Sandia science and technology: a vital resource for NM and the country

Presented to

New Mexico State Legislators

September 1, 2011

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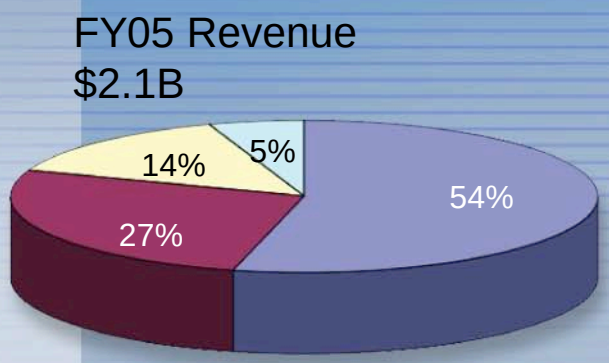
Sandia National Laboratories

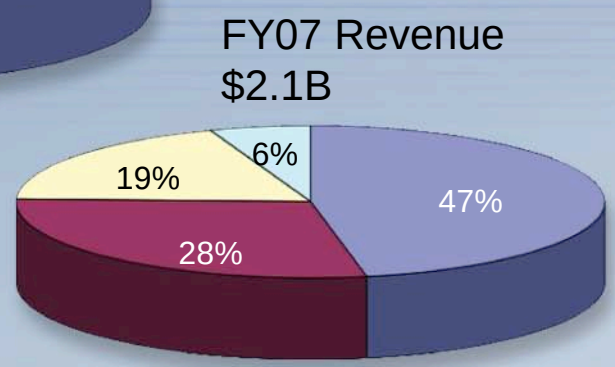
Sandia National Laboratories

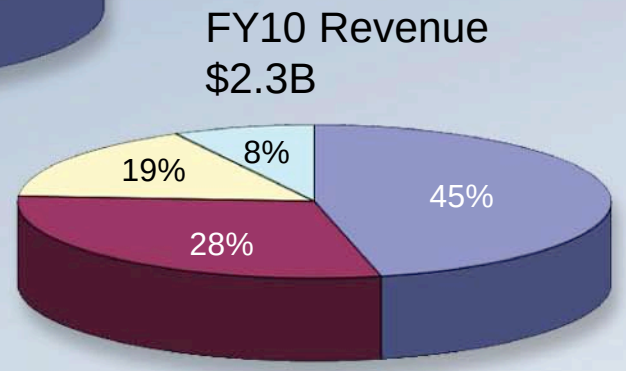
Todays' topics

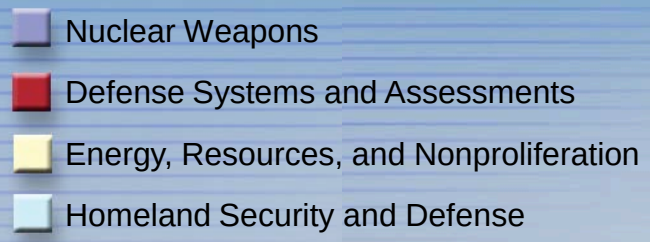
- **Sandia as a multi-program laboratory**
- **Highlights in energy research**
- **Highlights in national security research**
- **Supporting urgent national needs**
- **Economic development programs**
- **Educational outreach programs**

Lab-Wide Budget Picture









Research investments across the spectrum

Office of Science

NNSA

NIH

BES

DOE/Energy

DoD/Research

DHS

DARPA

Other Government Agencies

LDRD

Industry Partners

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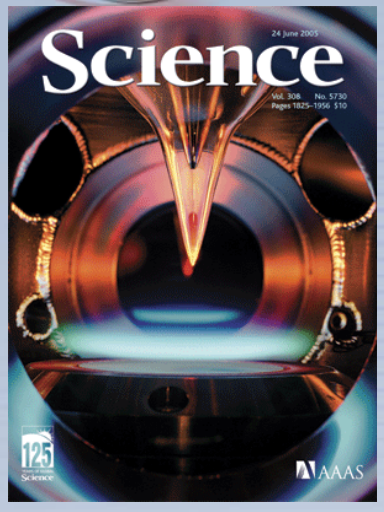
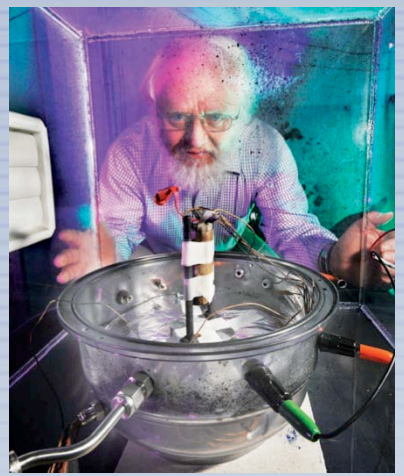
A major focus of Sandia research is new energy technology



