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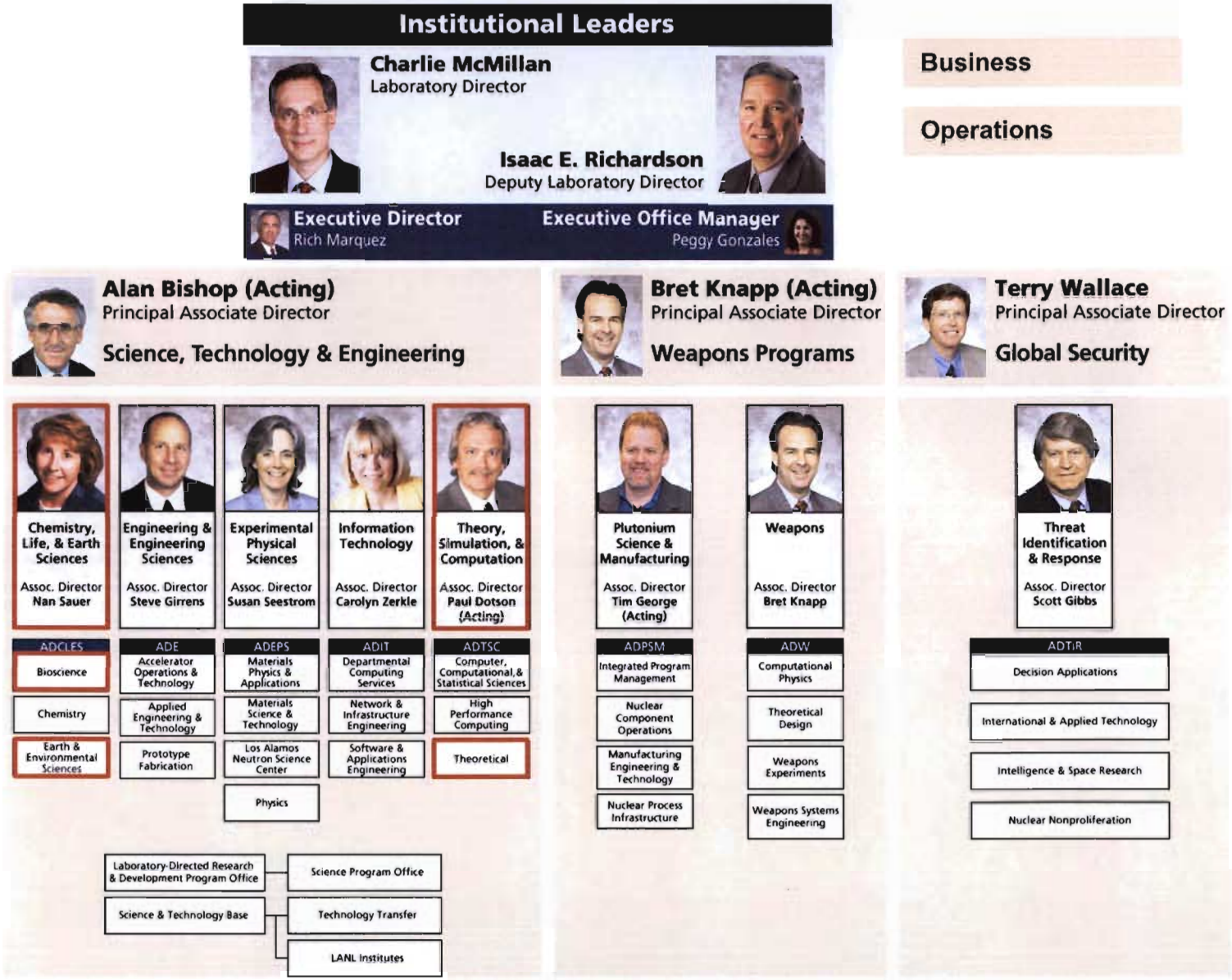
LANL Science Base Update to BER October 4th, 2011

