LLNL is one of 17 Department of Energy national laboratories
The Department of Energy national laboratories are located across the nation.
- Established in 1952
- ~ 7,400 LLNS employees
- 1 square mile and 517 facilities, ~40 miles from San Francisco
- Annual budget: ~ $2.3B
- Operated by LLNS, LLC (University of California and Bechtel, BWXT, Amentum)
Our heritage: team science, audacious ideas, and pushing the extremes

“Our working philosophy ... called for always pushing at the technological extremes. We did not wait for higher government or military authorities.”

*Herbert F. York*
LLNL’s first director
Pushing extremes

*E.O. Lawrence*
University of California
Team science

*Edward Teller*
LLNL’s second director
Audacious ideas

*Making Weapons, Talking Peace: A Physicist’s Odyssey from Hiroshima to Geneva*
Herbert F. York
Our Mission: to strengthen national security through world-class science, technology, and engineering.
LLNL’s ~$2.3B budget reflects our national security focus

- Department of Defense: $278M
- Department of Homeland Security: $26M
- DOE Integrated Contractor: $115M
- DOE Science and Energy: $153M
- Construction: $23M
- Safeguards and Security: $99M
- Nonproliferation and Counterterrorism: $139M
- Other: $63M
- Weapons: $1,382M
LLNL has a talented and multidisciplinary technical workforce

ST&E Workforce by Highest Degree Level

- Engineering: 32%
- Math/Comp Sci: 16%
- Physical Sci: 12%
- Bio/Med: 6%
- Physics: 15%
- Other: 19%

Total LLNL Workforce

ST&E Workforce by High Discipline

(PSTS)

Supp Labor
Protective Force
Crafts/Machinists
Management and Administration
Students and Faculty

Dec 5, 2019

ST&E Workforce
by Highest Degree Level

Associates: 399
Bachelors: 1,252
Masters: 836
Ph.D.: 1,764

Source: DOE-MA-06-22-19
Our work diminishes the likelihood and impact of war, terrorism, and disasters through the innovative application of cutting-edge S&T

Stockpile Stewardship
- Annual Assessment
- Life extensions
- Improved predictive capability
- Enterprise integration and responsiveness

All-WMD Threat Reduction
- Nuclear counter proliferation and counterterrorism
- Chem/biosecurity
- Forensic science
- All-source intelligence

Multi-Domain Deterrence
- Strategic defense
- Conventional strike
- Space security
- Cybersecurity

Energy Security and Climate Resilience
- Diverse domestic energy resources
- Enhancing reliable delivery
- Climate impact assessment
Science-based stockpile stewardship is rooted in challenging our predictions with experiments.

High-performance computing, modeling, and simulation

Sierra

#3 on Top 500 List*
95 petaflops sustained
125 petaflops peak

Experimental challenge and validation

National Ignition Facility

192 laser beams
500 terawatts power output
2.15 MJ to target

95 petaflops sustained
125 petaflops peak

Lawrence Livermore National Laboratory
LLNL has long been at the forefront of enabling HPC hardware and software

- Ozone mixing models
- Helping the medical community plan radiation treatment
- Dynamics in three dimensions
- Global climate modeling
- Unprecedented dislocation dynamics simulations
- 3D 98-billion-cell hydrodynamic instability simulation (ICF-inspired)
- Projected to be the world's most powerful supercomputer

Historical Timeline:

- 1953: UNIVAC 1
  - Pioneering simulations of particle tracking
- 1960s: CDC 3600
  - Ozone mixing models
- 1970s: CDC 7600
  - Dynamics in three dimensions
- 1980s: CRAY 1
  - Global climate modeling
- 1990s: ASCI Blue-Pacific
  - Helping the medical community plan radiation treatment
- 2000s: Blue Gene
  - Breakthrough visualizations of mixing fluids
- 2010s: Sierra
  - Unprecedented dislocation dynamics simulations
- 2023: Projected to be the world's most powerful supercomputer

Lawrence Livermore National Laboratory
National Nuclear Security Administration
LLNL continues to define the “bleeding edge” of high-performance computing

Sierra
- On the path to exascale
- First NNSA GPU platform
- 125 petaflops (peak)
- On-line since 2018

El Capitan
- NNSA’s 1st exascale supercomputer
- Silicon based
- 1.5 exaflops (peak)
- Delivery late 2022

Beyond Moore’s Law

Top Computing Institutions (past 25 years)

- Courtesy of Erich Strohmaier (LBL) SC’18

DOE system

LLNL
USA

Norm-HPL

1600

1200

800

400

LLNL
USA
ORNL
USA
LANL
USA
SNL
USA
NSCC
CHN
RIKEN
JPN

Neuromorphic
Quantum
The National Ignition Facility is the largest and most energetic laser facility ever built.

Exploring the extremes of energy, temperature, and pressure that occur in stars, supernovae, and nuclear explosions.
Unique R&D Facilities

- National Ignition Facility
- Livermore Computing Complex B453
- Site 300
- Jupiter Laser Facility
- Advanced Manufacturing Laboratory
- High Explosives Applications Facility
The Laboratory provides critical reach-back capabilities to the nation and beyond

National Atmospheric Release Advisory Center
Forensic Science Center
Counterproliferation Analysis & Planning System
Biodefense Knowledge Center

OPCW Support
2013 – Present

Support of Analyses of DPRK Tests
2006-Present
Beyond today’s challenges
Anticipating unexpected and potentially disruptive developments

Accelerated Materials and Manufacturing
- Working towards accelerated qualification of components and novel materials, and an integrated materials and manufacturing strategy.

Cognitive Simulation
- Developing machine learning solutions that augment large-scale simulation and experiments to improve prediction.

Predictive Biology
- Developing new approaches to biosecurity countermeasures through systems biology.

Space Science and Security
- Applying expertise in intel analysis, modeling and simulation, and design and fabrication for advantages in contested space.

Engineering the Carbon Economy
- Anticipating the threat and preparing for the next major phase of climate mitigation technology.
LLNL technologies: a multi-billion-dollar impact on the economy

Over $1.4B of products with “LLNL Inside” were sold in the past 5 years

Higher fuel efficiency

Advanced medical devices

Better disease diagnosis

Improved airplane safety

Two public companies started by LLNL scientists have a total market value of over $21B
Frontier research underlies our ability to deliver cutting-edge solutions

The Dubna-LLNL collaboration has discovered 6 new elements since 1989
LLNL embraces its role in fostering education in and giving to the local community.
Science and Technology on a Mission