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07.17.2013 | UNCLASSIFIED | 2  
LA-UR-13-25375

**Los Alamos:**  
Where Great Mission and Science frontiers meet

*Our strategy as a multi-program national security capability laboratory is to develop and apply the best science, technology, and engineering solutions to the toughest national security missions:*

- ◆ Multidisciplinary science, technology, and engineering challenges
- ◆ Problems demanding unique experimental and computational facilities
- ◆ Highly complex security issues requiring fundamental breakthroughs

**People → Capability → Mission Impact**

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07.17.2013 | UNCLASSIFIED | 3  
LA-UR-13-25375

## Capability Pillars provide cross-cutting ST&E focus for our national security missions

**MISSION**

- Nuclear and Particle Futures**
- Complex Natural & Engineered Systems**
- Materials for the Future**  
defects and interfaces, extreme environments, and emergent phenomena
- Science of Signatures**  
discover signatures, revolutionize measurements, and forward deployment
- Information, Science, & Technology for Prediction**  
data science at scale, computational co-design, and complex networks

Nuclear Deterrence  
Energy Security  
Global Security

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## Advanced Manufacturing is emerging as a national need

REPORT TO THE PRESIDENT ON ENSURING AMERICAN LEADERSHIP IN ADVANCED MANUFACTURING

Executive Office of the President  
President's Council of Advisors on Science and Technology

**Integrated Computational Materials Engineering**  
A Transformational Discipline for Improved Competitiveness and National Security

U.S. Department of ENERGY

**FY 2012 Stockpile Stewardship and Management Plan**  
Report to Congress  
April 15, 2011

"need ... for sophisticated manufacturing linked to products and processes derived from scientific discovery and technological innovation"

"The materials development and optimization cycle can no longer operate at the rapid pace required, and this potentially threatens U.S. competitiveness in powerhouse industries such as electronics, automotive, and aerospace. In which the synergy among product design, materials, and manufacturing has given our nation a competitive advantage."

To mature and produce products for stockpile life extension, production sites require exceptional manufacturing capabilities and expertise.

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## 70 Current Manufacturing Missions at LANL

**Primary Mission areas: Nuclear Weapons, Global Security, Renewable Energy, Nuclear Energy**

- ◆ Small Lot Production
- ◆ Prototype component fabrication
- ◆ Prototype systems
- ◆ Process Development

**Unique attributes**

- ◆ Multi-scale materials modeling
- ◆ Hazardous and radiological materials
- ◆ Air sensitive materials
- ◆ Nanomaterials synthesis
- ◆ Integrated process modeling
- ◆ Secure facilities (incl. SCIF)
- ◆ High-performance computing

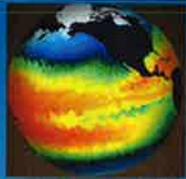
**Partnerships Emerging**

- ◆ New Mexico universities and community colleges
- ◆ Industry manufacturing partners (P&G, ATK, Boeing)



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## 70 Los Alamos Energy Security Focus Areas



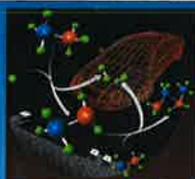
**Impacts of Energy Demand Growth**

- Coupled predictive models for climate, infrastructure impact analysis
- Prediction of abrupt change at multiple scales (regional to global)
- Global security and policy implications



**Sustainable Nuclear Energy**

- Efficient extraction of energy content from fuel
- Nonproliferation & safeguards
- Effective waste management



**Concepts and Materials for Clean Energy**

- Energy storage, generation, and transmission
- Revolutionary alternatives to petroleum
- Clean fossil energy

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 **Focus on the Southwest:**  
Drought and tree mortality



**In the world's two largest drought experiments, Los Alamos researchers seek to determine specifically why and where trees are dying.**

- Created a global monitoring system to determine where trees are dying to improve predictions of future tree mortality.
- The rapid death of these trees—long-term carbon reservoirs—might create a significant new carbon source that could accelerate the pace of climate change.