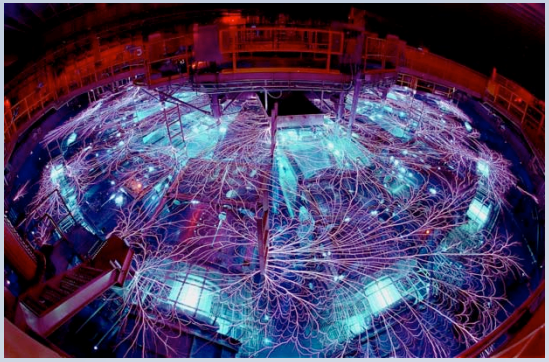
Combustion

Solid-State Lighting



Electrical Energy Storage

Fuels from Sunlight



Materials for Extreme Environments

Solar Energy Utilization

Smart Green Electrical Grid

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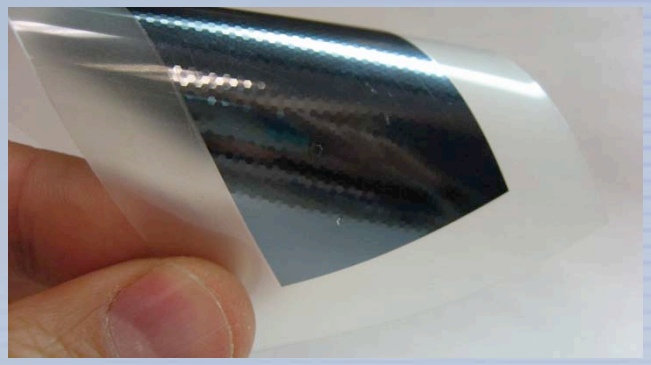
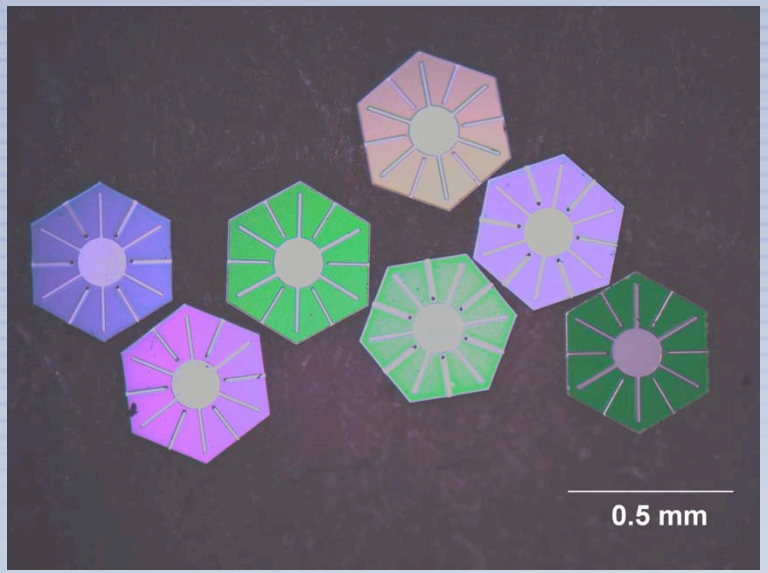
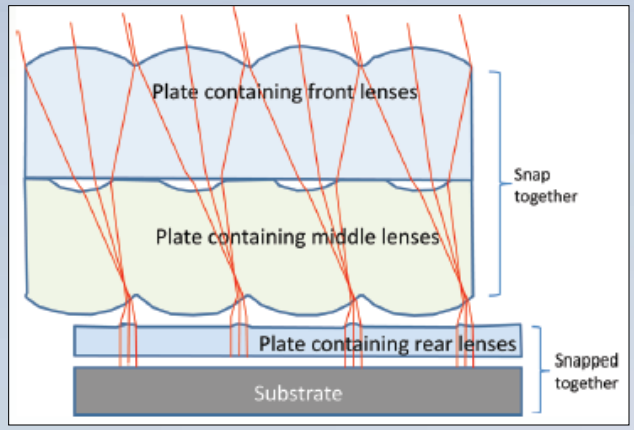
Solar Glitter: a new approach to high-efficiency photovoltaics (30-40% conversion goal)



Flexible arrays

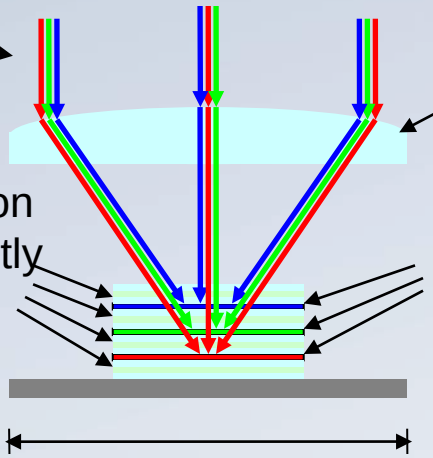


Core: Tiny efficient solar cells



A microlens concentrator array that enables coarse sun tracking

Incoming solar spectrum



Small dimensions allow high-quality, molded refractive optics

Each junction independently electrically connected

Cells grown independently, out of ideal materials, and optimum thickness

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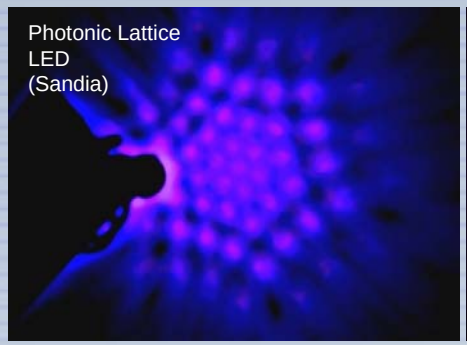
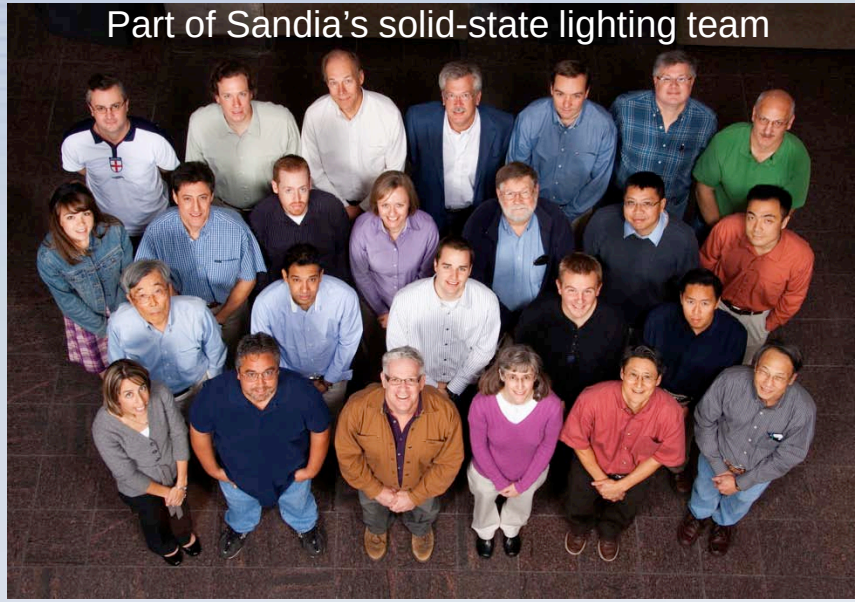
Solid state lighting (SSL): a new DOE Energy Frontier Research Center (EFRC)

