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“Horizon" Technology Research at Sandia National Laboratories

Presented to

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ST&E Innovations and Partnerships
Sandia National Laboratories

Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy’s National Nuclear Security Administration under contract DE-AC04-94AL85000.

Outline

- Laboratory Directed R&D (LDRD) program at Sandia
- Examples of LDRD projects as example 'horizon technologies'
- Sandia Science & Technology Park
- New Mexico Small Business Assistance Program
- Entrepreneurial Separation to Transfer Technology Program at Sandia

"Horizon" technologies (Gordon Meeks)
Technologies that Sandia is working on that the STTC should be aware of that could potentially impact/boost the high tech industry along the Rio Grande corridor.

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LDRD is vitally important to Sandia

- The Laboratory Directed Research and Development (LDRD) Program was authorized by Congress*, with oversight by DOE/NNSA, and strategic guidance by the Labs' Director
- LDRD is the Labs' sole source of discretionary R&D funds for staff-generated, innovative ST&E**
- LDRD creates the future of the Labs by:
  - Advancing the frontiers of science and technology
  - Enabling and supporting our Labs' national security missions

*National Defense Authorization Act for FY 1991 (P.L. 101-510, Section 3132)
** Energy Research and Development Administration Authorization Act for FY 1977 (P.L. 95-39, Section 303)

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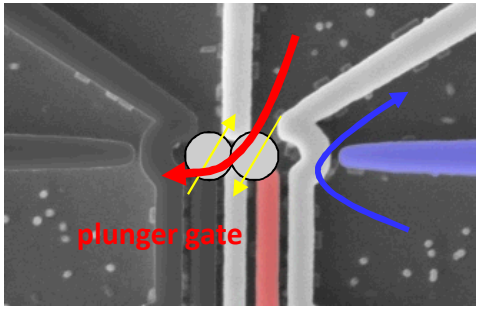
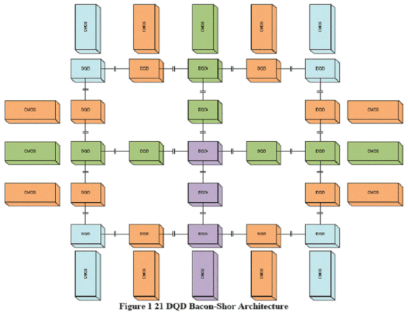
Quantum Information Science and Technology project resulted in next generation computing leadership

Quantum computing is expected to provide exponential speed-up over classical computing, but to date the hardware components of such a system do not exist.



Physical Qubit & Native Gate Set



Logical Qubit Architecture

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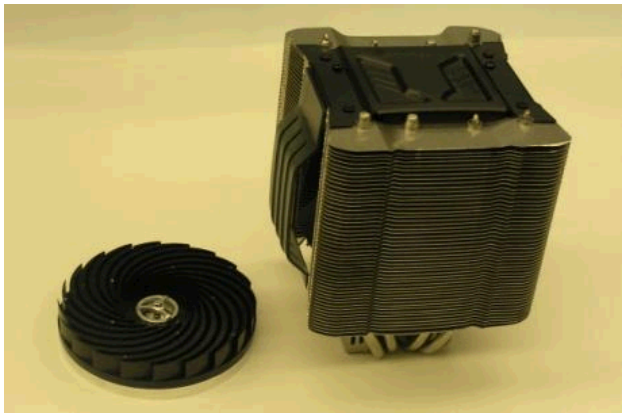
Exploration & Development of Air Bearing Heat Exchanger Technology

If successful, this technology could have significant impact on energy use and efficiency:

- **Extend range of electrical vehicles**
- **Solve thermal brick wall problem (IT sector)**
- **Provide more efficient air conditioning, heat pumps, and refrigeration**
- **Reduce electricity demand load spikes**



Proof-of-concept experiments demonstrated a factor of 30 improvement in heat transfer per unit heat exchanger area.