*New York Times*, December 24, 2012: Lead story in Science Section  
**As Forests Disappear, Examining the Mechanisms of Their Death**  
<http://www.nytimes.com/2012/12/25/science/los-alamos-national-laboratory-studies-tree-deaths.html>

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 **Investing in Science & Engineering Vitality:**  
Pipelines of people, ideas, and collaborations

**International User Facilities**  
Excellent Reviews





National High Magnetic Field Laboratory  
Center for Integrated Nanotechnologies  
LANSCe

**Science Vitality**

National Security Education Center

**Fundamental Science Program**



Innovation for our nation  
(\$145M in FY12)

**Institutes**



Universities & Industry

**Student and Postdoc Programs**

Students: ~1250 in FY12  
Postdocs: ~ 450 in FY12



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## Los Alamos has fostered a "Culture of Partnership"

<p style="text-align: center; background-color: #FFD700; padding: 2px;"><b>Technology Transfer</b></p> <div style="display: flex; justify-content: space-between; align-items: center;"> </div> <p style="font-size: small;">Results from our reliability technology partnership with Los Alamos will reduce P&amp;G costs by \$1.5B annually. <i>Mark Peterson, Procter&amp;Gamble</i></p>	<p style="text-align: center; background-color: #FFD700; padding: 2px;"><b>Labs &amp; Universities</b></p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> <p><b>ExMatEx</b></p> </div> <div style="text-align: center;"> <p style="font-size: x-small;">Center for Materials at Irradiation and Mechanical Extremes</p> </div> <div style="text-align: center;"> <p style="font-size: x-small;">Consortium for Advanced Simulation of Light Water Reactors</p> </div> </div>
<p style="text-align: center; background-color: #FFD700; padding: 2px;"><b>International Partnerships</b></p> <div style="display: flex; justify-content: space-between; align-items: center;"> <div style="width: 45%;"> <p style="font-size: x-small;">Smart house with Los Alamos County</p> </div> <div style="width: 45%;"> <p style="font-size: x-small;">Japan: Ministry of Technology Development (NEDO)</p> </div> </div>	<p style="text-align: center; background-color: #FFD700; padding: 2px;"><b>New Mexico Consortium</b></p> <p style="font-size: x-small;">PROBE Supercomputing Center ribbon-cutting</p> <div style="text-align: right; margin-top: 5px;"> </div>

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## Partnership with the NM Consortium

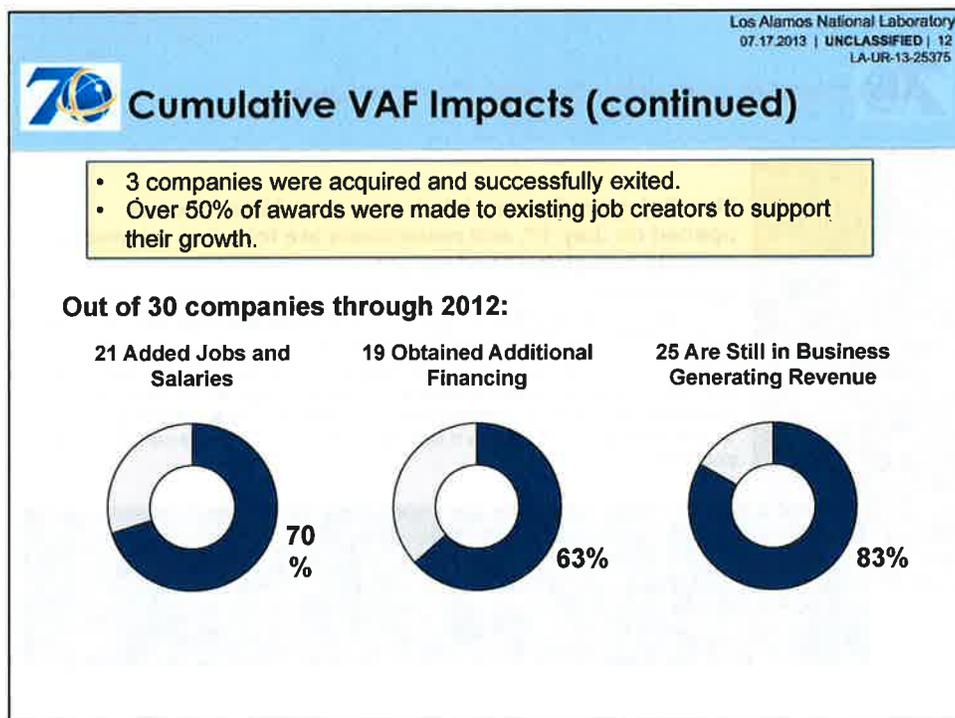
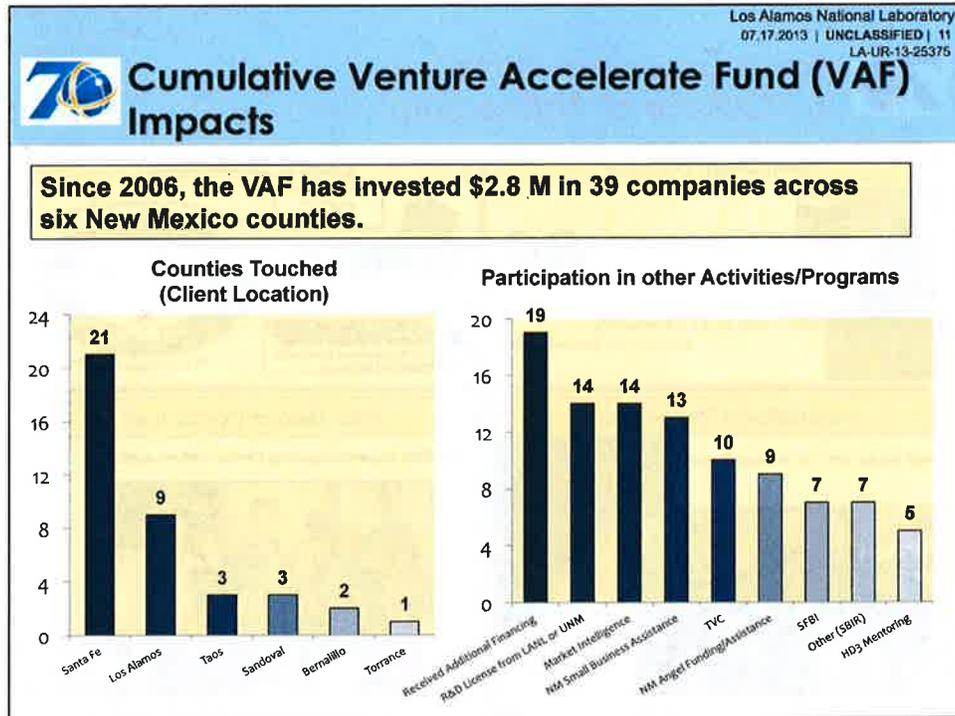
**The Biological Research Laboratory and Greenhouse opened on July 1<sup>st</sup>, and researchers are focusing on energy security and global food security**

