

# **Science and Technology and Research Foundations**

SAND2006-4901P

**Presented to the  
Sandia Corporation Board of Directors**

**Rick Stulen  
Vice President**

**Sandia National Laboratories  
July 26, 2006**

**LOCKHEED MARTIN** 



# Today's Discussion

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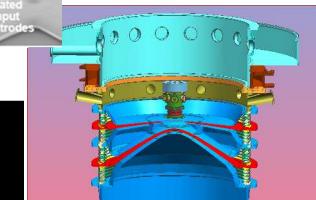
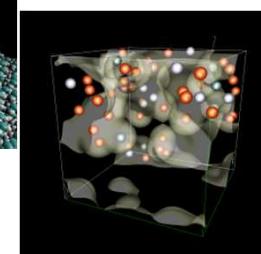
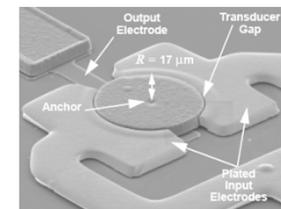
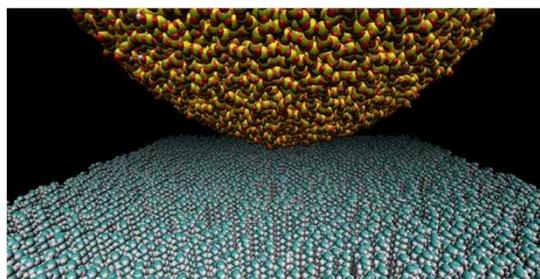


- **Personal History**
- **Current Responsibilities**
- **Key Challenges & Initiatives**

# Current Responsibilities



- **Chief Technology Officer for the Laboratory**
- **Lead and manage Division 1000 - Science and Technology and Research Foundations**
- **Lead the Science, Technology and Engineering Strategic Management Unit**



# Key Challenges



- **Nurture the core**
  - Increase innovation and risk-taking
- **Stay at the cutting edge**
  - Increase Sandia's engagement in and recognition by national and international Science & Technology and Engineering communities including universities and industry
- **Be relevant**
  - Improve application of R&D to Sandia programs
- **Anticipate the future**
  - Ensure that Sandia's science and engineering is anticipating and creating the future for the laboratory programs