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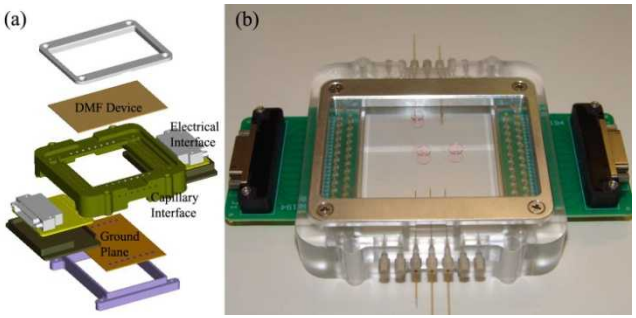
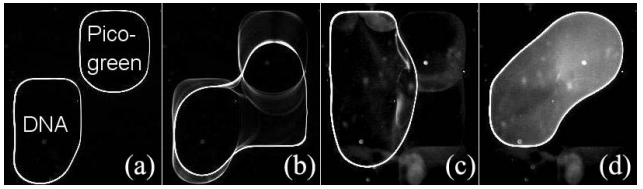
Rapid threat organism recognition (RapTOR) project is developing tools to identify biothreats

Rapid threat organism recognition (RapTOR) is developing a new, rapid, and powerful approach for identifying unknown pathogens, thus preventing or containing outbreaks in their earliest stages.





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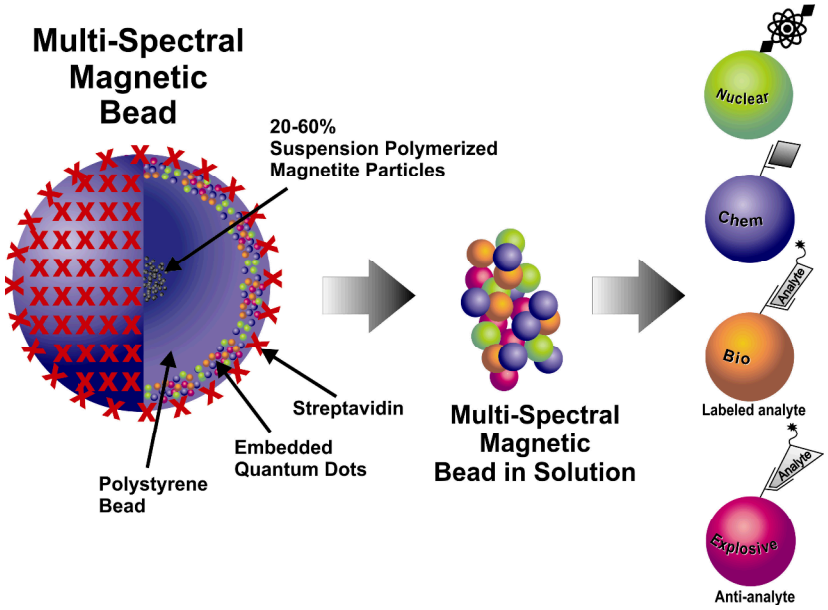
BioWarfare/Infectious disease detection microsystem to rapidly detect botulism in milk

Clear path to a detector capable of simultaneously identifying a vast number of different agents: chemical, biological and radionuclides.



- *Double-blind field test for BONT-A simulant with no false positives in raw milk*
- *Demonstrated 10^{-17} molar sensitivity*

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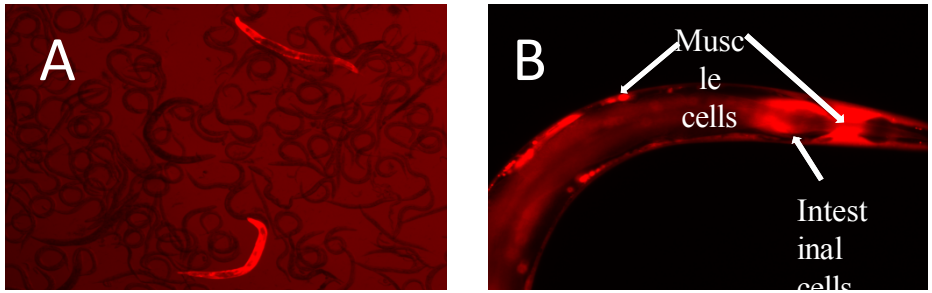
A *C. elegans*-Based Foam may be used for Rapid On-Site Detection of Residual Live Virus

Recovery from a critical release of a biological agent requires slow, labor-intensive "clearance sampling" and uses significant laboratory space.

