

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**



Today's Discussion

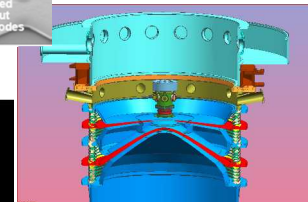
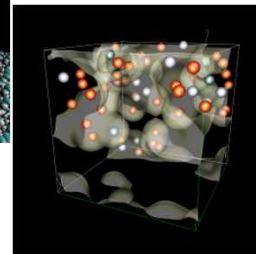
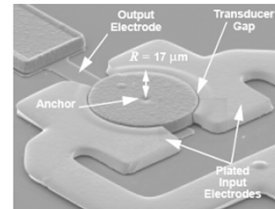
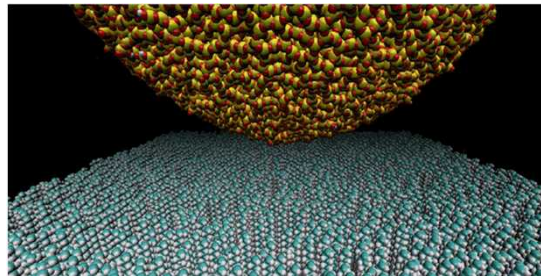


- **Personal History**
- **Current Responsibilities**
- **Key Challenges & Initiatives**

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**



Division 1000

“Science and Technology and Research Foundations”

