



Los Alamos National Laboratory Overview

LANL, the ASC Program, and the Supporting LANL Organizations
PSAAP III Kick-Off Meeting

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Jason Pruet, ASC-PO

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LANL's National Security Mission is Broad

Ensure the safety, reliability, and performance of the U.S nuclear stockpile

- Physics & Design
- Engineering
- Production



Excellence in nuclear security

to ensure the nation's nuclear deterrent through theory, modeling and simulation, and experimentation

NUCLEAR
DETERRENCE

Preventing and countering

efforts of proliferants to acquire, develop or disseminate materials and expertise necessary for nuclear weapons

NON-PRO
& COUNTER-
PROLIFERATION

NATIONAL
SECURITY
MISSION

CROSS
DOMAIN
DETERRENCE



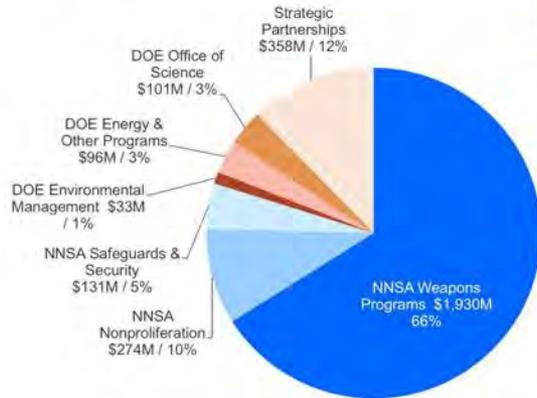
Energy security

- Sustainable Nuclear Energy
- Resilient Materials
- Complexity in Energy Systems

Supporting the DoD, IC, and other national security partners to execute multidomain operations across land, air, sea, space and cyber

The Major Component of LANL's Mission Involves Supporting NNSA's (Nuclear) Weapons Programs