***C. elegans*-based foam can be applied directly to the contaminated area for quick and accurate detection of any and all residual live virus by means of a fluorescent signal.**



A *C. elegans*-Based Foam for Rapid On-Site Detection of Residual Live Virus

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Sunshine-to-Petrol project is using solar energy for synfuel production

Renewable Energy Problem is that energy sources that do not produce CO_2 emissions (climate change) are becoming increasingly scarce. Solar power could be used to convert CO_2 to synthetic fuels.

$$\text{Sunlight} + CO_2 + H_2O \rightarrow \text{Fuel} + O_2$$

Recycling CO_2 into Fuel

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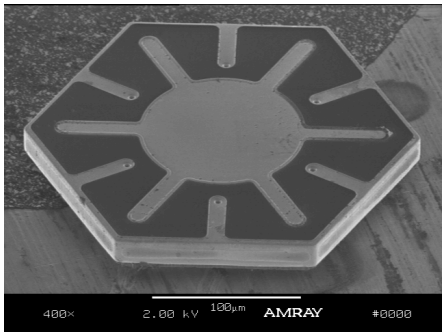
Greater Than 50% Efficient Photovoltaic Solar Cells project shows promise for enhanced photovoltaics

Monolithic photovoltaic cells typically produce solar conversion efficiencies in the 20% range. Stacked individually-grown and connected junctions, each sensitive to a different region of the solar spectrum, are being evaluated for greater PV system efficiencies.



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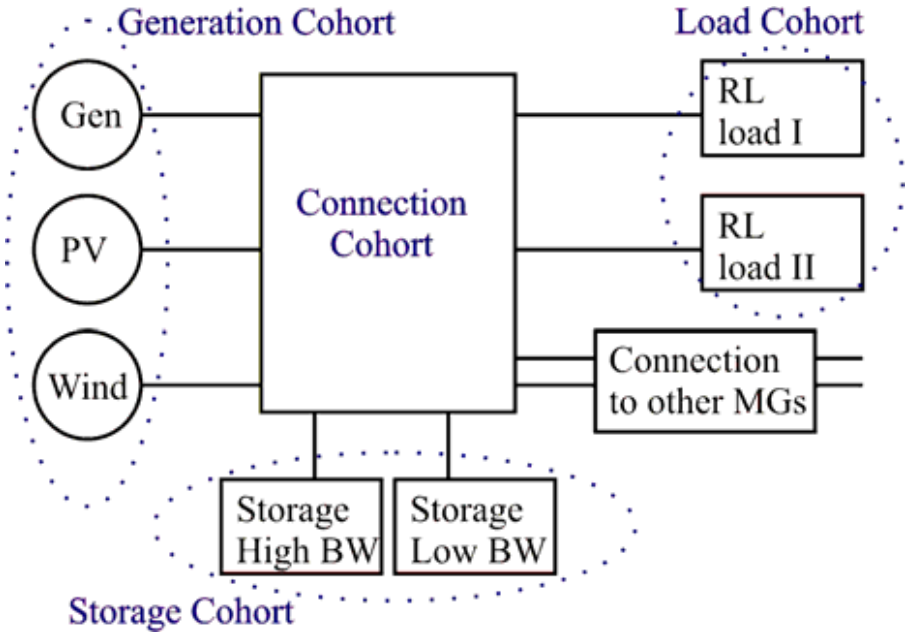
Enabling Secure, Scalable Microgrids with High Penetration Renewables

Enable high penetration levels of stochastic renewable sources, with a reliability, resiliency, security, and cost that is equal to or better than the U.S. grid of today.



Microgrid organization: conceptual schematic

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Technology-Based Economic Development Programs