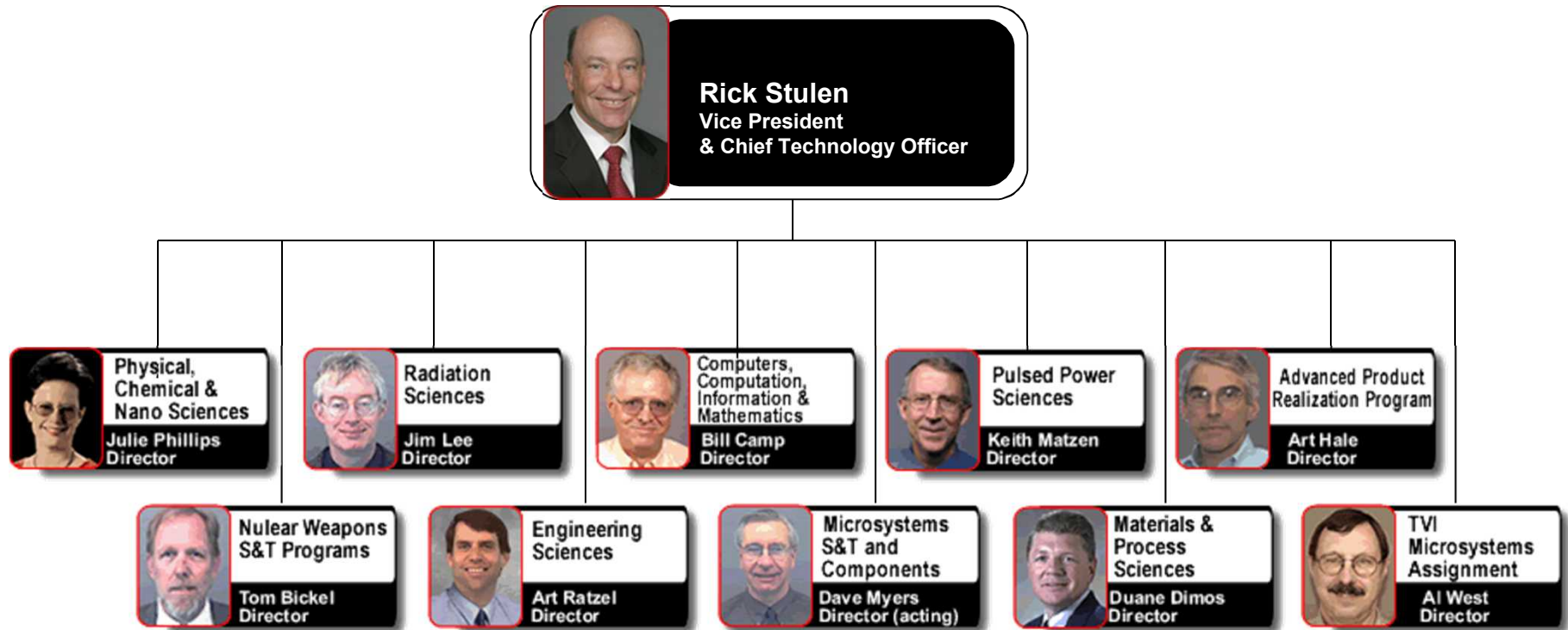
Division 1000 by the numbers



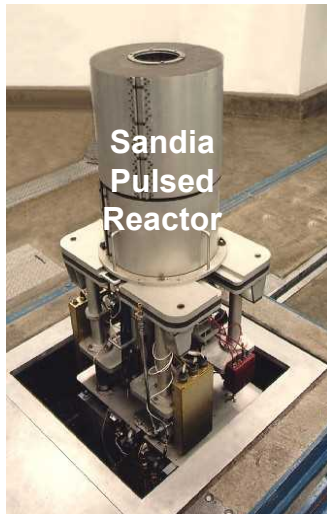
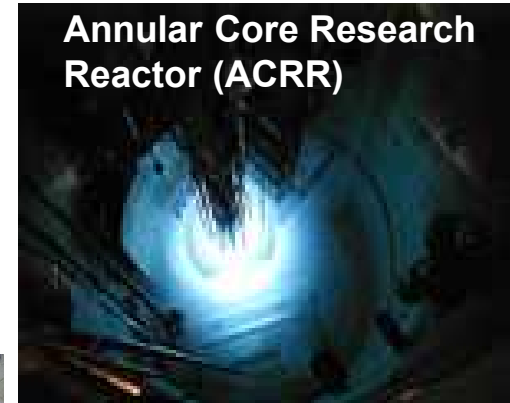
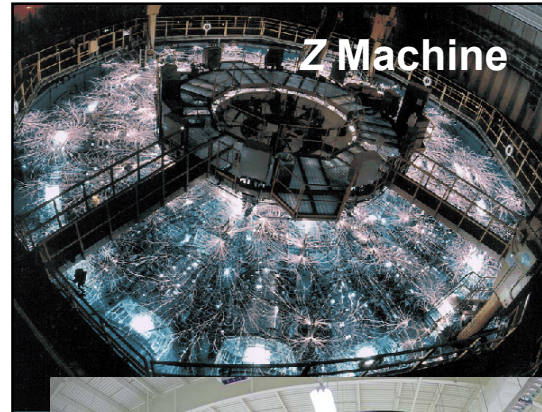
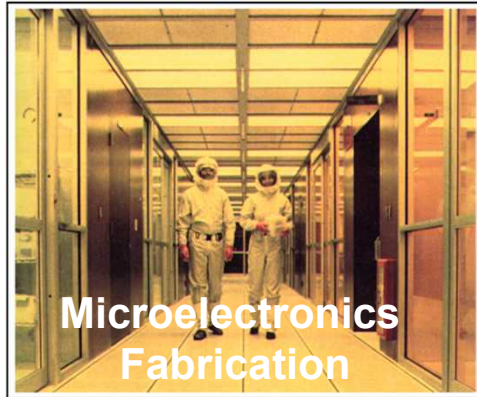
- **10 Directors**
- **Our People**
 - **1287 Regular Employees**
 - **89 Limited Term Employees**
 - **54 Post Docs**
 - **260 Students**
 - **924 Contractors/Consultants**
- **~ \$550M FY05 costs**
- **~950,000 ft² - offices, labs, fabs, large scale test**