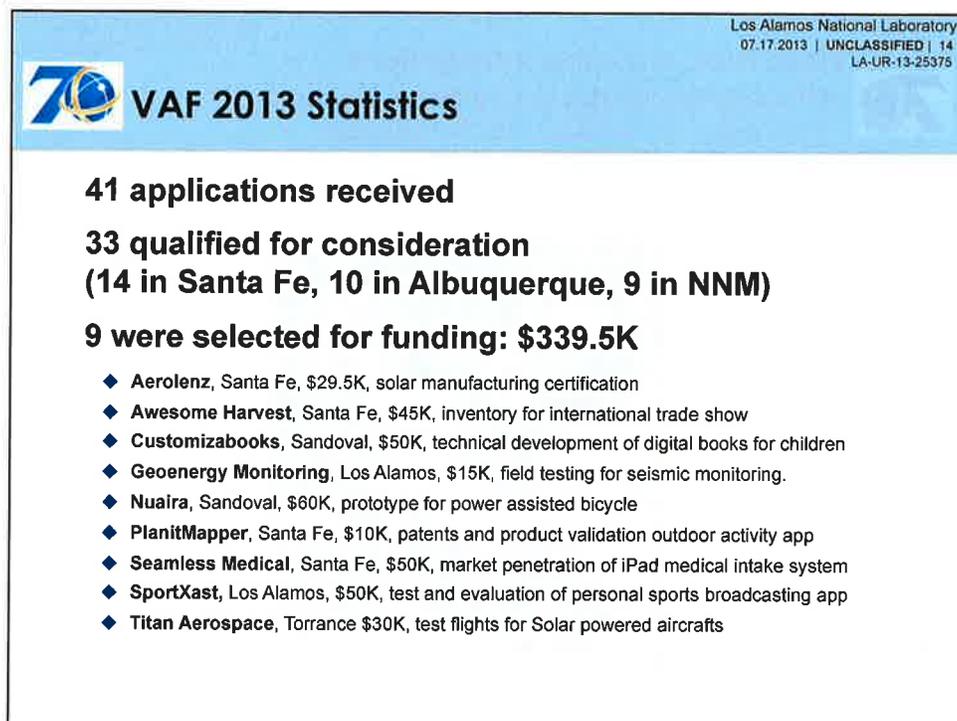
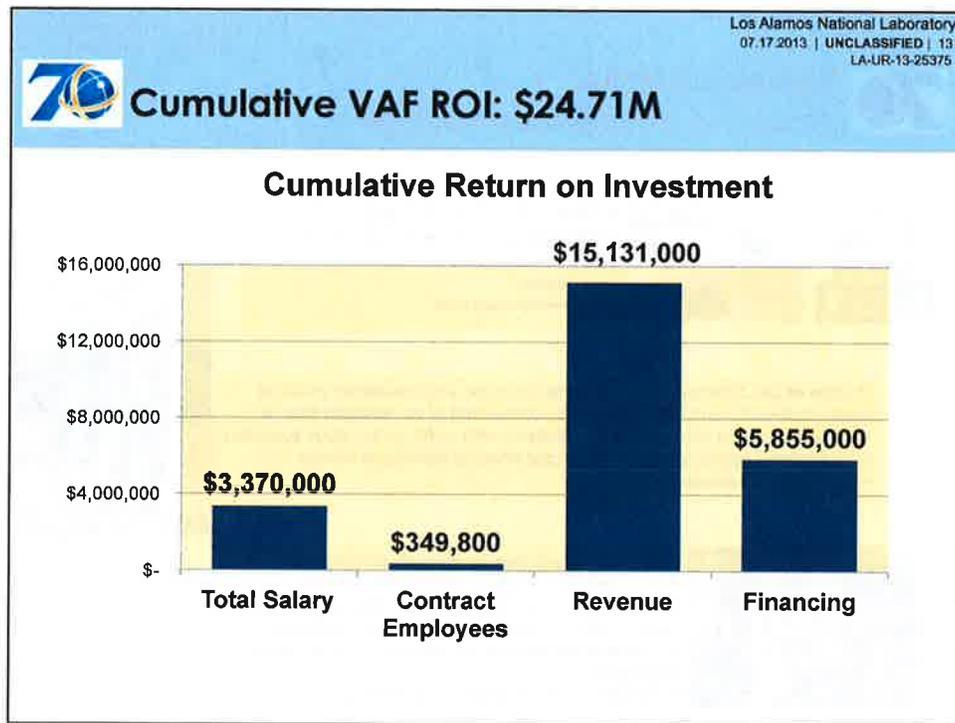
**Partners:** New Mexico Consortium (the three NM research universities), LANL, Los Alamos County, and Richard Sayre and his research team (with funding from the Air Force, DOE, NSF, NIH, and Gates Foundation).

