

# **Sandia Microsystems**

## **Developing Critical Skills**

### **MEMS University Alliance**

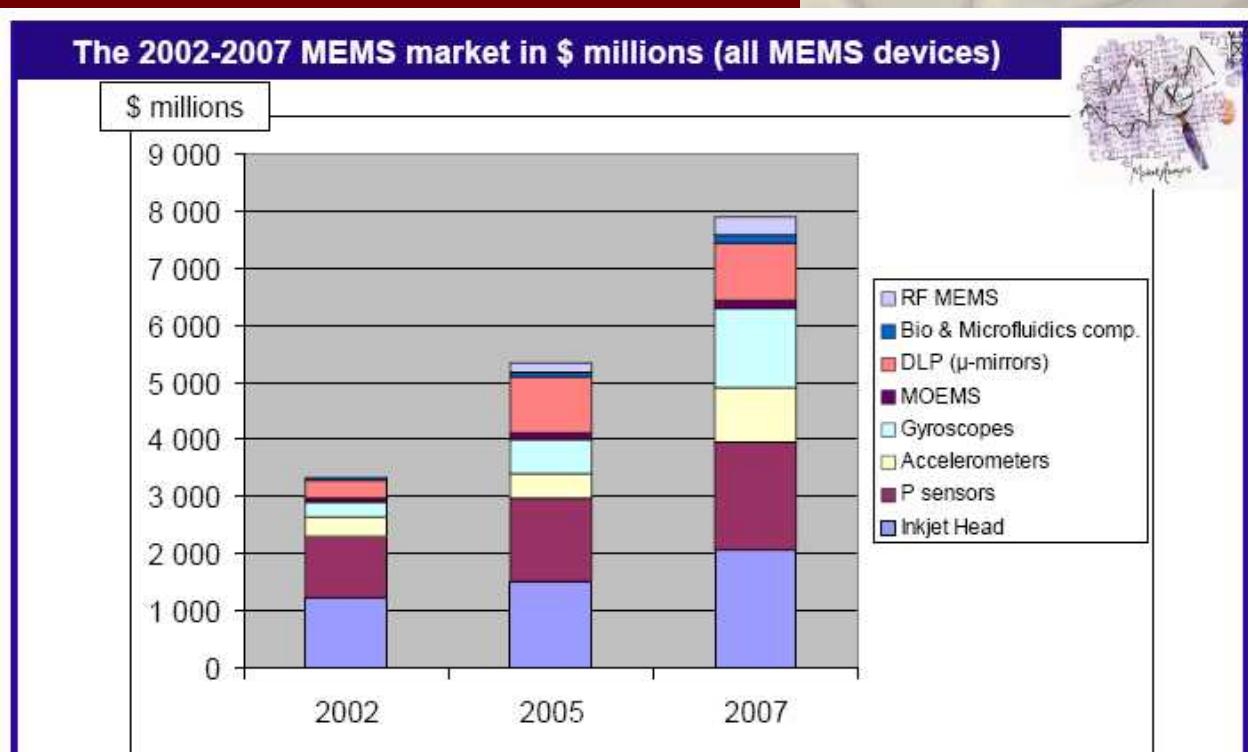
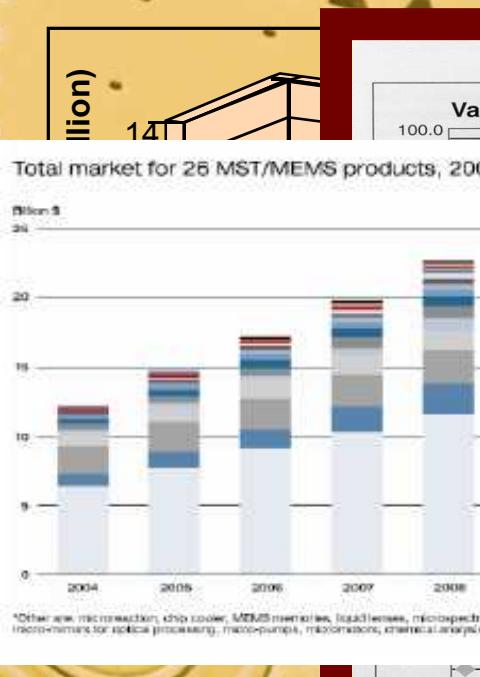
**SAME-TEC Workshop – July 24, 2006**