Division 1000 Leadership Team



Unique Division 1000 Facilities



Division 1000 is strongly coupled to MESA*



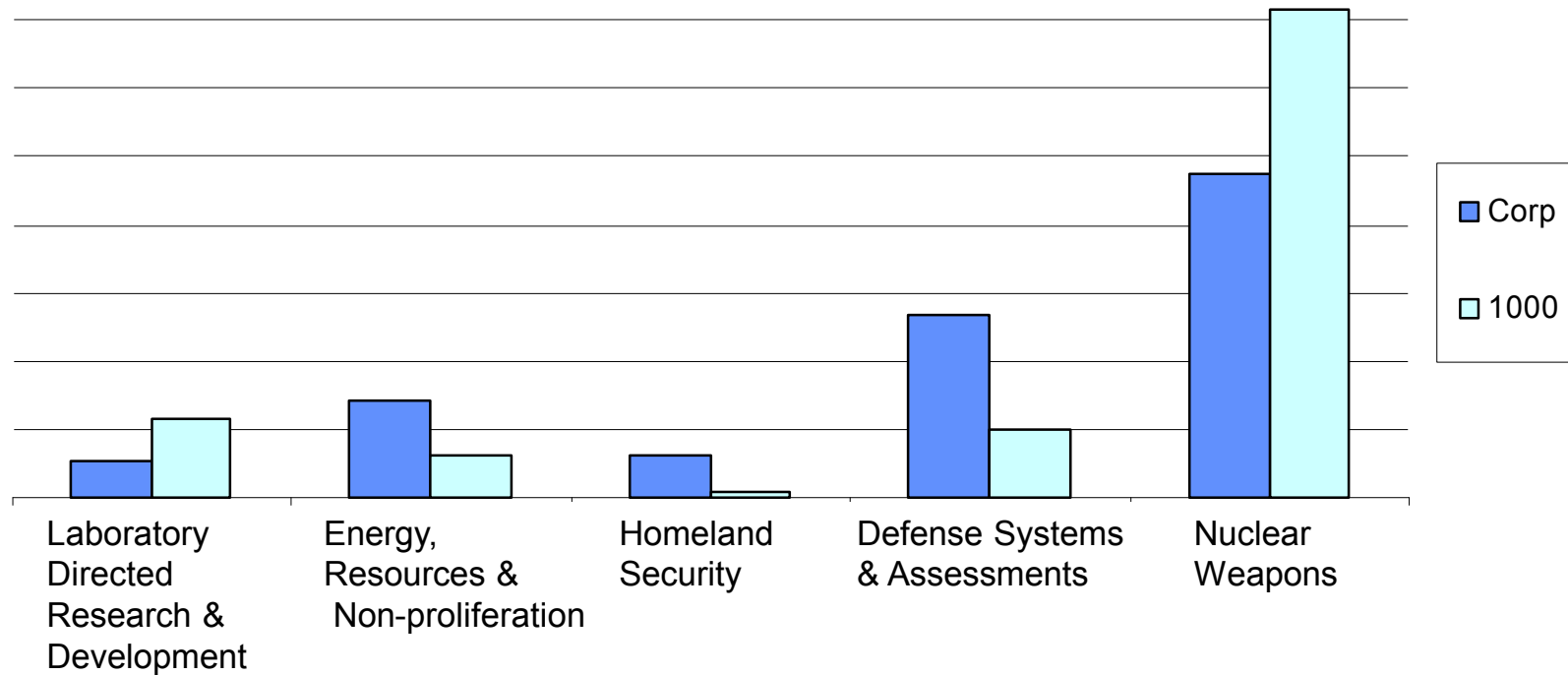
**Microelectronics
Development
Laboratory**