SANDIA SCIENCE & TECHNOLOGY PARK

NMSBA

Los Alamos National Laboratory
Sandia National Laboratories

ESTT

Entrepreneurial Separation to Transfer Technology

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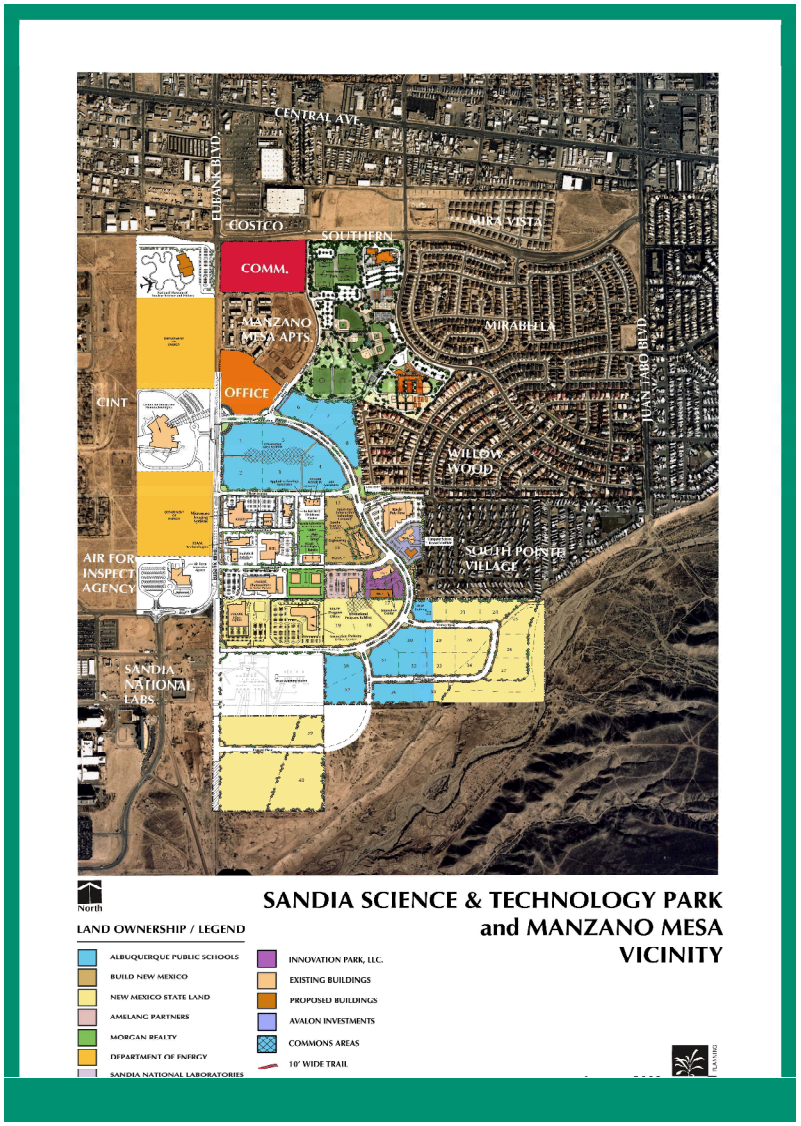
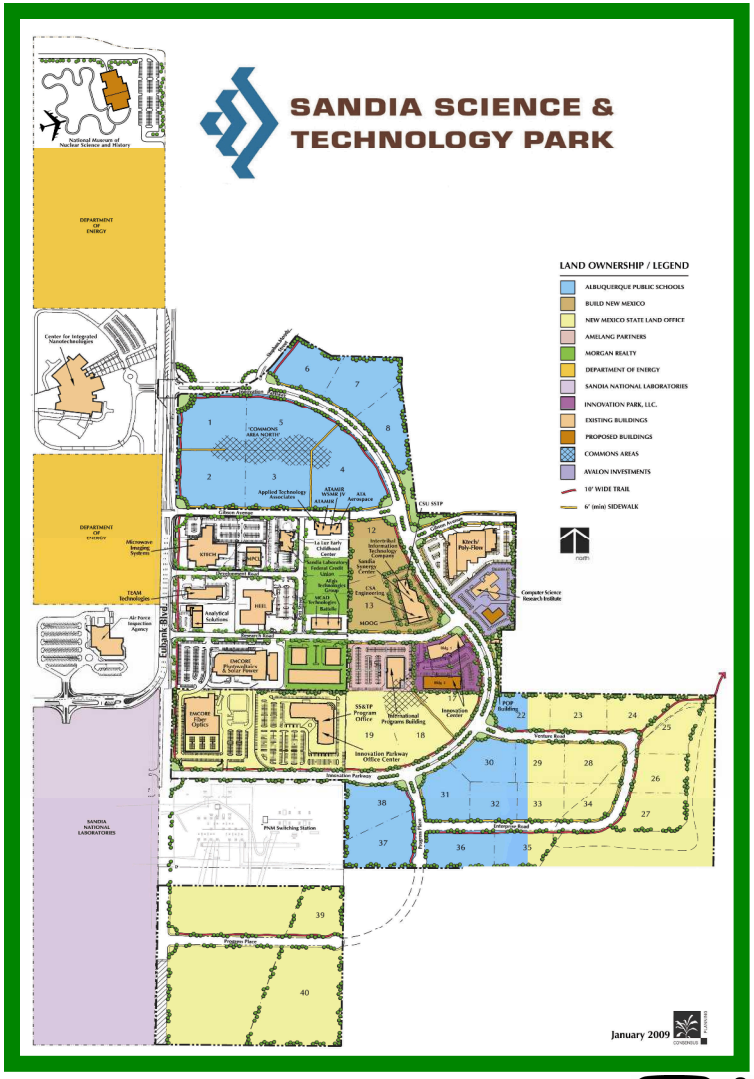
The SS&TP





