, promotes workforce revitalization, and supports U.S. energy and national security goals. As the only government-owned and government-operated laboratory in the DOE complex, NETL and its predecessor laboratories support DOE goals by maintaining nationally recognized technical competencies and collaborating with partners in industry, academia, and other research organizations to nurture emerging technologies.

FUNDING BY SOURCE

FY 2019 Costs (in $M)
Total Laboratory Operating Costs: $303
DOE/NNSA Costs: $773
SPP (Non-DOE/Non-DHS) Costs: $1.4
SPP as % of Total Laboratory Operating Costs: 0.46%
DHS Costs: $0
Active Research (DOE + Performer Share): $6.953 billion



FACTS

Location: Pittsburgh, PA; Morgantown, WV; Albany, OR; Houston, TX; Anchorage, AK
Type: Multiprogram Laboratory*
Website: netl.doe.gov
**The only government-owned and government-operated laboratory among the 17 National Laboratories.*

PHYSICAL ASSETS

237 acres
110 buildings
$686.5 million replacement plant value
1,137,097 GSF in buildings
13,225 GSF in leased facilities
15,078 GSF in 3 excess facilities

HUMAN CAPITAL

1,712 FTE employees
108 joint faculty
121 postdoctoral researchers
54 undergraduate students
115 graduate students

CORE CAPABILITIES

Applied Materials Science and Engineering
Chemical Engineering
Computational Science
Decision Science and Analysis
Environmental Subsurface Science
Systems Engineering and Integration

MISSION UNIQUE FACILITIES

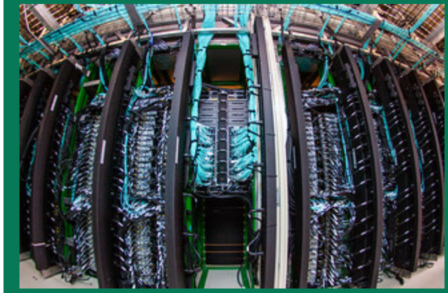
Pittsburgh, PA
Carbon Capture Materials Synthesis Laboratory
Subsurface Experimental Laboratory
Center for Data Analytics and Machine Learning
Biogeochemistry and Water Laboratory

Albany, OR
Severe Environment Corrosion Erosion Research Facility
Magnetohydrodynamics (MHD) Laboratory
Metals Fabrication Laboratory / Metals Melting Facility

Morgantown, WV
Center for High Performance Computing (Joule 2.0 Supercomputer)
Reaction Analysis and Chemical Transformation (ReACT) Facility
Solid Oxide Fuel Cell Manufacturing and Test Laboratory
Center for Advanced Imaging and Characterization

AT A GLANCE: NATIONAL ENERGY TECHNOLOGY LABORATORY

ACCOMPLISHMENTS



Unique Facility: Key Computational Science and Engineering Facilities Supercomputing is essential in achieving NETL's mission to discover, integrate, and mature technology solutions that enhance the nation's energy foundation and protect the environment for future generations. By expediting technology development through computational science and engineering, NETL can cut costs, save time, and spur valuable economic investments with a global impact. NETL's Center for High-Performance Computing is home to NETL's supercomputer, Joule 2.0. This supercomputer enables the numerical simulation of complex physical phenomena. Joule 2.0 provides computational throughput to run high-fidelity modeling tools at various scales, ranging from molecules, to devices, to entire power plants and natural fuel reservoirs. Facilities associated with Joule allow for enhanced visualization and data analysis, as well as data storage capabilities that enable researchers to discover new materials, optimize designs, and predict operational characteristics.

Tech-to-Market Highlight: Breakthroughs in Laser-induced Breakdown Spectroscopy NETL researchers revolutionized a laser-induced breakdown spectroscopy (LIBS) subsurface monitoring tool that, because of its simplified construction, reduces the amount of fabrication and alignment needed, thereby minimizing costs. Developed for use in harsh, remote environments, the improved technology requires only two mirrors—as opposed to four in previous versions. By reducing the complexity and cost of the laser head, the probe maximizes the amount and quality of light returned for improved analysis and increases the usefulness of LIBS research. This effort won a 2019 R&D 100 Award and was awarded a U.S. patent.

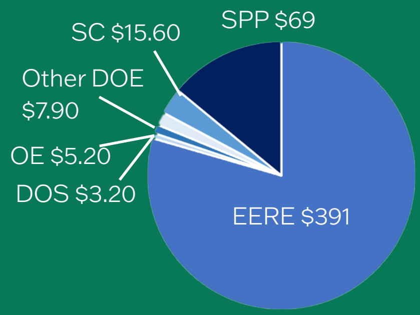
Research Highlight: IDAES Computational Platform The Institute for the Design of Advanced Energy Systems (IDAES) develops and utilizes multi-scale, optimization-based computational tools to improve the design and operation of fossil energy systems—both the existing fleet and the innovative, advanced coal energy systems of the future. The open-source, next-generation IDAES computational platform revolutionizes industry decision-making by enabling large-scale optimization to gain system-wide insights—to enhance the operation, profitability, efficiency, and design of energy systems. In 2019, IDAES worked extensively with the Escalante Generating Station to improve flexibility and efficiency, while also rolling out the computational platform to multiple stakeholders through its initial open-source release and two major workshops. This effort won a 2020 R&D 100 Award.

AT A GLANCE: NATIONAL RENEWABLE ENERGY LABORATORY

National Renewable Energy Laboratory (NREL) is DOE's primary National Laboratory for renewable energy and energy efficiency R&D. The laboratory delivers impactful scientific discoveries, innovations, and insights that transform clean energy technologies, systems, and markets. Also, the laboratory's research focuses on engineering of energy efficiency, sustainable transportation, and renewable power technologies and provides the knowledge to integrate and optimize energy systems. Finally, NREL's mission space delivers foundational knowledge, technology and systems innovations, and analytic insights to catalyze a transformation to a renewable and sustainable energy future.