MicroFab

MicroLab

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

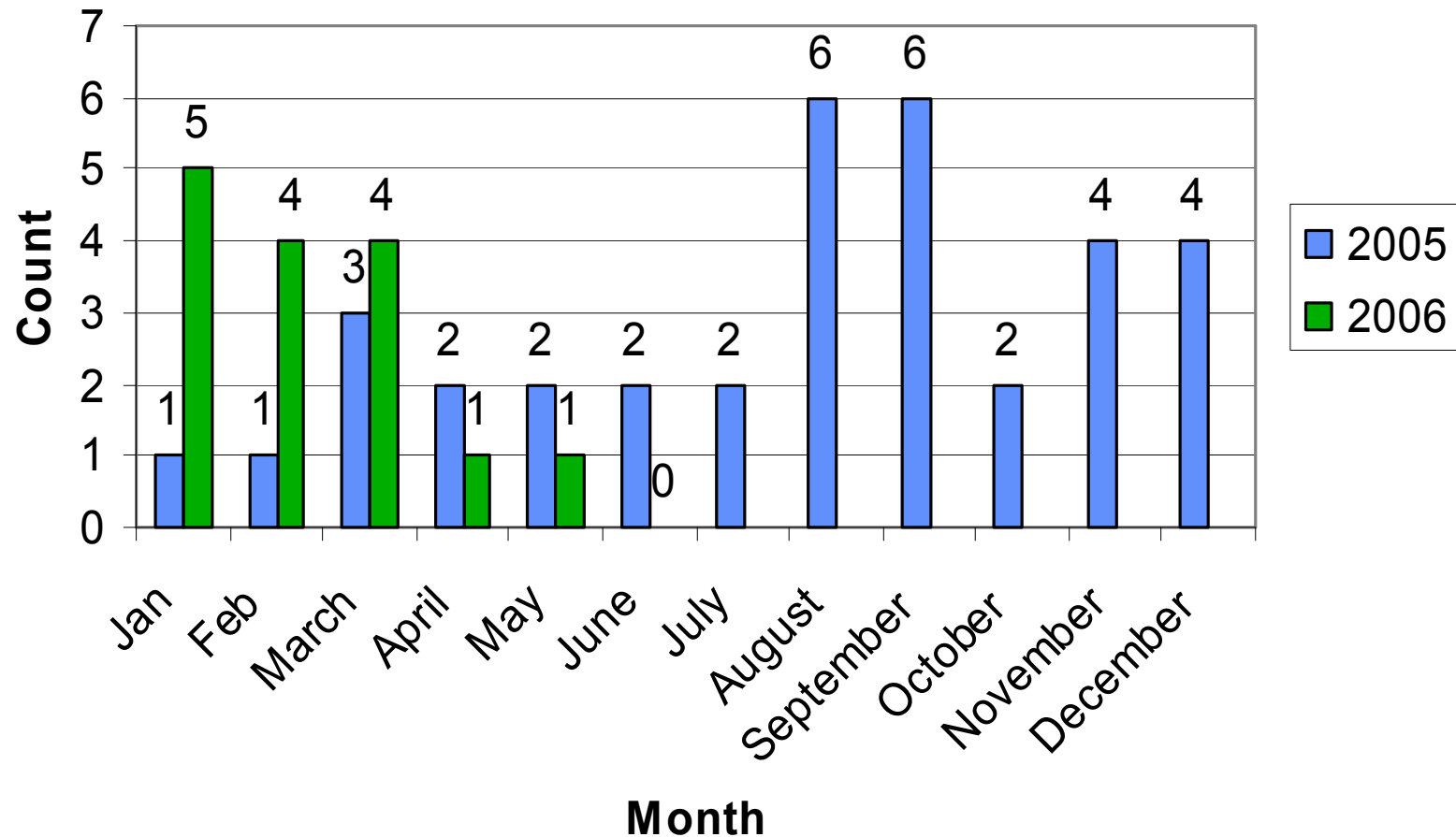
Key challenge to diversify portfolio



We are making progress on the safety culture



Improving trend in reducing recordable injuries





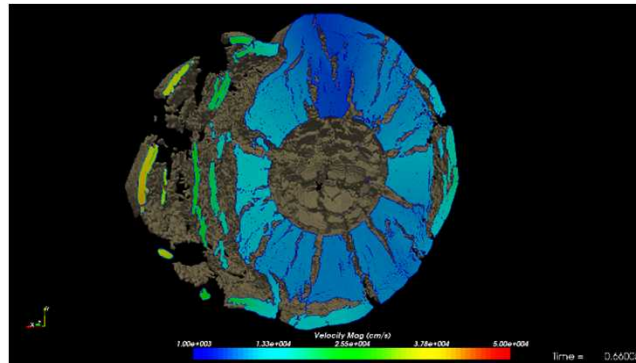
The Science Technology and Engineering (ST&E) Strategic Management Unit

