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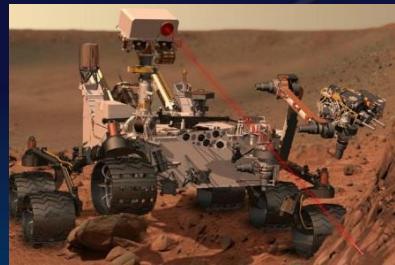
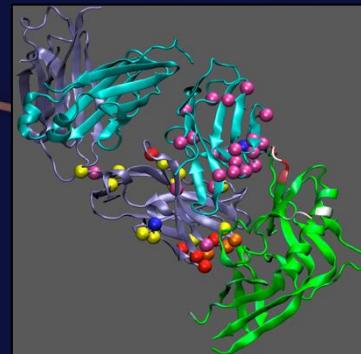
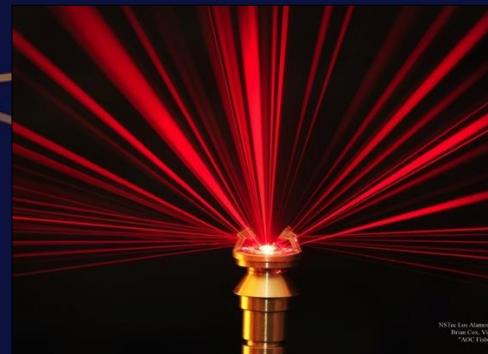
Issued: 2014-03-19



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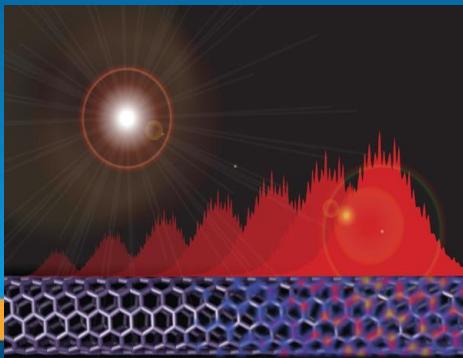
# Los Alamos National Laboratory Science Excellence for Mission Impact

**Alan Bishop**

Principal Associate Director  
Los Alamos National Laboratory

March 19, 2014

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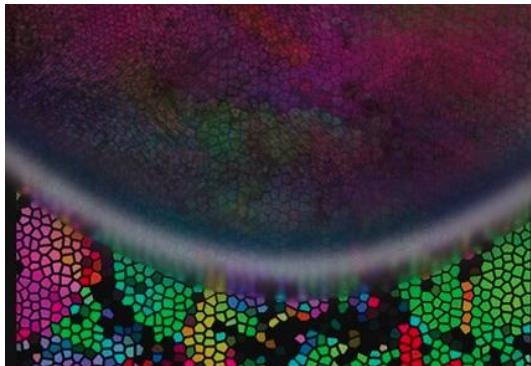
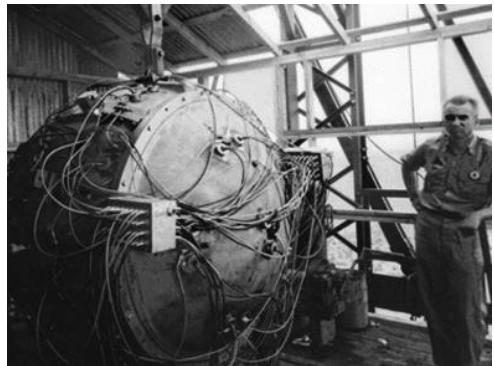


# Los Alamos: National Security Science Laboratory

solving this nation's most crucial challenges



- We anticipate, innovate, and deliver solutions.
- We span the spectrum from Discovery through Applied Science to Prototypes.
- We use the outstanding science, engineering, and technology from our core stockpile stewardship mission for other national needs.