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History of the Park

- Founded in 1998
- Partnership Tool for Sandia
  - Create Joint Research and Development
  - Commercialize Technologies
  - Develop Business
  - Strengthen Supplier Relations
  - Foster Economic Development
- Sandia Science and Technology Park Development Corporation, a nonprofit entity, was established to manage and develop the Park

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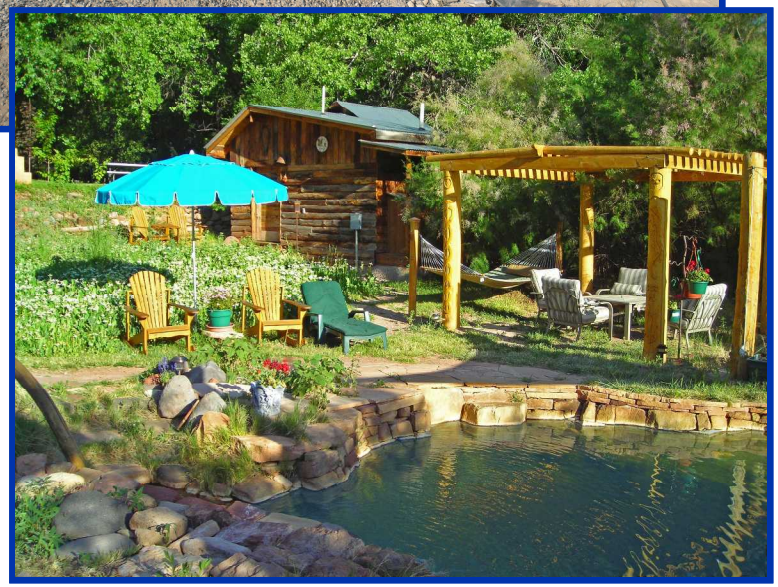
New Mexico
Small Business Assistance



- 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

	2000-2009	2009
Number of Assistances Provided	2666	320
Number of Unique Businesses Assisted	1597	112
Number of Counties Supported (out of 33)	32	25
Dollar Value of Assistances to Companies	$20.7M	$4.3M

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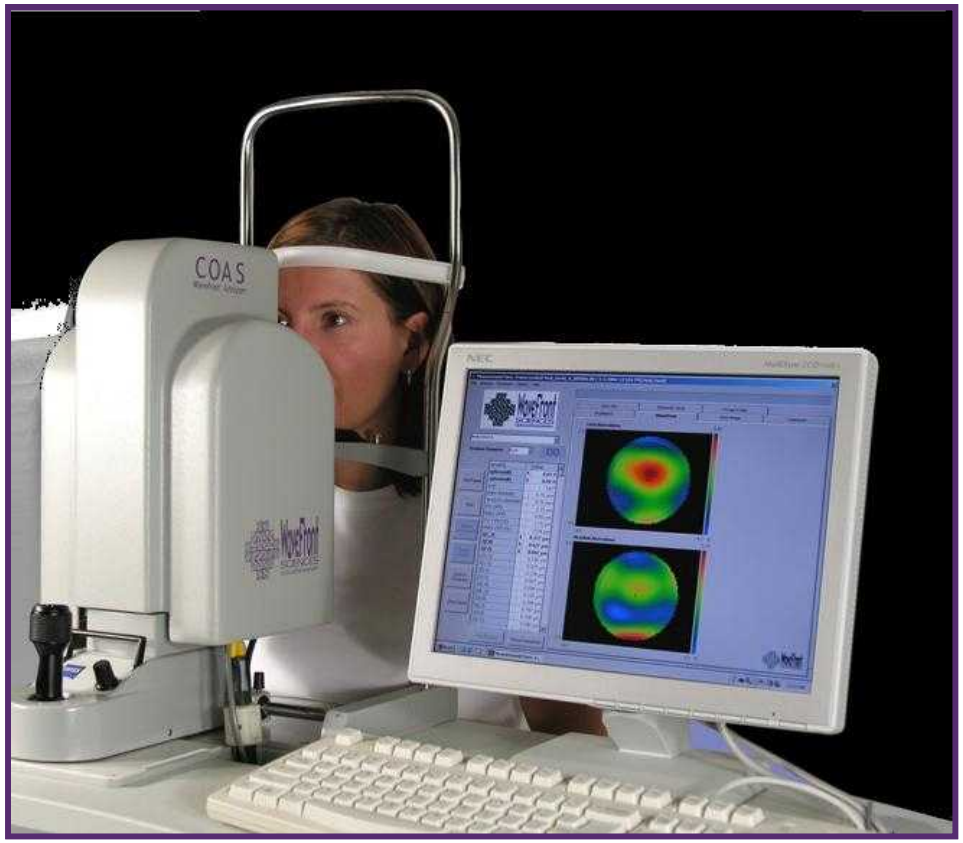
Entrepreneurial Separation to Transfer Technology (ESTT)



