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Engineering Science Overview

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Sandia is a Multiprogram Laboratory Operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy Under Contract DE-ACO4-94AL85000.

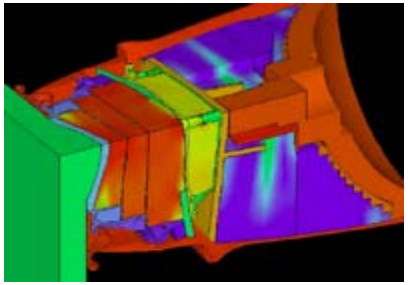
National Nuclear Security Administration

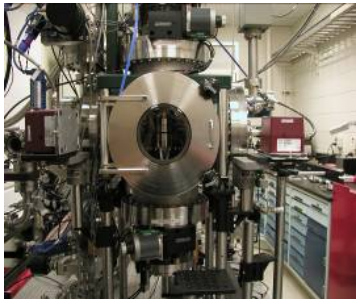
Sandia National Laboratories

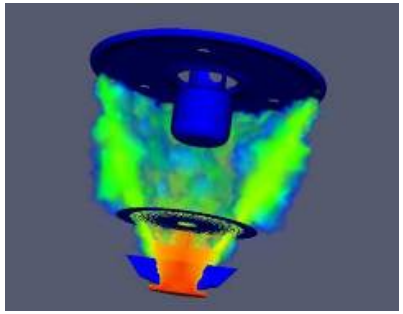
Engineering Sciences at Sandia National Laboratories

Mission:

Provide Validated, Science-Based, Engineering Solutions Across The Product Life Cycle to Meet the Mission Needs of Sandia National Laboratories.

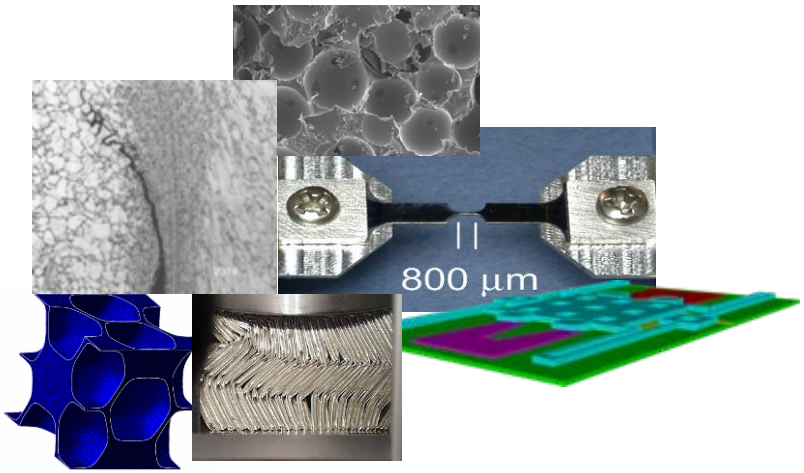






There are ~400 Engineering Sciences staff and management to meet the research, development and application needs of the Lab and its customers

Engineering Sciences provides Sandia's stewardship of the engineering disciplines

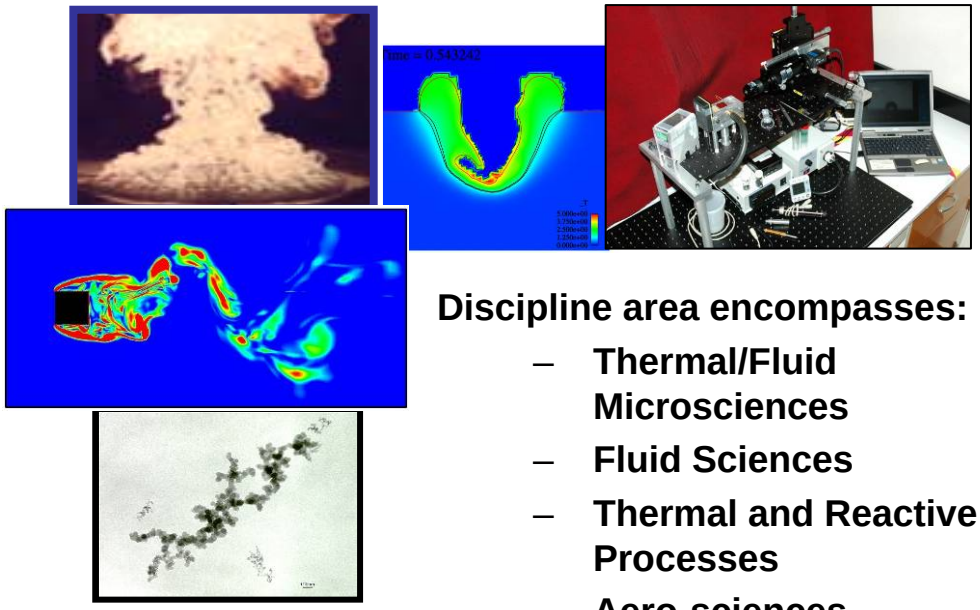


Solid/Material Mechanics & Structural Dynamics

Discipline area encompasses:

- Solid Mechanics
- Structural Dynamics
- Material Mechanics

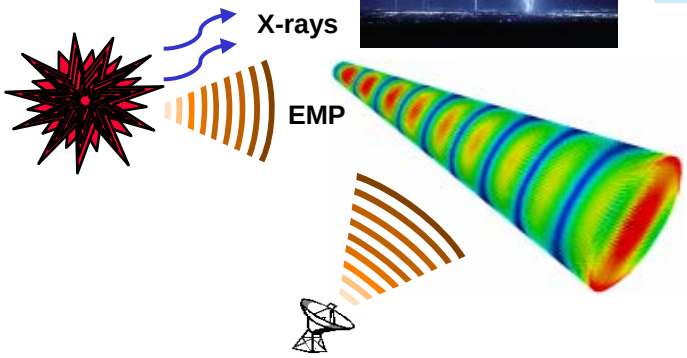
Thermal, Fluids & Aero-sciences



Discipline area encompasses:

- Thermal/Fluid Microsciences
- Fluid Sciences
- Thermal and Reactive Processes
- Aero-sciences

Electrical Sciences

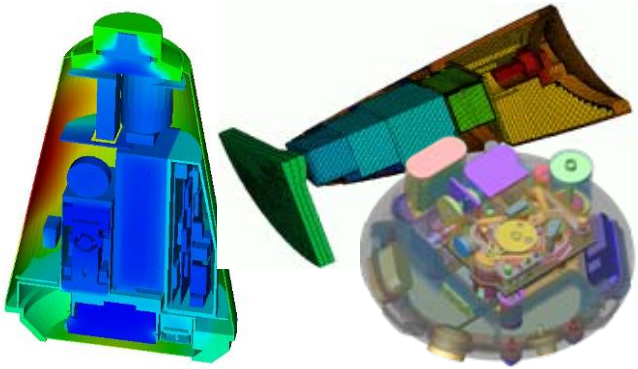


Discipline area encompasses:

- Electromagnetics, electrical effects, electrical devices, components & systems

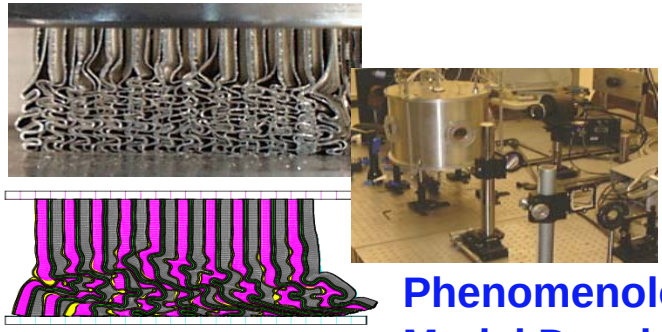
Engineering Sciences capabilities span research, development, and application

Engineering Computational Simulation

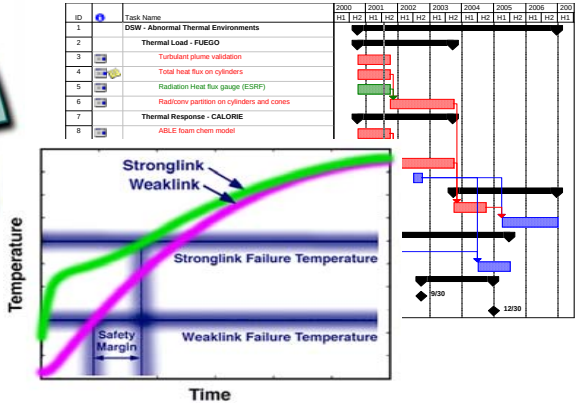


Large-Scale Test /Qualification

Code Development



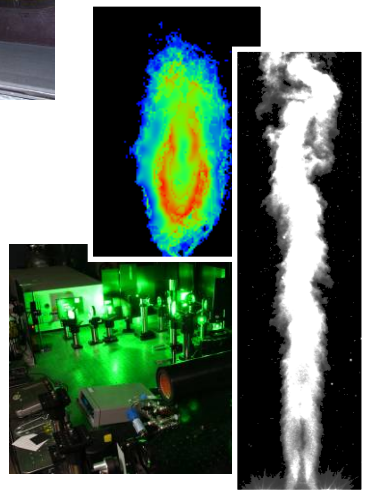
Phenomenology & Model Development



Uncertainty Quantification, Verification & Validation

We steward significant lab-scale and large-scale testing capabilities where we perform research, development and applications work