ST&E Strategic Management Unit

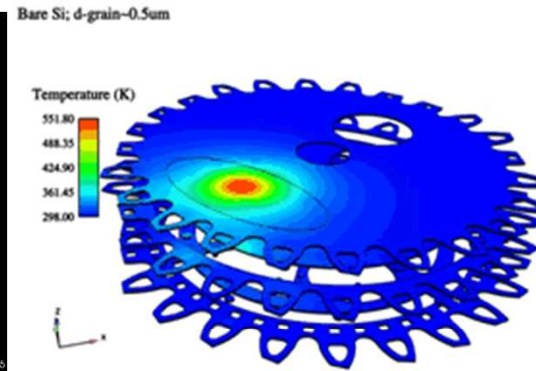


- **Comprised of ST&E activities across the Laboratory**
- **Includes 6 Research Foundations**
- **Represented by work of ~ 2000 FTEs and ~\$600M**
- **Except for Laboratory Directed Research and Development (LDRD), work is funded and coordinated through the programs**

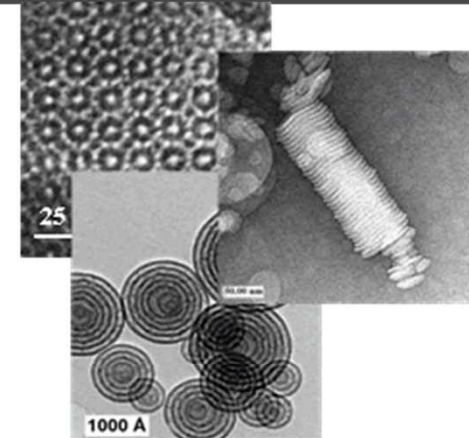
ST&E Research Foundations



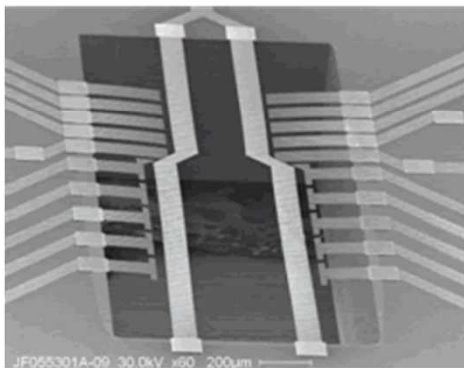
**Computational and
Information Sciences**



