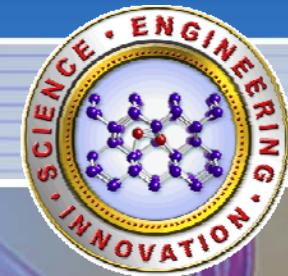


National Security Science & Technology Needs

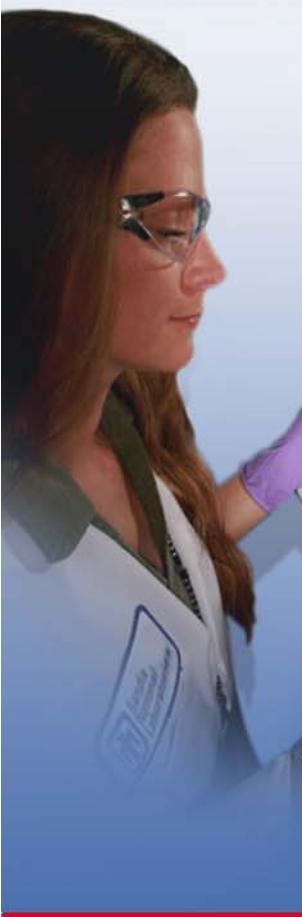


Rick Stulen

Vice President and Chief Technology Officer
Science, Technology & Research Foundations
Sandia National Laboratories

Critical National Needs in New Technologies:
Opportunities for the Technology Innovation Program

April 24, 2008



Sandia National Laboratories

National Security Concerns



Nuclear Weapons



Energy

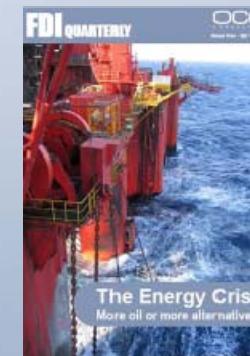


Nuclear Power

Homeland Security



Supporting the Warfighter



Science at Risk

Future challenges are varied and complex



WMD



**Nuclear
Surety**



Cyber Security



Energy

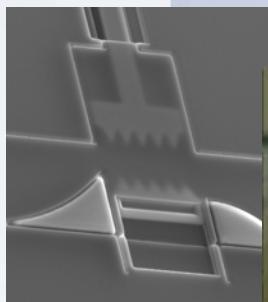
Critical National Security Needs

– Prevent WMD –

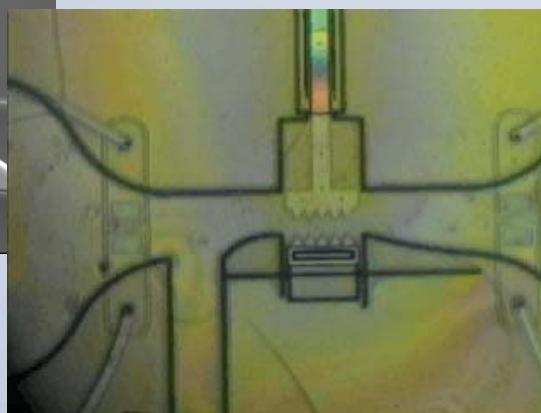


CBRNE Sensors:

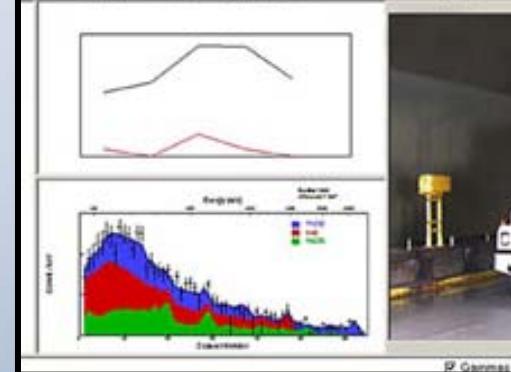
- Chemical, Biological, Radiological, Nuclear & Explosive
- Sense, decide, act & communicate
- Provide pre-symptomatic medical screening diagnostics