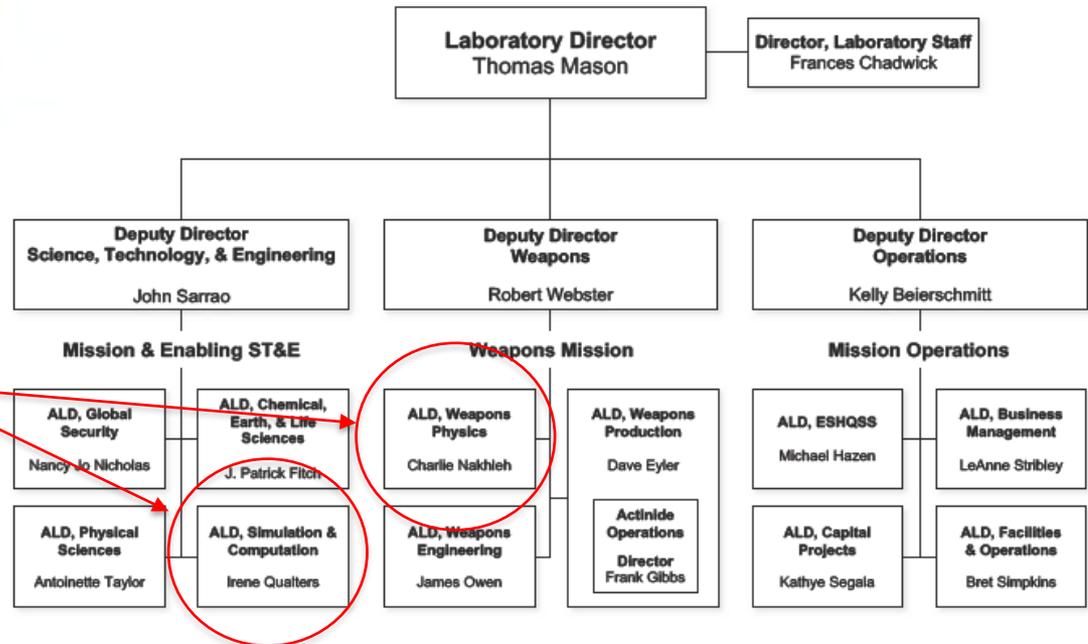
FY19 LANL programmatic portfolio



FY19 LANL Budget Authority = \$2.92B

- 81% funded by NNSA
- 99% funded by U.S. Federal government

Los Alamos National Laboratory



The majority of your TST and RT members will be from these directorates

LANL's nuclear weapons mission accounts for approximately 70% of a \$3B budget

The Lab Agenda Establishes Goals and Initiatives Around Four Priority Pillars

- Nuclear Security

Design, produce, and certify current and future nuclear weapons, and reduce global nuclear threats

- Execute LANL's manufacturing mission
- Transform nuclear weapons warhead design and production
- Anticipate threats to global security
- Continue to support the Annual Assessment Review
- Assess the stockpile as it ages

- Mission-Focused Science, Technology, and Engineering

Deliver scientific discovery and technical breakthroughs that support DOE and NNSA missions

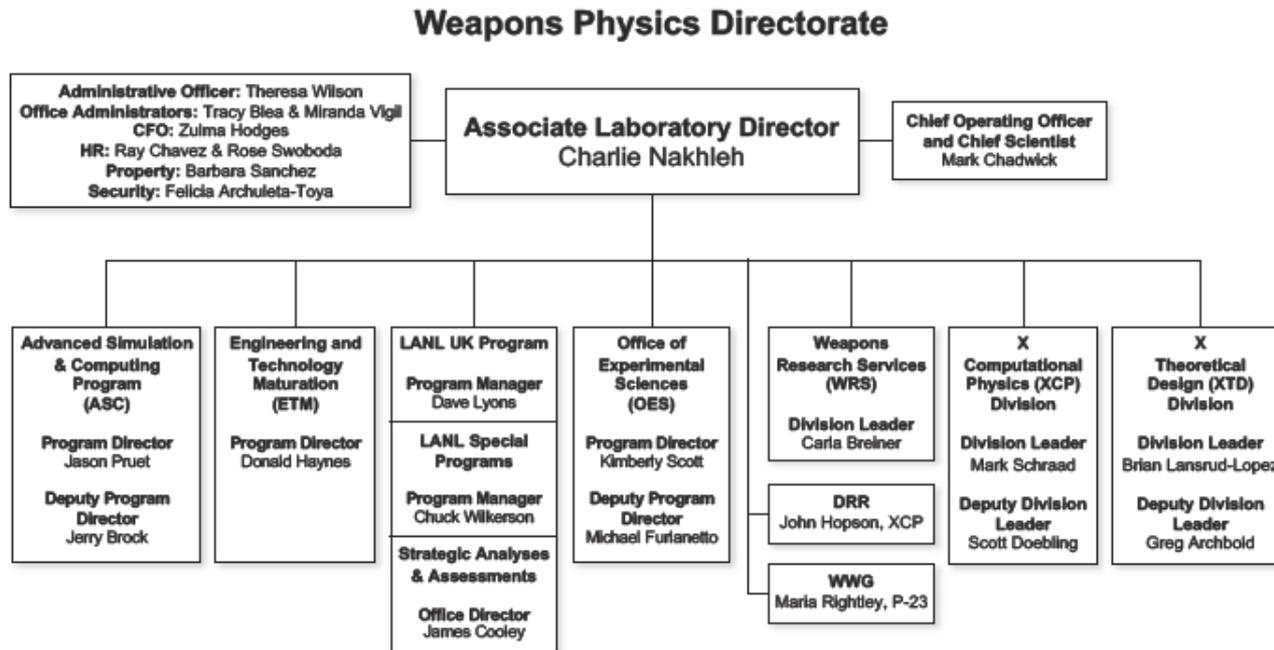
- Advance the frontiers of computing to exascale and beyond
- Etc.