FUNDING BY SOURCE

FY 2019 Costs (in $M)
Total Laboratory Operating Costs: $491.8
DOE/NNSA Costs: $420.2
TPP (Non-DOE/Non-DHS) Costs: $71
TPP as % of Total Laboratory Operating Costs: 14.5%
DHS Costs: $0.6



FACTS

Location: Golden, Colorado
Type: Single-program Laboratory
Contractor: Alliance for Sustainable Energy, LLC
Site Office: Golden Field Office
Website: nrel.gov

PHYSICAL ASSETS

630 acres
58 buildings and 4 trailers (owned)
$503,332,504 replacement plant value
1,082,068 GSF in buildings/trailers (owned)
169,949 GSF in leased facilities (five buildings, whole or partial)

HUMAN CAPITAL

2,265 FTE and part-time employees
27 joint faculty
189 postdoctoral researchers
79 undergraduate students
85 graduate students
39 facility users
2 visiting scientists

CORE CAPABILITIES

Computer Science and Analysis
- Advanced Computer Science, Visualization, and Data
- Decision Science and Analysis

Innovation and Application
- Biological and Bioprocess Engineering
- Chemical Engineering
- Mechanical Design and Engineering
- Power Systems and Electrical Engineering

Foundational Knowledge
- Applied Materials Science and Engineering
- Biological Systems Science
- Chemical and Molecular Science

System Integration
- Systems Engineering and Integration
- Large-Scale User Facilities

MISSION UNIQUE FACILITIES

Battery Thermal and Life Test Facility
Controllable Grid Interface Test System
Distributed Energy Resources Test Facility
Energy Systems Integration Facility
Field Test Laboratory Building
High-Flux Solar Furnace
Hydrogen Infrastructure Testing and Research Facility
Integrated Biorefinery Research Facility
Outdoor Test Facility
Renewable Fuels and Lubricants Laboratory
S&T Facility
Solar Energy Research Facility
Thermal Test Facility
Thermochemical Process Development Unit
Thermochemical Users Facility
Vehicle Testing and Integration Facility
Wind Dynamometer Test Facilities
Wind Structural Testing Laboratory
Wind Turbine Field Test Sites

AT A GLANCE: NATIONAL RENEWABLE ENERGY LABORATORY

NREL Transforming ENERGY

ACCOMPLISHMENTS

Unique Facilities: Centers for Bioenergy, Energy Systems Integration, Photovoltaics, and Wind NREL is home to three national research centers—the National Bioenergy Center, the National Center for Photovoltaics, and the National Wind Technology Center, which is located at NREL's Flatirons Campus. The laboratory is developing the latter, which offers specialized facilities and provides technical support critical to the development, primarily, of wind energy, to allow for testing at the 20 megawatt (MW) scale. Other unique facilities at NREL include the 185,000-square-foot Energy Systems Integration Facility (ESIF), which is the only facility that can conduct integrated MW-scale testing of the components and strategies needed to reliably move significant amounts of clean energy onto the electrical grid.

Tech-to-Market Highlight: Record Year for Technology Partnerships NREL is the only National Laboratory dedicated to the research, development, commercialization, and deployment of renewable energy and energy efficiency technologies. The laboratory accelerates the commercialization of energy technologies through licensing and partnerships with industry. NREL just closed the books on the best partnership year in its history, inking nearly 300 new, high-impact agreements. The laboratory now has more than 900 active technology partnerships with 500+ unique partners across businesses, governments, nonprofits, and academia. NREL has executed 260+ licenses since 2000 and has approximately 700 patented or patent-pending technologies—plus 250+ software solutions available for licensing. For the U.S. and beyond, our analysis informs policy and investment decisions leading to more resilient, reliable, and efficient energy systems. With objective, technology-neutral analysis, NREL aims to increase understanding of energy policies, technologies, and more to address U.S. economic and other priorities.

Research Highlight: Circular Economy, Electrons to Molecules, and Integrated Energy Pathways NREL's research vision centers around three critical objectives. A circular economy for energy materials focuses on reducing waste and preserving resources through the design of materials and products with reuse, recycling, and upcycling in mind from the start. Electrons to molecules explores the use of renewable, affordable electricity as the driving force for the conversion of low-energy molecules (e.g., water) to generate other molecules that could be used as chemicals, materials, fuels, or energy storage. Integrated energy pathways focuses on replacing today's outdated grid with a modern, intelligent infrastructure that, for one, looks to expand our options for mobility. One highlight, among many, from NREL's research vision, has involved building on their ground-breaking discovery of perovskites' use in solar cells. A team of NREL researchers has uncovered a change in chemical composition shown to boost the longevity and efficiency of a perovskite solar cell by resisting a stability problem that has so far thwarted the commercialization of perovskites.

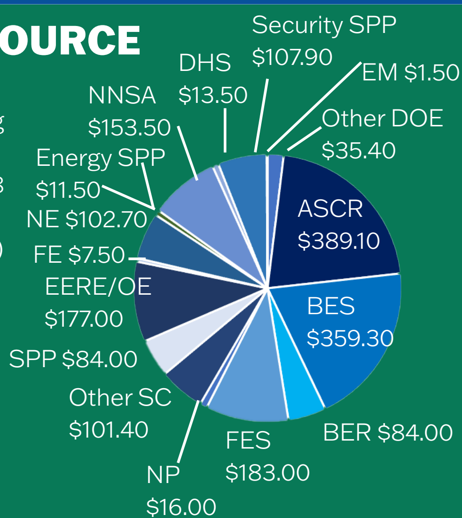
AT A GLANCE: OAK RIDGE NATIONAL LABORATORY

Oak Ridge National Laboratory

Oak Ridge National Laboratory (ORNL) is the largest multiprogram science and energy laboratory in the DOE system. Its mission is to deliver scientific discoveries and technical breakthroughs that accelerate the development and deployment of solutions in clean energy and national security, creating economic opportunity for the Nation. Established in 1943 as part of the Manhattan Project, ORNL pioneered plutonium production and separation, then focused on nuclear energy and later expanded to other energy sources and their impacts. Today, the laboratory manages one of the Nation's most comprehensive materials programs; two of the world's most powerful neutron science facilities, the Spallation Neutron Source and the High Flux Isotope Reactor; unique resources for fusion and fission energy and science; production facilities for life-saving isotopes; leadership-class computers including Summit, the Nation's fastest; and a diverse set of programs linked by an urgent focus on clean energy, Earth system sustainability, and national security.