Cell Lysing



143	1.7	0 (Very Low)	RA0001
139	0.7	0 (Very Low)	K4001
305	1.2	0 (Very Low)	TAC0001
3060	6	1 (Low)	N/A
241	1.2	0 (Very Low)	TAC0204
249	1.2	0 (Very Low)	TAC0204
709	0.1	0 (Very Low)	RA0004

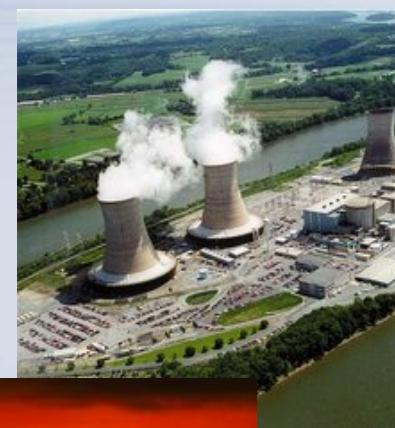


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Critical National Security Needs

– Ensure Nuclear Surety –

- Integrate safety and security
 - Nuclear weapons, power, and nonproliferation all together
 - Material and facilities
- Advance counter nuclear and radiological terrorism

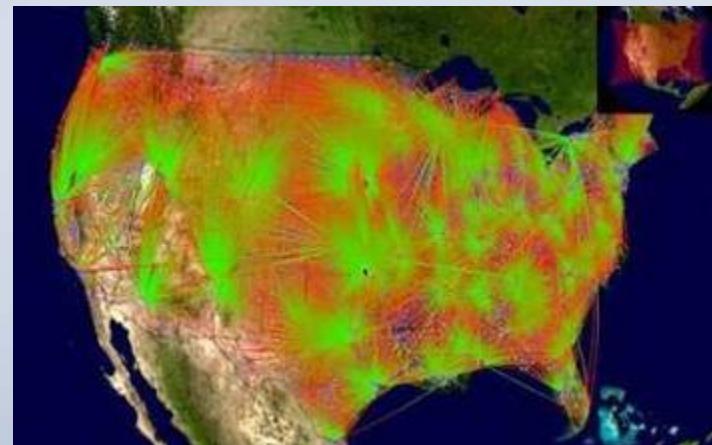


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Critical National Security Needs

– Secure Cyber Space –

- Trust
- Resilience
- Attribution
- Simulation

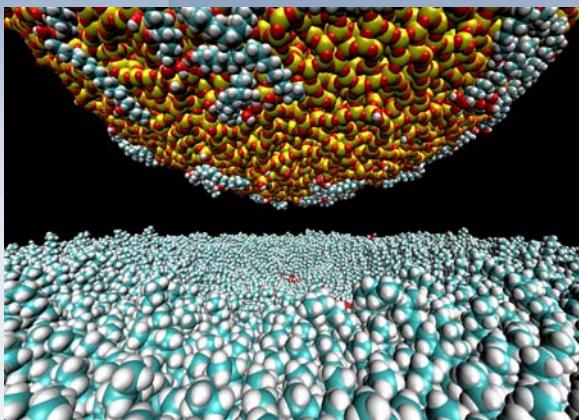


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Critical National Security Needs