**AND**

- **Transform the safety culture in an R&D organization**



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# **Division 1000**

# **“Science and Technology and Research Foundations”**

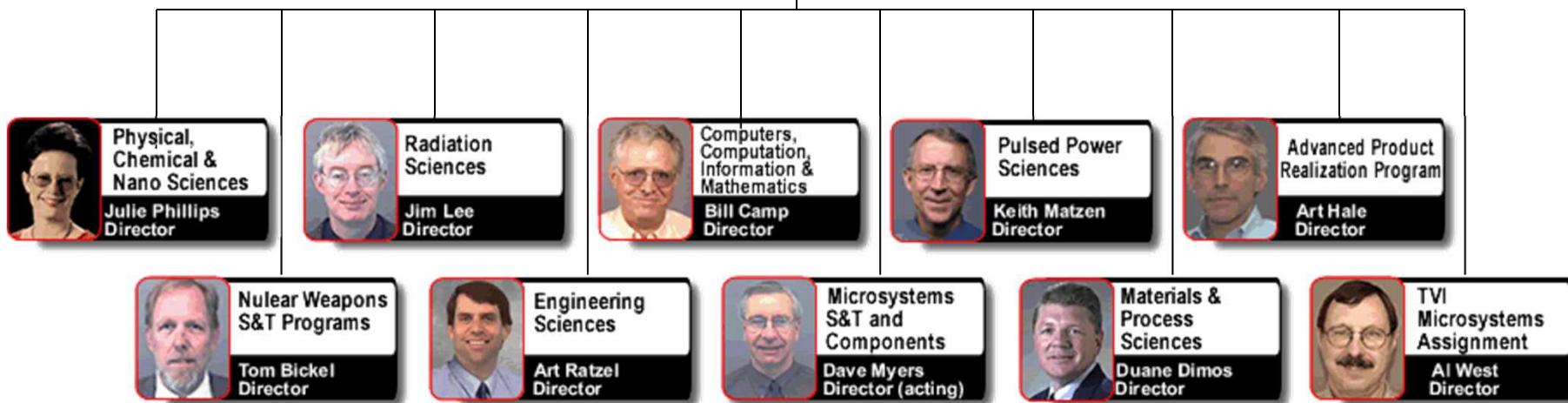
# Division 1000 by the numbers



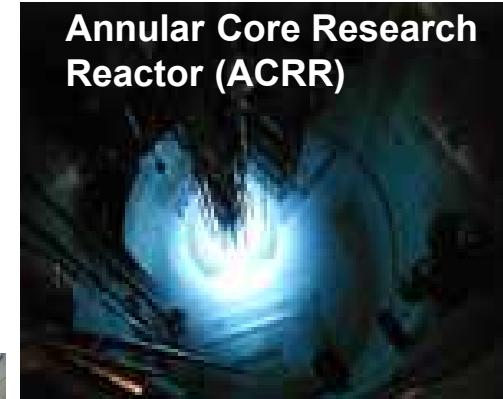
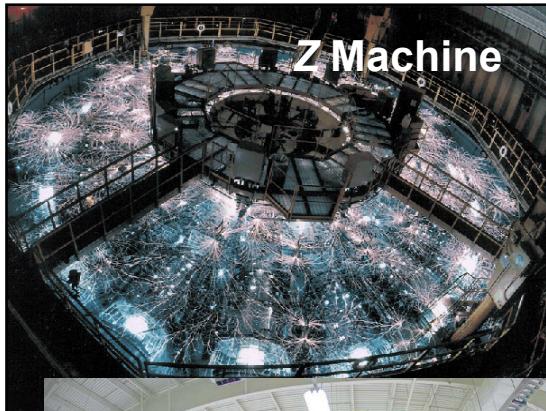
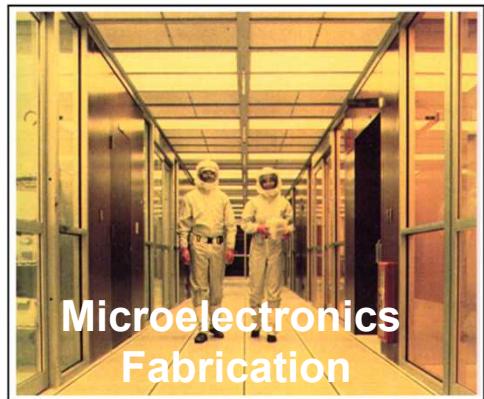
- **10 Directors**
- **Our People**
  - **1287 Regular Employees**
  - **89 Limited Term Employees**
  - **54 Post Docs**
  - **260 Students**
  - **924 Contractors/Consultants**
- **~ \$550M FY05 costs**
- **~950,000 ft<sup>2</sup>** - offices, labs, fabs, large scale test