FUNDING BY SOURCE

FY 2019 Costs (in $M)
Total Laboratory Operating Costs: $1,824.6 million
DOE/NNSA costs: $1,607.8 million
SPP (Non-DOE/Non-DHS) costs: $203.4 million
SPP as % of Total Laboratory Operating Costs: 11.9%
DHS costs: $13.5 million



FACTS

Location: Oak Ridge, Tennessee
Type: Multiprogram Laboratory
Contractor: UT-Battelle, LLC
Responsible Site Office: ORNL Site Office
Website: ornl.gov

PHYSICAL ASSETS

4,421 acres
272 buildings
$7.3 billion replacement plant value
4.85 million GSF in buildings
1.1 million GSF in leased facilities
1.4 million GSF in 63 excess facilities

HUMAN CAPITAL

4,856 FTE employees
194 joint faculty
323 postdoctoral researchers
556 undergraduate students
532 graduate students
2,928 facility users
1,691 visiting scientists

CORE CAPABILITIES

Accelerator S&T
Advanced Computer Science, Visualization, and Data
Applied Materials Science and Engineering
Applied Mathematics
Biological and Bioprocess Engineering
Biological Systems Science
Chemical Engineering
Chemical and Molecular Science
Climate Change Science and Atmospheric Science
Computational Science
Condensed Matter Physics and Materials Science
Cyber and Information Sciences
Decision Science and Analysis
Earth Systems Science and Engineering
Environmental Subsurface Science
Large-Scale User Facilities/Advanced Instrumentation
Mechanical Design and Engineering
Nuclear Engineering
Nuclear Physics
Nuclear and Radio Chemistry
Plasma and Fusion Energy Science
Power Systems and Electrical Engineering
Systems Engineering and Integration

MISSION UNIQUE FACILITIES

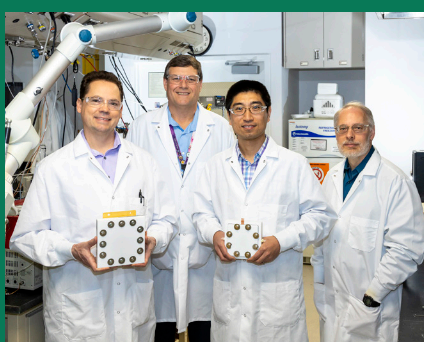
Building Technologies Research and Integration Center
Carbon Fiber Technology Facility
Center for Nanophase Materials Sciences
Center for Structural Molecular Biology
Grid Research, Integration and Deployment Center
High Flux Isotope Reactor
Manufacturing Demonstration Facility
National Transportation Research Center
Oak Ridge Leadership Computing Facility
Spallation Neutron Source

AT A GLANCE: OAK RIDGE NATIONAL LABORATORY

Oak Ridge National Laboratory

ACCOMPLISHMENTS

Unique Facility: High Flux Isotope Reactor (HFIR) Operating at 85 MW, HFIR is the most powerful reactor-based source of neutrons in the United States. More than 500 researchers from around the world use the thermal and cold neutrons and specialized instruments at HFIR each year for fundamental and applied research on the structure and dynamics of matter, with applications in physics, chemistry, materials science, engineering, and biology. Discoveries enabled by HFIR lead to improvements in products including solar cells, hard drives, drugs, and biofuels. HFIR also produces isotopes for medical, industrial, and research uses as well as new element discovery. It is the western world's only supplier of californium-252, a versatile isotope used to start up new reactors, detect impurities in coal and cement, and provide port security. HFIR also produced plutonium-238 for NASA's Mars Rover. Additionally, HFIR is used for studies of the effects of radiation on materials.



Tech-to-Market Highlight: Laboratory Technology Converts Carbon Dioxide Into Ethanol ReactWell, LLC, licensed Voltanol, a novel ORNL waste-to-fuel technology that converts carbon dioxide directly into ethanol using tiny spikes of carbon and copper to turn the greenhouse gas into a sustainable liquid. It is being incorporated into the company's existing process, allowing refineries to upgrade their feedstock or to convert biomass to oil while removing a refinery's need to purchase or produce additional hydrogen, resulting in significant savings in capital investments and long-term operating costs. Another key benefit: The ORNL catalyst uses no rare earth elements, which are expensive and can be difficult to acquire. In addition to recycling carbon dioxide that would otherwise be released, ORNL's technology can offer a useful alternative to batteries for long-term or portable storage of renewable electricity.

Research Highlight: Artificial Intelligence for Breakthrough Science As home to the Nation's most powerful supercomputer, ORNL is pioneering the application of AI to diverse fields through its lab-wide AI Initiative. Experts in data science apply algorithms in both machine learning (allowing computers to learn from data and predict outcomes) and deep learning (which uses neural networks inspired by the human brain to uncover patterns of interest in datasets) to accelerate breakthroughs across the scientific spectrum. For instance, AI extracts new insights from mountains of health data (e.g., medical tests) to help providers diagnose and treat problems ranging from PTSD to cancer. In additive manufacturing, AI enables consistency in 3D printing of specialized aerospace components by instantly locating defects and adapting in real time. Through partnerships with power companies, ORNL has used AI in many other areas, including complex materials and structures, as well as improvements to the security and reliability of power grids.

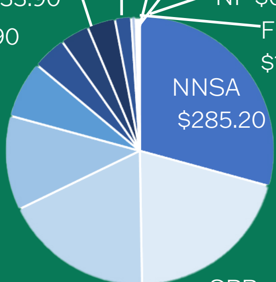
AT A GLANCE: PACIFIC NORTHWEST NATIONAL LABORATORY

Pacific Northwest National Laboratory (PNNL) advances the frontiers of knowledge, taking on some of the world's greatest S&T challenges. Distinctive strengths in chemistry, Earth sciences, biology and data sciences are the heart of PNNL's science mission, enabling innovations for energy resiliency and national security. PNNL advances theoretical and applied foundations of these disciplines, applying them to critical, complex challenges such as predicting ecosystem responses to climate change, power grid modernization, energy storage, cybersecurity, and nonproliferation.

PNNL stewards the Environmental Molecular Sciences Laboratory, a DOE user facility focused on deeper understanding of environmental processes from the molecular to the Earth system level. PNNL also manages the nine-laboratory DOE Atmospheric Radiation Measurement Program, a unique, distributed user facility with fixed and mobile sites worldwide gathering essential data on Earth's climate. PNNL's Energy Sciences Center, opening in 2021, will be a landmark research facility for the development of new materials and technologies for advanced clean energy systems.