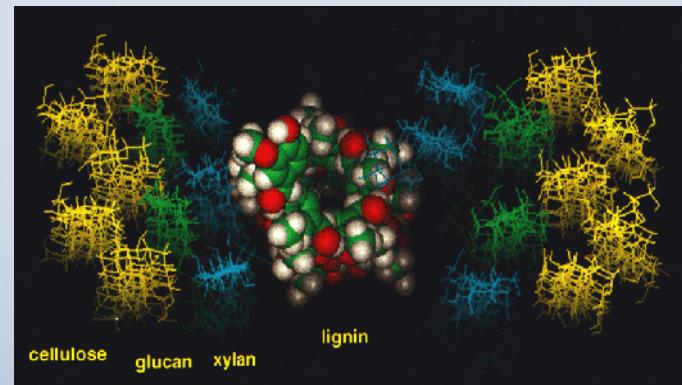
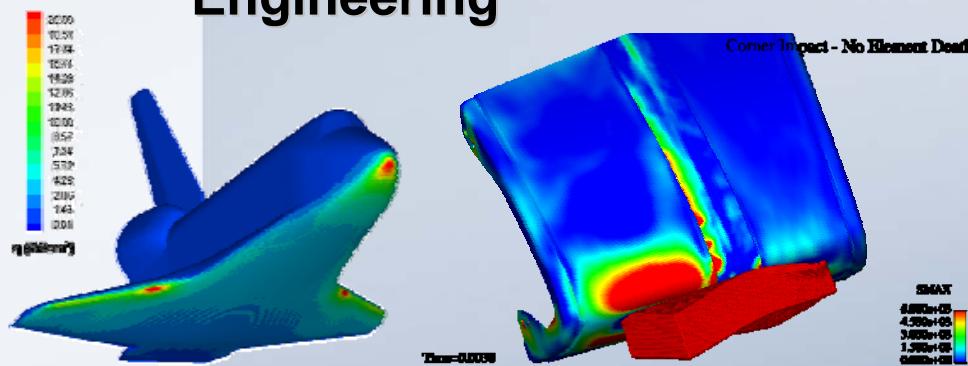
– *Enabling Simulation Tools* –

Science



- Develop and deploy scalable informatics platforms and algorithms
- Accelerate innovation through pervasive computational simulations