**Kathryn Hanselmann**  
**Sandia National Laboratories**

# Outline

- The Micro/Nano Industry
- Barriers & Concerns
- Skilled Work Force
- Sandia's Motivation
- Sandia's University Alliance Program

# Poised for a Microsystems Revolution



- In 2005, the MEMS market will be 5.35 B\$; it will grow to 7.9 B\$ in 2007
- CAGR ~ 18%

# Barriers to Commercialization

Standards

Integration

Other

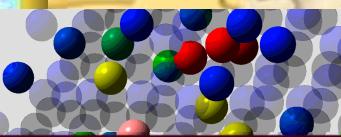
Market Pull

Business  
Synergies

Advanced  
Business  
Community

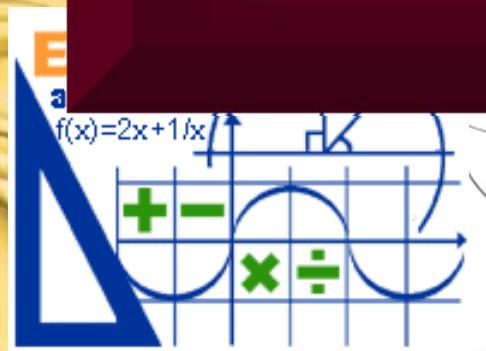
# Skilled Technical Workforce

# Challenges

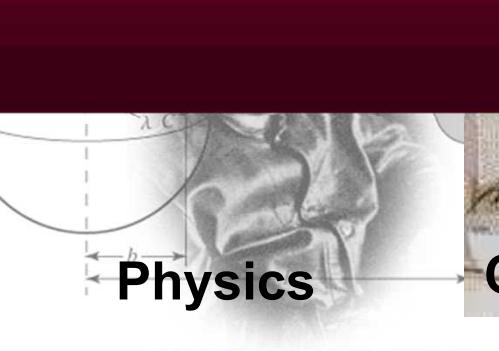


Engineering

## Cross-disciplinary Skills Needed



Mathematics



Physics



CAD



Chemistry



Sandia  
National  
Laboratories

# Challenges

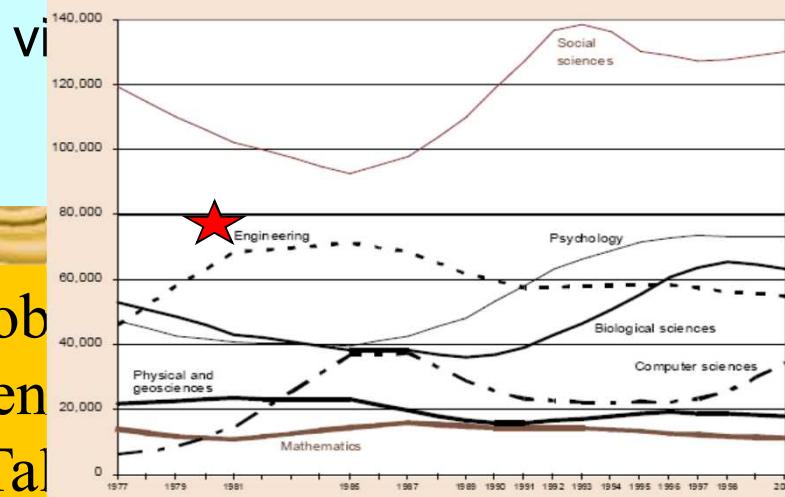
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## EDUCATION - US

"If we don't have  
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"The number of

FIGURE 1

BACHELOR'S DEGREES EARNED IN SELECTED S&E FIELDS BY U.S. CITIZENS AND PERMANENT RESIDENTS: SELECTED YEARS, 1977-2000



"All stakeholders must mobilize and initiate efforts that increase the number of US citizens pursuing science and engineering studies and careers."

-- NSB Report, 2003

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dents from all  
especially those  
errepresented in  
ers."