Nan Sauer

Associate Director

Chemistry, Life and Earth Sciences

Laboratory Science Organization



Chemistry, Life, and Earth Sciences

Nan Sauer, Associate Director
Randy Erickson, Deputy AD

Bioscience
Gary Resnick, DL
Chris Detter, Act. DDL

- Genome Science JGI/Los Alamos
- Biosecurity & Public Health
- Bioenergy & Environmental Science
- Advanced Measurement Science

Chemistry
Carol Burns, DL
Jurgen Schmidt, (Act DDL)

- Actinide Analytical Chemistry
- Physical Chemistry and Applied Spectroscopy
- Chemical Diagnostics and Engineering
- Nuclear and Radiochemistry
- Inorganic and Isotope Chemistry

Earth & Environmental Sciences
James E. Bossert, DL
Andy Wolfsberg, Acting DDL

- Repository Science and Operations
- Earth Systems Observations
- Computational Earth Sciences
- Geophysics

Laboratory LDRD Investments – Climate Example

26 active DRs (2009-2011) in climate-related research

48 active DRs (2009-2011) in climate-related research

15 active LDRDs (2009-2011) in Complex Bio

7 active DRs (2009-2011) in Energy and Earth Systems

1. Terrestrial Vegetation, CO_2 Emissions, and Climate Dynamics
2. Predicting Climate Impacts and Feedbacks in the Terrestrial Arctic
3. Integrated Experimentation and Hybrid Modeling for Prediction and Control of Multiphase Flow and Reaction in CO_2 Injection and Storage
4. Revolutionary Science at the Intersection of Extreme and Transient Events, Natural Hazards, and National Security
5. Energy Storage
6. Radioparagenesis: Robust Nuclear Waste Form Design and Novel Materials Discovery
7. High-Resolution Physically-Based Model of Semi-Arid River Basin Hydrology

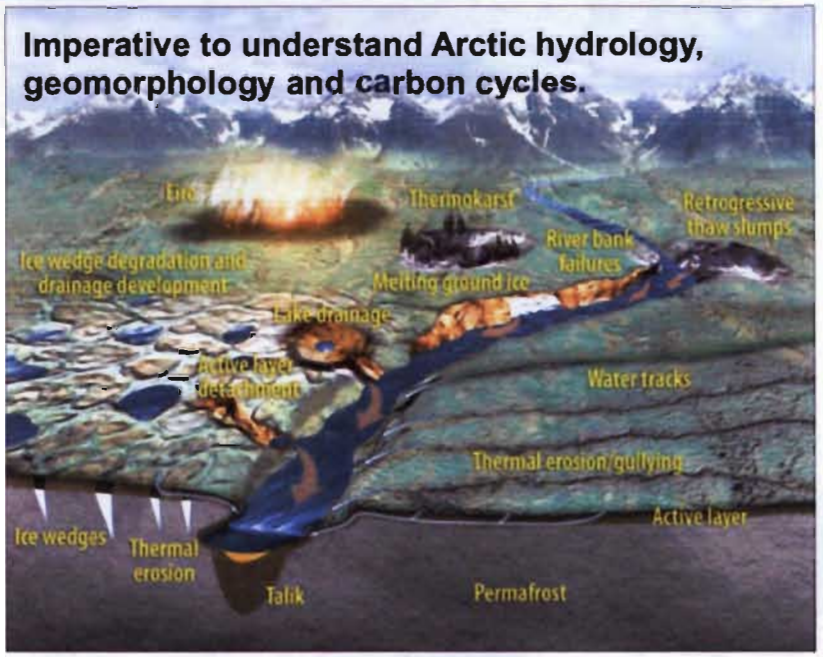
Laboratory LDRD Investments – Climate Example