Engineering Sciences



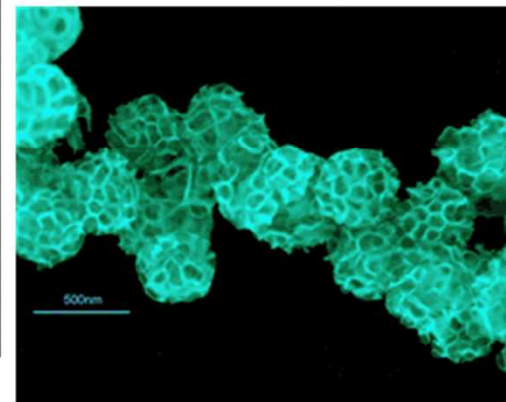
**Materials Science and
Technology**



**Microelectronics and
Photonics**



Pulsed Power

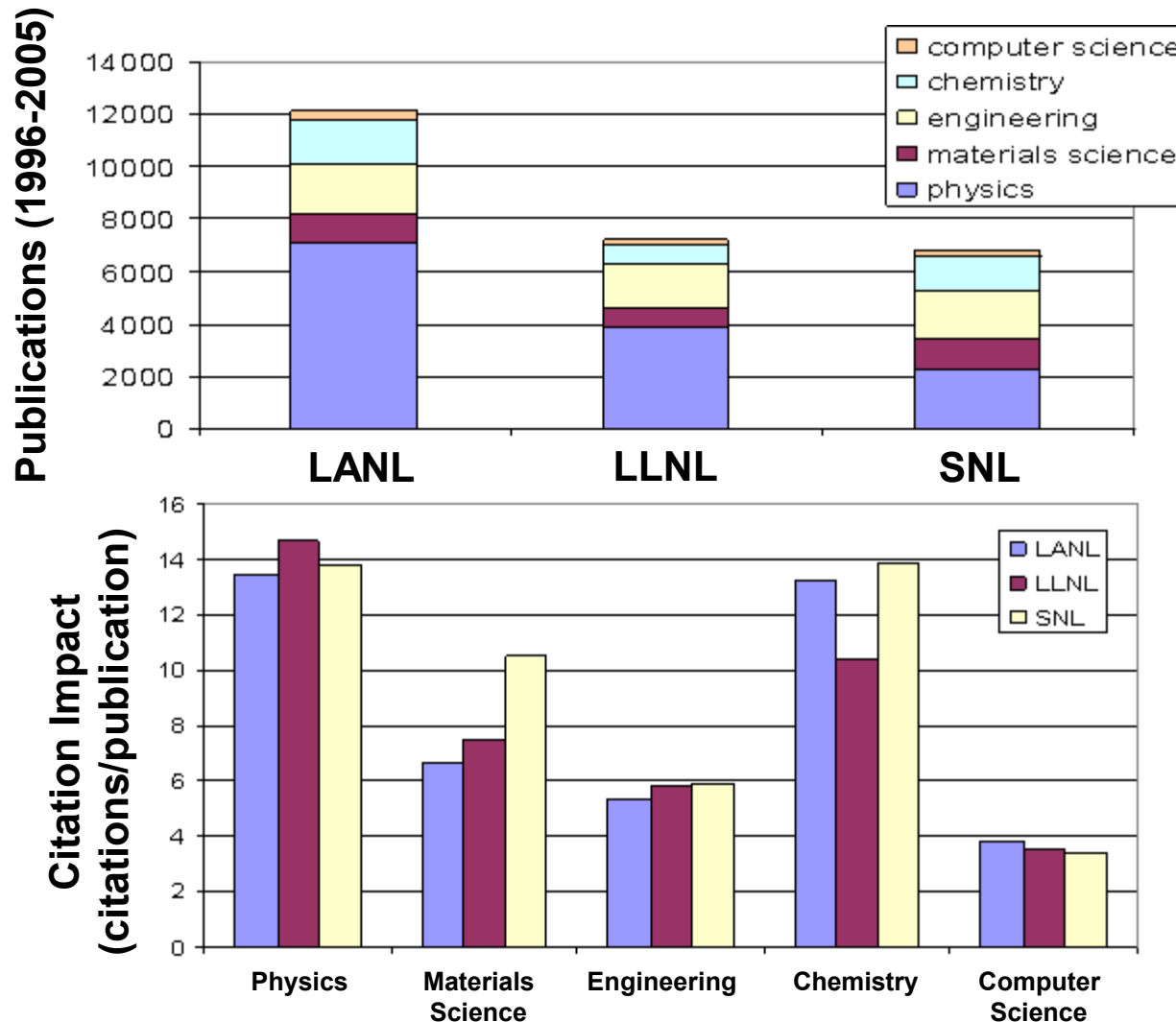


Biotechnology

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



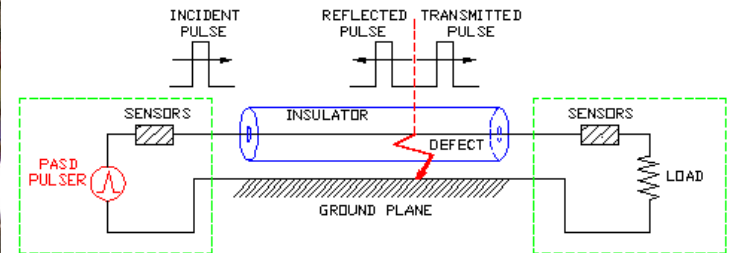
Publication and citation impact for Sandia and the 3 NNSA labs (1996-2005)