SSLS EFRC
SOLID-STATE LIGHTING SCIENCE
ENERGY FRONTIER RESEARCH CENTER



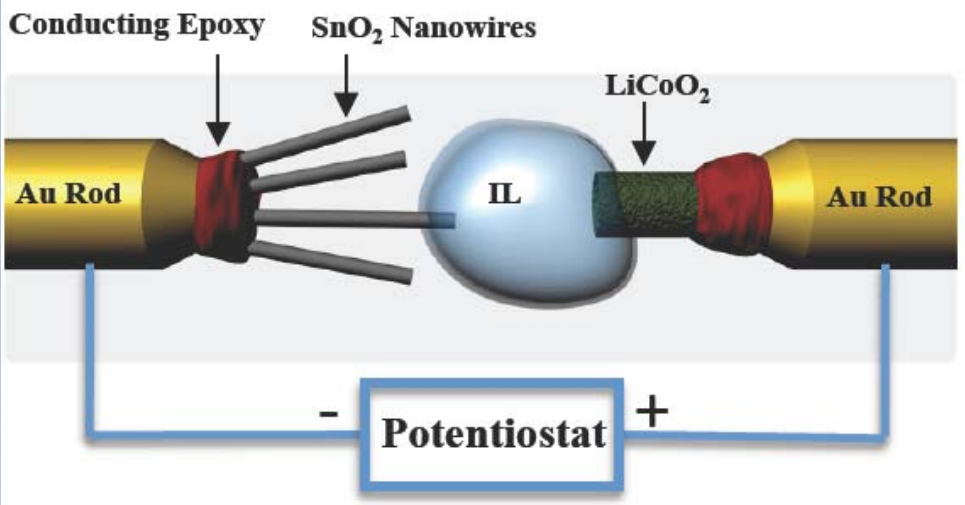
- **$3.6M / year budget for 5 years**
- **9 institutions**

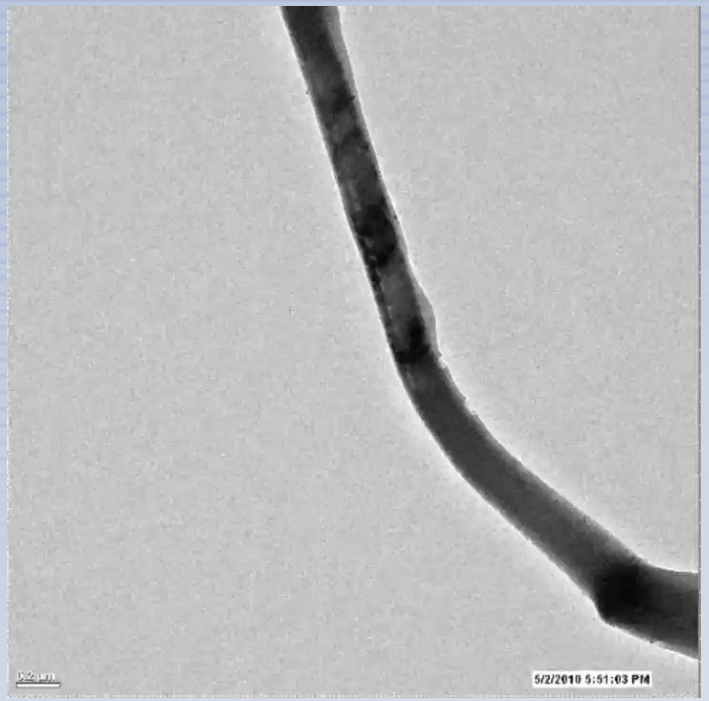
Research plan: Investigate conversion of electricity to light using radically new designs in sub-wavelength structures; understand and eliminate defects in SSL semiconductor materials that presently limit the energy efficiency.



Rensselaer Polytechnic Institute · The University of New Mexico · Northwestern University · UMASS · Los Alamos National Laboratory · Philips · Yale University · California Institute of Technology · Sandia National Laboratories

Li-ion battery research at the nanoscale provides atomistic view of electrochemistry

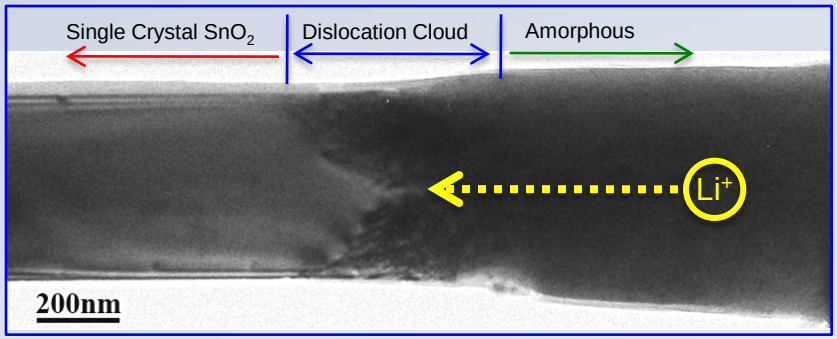




World's smallest battery inside a transmission electron microscope, enabling real time observations of electrochemistry at atomistic length scales

New EFRC led by University of Maryland

Sandia comprises ~ 20%



U.S. DEPARTMENT OF ENERGY | Office of Science

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Another major focus of Sandia research is national security