- Terrestrial Vegetation, CO2 Emissions, And Climate Dynamics – McDowell (2011, $1.65M/yr)
- Multi-Scale Science Framework For Climate Treaty Verification: Attributing And Tracking Greenhouse Gas Fluxes Using Co-Emitted Signatures – Dubey (2011, $1.65M/yr)
- Advanced Metagenomic Analysis To Understand Dynamics Of Soil Microbial Community Under Conditions Of Climate Change – Han (2011, $1.65M/yr)
- Understanding Arctic Hydrologic Response To Climate Change – Travis (2010, ~$300K)
- Isotopic Tracer For Climate Relevant Secondary Organic Aerosol –Rahn (2009, ~$300K)
- A Visionary New Approach To Assess Regional Climate Impacts On Vegetation Survival And Mortality – McDowell (2009, ~$300K)
- Site Specific Isotope Measurements and Multiply Substituted Isotopologues Larson, Mora (2011, seedling)
- Modeling The Surface Mass Balance And Freshwater Runoff From The Greenland Ice Sheet In A Changing Climate – Hecht (2010, seed funding)
- Roles Of Fungi In Terrestrial Ecosystem Carbon Cycling – Kuske (2010, seed funding)
- Carbon And Oxygen Isotopic Variability In Succulent Plants And Their Spines: A New Tool For Climate And Ecosystem Studies In Desert Regions – Mora (2009, Director's funded Post-doc)
- IGPP Minigrants – Claudia Mora and Joel Rowland

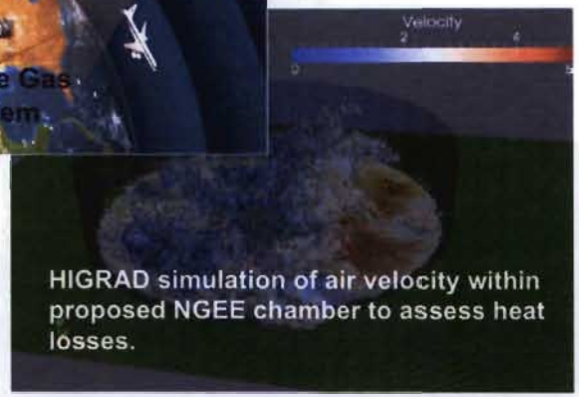
LANL science strategy is well aligned with BER vision

A Strategy of Science That Matters – Science of Signatures

Climate challenge: Establish the grand challenges in Arctic climate science that LANL can address



Isotope challenge: Develop programmatic opportunities in Greenhouse Gas Information System (GHGIS) and Next Generation Ecological Experiment (NGEE).



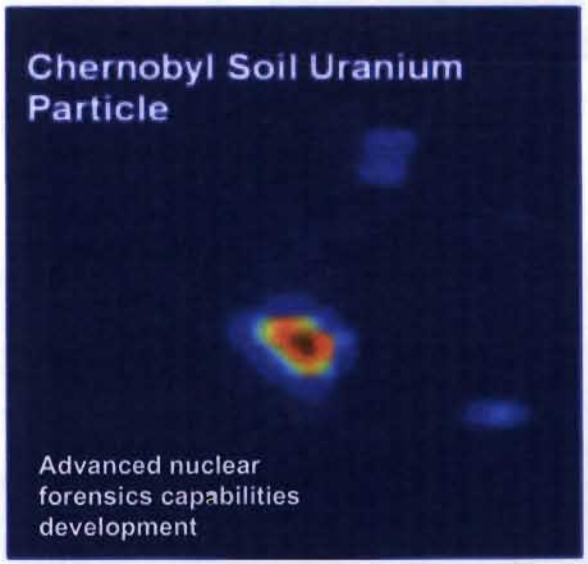
LANL science strategy is well aligned with BER vision

A Strategy of Science That Matters – Science of Signatures

Biosecurity challenge: Develop technology for characterization of natural and engineered complex biological systems. Characterization, prediction, and management of algal production.

Radiological and Nuclear challenge:

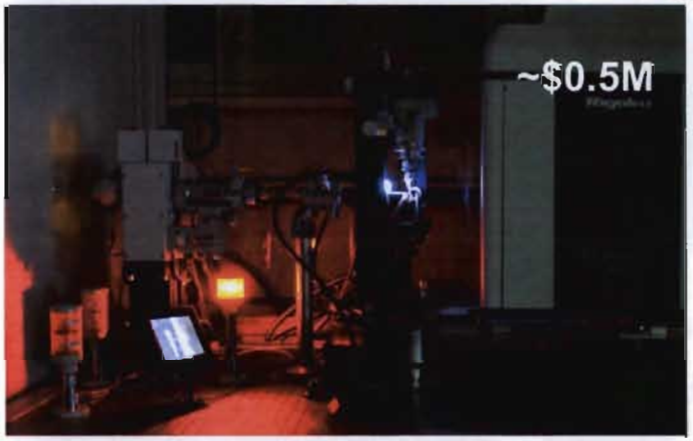
Radiological and nuclear forensics enhancements to detect and deter weapons of mass effect. Signatures that arise from nuclear production, conversion, and aging process.