Trisonic & hypersonic flow characterization



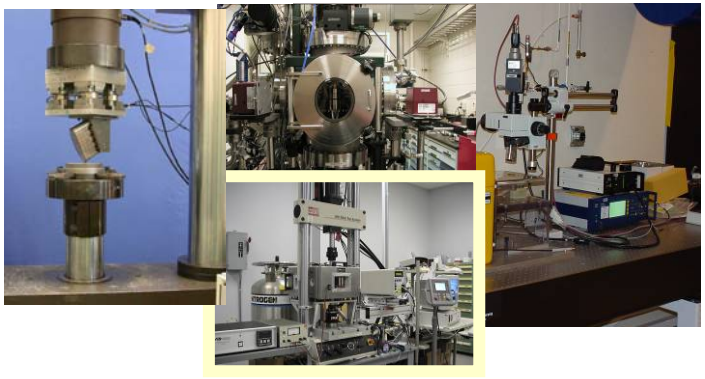
Noninvasive laser-based thermal/flow diagnostics

Sled Track, Blast Tube and Aerial Cable facilities

Electrical & EM Facilities

Thermal Test Complex – Radiant heat & fire testing

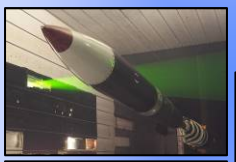
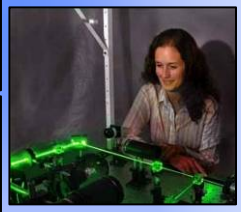
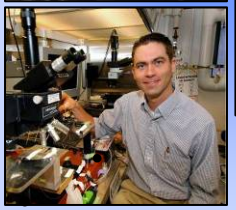
Modal, vibration, and mechanical shock & centrifuge facilities



ES Laboratories

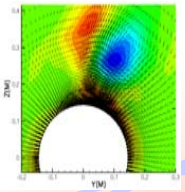
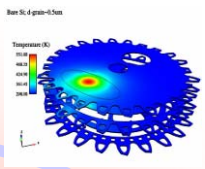
Engineering Sciences drives Simulation-enabled Engineering and predictive capability

Research
•*establishes scientific understanding* of the engineered product

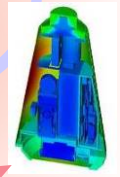
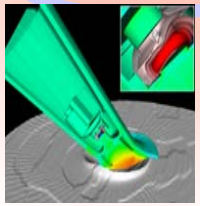




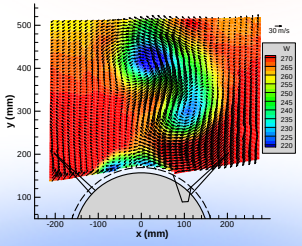
… and forms the basis for the physical models used •in numerical simulations


Advanced Computational Platforms must provide both capacity and capability computing

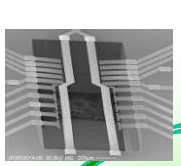



Computational Simulation

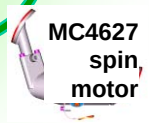





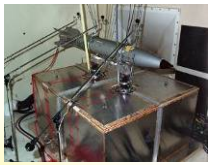
Experiments *validate the models* used in the numerical simulations



Product Engineering

Physical Simulation


Component & system **testing** *supports* design & development process

We manage our Science & Technology work through the Engineering Sciences Research Foundation (ESRF)

Vision:

Lead the nation in science and technology that enables predictive simulation* to impact engineering decision making for our national security mission

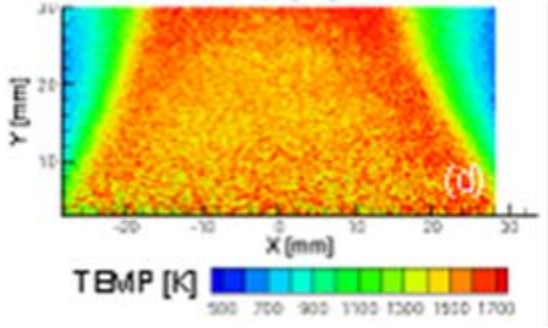
**** Computational & Physical Simulation***