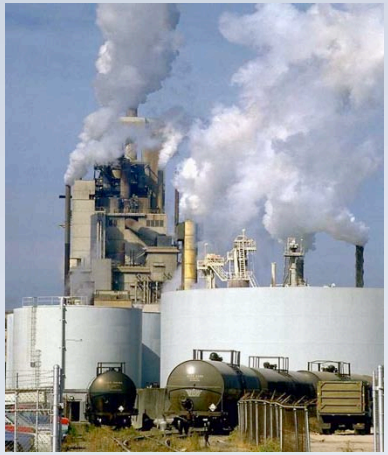
Nuclear Weapons

Counterterrorism

Intelligence

Chem-Bio Defense

Cyber Security



Infrastructure Surety

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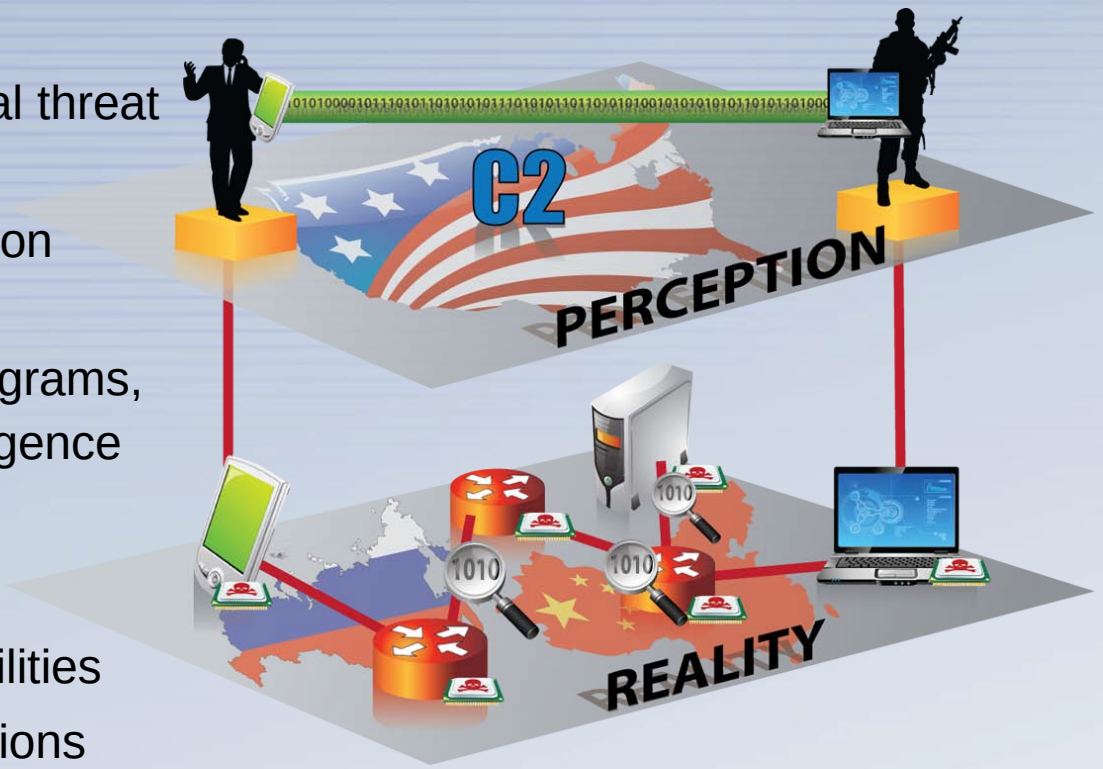
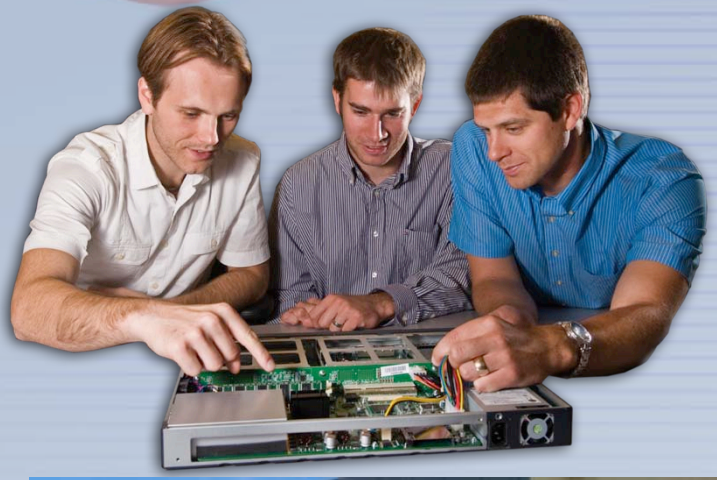
Cyber is THE national security issue of the 21st Century

Sandia supports the nation in cyber security research

- History of providing adversarial threat assessment
- Sandia has significant impact on national cyber missions
- Synergy among research, programs, operations, and counter intelligence
- SNL differentiators:
  - Threat perspective
  - Key investments in capabilities
  - Enterprise network operations expertise & test environment



CERI: Partnering to advance cyber S&T



Cyber Engineering Research Institute (CERI)

- Open, exploratory research portal
- Industry and academia outreach

(located in Sandia Science & Technology Park)

- Next generation of national talent

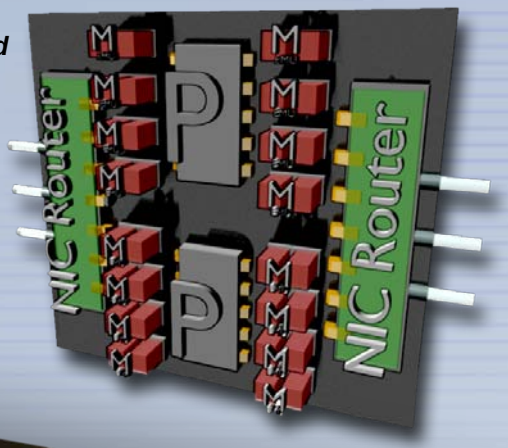
Continued Labs-wide Program Growth

- Funding continues to grow
- Cyber workforce shortages

S&T Focus Areas

- Supply chain risk management
- Dynamic defense
- Situational awareness

High Performance Computing: lowering energy demand to enable performance



Conceptualized Sandia board for 2018

- Sandia, in partnership with Cray and Los Alamos, successfully developed and deployed the Cielo petascale supercomputer for the Advanced Simulation and Computing Program.
- Sandia led adoption of co-design of architectures and applications as a key strategy of the National Exascale Computing Initiative.