Equipment investments

- 700 MHz AVANCE III Bruker NMR spectrometer – **National Security/ Energy/Signatures. Being Installed Sept/Oct. 2011**

- Rigaku R-Axis X-Ray for protein crystallography: **Operational August 2011.**



- Cameca Secondary ionization mass spectroscopy (SIMS). **National Security/ Signature Applications. Installation ongoing September 2011.**

LANL Mission

***Our mission as a DOE national security science laboratory* is *to* develop and apply science, technology, and engineering solutions to:**

- Ensure the safety, security, and reliability of the U.S. nuclear deterrent
- Reduce global threats
- Solve Energy Security and other emerging national security challenges

Our vision is to be the premier National Security Science Laboratory.

Los Alamos Science in the 21st Century

A Premier National Security Science Laboratory:

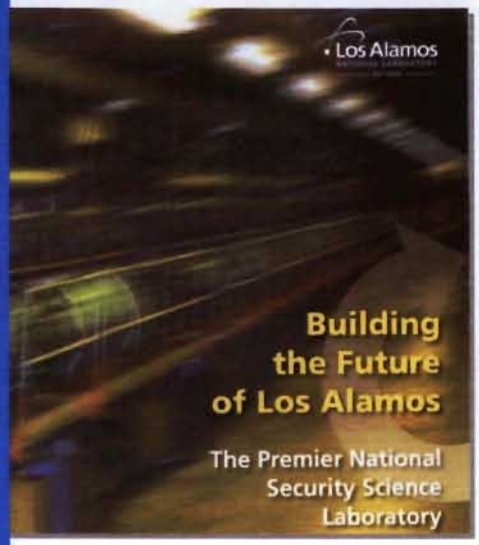
- Integrates theory, simulation, and experiments.
- Uses multidisciplinary science, technology, and engineering.
- Solves problems that are large scale, complex, and high impact.
- Utilizes unique, multifaceted, or experimental and computational facilities.
- Develops technology that is highly complex, and sensitive or classified in nature.

High Throughput Laboratory Network

High performance computing and visualization

Raptor "thinking" telescopes

LANL's Major S&T Initiatives



- Experimental science focused on materials for the future
- Information science and technology enabling integrative and predictive science
- Science of Signatures for enduring national needs

Materials for the Future

Information Science and Technology for Integrative and Predictive Science

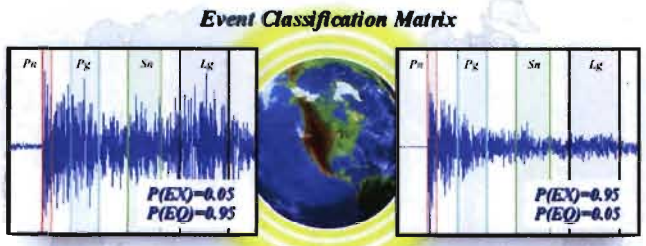
Science of Signatures

Science of Signatures (SoS) Capability Pillar

Vision

Detect vulnerabilities and threats, develop signatures, and understand components, species or processes that have a major impact or are important indicators for large complex systems.

Cameca Ion Probe Mass Spectrometer (forensics)



Seismic Detection of Nuclear Explosions

Capability Elements

- People/Skills
- Equipment
- Facilities and Infrastructure
- Investments (LDRD, centers, etc.)
- Partnerships

SoS Capability

- Threat Analysis
- Signature Discovery
- Signature Measurement
- Signature Exploitation & Information

Management of the SoS Capability is Strategic

Capability pillars are comprised of LANL expertise from multiple historical missions, such as nuclear design and testing, nonproliferation, human genome, space sciences, remote detection, energy, surveillance and other past and current programs.