ESRF Stewardship

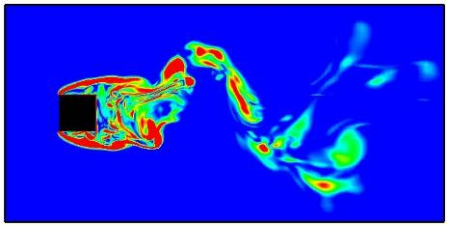
- **Assure a sound science-base to meet Sandia's mission goals of today**
- **Develop and nurture future science and technology that Sandia will depend upon to achieve its mission goals of tomorrow.**
- **Provide significant contributions to the leadership of engineering.**

Our research themes span the ESRF disciplines

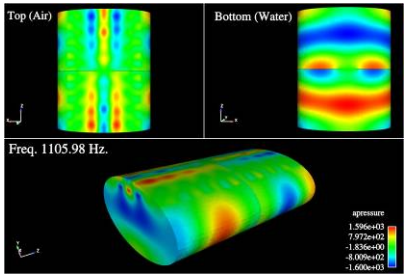
- **High fidelity diagnostics and novel experimental approaches**
- **Constitutive phenomena critical to closure for predictive simulation**
- **Advanced computational capabilities**



2-D Temperature Imaging w/ FRS

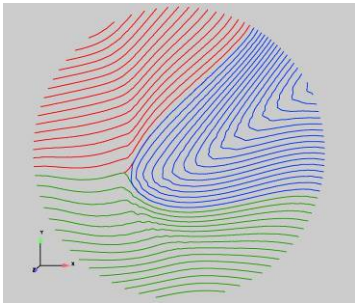


Detached Eddy Simulation



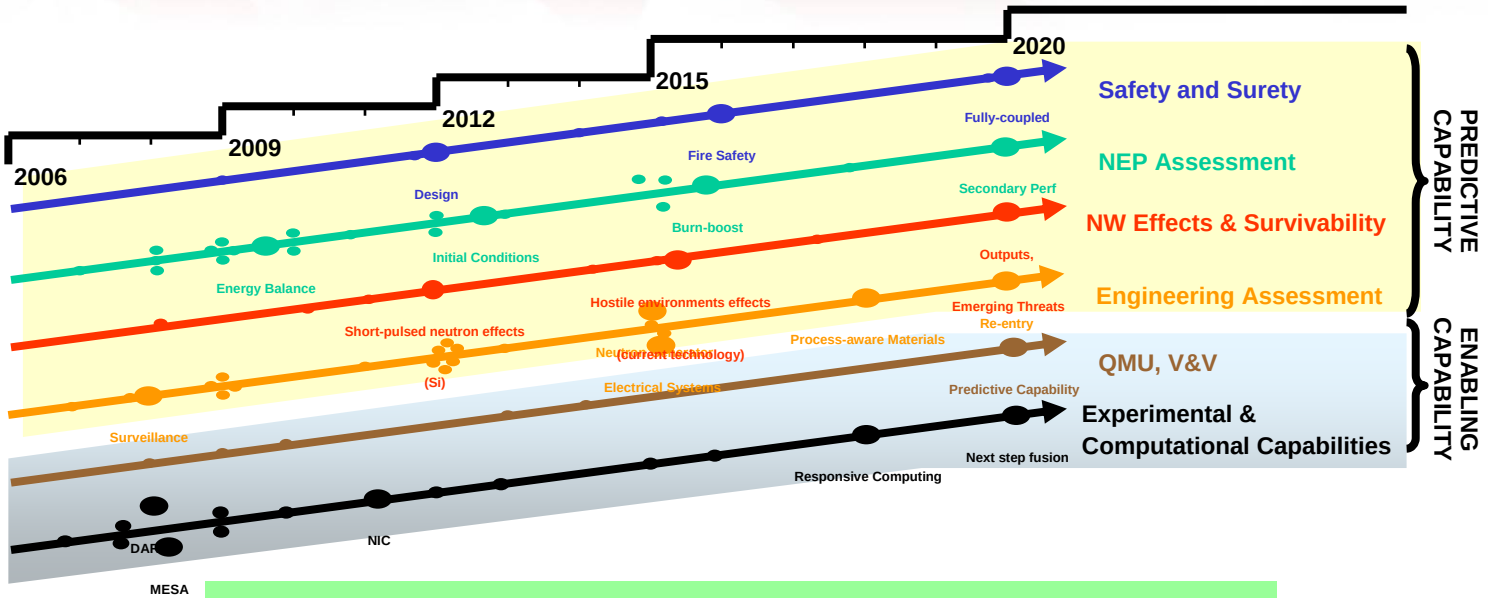
Acoustic simulation capabilities

Multiphase tracking

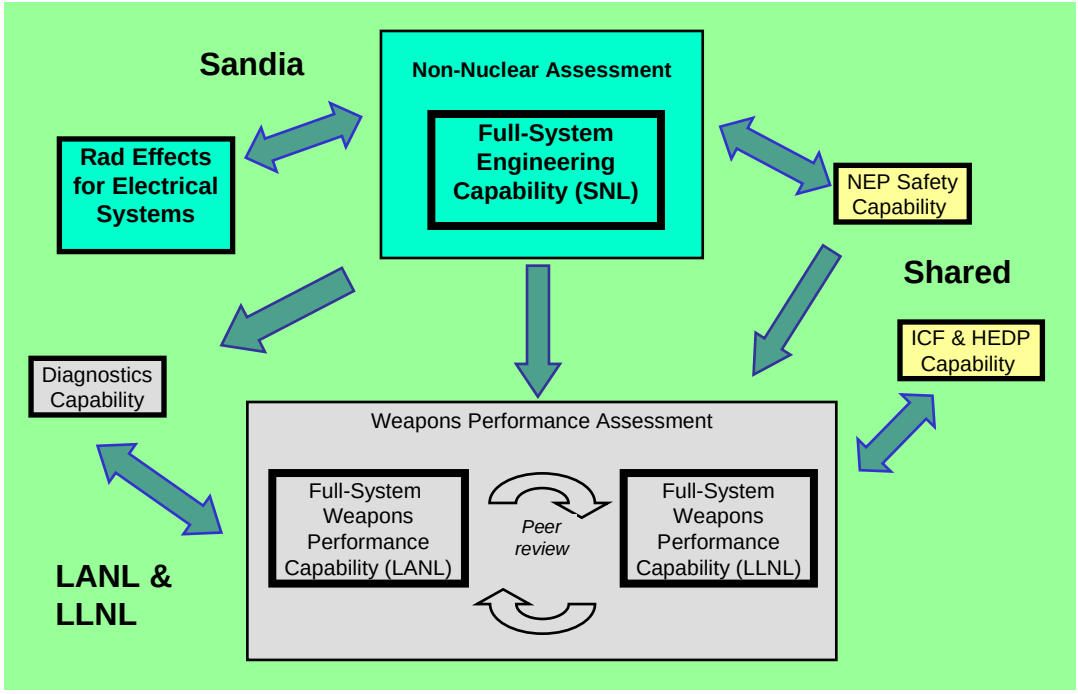


The Nuclear Weapons Program has provided the principal drivers for our S&T activities

The Predictive Capabilities Framework brings together work in ASC, ICF, Science and Engineering Campaigns



Sandia has the Engineering Stewardship role in the ASC National Simulation Portfolio for Stockpile Certification



Enable Predictive Simulation strategy: we have identified and prioritized key technology needs for funding in FY2009

Technology Focus Areas

Solid Mechanics	• Material response with focus on Failure
Structural Dynamics	• Environmental loads (energy transfer and dissipation)
Thermal Sciences	• Thermo-chemical phenomena (polymers & energetic materials)
Aerosciences	• Aerothermodynamics of hypersonic systems
Multiphase Flows	• Manufacturing processes
Microsystem Engineering Science	• Non-continuum phenomenology for Thermal Actuators
Electrical Sciences	• Response to Extreme Electrical Environments

For each Technology Focus Area, we have established the highest priority needs and are directing 40-50% of our total S&T funding in those areas

Engineering Sciences S&T stewardship requires we meet the following challenges

- Enable pervasive use of physical and computational simulation capabilities
- Sustain the appropriate work mix (research, development, and applications) which includes synergistic efforts in computation and experimentation
- Sustain the ES infrastructure
  - Attract and retain the nation's best Engineering Scientists
  - Sustain/improve the experimental and computational "backbone"
- Establish and expand strategic partnerships* that will enable ES to meet its long-term vision

*with the industrial sector, academia, and other science & engineering labs