FUNDING BY SOURCE

FY 2019 Costs (in $M)
FY 2019 Laboratory Operating Costs: $938.3
FY 2019 DOE/NNSA Costs: $708.7
FY 2019 SPP (Non-DOE/Non-DHS) Costs: $200
FY 2018 SPP % of Total Laboratory Operating Costs: 21.3%
FY 2018 DHS Costs: $66.9
FY 2018 EM-Related Costs*: $37.3
**Reflected in Total Laboratory Operating Costs.*



HUMAN CAPITAL

4,301 FTE; headcount ~4,700
150 joint appointments
287 postdoctoral researchers
398 undergraduate students
414 graduate students
1,557 facility users
71 visiting scientists

CORE CAPABILITIES

Advanced Computer Science, Visualization, and Data
Applied Materials Science and Engineering
Applied Mathematics
Biological and Bioprocess Engineering
Biological Systems Science
Chemical and Molecular Science
Chemical Engineering
Climate Change Sciences and Atmospheric Science
Computational Science
Condensed Matter Physics and Materials Science
Cyber and Information Sciences
Decision Science and Analysis
Earth Systems Science and Engineering
Environmental Subsurface Science
Nuclear and Radiochemistry
Nuclear Engineering
Power Systems and Electrical Engineering
Systems Engineering and Integration
User Facilities and Advanced Instrumentation

FACTS

Location: Richland, Washington
Type: Multiprogram Laboratory
Contractor: Battelle
Site Office: Pacific Northwest Site Office
Website: pnnl.gov

PHYSICAL ASSETS

781 acres (including 117 in Sequim, Wash.)
76 buildings
2,316,000 GSF total buildings
1,180,000 GSF of DOE-owned buildings
969,000 GSF in 30 leased buildings or third-party agreements
166,500 GSF in 11 Battelle-owned buildings and 21 OSFs
Replacement plant value: $934,315,000

MISSION UNIQUE FACILITIES

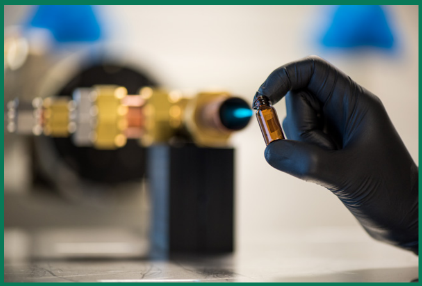
Atmospheric Radiation Measurement User Facility
Bioproducts, Sciences, and Engineering Laboratory
Electricity Infrastructure Operations Center
Energy Sciences Center
Environmental Molecular Sciences Laboratory
Marine and Coastal Research Laboratory
Radiochemical Processing Laboratory

AT A GLANCE: PACIFIC NORTHWEST NATIONAL LABORATORY

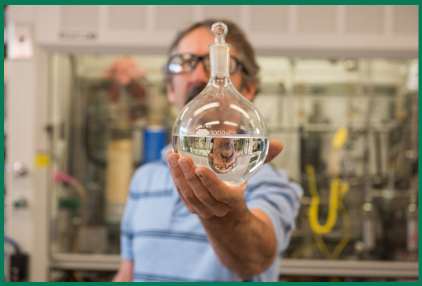
Pacific Northwest NATIONAL LABORATORY

ACCOMPLISHMENTS

Unique Facility: Energy Sciences Center The Energy Sciences Center—opening in late 2021—is a research facility at PNNL that will focus on fundamental research in chemistry, materials science and computing. PNNL researchers will apply their findings to develop faster, safer and more efficient chemical processes; turn wastes into commercial fuels; and create more advanced energy storage materials for energy and transportation technologies. Along with specialized equipment and expertise, the center is designed to encourage a collaborative environment, which aims to spur accelerated scientific discovery and technology advancement.



Research Highlight: Keeping America Safe PNNL researchers are contributing much of the science that underlies detection technologies that are keeping America and the world safe from threats posed by nuclear and chemical weapons of mass effect. PNNL discoveries and innovations form the heart of the radionuclide detection technology used in the International Monitoring System, a global network designed to monitor for nuclear explosions worldwide. The measurements are incredibly sensitive, detecting ultra-trace levels of radioactive xenon hundreds or even thousands of miles away. On the chemical front, an ultrasensitive technology detects explosive vapors, deadly chemicals, and illicit drugs with unparalleled accuracy. And it works in seconds. The non-contact technology is a potential game-changer for transportation hubs, mail facilities, and other safety and security screening applications.



Technology-to-Market Highlight: Jet Fuel from Waste Recycled carbon from waste is the future of aviation and it's here now, thanks in part to PNNL. In 2018, a blend of jet fuel created from industrial waste gas powered a Virgin Atlantic flight from Orlando to London. LanzaTech—a biotech and carbon recycling company that uses bacteria to convert wastes into chemicals and ethanol—turned to PNNL for its unique catalytic process and proprietary catalysts, to upgrade ethanol to drop-in jet fuel. LanzaTech recently launched LanzaJet, with commercial investors and a DOE grant, to build a demonstration plant that will produce 10 million gallons per year of sustainable aviation fuel from ethanol starting in 2022. LanzaTech's bioconversion process can create ethanol from many waste sources, and PNNL's licensed conversion technology transforms it to sustainable aviation fuel.

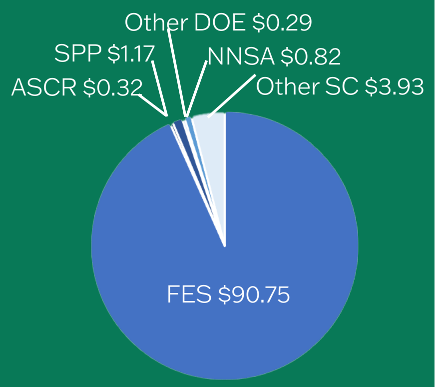
U.S. DEPARTMENT OF ENERGY

AT A GLANCE: PRINCETON PLASMA PHYSICS LABORATORY

Princeton Plasma Physics Laboratory (PPPL), a collaborative national center for fusion energy science, basic sciences, and advanced technology, has three major missions: (1) to develop the scientific knowledge and advanced engineering to enable fusion to power the U.S. and the world; (2) to advance the science of nanoscale fabrication for future industries; and (3) to further the scientific understanding of plasmas from nano- to astrophysical scales. PPPL has been a world leader in magnetic confinement experiments, plasma science, fusion science, and engineering. As the only DOE National Laboratory with a Fusion Energy Sciences mission, PPPL aspires to be the nation's premier design center for the realization and construction of future fusion concepts (e.g., next wave of scientific innovation in plasma nanofabrication technologies). The laboratory is evolving, broadening its expertise to more effectively contribute to U.S. economic health and competitiveness by being a national leader in computation, nanofabrication, surface science, and technology.