-- NSB Task Force Chairman :  
*China's Potential*

Glob  
Scienc  
Tal

Labor Statistics

SOURCES: National Science Foundation, Division of Science Resources Statistics (NSF/SRS) Science and Engineering Degrees, by Race/Ethnicity of Recipients 1991-2000, Detailed Statistical Tables, NSF 02-329; and NSF/SRS, WebCASPAR database system, <http://caspar.nsf.gov>

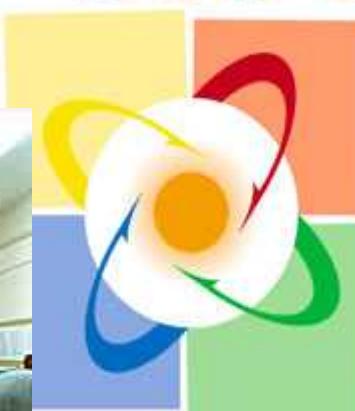
# Sandia Recognizes the Importance of Education and Critical Skills Development



## Post-Secondary Programs



## Internships & Co-ops



## Secondary Programs

## Underrepresented Programs



# Historic Facilities

## Sandia Investment in Microsystems

Microelectronics Development Laboratory (MDL)



Compound Semiconductor Research Laboratory (CSRL)



Integrated Materials Research Laboratory



Processing and Environmental Technology Laboratory (PETL)

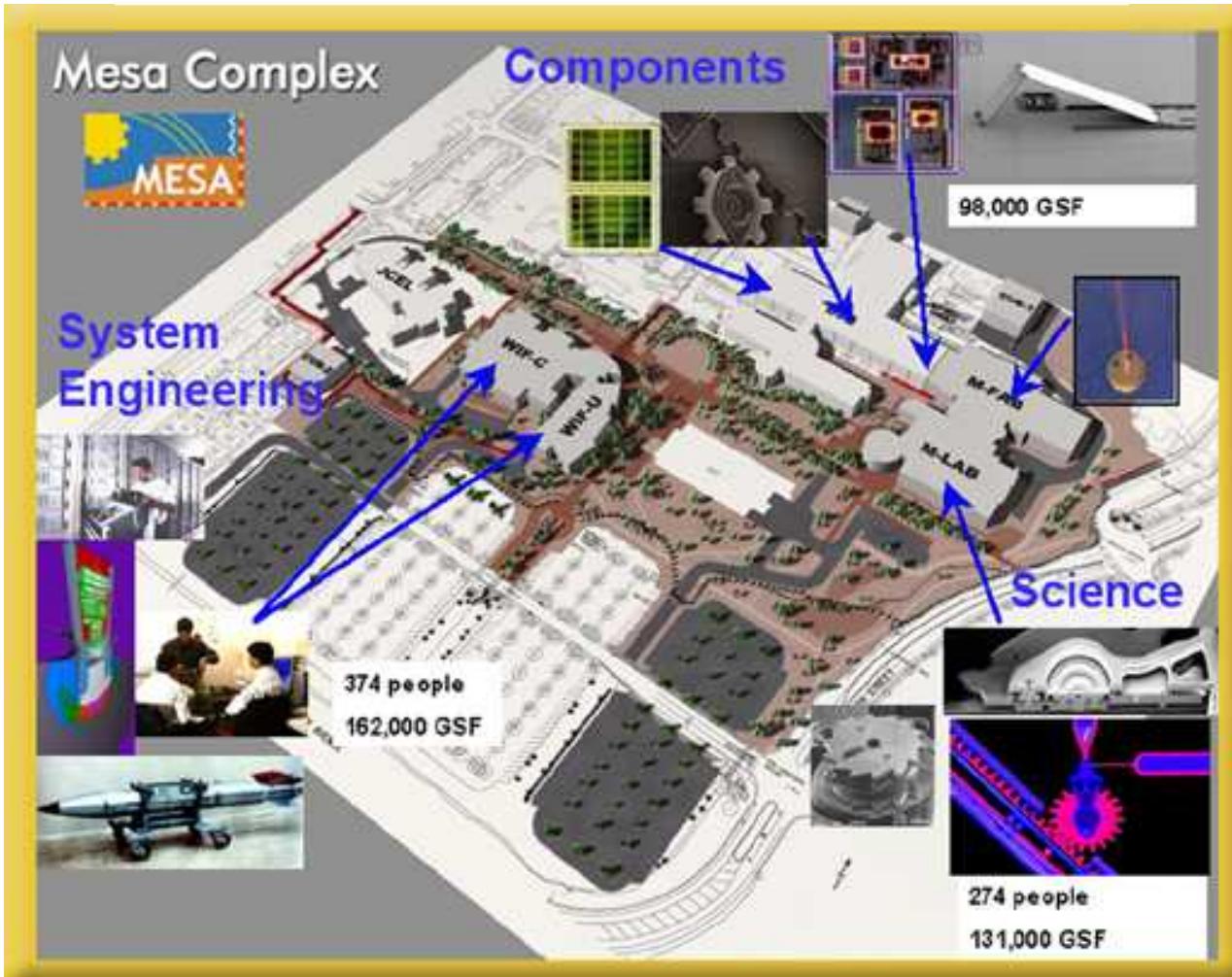


Integrated Manufacturing Technologies Laboratory Complex (IMTL)