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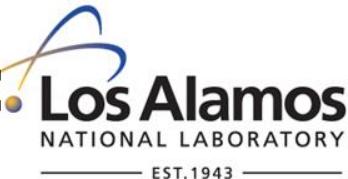
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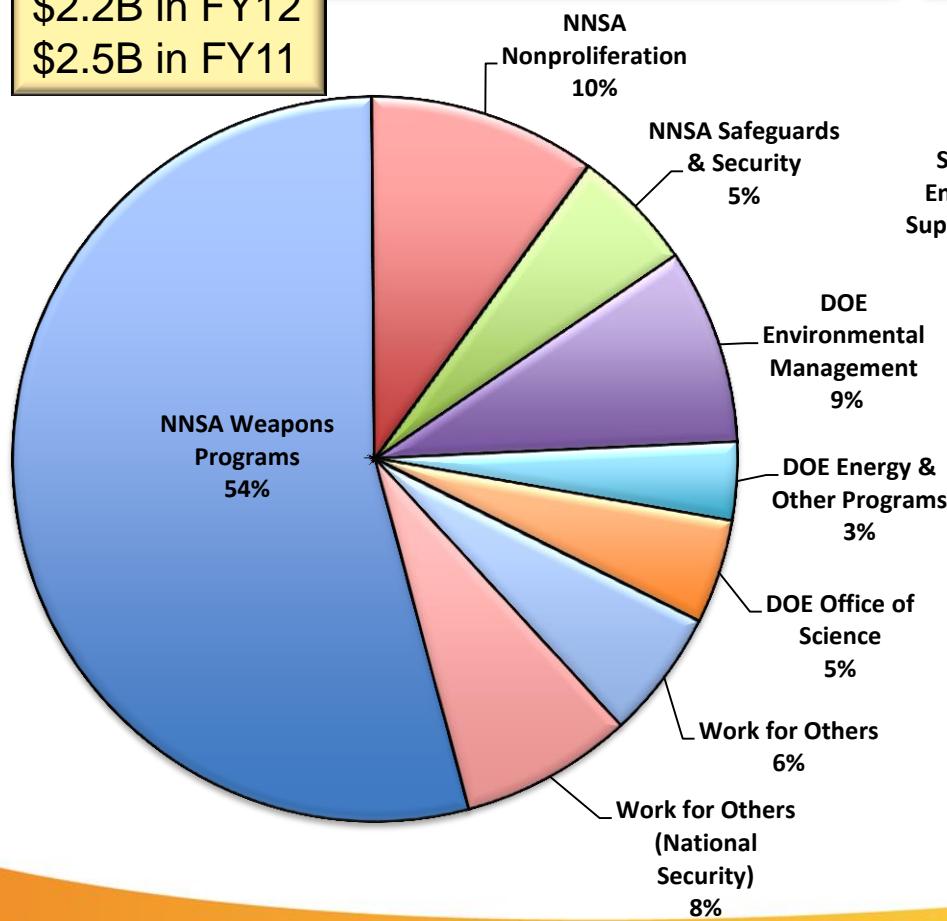
# Applying multidisciplinary capability:

Inherent in our broad funding and workforce base

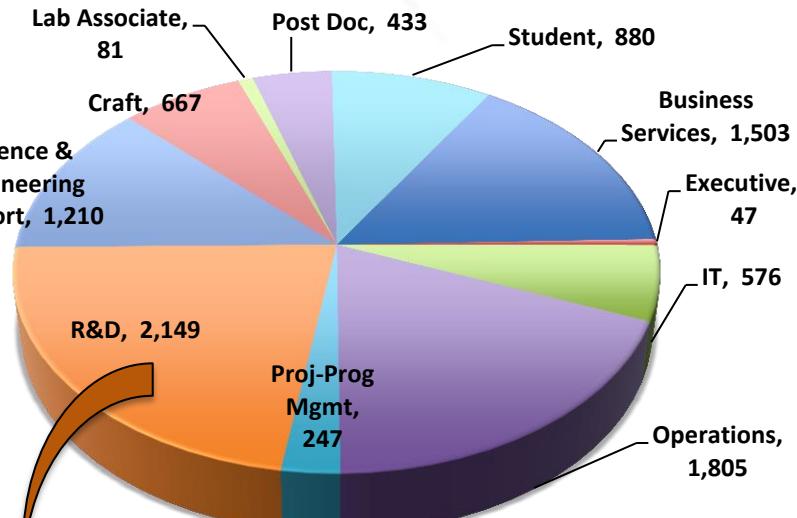


**\$2.1–2.2B in FY2013/2014**

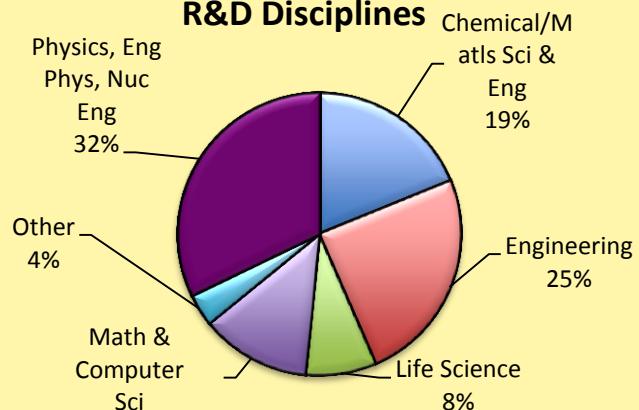
\$2.2B in FY12  
\$2.5B in FY11



9,600 National Security specialists collaborate in a wide variety of technical disciplines



## R&D Disciplines



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# ST&E Capability Pillars:

## Build cross-disciplinary teaming expertise for current and future missions



### SCIENTIFIC EXCELLENCE FOR NATIONAL SECURITY

LANL  
MISSIONS

Nuclear  
Deterrence

Global  
Security

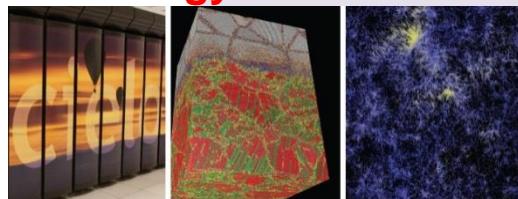
Energy &  
Emerging  
Threats

Integrating Assets for  
Program Execution

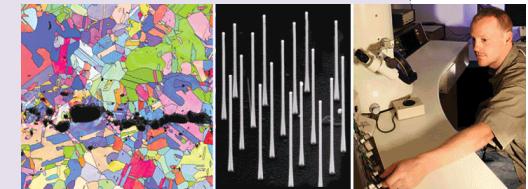
Science of Signatures



Information, Science, and  
Technology for Prediction



Materials for the Future



CAPABILITY  
PILLARS

Nuclear and Particle Futures



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# Scientific vitality underpins LANL missions:

Investments in reciprocal pipelines of people, ideas, partnerships



## International User Facilities

Excellent Reviews in FY13



National High Magnetic Field Laboratory



Center for Integrated Nano Technologies



LANSCE

## Institutes



## Universities & Industry

# Scientific Vitality

## National Security Education Center

## Fundamental Science Investment



Innovation for our Nation

## Student and Postdoc Programs

Excellent Review in FY13



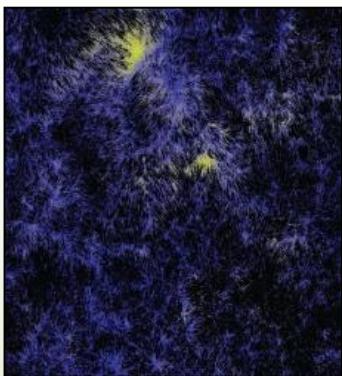
Students: ~1,250 in FY13

Postdocs: ~420 in FY13

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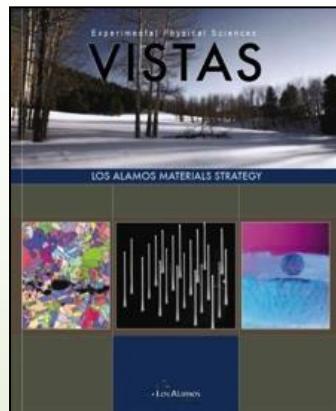
# FY15 DR Focus Areas support all missions

## Information Science and Technology



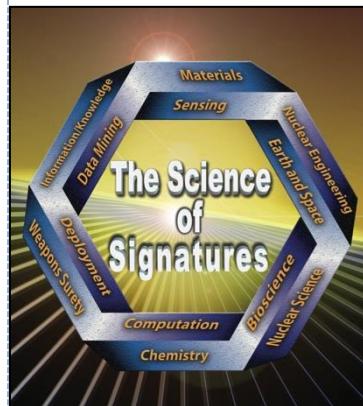
- Data Science at Scale
- Computational Co-design (Novel Computing Devices, Software, Algorithms)