- Mission Operations

- Community Relations



The Weapons Physics Directorate Leads the Design, Certification, and Assessment of U.S. Nuclear Weapons



- ALDX executes its mission through the development (XCP) and application (XTD) of cutting-edge theory, computational models, and large-scale weapons simulation codes, as well as the design and execution of state-of-the-art experiments.
- ALDX is responsible for more than \$700M of Program Budget and more than 350 full-time staff and post docs
- Both the ASC Program Director (Jason Pruet) and the X-Computational Physics Division Leader (Mark Schraad) report to the Associate Laboratory Director for Weapons Physics (Charlie Nakhleh)
- XCP is the integrating and executing arm of the ASC Program

Advanced Simulation and Computing (ASC) Program

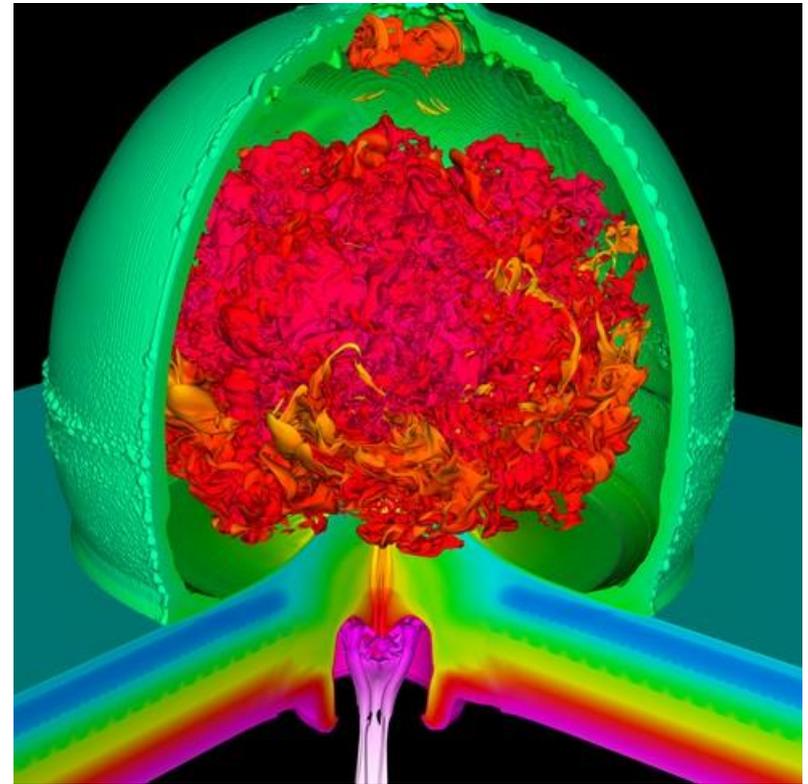
- Program Director: Jason Pruet
- ~\$250M Program Budget
- Enabling the development of simulation capabilities and deploying computing platforms to analyze and predict the performance, safety, and reliability of nuclear weapons and to certify their functionality in the absence of nuclear testing.
- Physics and Engineering Models
- Integrated Codes
- Verification and Validation
- Advanced Technology Development and Mitigation
- Computational Systems and Software Environments
- Facility Operations and User Support
- Platforms



The Predictive Science Academic Alliance Program (PSAAP) provides ASC's national-level university partnership and outreach

X-Computational Physics (XCP) Division

- Division Leader: Mark Schraad
Stanford TST Chair
>350 staff, post docs, students; >\$100M
- Developing, integrating, and delivering LANL's mission-critical modeling and simulation software
- Lagrangian Codes
- Eulerian Codes
- Radiation Transport Codes
- Continuum Models and Numerical Methods
- Materials and Physical Data
- Plasma Physics
- Radiation Transport Applications
- Verification and Analysis