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

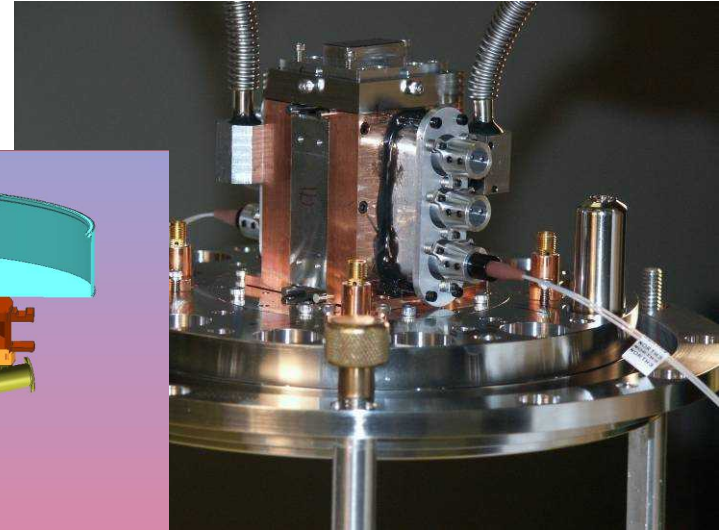
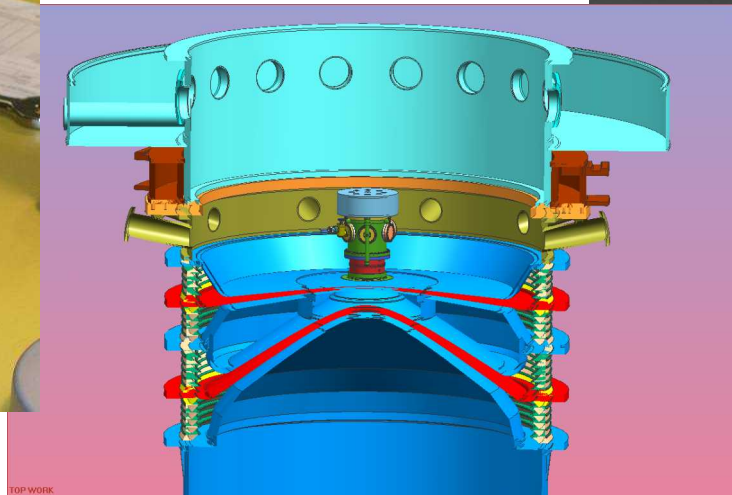


Pulsed Arrested Spark Discharge or PASD can quickly and inexpensively find defects in airplane wiring



- 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

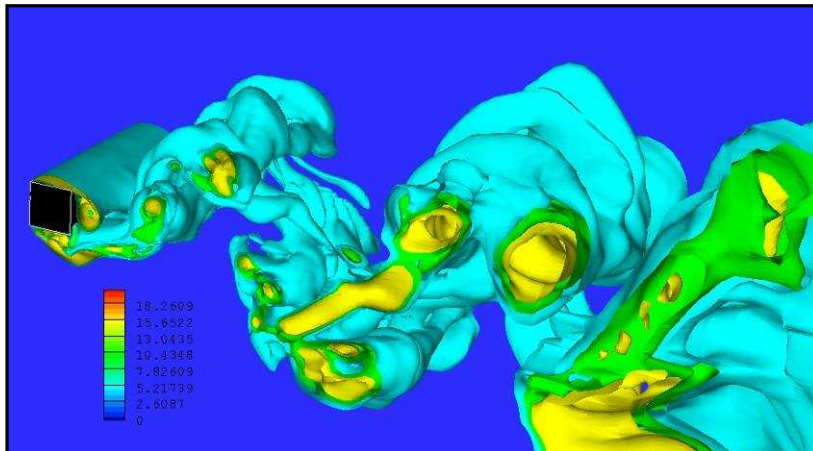


“ These experiments address one of the toughest questions on a top priority physics topic.” Dawn Flicker, LANL