## Materials for the Future



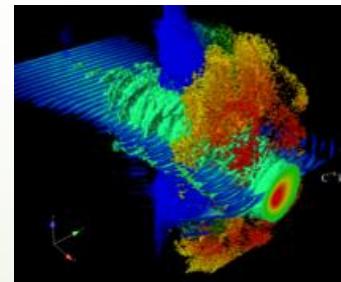
- Defects and Interfaces
- Extreme Environments
- Emergent Phenomena

## Science of Signatures



- Discover Signatures
- Revolutionize Measurement
- Forward Deployment

## Nuclear and Particle Futures



- Nuclear & Particle Physics, Astrophysics & Cosmology
- Applied Nuclear Science & Engineering
- High Energy Density Physics and Fluid Dynamics
- Accelerators and Electrodynamics

## Complex Natural and Engineered Systems



- Multi-scale and Collective Phenomena
- Dynamics and Feedbacks across Boundaries and Interfaces
- Large-scale Integration

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# Perils of Uncertainty:

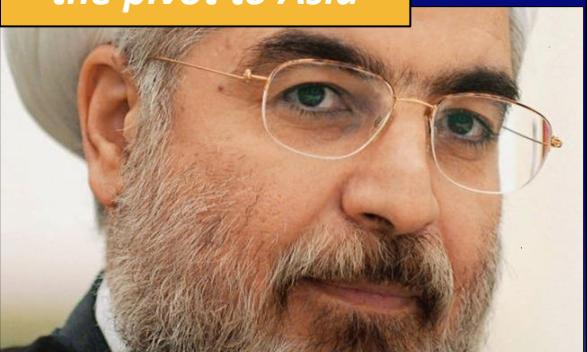
## We *will* be called to address new problems