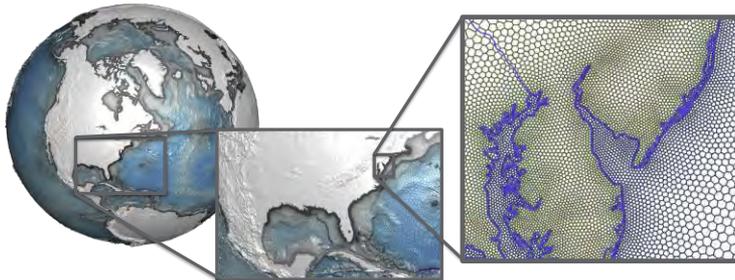


Simulated temperature plot of a laser-based laboratory supersonic plasma jet experiment used to understand astrophysical jets

XCP conducts research in theoretical and computational physics, and develops validated models, algorithms, and verified multi-physics codes, designed for the world's fastest and most advanced computer architectures

The Simulation and Computing Directorate is Central to the National Need for ...

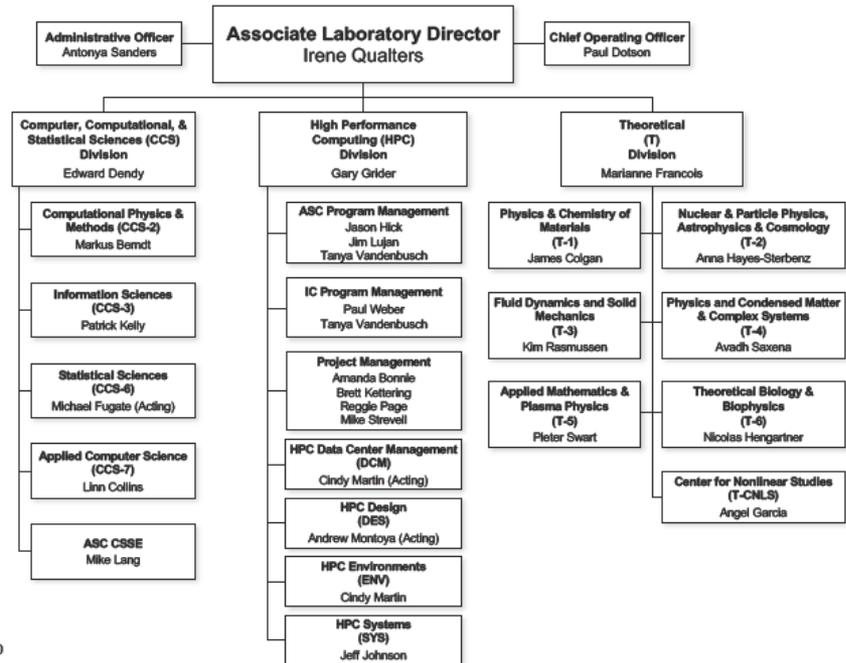
- New ideas, concepts, and methodologies
- To improve the fidelity, reliability, certainty, and usability of tools
- To guide and interpret experiments
- And to provide prediction and control for complex phenomena and systems