# Division 1000 Leadership Team



# Unique Division 1000 Facilities



# Division 1000 is strongly coupled to MESA\*



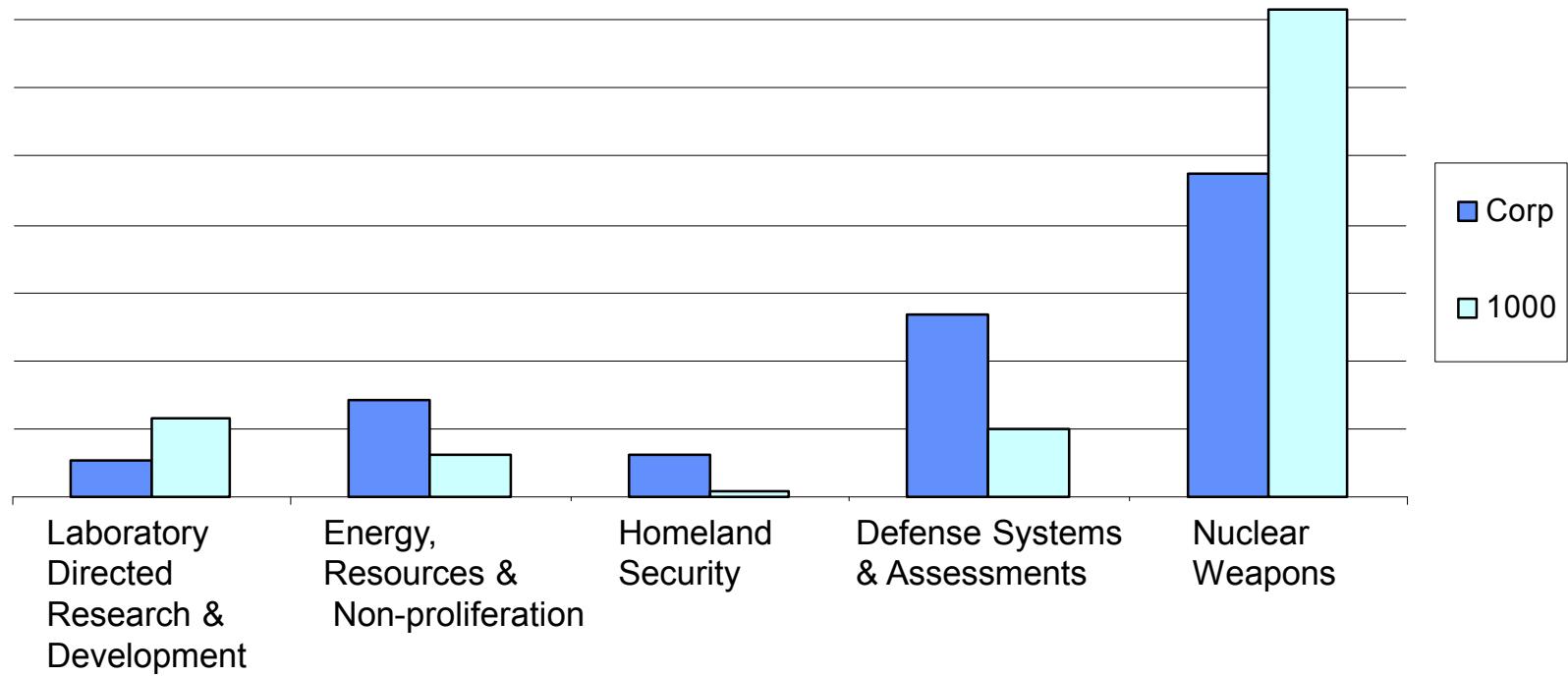
***Microelectronics  
Development  
Laboratory***