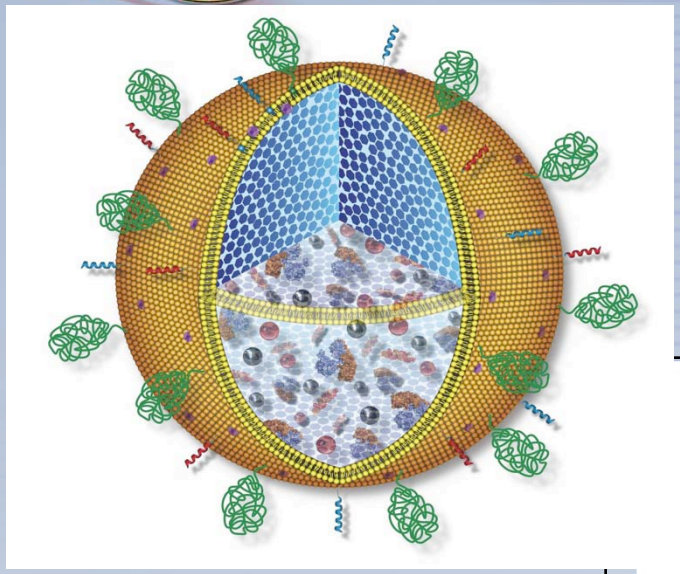
- Our Exascale Grand Challenge LDRD is aimed at dramatically lowering energy consumption through 3-D integration of processing, network, and memory components.
  - Will expand upon an Office of Science project with Micron

Intel and Sandia have collaborated in high performance computing since the mid 90s

- **Jointly developed the first Teraflops supercomputer, ASCI Red**
- **Intel is an active contributor to Sandia's Portals project**
  - **Portals is a message passing interface that has been used by Cray, Intel and the Lustre file system**
- **Intel is collaborating on the development of Sandia's Structural Simulation Toolkit which enables hardware/software co-simulation**
- **We are currently working to extend the Intel Umbrella CRADA through 2016 and to expand the scope to include High Performance Computing as well as Advanced Electronics**

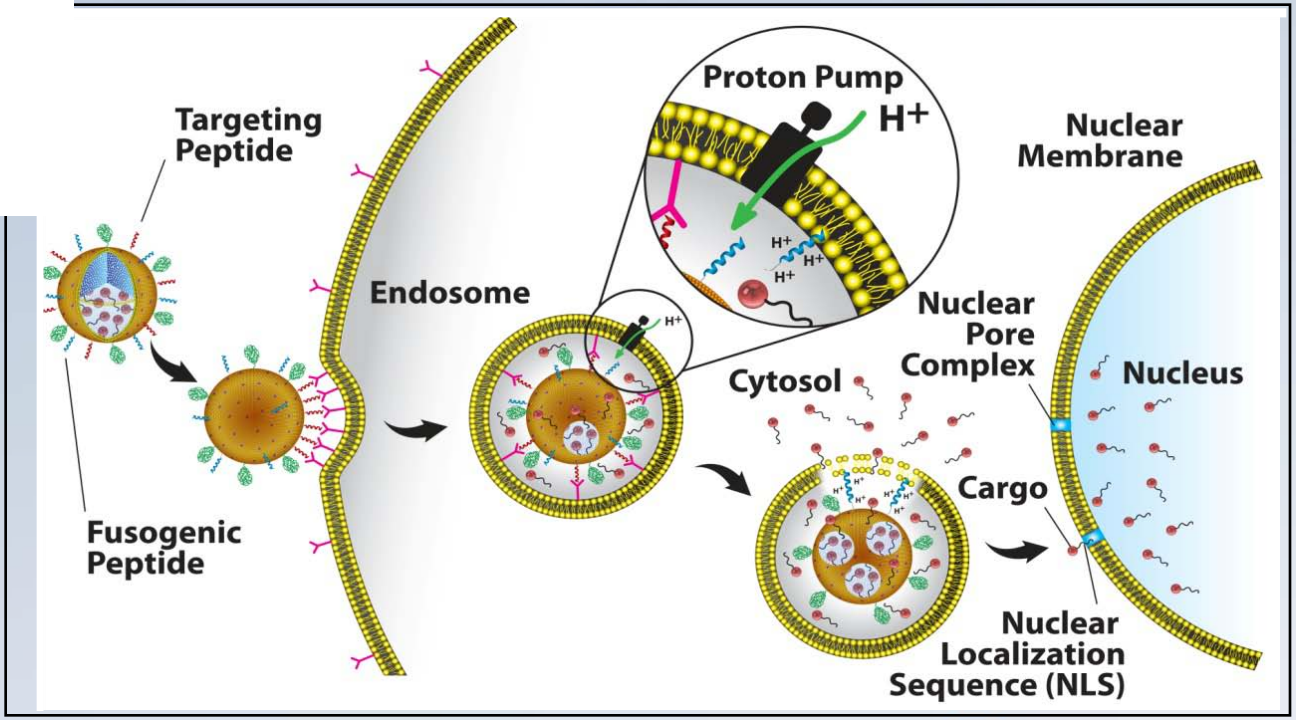
ASCI Red, developed by Intel and Sandia, was the fastest computer in the world from June 1997 to June 2000

“Protocells”: Joint project of Sandia and UNM Cancer Center



- Principal investigator Jeff Brinker has joint appointment
- Based on porous nanoparticle work supported by DOE Office of Science
- Applications to targeted cancer therapy

- 100 nm “Protocell” has silica core containing cargo of chemo drugs.
- Outer surface has specific molecules that select cancer cells for
- invasion
- Cargo is delivered inside cancer cell



Sandia's deep S&T expertise allows us to respond to the nation's most urgent technical needs

Sandia leads DOE response to BP Deepwater Horizon oil spill

Former President Tom Hunter briefs press along with DOE Sec. Chu and Interior Sec. Salazar