FUNDING BY SOURCE

FY 2019 (Costs in $M)
Total Laboratory Operating Costs: $97.28
DOE/NNSA Costs: $96.11
SPP (Non-DOE/Non-DHS) Costs: $1.17
SPP as % of Total Laboratory Operating Costs: 1.2%



FACTS

Location: Princeton, NJ
Type: Single-program Laboratory
Contractor: Princeton University
Site Office: Princeton Site Office
Website: pppl.gov

PHYSICAL ASSETS

90.7 acres
30 buildings
$744.1 million replacement plant value
758,000 GSF in buildingsinfrastructure assets (OSFs)

HUMAN CAPITAL

531 FTE employees
8 joint faculty
36 postdoctoral researchers
24 undergraduate students
45 graduate students
318 facility users
28 visiting scientists

CORE CAPABILITIES

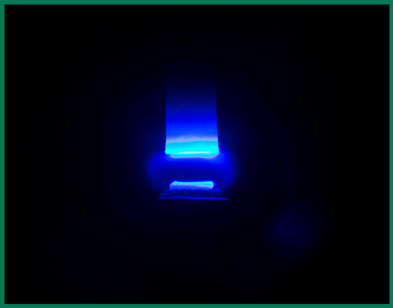
Large-Scale User Facilities/Advanced Instrumentation
Mechanical Design and Engineering
Plasma and Fusion Energy Sciences
Power Systems and Electrical Engineering
Systems Engineering and Integration
**Proposed new core capabilities: Computational Science, and Condensed Matter Physics and Materials Science.*

MISSION UNIQUE FACILITIES

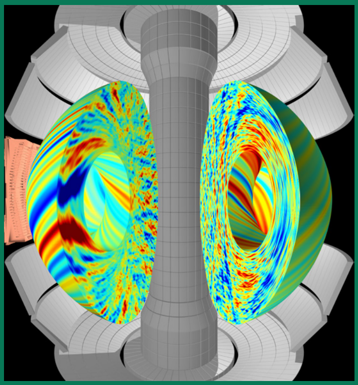
Laboratory for Plasma Nanosynthesis
Lithium Tokamak Experiment
Magnetic Reconnection Experiment
National Spherical Torus Experiment-Upgrade
Facility for Laboratory Reconnection Experiment

AT A GLANCE: PRINCETON PLASMA PHYSICS LABORATORY

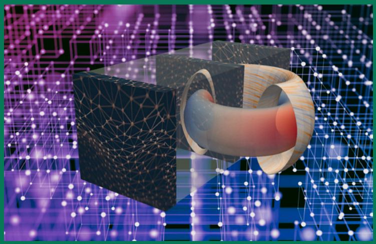
ACCOMPLISHMENTS



Unique Facility: Princeton Collaborative Research Facility on Low Temperature Plasma Low temperature plasma, a dynamic state of nature, has applications in fields ranging from golf clubs and swimwear to aerospace and biomedical equipment. Princeton Plasma Physics Laboratory has for years been exploring such plasmas and recently launched a facility open to researchers from across the country—to advance understanding and control of this practical state. The Princeton Collaborative Research Facility on Low Temperature Plasma, housed at PPPL, makes the extensive diagnostic and computational resources at PPPL and Princeton readily available to the U.S. academic, scientific, and industrial communities. "It's important for the nation's plasma physics laboratory to make a major contribution to understanding the physics of low-temperature plasmas," said Jon Menard, deputy director for research at PPPL. "This facility will open all the tools in the laboratory's low-temperature area for wider use."



Tech-to-Market Highlight: Innovation Network for Fusion Energy PPPL is sharing its state-of-the-art computer codes and world-class research expertise with five companies developing facilities to produce fusion energy. The five partners are Commonwealth Fusion Systems in Massachusetts, developing high-temperature superconducting magnets to build smaller, lower-cost fusion reactors; TAE Technologies in California, working toward developing a fusion reactor based on the field-reversed configuration (FRC) concept; Tokamak Energy in Britain, developing a compact spherical tokamak with high-temperature superconducting magnets; HelicitySpace in California, designing a combined magnetic and inertial plasma confinement system to drive spacecraft and generate electricity; and General Fusion in Canada, pursuing a novel magnetized fusion device that uses pistons to compress plasma tightly to produce fusion energy. These public-private partnerships are drawing on decades of PPPL scientific and engineering advances to speed the arrival of commercial fusion power to generate electricity.



Research Highlight: Fusion Disruption Predictions PPPL scientists have opened promising new pathways to the capture and control of fusion energy, the power that drives the sun and stars as a source of safe, clean, and abundant energy for generating electricity. In recent years the laboratory has applied AI, the branch of computer science that is transforming scientific inquiry, to forecast sudden disruptions that can halt fusion reactions and damage the doughnut-shaped tokamaks that house the reactions. The deep learning AI code that researchers have produced has demonstrated its ability to predict true disruptions within a 30-millisecond time frame. Even more significant for risk mitigation, the code now can move well beyond those 30 seconds to provide warnings for more than 100 milliseconds before disruptions occur. The next step will be to move from the prediction of disruptions to their control.

AT A GLANCE: SANDIA NATIONAL LABORATORIES

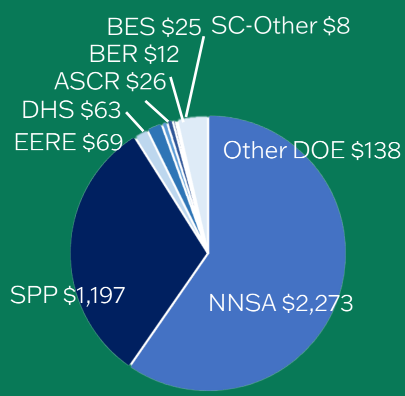
Sandia National Laboratories

Sandia grew out of the effort to develop the first atomic bombs. Today, maintaining the U.S. nuclear stockpile is a major part of Sandia's work as a multimission national security engineering laboratory. Its role has evolved to address the complex threats facing the United States through R&D in the following: Supporting U.S. deterrence policy by ensuring a safe, secure, and effective nuclear stockpile; protecting nuclear assets and materials, and addressing nuclear emergency response and global nonproliferation; supplying new capabilities to U.S. defense and national security communities; ensuring a stable energy supply and infrastructure; and creating science-based, systems engineering solutions to the Nation's most challenging national security problems.

After 70 years, Sandia's highly specialized research staff remains at the forefront of innovation, collaborating with government, academia, and industry to live up to its mandate of providing exceptional service in the national interest.