*the pivot to Asia*



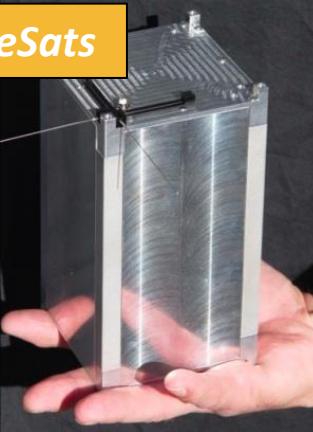
*nuclear  
proliferation*



*terrorism & the increasing  
reach of technology*



*CubeSats*



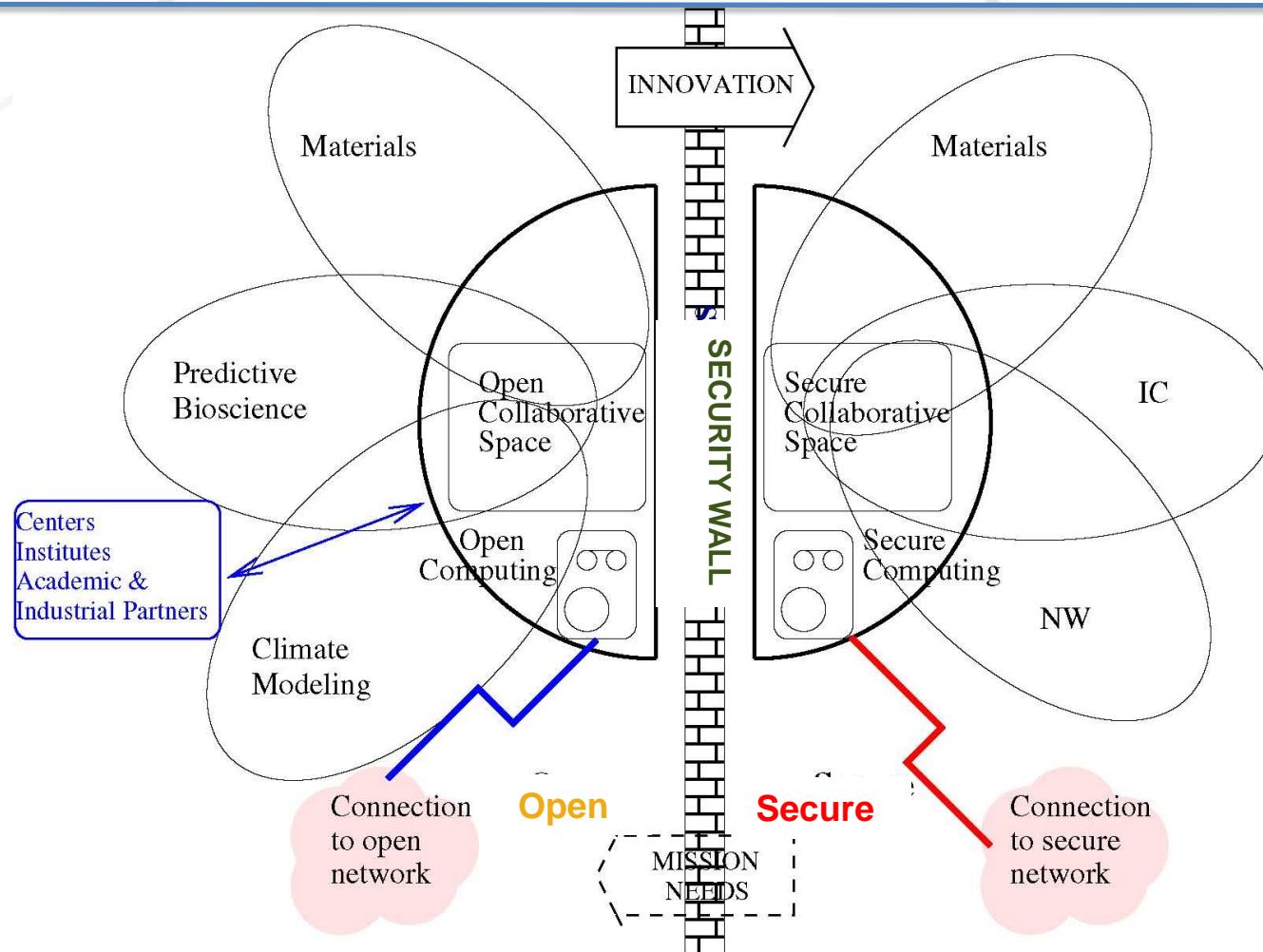
*asymmetry & the rise  
of the individual*



*contested space*



# Los Alamos has a unique environment for national security end-to-end integrated capability

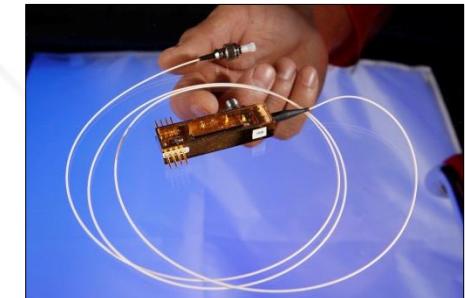


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# Quantum cryptography applied to electric grid security

First-ever demonstration to secure control data for electric grids using quantum cryptography.

- Performed in the electric grid test bed at the Trustworthy Cyber Infrastructure for Power Grid project (University of Illinois)
  - Provides a means to detect and defeat an adversary who tries to intercept or defeat communications.
  - System is based on a miniaturized quantum cryptography invention developed at Los Alamos.



Miniature transmitter communicates with a trusted authority to generate random cryptographic keys to encode and decode information.

Demonstration benefits from partnership with Univ. of Illinois.

Media reports: *Electric Energy Online*, *Nanotechnology Now*, *Electric Energy T&D Magazine*, *Innovations Report Online*, *Smart Grid*, *Penn Energy*.

*Method is compatible with electric-grid control communications, providing strong security based on physics without introducing excessive delays in data delivery.*

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# EMC Partnership (2012): Pushing innovation boundaries



## Reducing checkpoint bottlenecks and data storage costs with software

- ◆ LANL Parallel Log Structured File System (PLFS)



## The Active Burst Buffer Appliance (aBBA)

- ◆ Hardware/software solution jointly developed by LANL & EMC
- ◆ Leverages PLFS
- ◆ Enables real-time analytics on burst data
- ◆ aBBA will be a new EMC product

## Cyber Security

- ◆ EMC is evaluating commercializing LANL's PathScan technology
- ◆ PathScan detects adversaries moving/traversing around networks

Laying the groundwork to Exascale through partnership

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