***MicroFab***

***MicroLab***

**\*MESA - Microsystems and engineering sciences applications**

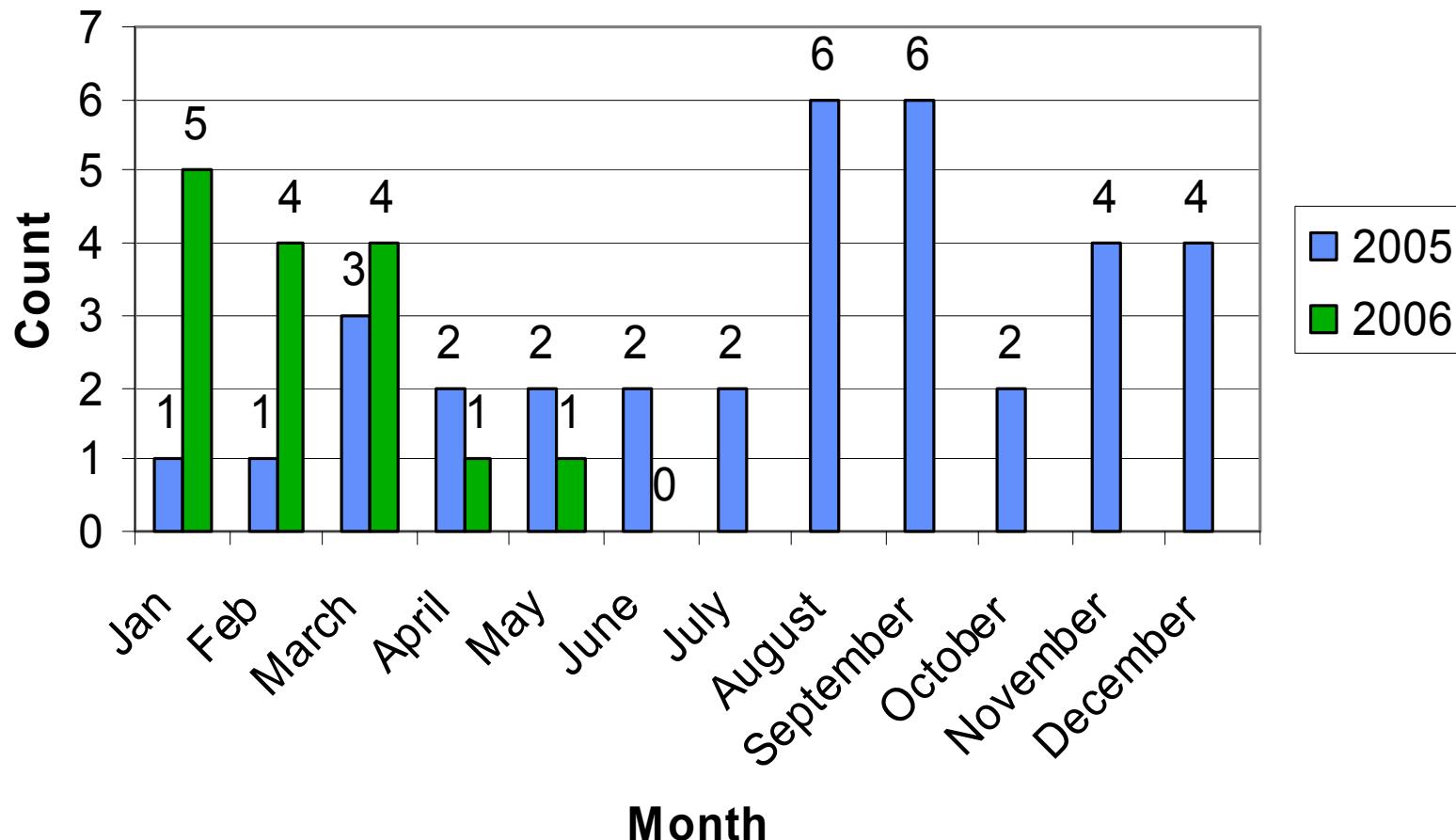
# Key challenge to diversify portfolio



# We are making progress on the safety culture



Improving trend in reducing recordable injuries





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# **The Science Technology and Engineering (ST&E) Strategic Management Unit**

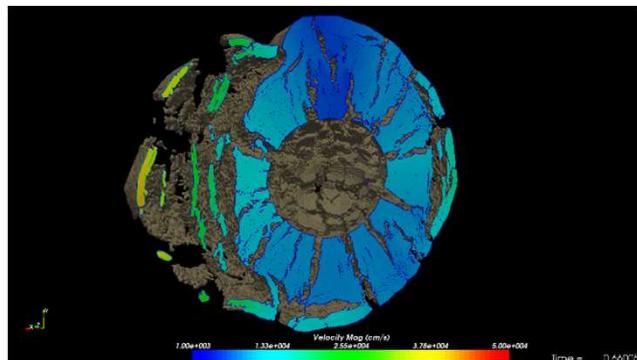
# ST&E Strategic Management Unit

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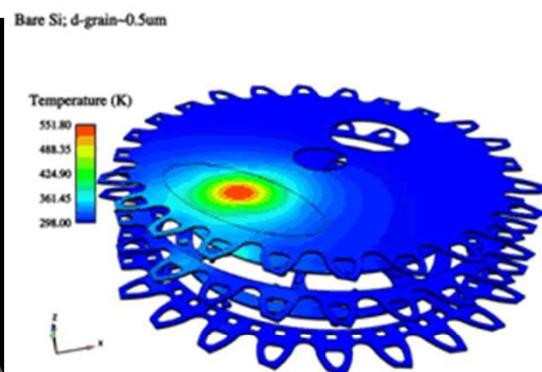


- **Comprised of ST&E activities across the Laboratory**
- **Includes 6 Research Foundations**
- **Represented by work of ~ 2000 FTEs and ~\$600M**
- **Except for Laboratory Directed Research and Development (LDRD), work is funded and coordinated through the programs**