FUNDING BY SOURCE

FY 2019 (Costs in $M)
Total Laboratory Operating Costs: $3,811
DOE/NNSA Costs: $2,551
SPP (Non-DOE/Non-DHS) Costs: $1,197
SPP as % of Total Laboratory Operating Costs: 33%
DHS costs: $63



HUMAN CAPITAL

12,783 FTE employees
32 joint faculty
251 postdoctoral researchers
948 undergraduate and graduate students

CORE CAPABILITIES

Cyber technology
High-reliability engineering
Micro and nano devices and systems
Modeling and simulation and experiment
Natural and engineered materials
Pathfinder engineered systems
Radiation-hardened, trusted microelectronics development/production
Systems engineering
Safety, risk, and vulnerability analysis

FACTS

Location: Albuquerque, NM; Livermore, CA; Carlsbad, NM; Amarillo, TX; Tonopah, NV; Kauai, HI
Type: Multiprogram Laboratories
Contractor: National Technology and Engineering Solutions of Sandia LLC
Site Office: Sandia Field Office
Website: sandia.gov

PHYSICAL ASSETS

196,192 acres
1,001 buildings/trailers (all sites)
$16,397,460,863 replacement plant value (includes structures)
7,695,261 GSF in buildings/trailers
375,289 GSF in leased facilities
42,603 GSF in 16 excess facilities

MISSION UNIQUE FACILITIES

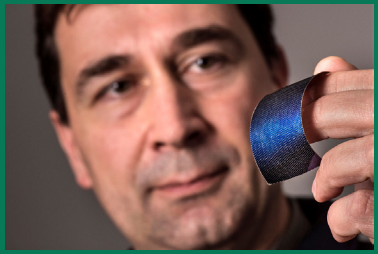
Center for Integrated Nanotechnologies (CINT)
Combustion Research Facility
Microsystems Engineering, Science and Applications (MESA) complex
National Solar Thermal Test Facility
Z Machine

AT A GLANCE: SANDIA NATIONAL LABORATORIES

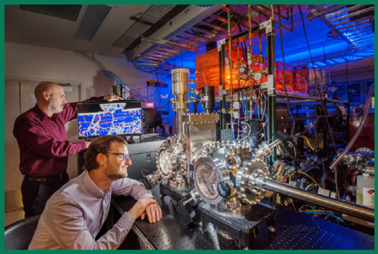
Sandia National Laboratories

ACCOMPLISHMENTS

Unique Facility: The Z Machine Sandia's Z machine, Earth's most powerful pulsed-power facility and generator of gamma and X-rays, provides the fastest, most accurate method to determine how materials will react under extreme pressures and temperatures and to study the dense plasmas that make up the Sun and other stars. Data generated in hundreds of experiments at Z over the years have advanced mankind's understanding of the fundamentals of physics. Visiting researchers who use Z have gained important insights into how materials behave, how black holes grow, how hot the Sun is, and how old the planets in the solar system are. Z also serves as a vital source for studies of nuclear weapon effects and of the optimal methods to increase neutron output in the quest to generate fusion energy.



Tech-to-Market Highlight: Microsystems Enabled Photovoltaics With Laboratory Directed R&D funds, Sandia designed Microsystems Enabled Photovoltaics (MEPV) to reduce semiconductor size and material costs and enhance solar cell performance. The smaller photovoltaic cells are flexible, nearly unbreakable, and can be integrated into many different materials. They harness energy that can power devices in flexible, moldable, or flat-plate formats for a wide range of applications, including space satellites, UAVs, or portable power for soldiers or campers. A small, New Mexico-based startup, mPower Technologies, licensed MEPV in 2017 and is now developing and testing solar modules for the U.S. Army and others based on its DragonSCALES™ (SemiConductor Active Layer Embedded Solar) design. The technology provides the freedom to integrate solar power capability into buildings, clothing, portable electronics, or vehicles in nearly any shape.



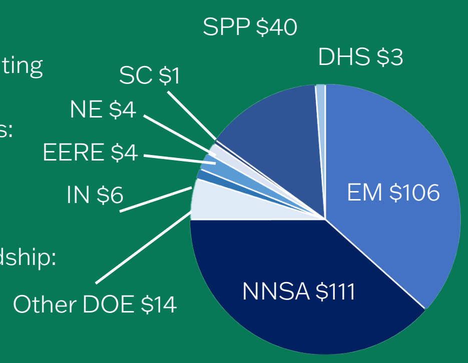
Research Highlight: The Friction Behavior of Metals Sandia researchers have designed computer models that predict the limits of friction behavior of metals based on materials properties—how much pressure can be put on materials or how much current can go through them before they stop working properly. Their model is especially valuable for electrical contacts, with impacts on everything from small electronic devices to electric vehicles to wind turbines. By extrapolating from models of friction and wear at the fundamental level in pure metals—down to how tiny differences in grain size produce big changes in friction—to more complex materials and structures, the researchers developed models that provide guidelines valuable in developing a variety of new materials.

AT A GLANCE: SAVANNAH RIVER NATIONAL LABORATORY

From the beginning, Savannah River National Laboratory (SRNL) has put science to work to protect our nation. When it was established in the early 1950s, the laboratory's primary focus was the start-up and operation of the Savannah River Site (SRS), including its five reactors, to produce tritium and plutonium—the basic materials for the U.S. nuclear weapons used to maintain the balance of power during the Cold War. Today, SRNL protects our Nation by supporting multiple federal agencies in providing practical, cost-effective solutions to nuclear materials management, national security, environmental stewardship, and energy security challenges. Building upon its pioneering work at SRS, SRNL now performs cutting-edge scientific research and technology development in various fields to protect the country's interests here and around the world.

FUNDING BY SOURCE

FY 2019 Costs (in $M)
Total Laboratory Operating Costs: $289
National Security Costs: 41%
Nuclear Materials Management: 29%
Environmental Stewardship: 26%
Secure Energy Manufacturing: 4%



FACTS

Location: Aiken, SC
Type: Multiprogram Laboratory
Contractor: Savannah River Nuclear Solutions
Site Office: Savannah River Site
Website: srnl.doe.gov

PHYSICAL ASSETS

39 acres
13 nuclear facilities with more than 200,000 GSF of radiologically controlled laboratory and process space, with 155 laboratories and 326 offices
$2 billion (approx.) replacement plant value
829,800 GSF in buildings/trailers/etc.
58,850 GSF in leased facilities

HUMAN CAPITAL

1,000 FTE employees
500+ engineers and scientists (200+ Ph.D.s)
26 postdoctoral researchers
50 student interns

CORE CAPABILITIES

Environmental Remediation and Risk Reduction
Nuclear Materials Detection, Characterization, and Assessment
Nuclear Materials Processing and Disposition
Tritium Processing, Storage, and Transfer Systems

MISSION UNIQUE FACILITIES

Atmospheric Technology Center
FBI Radiological Evidence Examination Facility
Outfall Constructed Wetland Cell Facility
Radiological Testbed Facilities
Shielded Cells Facility
Ultra-Low-Level Underground Counting Facility

AT A GLANCE: SAVANNAH RIVER NATIONAL LABORATORY

ACCOMPLISHMENTS

Unique Facility: Improving Energy Storage SRNL developed novel, high-temperature thermal energy storage (TES) material based on a ternary alloy of low-cost and highly abundant elements. The novel metal hydride has higher gravimetric and volumetric energy densities than other materials, as well as enhanced thermal conductivity and reaction rates under operating conditions. This allows for a reduction in heat exchangers, thereby reducing system costs.