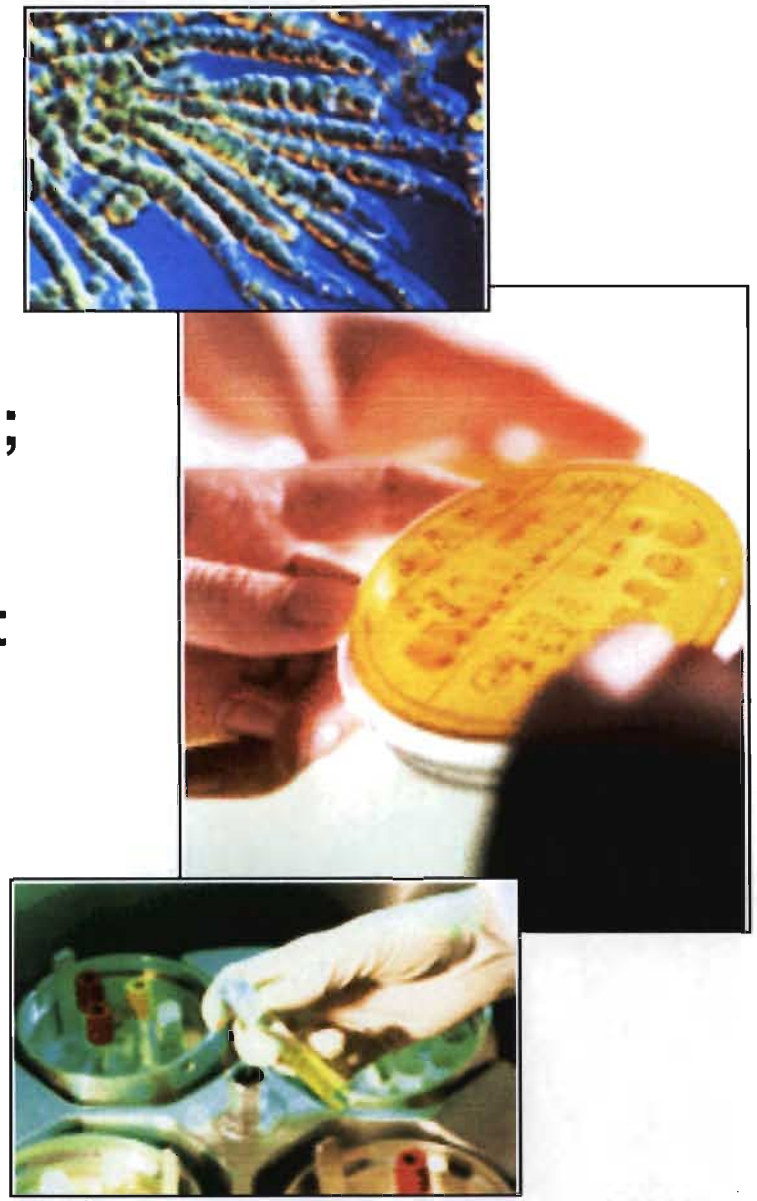
- **Efficiencies**
  - Better equipment, tools, resources
  - Physical co-location of common tools
  - Shared procurements; leveraged buying
  - Greater return on investment
- **Enhanced Laboratory Capabilities**
  - Internal awareness of common activities
  - Cross-cutting thinking
  - Identification of gaps in our capabilities
  - Enabling multidisciplinary ST&E
  - Increased ability to engineer solutions

Targets:

- World-leading science
- Recognition of capability for application to a broad suite of programs
- Laboratory focus & agility for current and emerging national needs
- *Technical community and staff ownership*

Bioscience Mission

- Reduce natural and deliberate threats to the human populations and the environment;
- Prevent the proliferation of biological and chemical weapons;
- Provide technologies for their detection and for defense against their use; and
- Contribute to the health and well-being of the world population.



Climate Impacts: Focus on the Arctic

Predicting river system response to warming

Methane in permafrost studies

Greenhouse Gas Information System

HIGRAD modeling of atmospheric effects