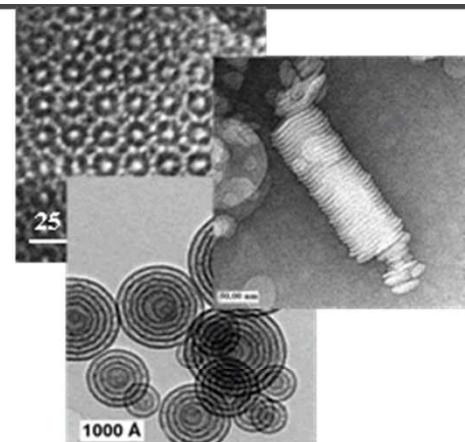
# ST&E Research Foundations



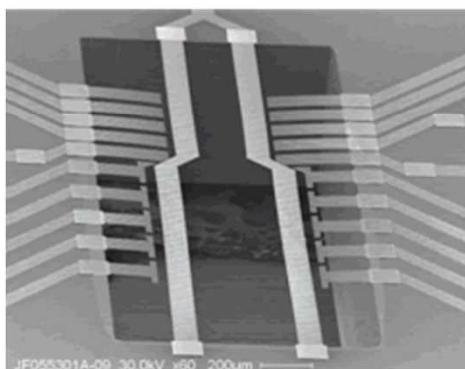
# Computational and Information Sciences



## Engineering Sciences



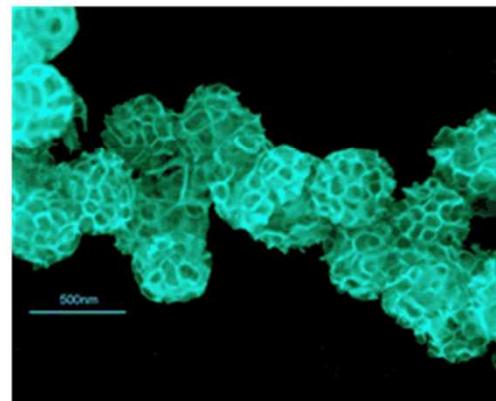
## Materials Science and Technology



## Microelectronics and Photonics



## Pulsed Power



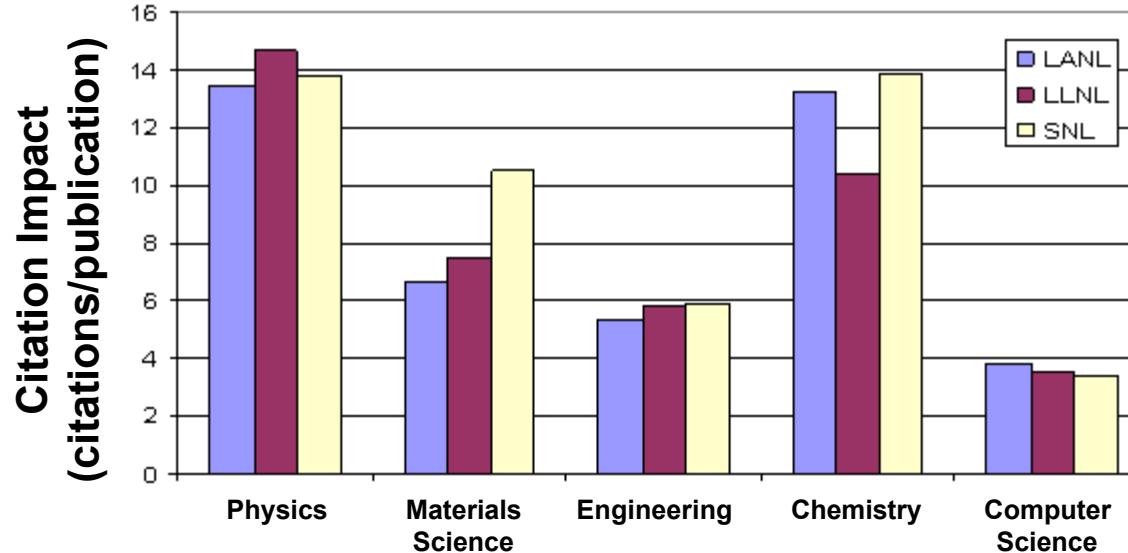
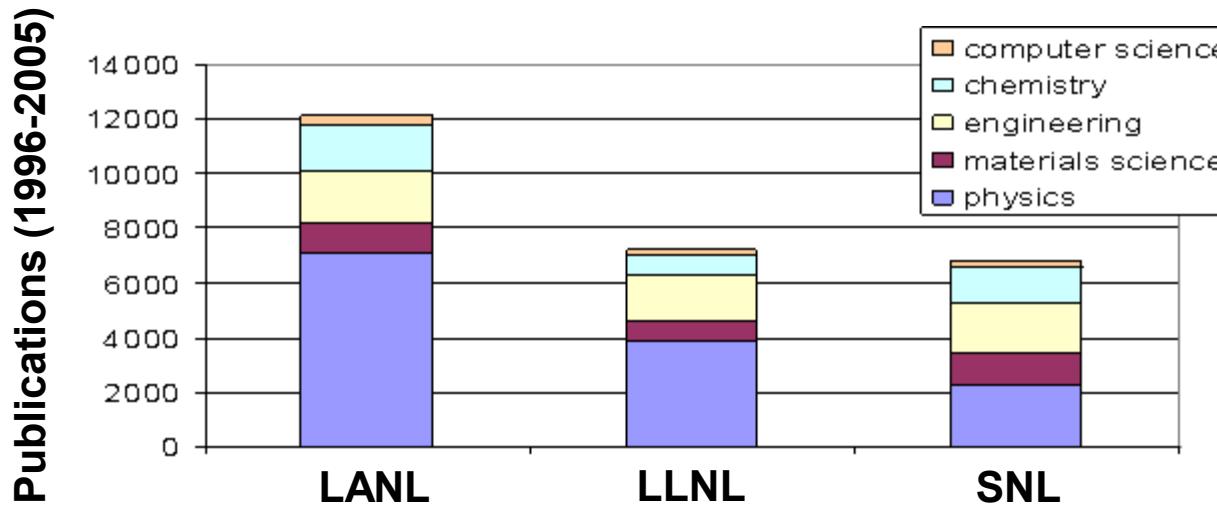
## Biotechnology