Tech-to-Market Highlight: Recovering Rare Nuclear Material In an ongoing project to harvest Pu-244, a material not found anywhere else within the United States and maybe the world, SRNL built a full-scale mock-up of equipment for training and process development. The equipment, training, and processes will be used for the future transfer of the MK-18A targets into SRNL hot cells. The targets will be reduced in size, and chemical processes will be applied to recover plutonium, americium/curium, and other isotopes, that will then be packaged for shipment.

Research Highlight: SRNL Collaboration Across the DOE Complex SRNL led a multi-laboratory Technical Review Team (TRT) to assess the potential reactivity of LANL remediated nitrate salt drums stored at the Waste Control Specialists facility. The TRT concluded that the drums remain vulnerable because of the content uncertainty, but the nitric acid chemistry has caused an increased stability, which should improve with engineering controls (temperature and venting) during removal and transport.

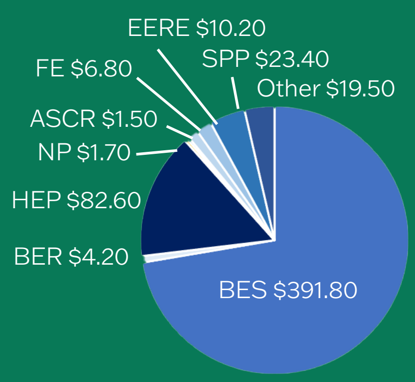
AT A GLANCE: SLAC NATIONAL ACCELERATOR LABORATORY

SLAC NATIONAL ACCELERATOR LABORATORY

Managed by Stanford University and located in Silicon Valley, SLAC is a vibrant multiprogram laboratory whose mission is to explore how the universe works at the biggest, smallest, and fastest scales and invent powerful tools that scientists around the globe use. Since its founding in 1962, SLAC has made revolutionary discoveries that have established the laboratory's leadership in high energy physics. Today, SLAC is the world's leading laboratory in X-ray and ultrafast science due in large part to its X-ray user facilities, the Stanford Synchrotron Radiation Lightsource (SSRL), and the Linac Coherent Light Source (LCLS). Through diverse research programs in materials, chemical, biological and energy sciences, high-energy density science, cosmology, particle physics, bioimaging and technology development, SLAC helps solve real-world problems and advances the interests of the Nation.

FUNDING BY SOURCE

FY 2019 (Costs in $M)
Total Laboratory Operating Costs: $541.5
DOE/NNSA Costs: $518.1
SPP (Non-DOE/Non-DHS) Costs: $23
SPP as % of Total Laboratory Operating Costs: 4%
DHS costs: $0.4



FACTS

Location: Menlo Park, California
Type: Multiprogram Laboratory
Contractor: Stanford University
Site Office: Bay Area
Website: slac.stanford.edu

PHYSICAL ASSETS

426.3 acres
150 buildings
$3.1 billion replacement plant value
1.8 million GSF in buildings
0 GSF in leased facilities
1,170 GSF in 1 excess facility

HUMAN CAPITAL

1,620 FTE employees
22 joint faculty
227 postdoctoral researchers
121 undergraduate students
241 graduate students
2,608 facility users*
22 visiting scientists
Facility users as reported to DOE by the user facilities LCLS, SSRL, and FACET, and test facilities ASTA, LSST, ESTB, and NLCTA.

CORE CAPABILITIES

Accelerator S&T
Advanced Computer Science, Visualization, and Data*
Chemical and Molecular Science
Condensed Matter Physics and Materials Science
Large-Scale User Facilities/Advanced Instrumentation
Particle Physics
Plasma and Fusion Energy Science
**Emerging core capability*

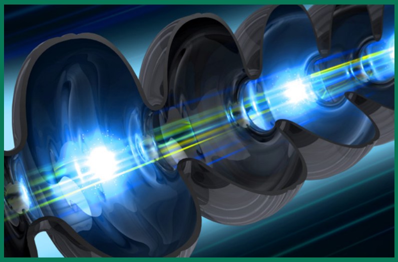
MISSION UNIQUE FACILITIES

Facility for Advanced Accelerator Experimental Tests (FACET)
Linac Coherent Light Source (LCLS)
NIH Common Fund Stanford-SLAC Cryo-EM Center (S2C2)
NIH Common Fund Stanford-SLAC CryoET Specimen Preparation Service Center (SCSC)
Stanford-SLAC cryogenic electron microscopy (cryo-EM) facilities
Stanford Synchrotron Radiation Lightsource (SSRL)
Ultrafast Electron Diffraction facility (MeV-UED)
**Also leading DOE contributions to the construction and operation of the Vera C. Rubin Observatory, as well as the joint DOE-National Science Foundation (NSF) construction of the next-generation dark matter experiment SuperCDMS-SNOLAB.*

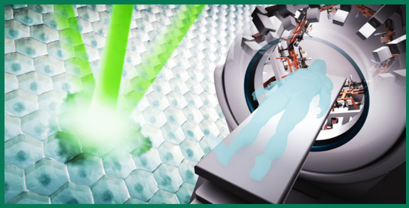
AT A GLANCE: SLAC NATIONAL ACCELERATOR LABORATORY

SLAC NATIONAL ACCELERATOR LABORATORY

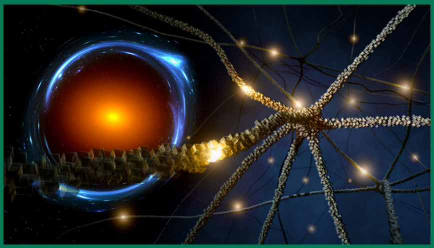
ACCOMPLISHMENTS



Unique Facility: X-ray and Electron Beams Draw Thousands
Thousands of scientists come to SLAC each year to explore the natural world at the largest, smallest, and fastest scales with powerful X-ray and electron beams. It's a combination found nowhere else: the pioneering Linac Coherent Light Source (LCLS) X-ray free-electron laser, being upgraded to increase its firing rate to a million pulses per second; Stanford Synchrotron Radiation Lightsource (SSRL), a forefront light source providing bright X-rays and outstanding user support; and the MeV-UED "electron camera," which tracks atomic motions in a broad range of materials in real time. Our advanced instrumentation and facilities for cryogenic electron microscopy make us one of the world's leading centers for cryo-EM research, training, technology development and service to the scientific community.