In addition to its work in energy security, Sayre's team is beginning new research in solar energy, combining material science and biology to improve the efficiency of photosynthesis. The team is also expanding its research program in food security. "Just as exciting as our research in biofuels—and absolutely critical—is our work in global food security," said Sayre.

"Los Alamos National Laboratory has always pioneered discoveries to protect our nation, and today energy security is an important part of that work. This biology research lab is a great step forward for the consortium and for our nation. I'm especially excited about the work that will be done here on biofuel and biotechnology benefits of algae."

Senator Tom Udall





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07.17.2013 | UNCLASSIFIED | 15  
LA-UR-13-25375

**70** **VAF and NMSBA:**  
What are our partners saying?





**Tape-Ease:** "The VAF award came at the most opportune time for Tape-Ease....The grant has been a lifeline for Tape-Ease. We're so grateful!"  
Linda Johnson  
<http://www.tape-ease.com/>



**Pueblo of Zia, Sandoval County:** "The expertise and assistance provided to the Pueblo of Zia by NMSBA is a key component of our success thus far. We look forward to our continued partnership with LANL as the study evaluates our integrated approach to producing cost-effective renewable energy."  
*Peter Pino, Tribal Administrator*



**"Vapour Organic Beauty** owes much of its potential for success as true player in the international cosmetics world to the timely assistance of the VAF Grant... We are now well positioned for the future as a successful international company based in Northern New Mexico."

*Krysla Boinis, co-founder of Vapour Organic Beauty*

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LA-UR-13-25375

**70** **Heat map showing interactions**  
**with companies across New Mexico**  
(includes VAR, NMSBA, Tech Transfer)