- **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**

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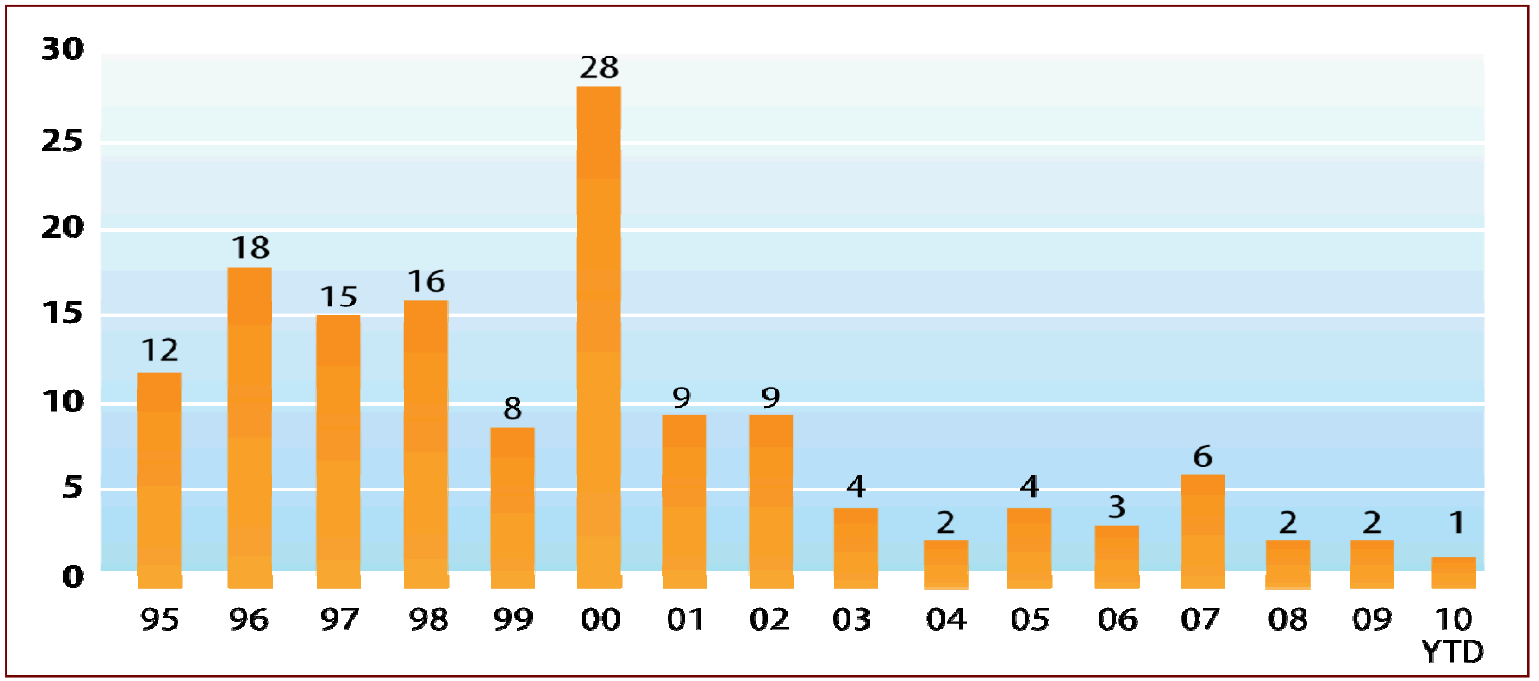
ESTT Program Results

Separations of People by Calendar Year (139 Total)



	In NM	Outside NM	Total
ESTT Start-up Companies	38	6	44
ESTT Expansion Companies	20	27	47

91 Companies have benefitted from the ESTT Program

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Questions?

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