April 20, 2010

Sandia supports DOE response to Japanese earthquake and tsunami

Sandia, DOE and NNSA employees and 8.5 tons of equipment were flown to Japan to assist in the monitoring of the Fukushima nuclear power plant. Sandia provided technical expertise and data analyses.
(photo from NNSA)

Partnerships: Getting Sandia Technologies into the Marketplace

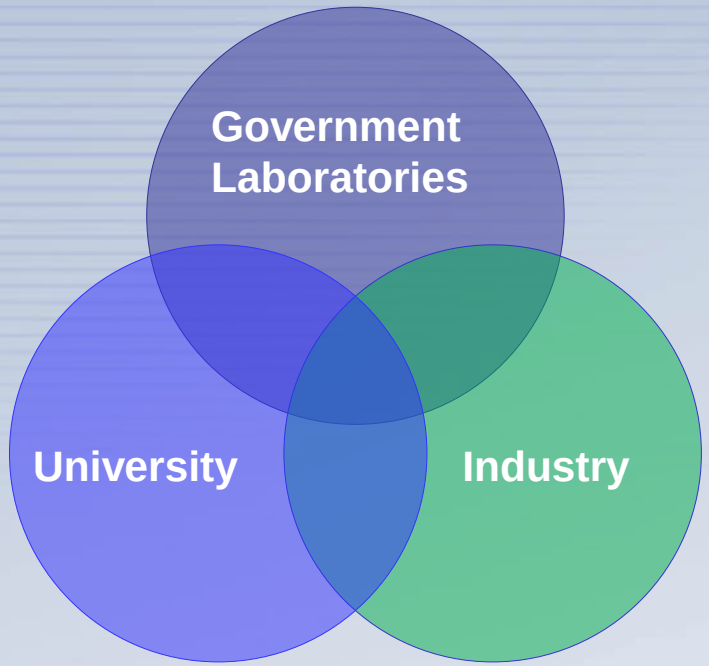
NMSBA

Los Alamos National Laboratory
Sandia National Laboratories

ESTT

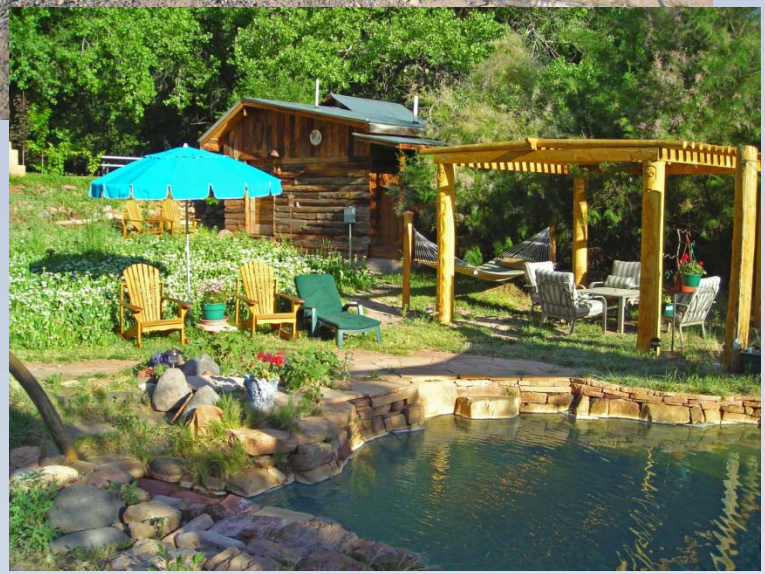
Entrepreneurial Separation to Transfer Technology

SANDIA SCIENCE & TECHNOLOGY PARK



Strategic Partnerships

New Mexico Small Business Assistance (NMSBA)



- Governed by the Laboratory Partnership with Small Business Tax Credit Act (a New Mexico State Law)
- Public/Private Partnership with Sandia National Laboratories, Los Alamos National Laboratory, State of New Mexico, and New Mexico Small Businesses
- Allows up to $2.4M per lab per year in assistances and tax credits
- Must be a New Mexico for-profit small business to qualify
- Companies in rural counties are eligible for $20K per business each year/urban counties are eligible for $10K per business each year