# Sandia Science & Engineering featured on numerous journal covers during the past year



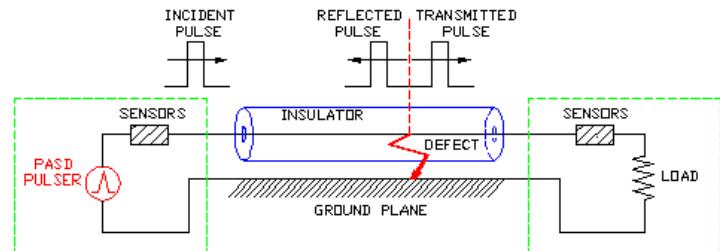
# Publication and citation impact for Sandia and the 3 NNSA labs (1996-2005)



# Sandia ST&E in the news: A new aircraft diagnostic is receiving significant national attention

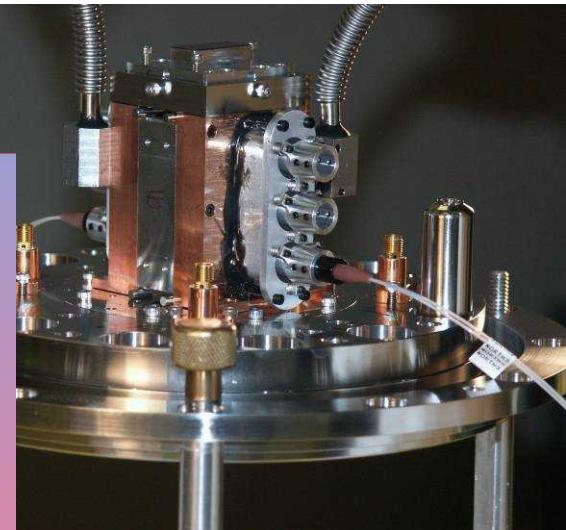
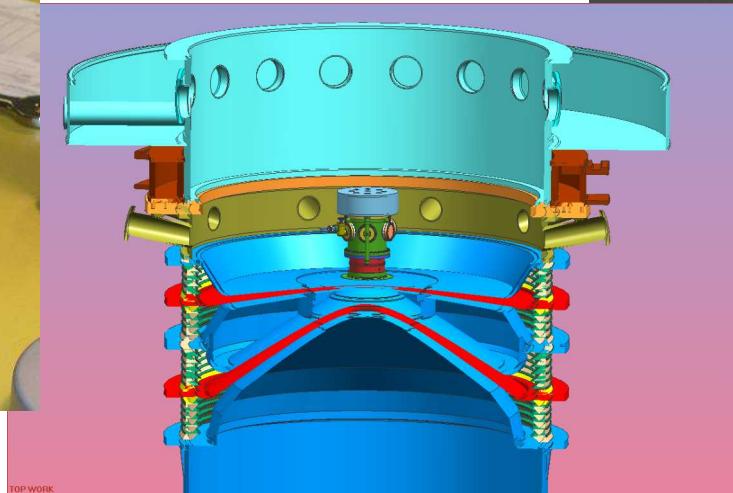