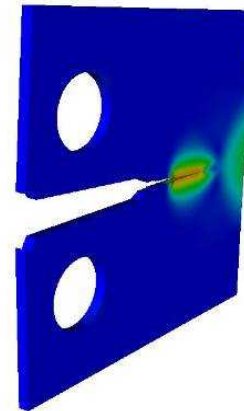
Red Storm: A new standard for engineering



- 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



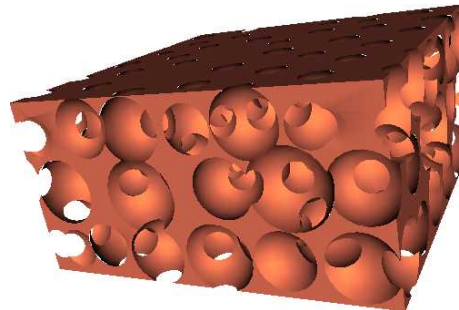
- **Improve the Laboratory Directed Research and Development (LDRD) program**
- **Improve application of R&D to the programs**
- **Provide national leadership for engineering innovation and education - responding to the American Competitiveness Initiative**



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...

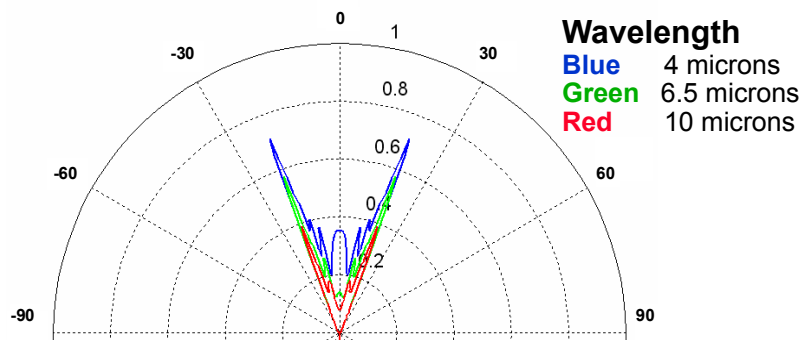


Objective

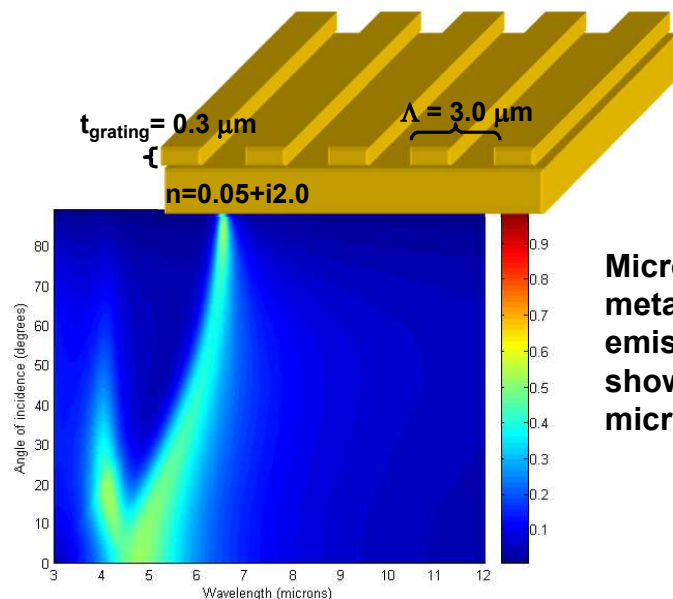
FY07 Outcome

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

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



Microfabricated metal grating emission spectra shows peak at 6-7 micron wavelength

- 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



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.**