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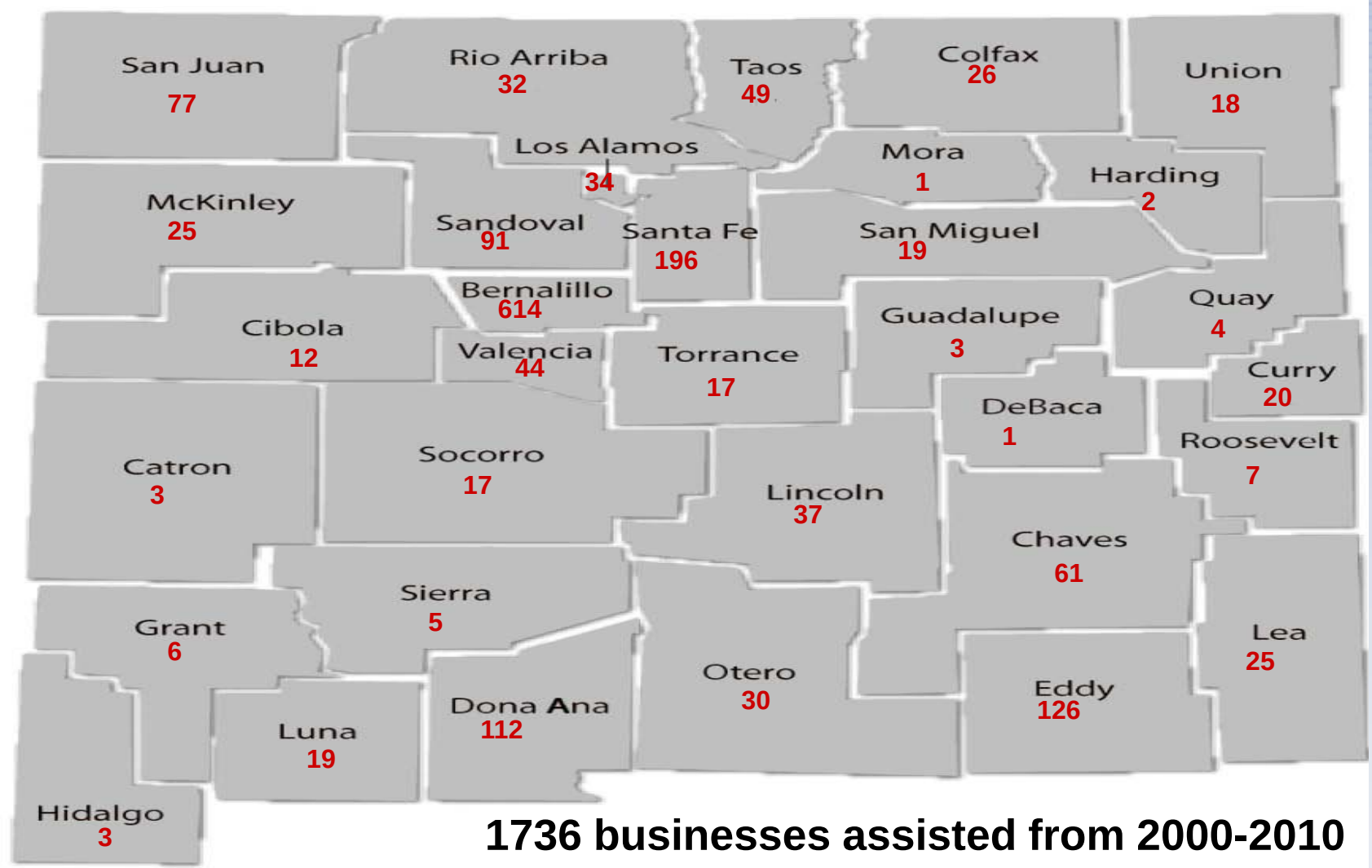
NMSBA joint program results (SNL and LANL)

	2000-2010	2010
Number of Unique Businesses Assisted	1736	339
Number of Counties Supported (out of 33)	33	27
Dollar Value of Assistances to Companies	$25.2M	$4.6M

NMSBA has served every county in New Mexico



1736 businesses assisted from 2000-2010

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Sandia Science & Technology Park: "A Master-Planned Technology Community"

- 340+ Acres
- Founded in 1998 to serve as a partnership and technology transfer tool for Sandia
- Key Sandia facilities located here: CINT, CSRI, IPB, and CERI (planned)
- Recent News: Raytheon acquired Ktech Corp., a company in the Park

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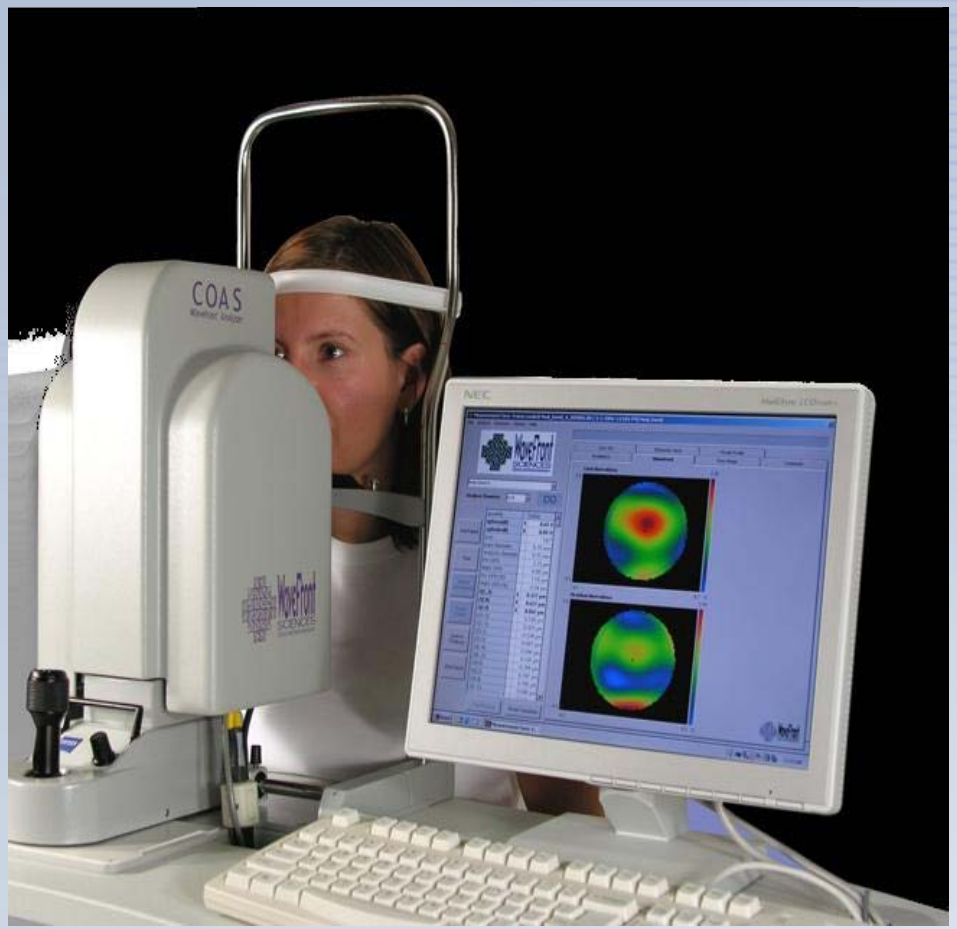
Sandia Science & Technology Park: metrics for success