Pulsed Arrested Spark Discharge or PASD can quickly and inexpensively find defects in airplane wiring



- Developed out of Sandia's pulsed power technology
- Over 4 pages of google hits and blogs last week

# Sandia & LANL achieved the first isentropic compression experiments on Z for Pu

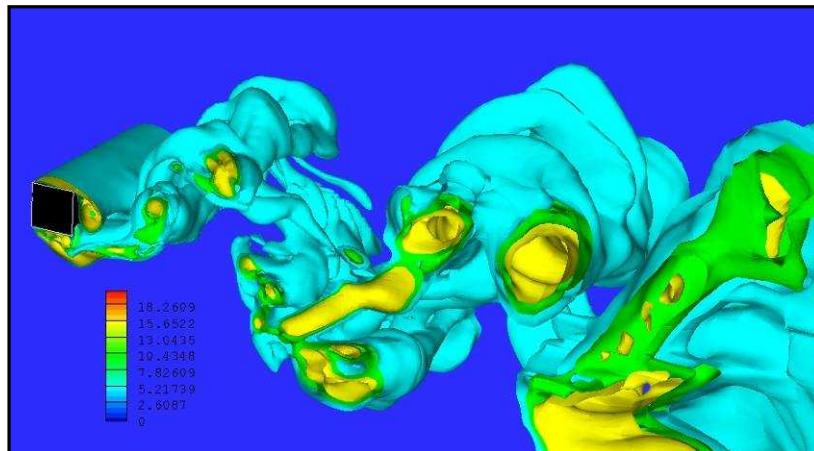


“ These experiments address one of the toughest questions on a top priority physics topic.” Dawn Flicker, LANL

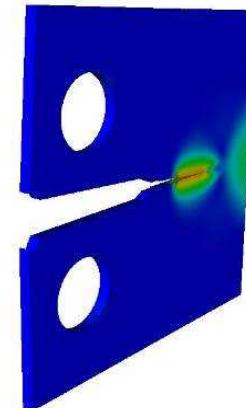
# Red Storm: A new standard for engineering



- Designed and optimized for engineering calculations
- 40 Tflops, upgrading to 125TF in FY07
- 10,000 processors



Turbulent Flow



Fracture Prediction

# Three broad new initiatives underway



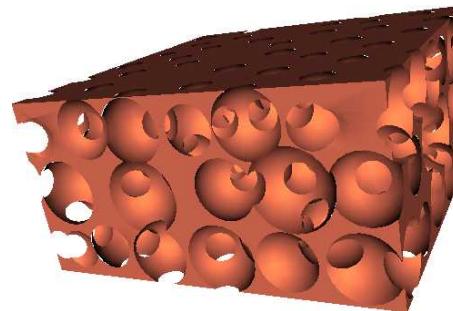
- **Improve the Laboratory Directed Research and Development (LDRD) program**
- **Improve application of R&D to the programs**
- **Provide national leadership for engineering innovation and education - responding to the American Competitiveness Initiative**



# Laboratory Directed Research and Development enables creation of knowledge and future capability



- **Proposal driven R&D in three broad categories**
  - Science and Technology
  - Mission Technologies
  - Grand Challenges
- **\$132 M in FY06**



## Concerns:

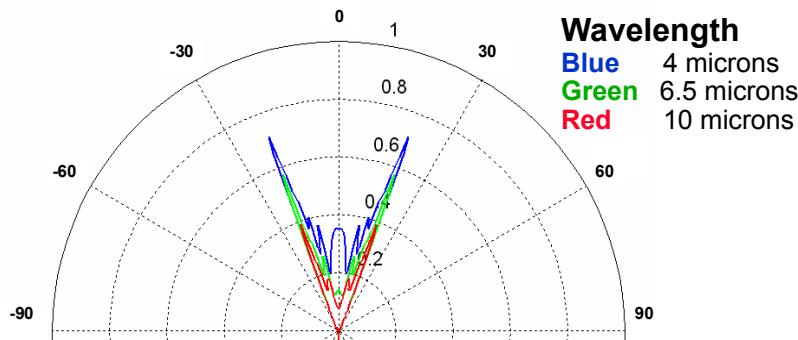
- Project portfolio becoming too risk averse
- Complicated bureaucracy and proposal selection process