High-fidelity Climate and Earth System Modeling and Simulation

05/12/2020

Simulation and Computation Directorate



Theory

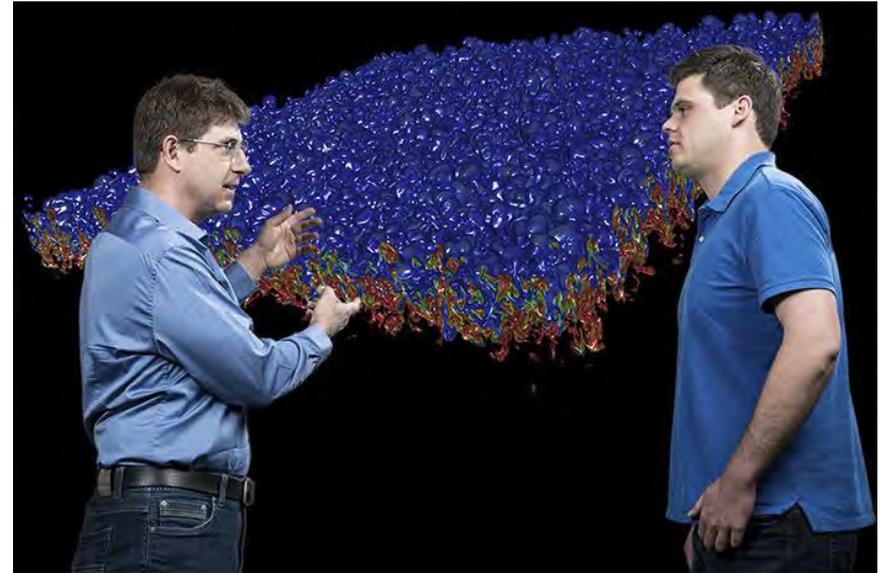
Computer and Computational Science

High-performance Computing

Applied to virtually all LANL Programs

Computer, Computational and Statistical Sciences (CCS) Division

- Division Leader: Ed Dendy
>350 staff, post docs, students; >\$100M
- CCS was formed circa early 2000s to strengthen the visibility and impact of computer and computational research on strategic directions for the Laboratory. Both computer science and computational science are now central to scientific discovery and innovation, as well as Weapons Program success.
- Computational Physics and Methods
- Information Sciences
- Statistical Sciences
- Applied Computer Science

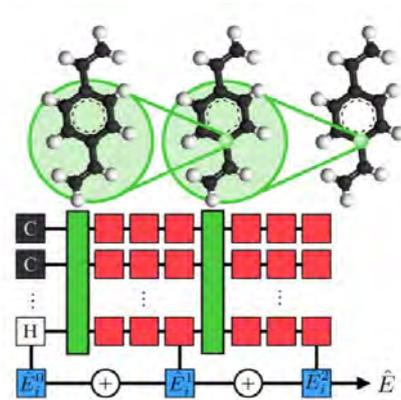


Staff in CCS have performed the largest high-resolution direct numerical simulations to date for a variety of turbulent flows relevant to inertial confinement fusion and stockpile stewardship applications.

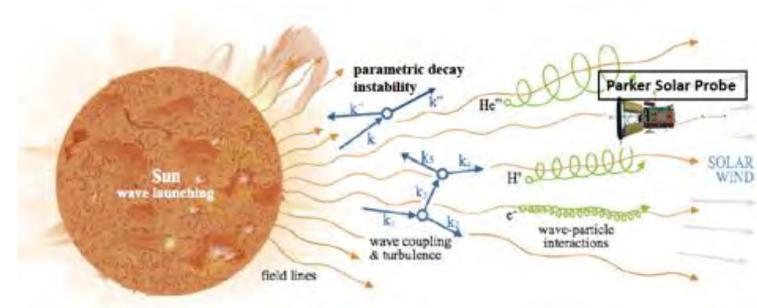
CCS Division provides a bridge between external partners and LANL programs, bringing new ideas and technologies to bear on today's important problems

Theoretical (T) Division

- Division Leader: Marianne Francois
~400 staff, post docs, and students; ~\$135M
- Provides excellence in basic and applied theoretical research across multiple disciplines to solve national security challenges and advance the frontiers of science
- Physics and Chemistry of Materials
- Nuclear and Particle Physics, Astrophysics and Cosmology
- Fluid Dynamics and Solid Mechanics
- Physics of Condensed Matter and Complex Systems
- Applied Mathematics and Plasma Physics
- Theoretical Biology and Biophysics



Quantum Mechanics and Molecular Dynamics



Space Physics

T Division is multidisciplinary

Development of our Modeling and Simulation Tools Requires Integration Across the Laboratory

The Key Players

- The Main Program Sponsor
 - Advanced Simulation and Computing (ASC) Program
- Partnering Line Organizations
 - X-Computational Physics (XCP)
 - Computer, Computational, and Statistical Sciences (CCS)
 - Theoretical (T)
- User Community
 - X-Theoretical Design (XTD) Division
 - Weapon Systems Engineering (W)
 - Global Security Directorate



The Foundation of Simulation Science for Stockpile Stewardship Applications