Engineering

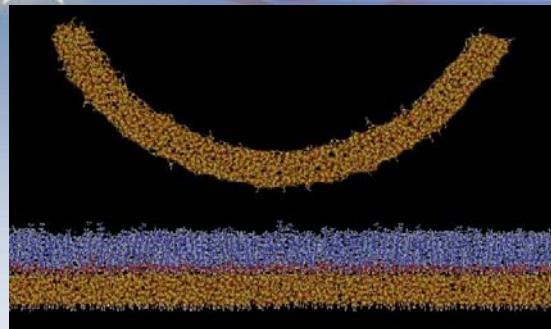


Informatics

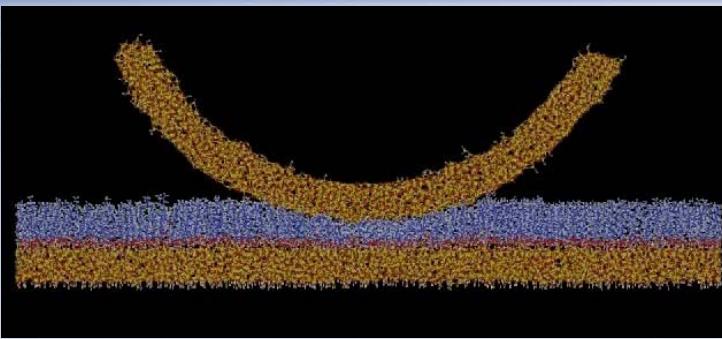


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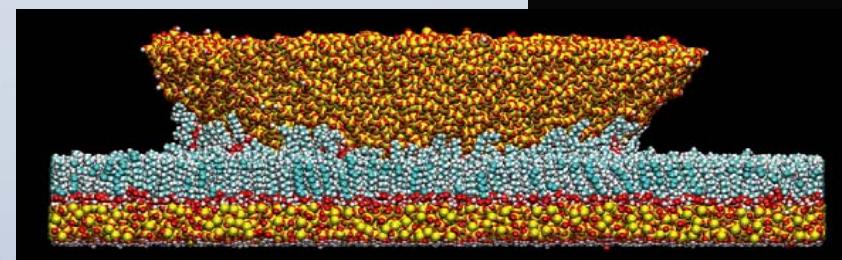
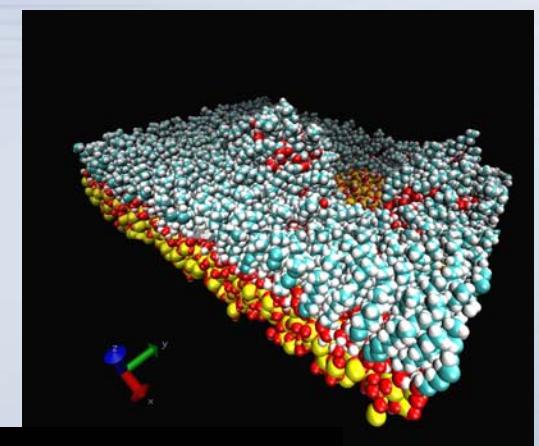
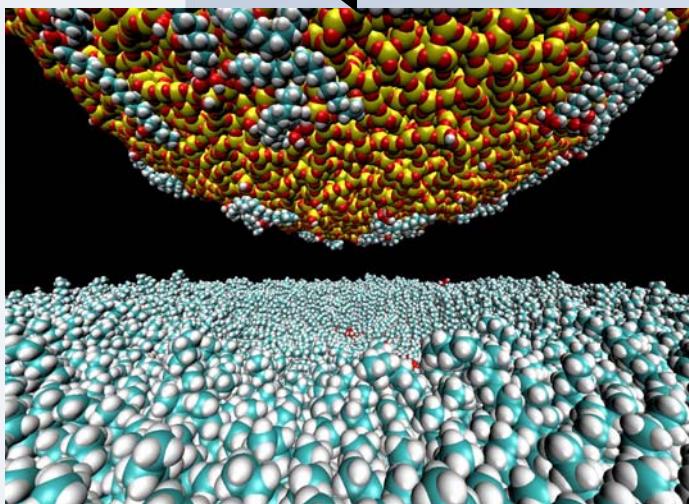
Molecular Level Study of Microsystems Coating



Science based simulations provide more detailed results – not less – than experiments alone



Probe Tip of Atomic Force Microscope

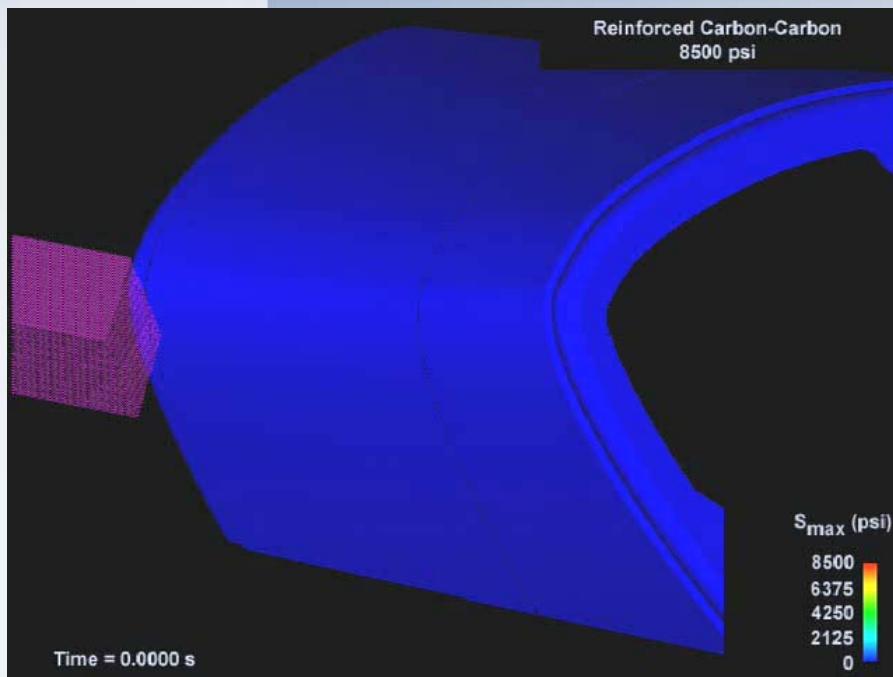
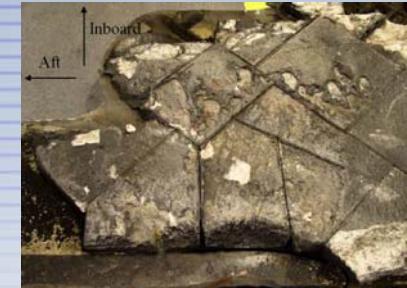
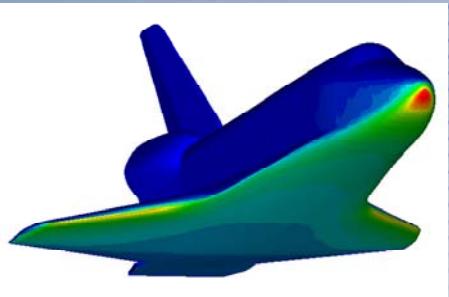
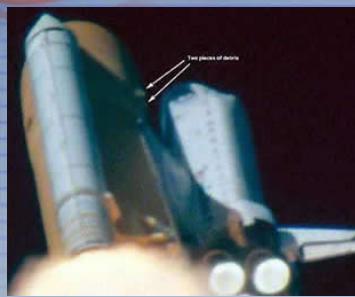