# LDRD program changes for FY07 are beginning to show desired effect...

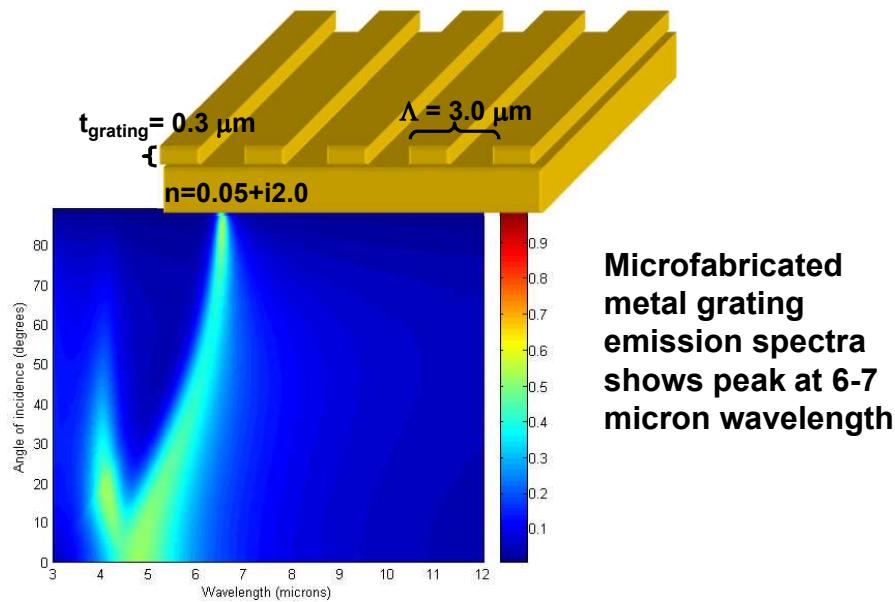


Objective	FY07 Outcome
<ul style="list-style-type: none"><li>• More high-risk, leading-edge R&amp;D and innovation</li></ul>	<ul style="list-style-type: none"><li>• Significant shift in successful FY07 proposals towards early stage innovation and discovery</li></ul>
<ul style="list-style-type: none"><li>• More effective and efficient proposal processes</li></ul>	<ul style="list-style-type: none"><li>• Reduced bureaucracy and simplified process</li></ul>

# FY07 LDRD Proposal: Designer coatings to render special forces “invisible” in the IR



Emissivity as function of angle for thin film embedded in silicon varies significantly for different wavelengths



- IR signature reduction could make soldiers “invisible” to night vision goggles
- Explore two approaches leading to coherent, directed thermal emission
  - Thin film materials stack with complex permittivities to direct thermal emission into narrow angular bands
  - Textured surface to preferentially emit in narrow spectral band
- Could be applied as a conformal, possibly flexible, coating
- Combines our microfabrication and materials know how

# Accelerating Engineering Innovation

## Summit June 1, 2006



[www.sandia.gov/AEI](http://www.sandia.gov/AEI)



Intel	Harvard	RPI	DOE
Monsanto	U Florida	MIT	NNSA
Goodyear	U Michigan	Yale	LANL
Microsoft	U Wisconsin	UNM	ORNL
ExxonMobil	U Illinois	UT Austin	NAE
LMC	UC Davis	UC Santa Barbara	
IBM	Rose-Hulman		
HP	Harvey-Mudd		



# In Closing



- **We must keep the creative and innovative spirit alive and well – both for current and future mission needs.**
- **We are using a strategy of driving improvements in LDRD to ensure R&D base remains vital, creative and innovative.**
- **We are linking to the national and international S&T communities to ensure we stay at the forefront of S&T.**
- **We continue to emphasize the need for improvements in our safety culture and are beginning to see results.**