Tech-to-Market Highlight: Inventions Enhance and Save Lives
Working with industry, universities, and federal partners, SLAC scientists are developing valuable and sometimes life-saving technologies—for instance, a new type of pocket-sized antenna that enables mobile communication where conventional radios don't work, a low-cost emergency ventilator that could save the lives of COVID-19 patients, and, in collaboration with Stanford University, accelerator-based cancer treatments that zap tumors with X-rays or electrons, decreasing treatment times from minutes to seconds. This would make radiation therapy more precise with fewer side effects.



Research Highlight: Machine Learning Boosts Research Across the Laboratory SLAC's big scientific facilities produce enormous amounts of data, and when our LCLS-II X-ray laser upgrade and Vera C. Rubin Observatory come online the data torrents will become tsunamis. One of the ways SLAC is meeting this challenge is machine learning, where computer programs carry out tasks by looking for patterns in examples. Machine learning is enhancing research and operations across the laboratory, allowing SLAC to operate accelerators more efficiently, speed the discovery of new materials, and uncover distortions in space-time 10 million times faster than before. At SLAC's X-ray facilities, scientists can use machine learning to analyze data in real time so they can adjust their experiments on the fly for maximum efficiency.

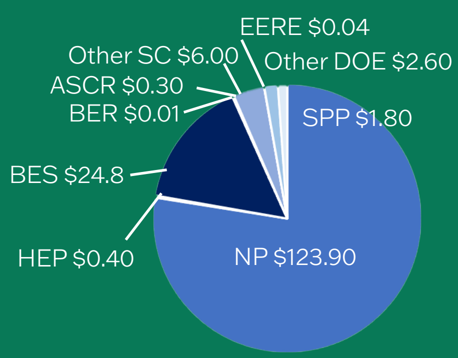
AT A GLANCE: THOMAS JEFFERSON NATIONAL ACCELERATOR FACILITY

Jefferson Lab

Thomas Jefferson National Accelerator Facility (TJNAF) is the preeminent laboratory in precision studies of the fundamental nature of confined states of quarks and gluons, including the protons and neutrons that make up the mass of the visible universe. Central to that is the Continuous Electron Beam Accelerator Facility (CEBAF), the first large-scale application of superconducting radiofrequency technology. Tools, techniques, and technologies developed in pursuit of the laboratory's scientific mission enable an ever-increasing array of applications—from detectors for medical and biological use, to advanced particle accelerators for environmental remediation.

FUNDING BY SOURCE

FY 2019 (Costs in $M)
Total Laboratory Operating Costs: $159.9
DOE/NNSA Costs: $158.1
SPP (Non-DOE/Non-DHS) Costs: $1.8
SPP as % of Total Laboratory Operating Costs: 1.1%
DHS Costs: $0.0



HUMAN CAPITAL

693 FTE employees
28 joint faculty
33 postdoctoral researchers
20 undergraduate students
42 graduate students
1,630 facility users
1,491 visiting scientists

CORE CAPABILITIES

Accelerator S&T
Large-Scale User Facilities/Advanced Instrumentation
Nuclear Physics

MISSION UNIQUE FACILITIES

Continuous Electron Beam Accelerator Facility

FACTS

Location: Newport News, Virginia
Type: Program-dedicated, Single-purpose Laboratory
Contractor: Jefferson Science Associates, LLC
Site Office: Thomas Jefferson Site Office
Website: jlab.org

PHYSICAL ASSETS

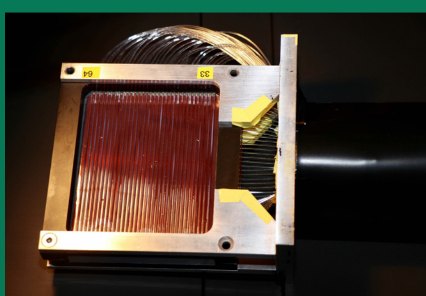
169 acres and 69 buildings
883,000 GSF in buildings
Replacement plant value: $480M
0 GSF in excess facilities
66,289 GSF in leased facilities

AT A GLANCE: THOMAS JEFFERSON NATIONAL ACCELERATOR FACILITY

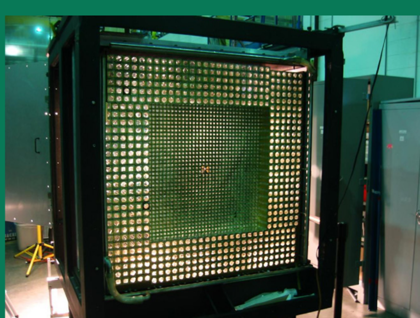
Jefferson Lab

ACCOMPLISHMENTS

Unique Facility: CEBAF The centerpiece of TJNAF's research program is the CEBAF—an electron accelerator based on SRF technology—which produces a stream of charged electrons that scientists use to probe the nucleus of the atom. As the first large-scale application of SRF technology in the world, CEBAF is the world's most advanced particle accelerator for investigating the quark structure of the atom's nucleus. The CEBAF's energy has been upgraded from 6 GeV to 12 GeV to expand the scientific reach of Jefferson Lab in support of the highest-energy experiments. The laboratory is a world leader in CEBAF-enabled SRF accelerator technology—and continues to advance accelerator technology as well as expand its applications beyond scientific research.



Tech-to-Market Highlight: Scintillating Medical Imaging In 2018, a new cancer treatment monitoring system, built by Radiadyne with detector technologies developed for Jefferson Lab's nuclear physics (NP) program, won an R&D 100 Award and the Medical Device Engineering Breakthrough Award. The OARtrac© monitoring system allows clinicians to monitor and adjust radiation delivered to patients through a novel application of scintillating fiber material used in NP to identify experiment-produced particles. The FDA cleared the system to use patient-specific Plastic Scintillating Detector sensors utilized during cancer treatments. Jefferson Lab's Cynthia Keppel, staff scientist and Halls A and C leader, collaborated with Radiadyne early in developing this technology—nearly a decade in moving from laboratory to market. This is the latest in a number of medical imaging applications based on Jefferson Lab particle detection technologies developed into successful products that are impacting cancer detection and treatment.



Research Highlight: The Size of the Proton All ordinary matter, from the sun that powers our solar system to the Earth we inhabit, is built on protons inside the atom's nucleus. In the early 2010s, new experiments measuring the size of the well-studied proton, in terms of its charge radius, yielded a smaller size than expected. Nuclear physicists carefully re-measured this basic quantity using a new experimental technique and the high-quality electron beam at TJNAF, finding an even smaller proton size of approximately .83 femtometers.