Polymer Coating on MEMS



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Study of the Columbia Accident



Sandia Simulation



Physical Test



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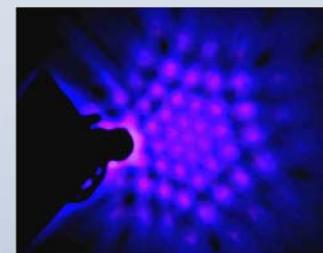
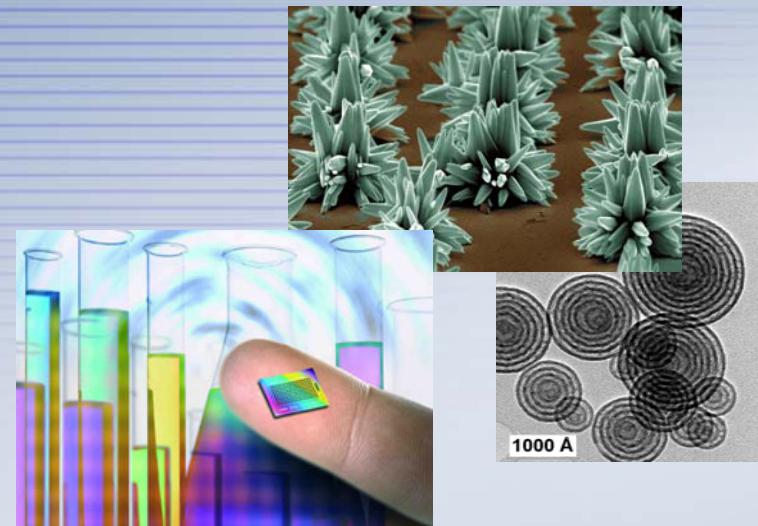
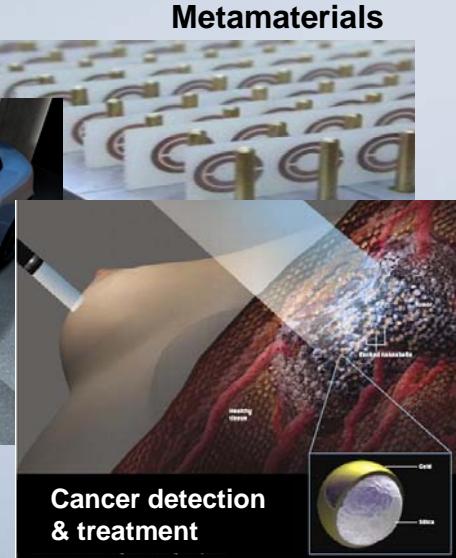
Critical National Security Needs

– *Creating Materials by Design* –

- Take advantage on new functions from complex & hierarchical micro/nano materials
 - Lab-on-a-chip based sensors
 - Energy
 - Bio-medicine
 - Intelligence



Cloaking



**Photonic
Lattice LED**



Sandia National Laboratories

Science & Technology Opportunities

- **Microsensors**
 - Wireless technology
 - Power harvesting / storage
 - New materials
- **Cyber security**
 - Network & infrastructure modeling
- **Petascale & exascale computing**
 - Power efficient hardware
 - Scalable software
- **From materials to integrated systems**
 - Design and functionalize
 - Processing, manipulation & integration