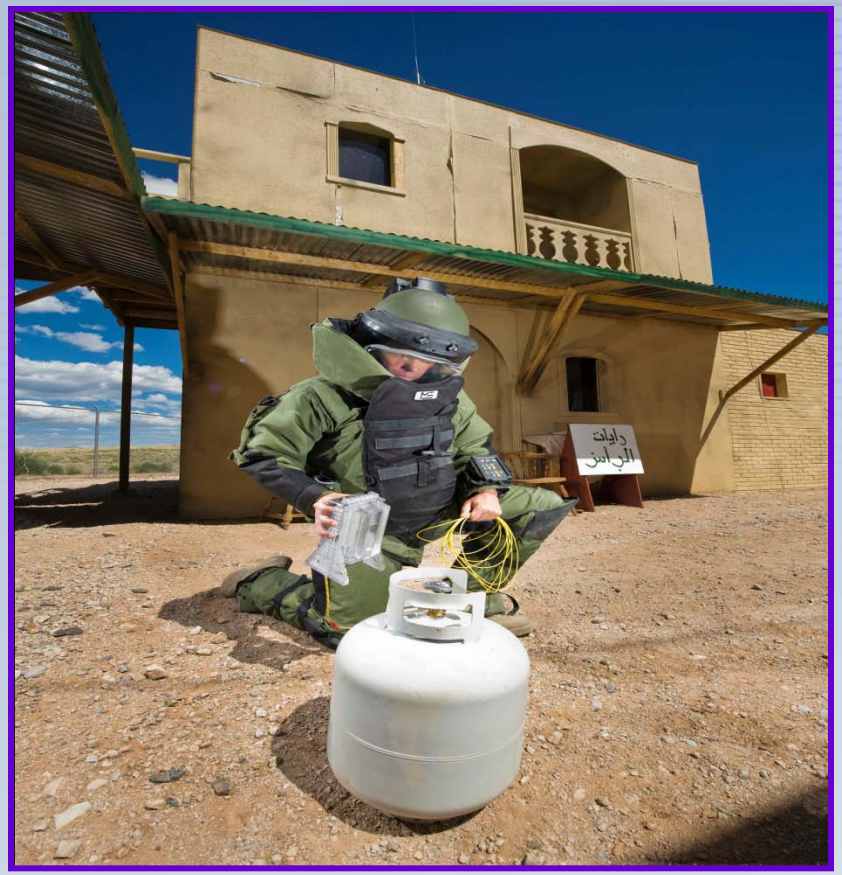
Number of Companies	**31**
Number of Employees	**2,085**
Number of Buildings	**20**
Square Feet of Occupied Space	**989,425**
Acreage Developed (out of 340)	**102**
Funds-In and In-Kind Services from Park Companies to Sandia (i.e. CRADAs, Licensing Agreements, WFOs)	**$18,418,476**
DOE/Sandia In-Kind Services to Park Companies (CRADAs)	**$2,667,916**
Contracts from Sandia Procurement to Park Companies	**$370,611,616**
Contracts between Park Companies	**$9,412,297**
Public and Private Investment in the Park **Public** **Private** **Total**	 **$68,648,901** **$281,857,983** **$350,506,884**
Average Salary for Each Full-Time Job in the Park	**$71,612**
Average Salary for Each Full-Time Job in Albuquerque	**$39,342**

Entrepreneurial Separation to Transfer Technology (ESTT)



- Entrepreneurs terminate Sandia employment
- Term of separation is two years with the option to request a third year
- Entrepreneurs are guaranteed reinstatement by Sandia if they return before ESTT expiration
- Participants may start up or help expand technology businesses
- 139 people have left to start up or expand 91 companies, mostly in New Mexico

Success story: TEAM Technologies

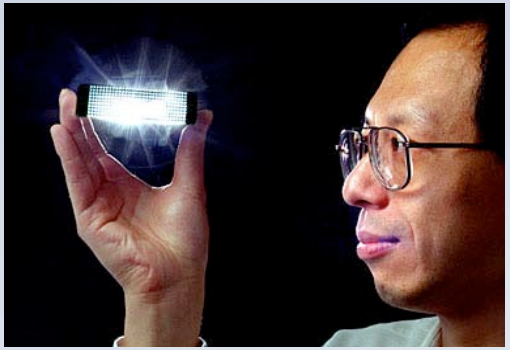


STINGRAY DISRUPTER

- Moved into Sandia Science & Technology Park in 2001; expanded in 2006
- Invested over $6M in the Park
- Contracts with Sandia since moving to Park > $60M
- Licensed technology from Sandia for “Stingray”; manufactured and shipped over 8000 of the $58 devices to Afghanistan for bomb disposal
- “Stingray” named one of the Best Inventions of 2010 by leading magazine

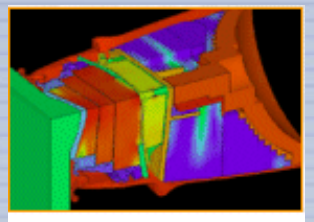
Education is integral to our mission

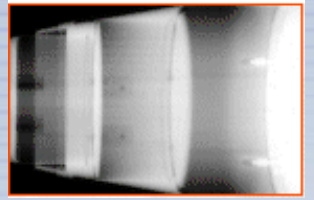
- University Research & Collaborations
- Student Internship Programs
- Educational Assistance Programs
- Special Degree Programs/Fellowships
- University Faculty Sabbaticals
  - Year-round faculty sabbaticals
  - University summer faculty
- Post-doctoral Fellowships
- President's Early Career Award for Scientists and Engineers (PECASE)



University Faculty Interactions

- Collaborative Research
  - ~ $25M annually, with ~100 universities
  - 2011: NMSU $1.3M, NMTech $1.4M, UNM $2.4M
- Sabbaticals and Summer research appointments
  - ~ 20 appointments annually
  - 4 weeks to full year
  - pay based on faculty salary
  - roundtrip travel and per diem provided
- PECASE
  - $250K award ($50k/yr over 5 years)
  - New faculty with prior lab relationship
  - Currently 5 awardees





Student Interactions

- Graduate Fellowships
  - ~80 annually
- Student Intern Program
  - Undergraduates, high school
  - ~ 800 technical interns annually
  - year-round (semester/quarter) or summer
- Post Doc appointments
  - ~175 annually
  - 2-year appointment, renewable
  - 3-year Truman Fellowships