Robotics Manufacturing, Science, and Engineering Laboratory

# Sandia Investment in Microsystems



# New Facilities

Microelectronics  
Development Lab



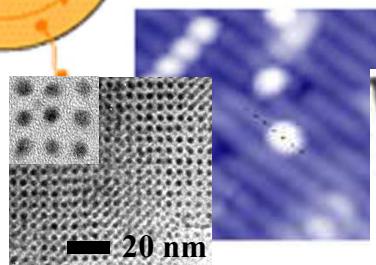
Compound  
Semiconductor  
Research Lab



Collaborators  
Laboratory  
University  
Industry

**CINT**  
Core Facility

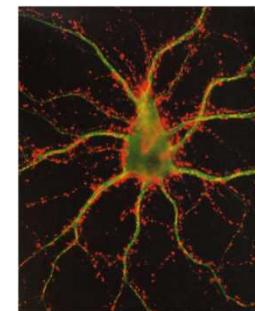
Gateway  
to SNL



Gateway  
to LANL



Biosciences



National High Magnetic  
Field Lab



Los Alamos  
Neutron Science Center



Synthesis, Characterization, & Theory

One scientific community focused on nanoscience integration.

# Established Post-Secondary Programs



**CNM (TVI)  
MEMS  
Program**

**MEMS University  
Alliance**

**UNM Manufacturing  
Training &  
Technology Center**

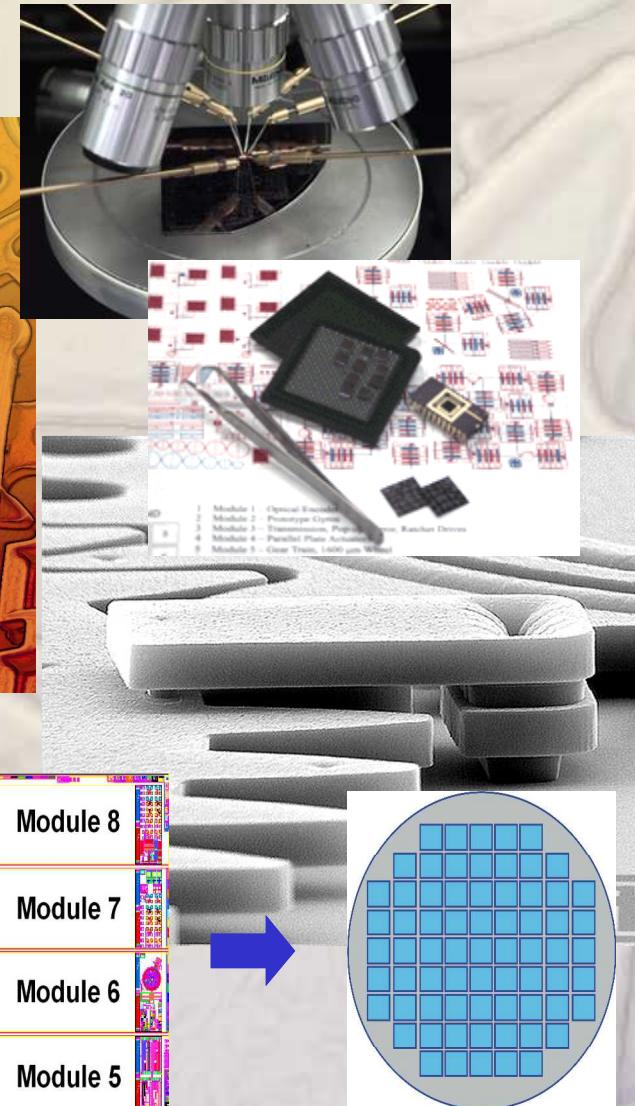
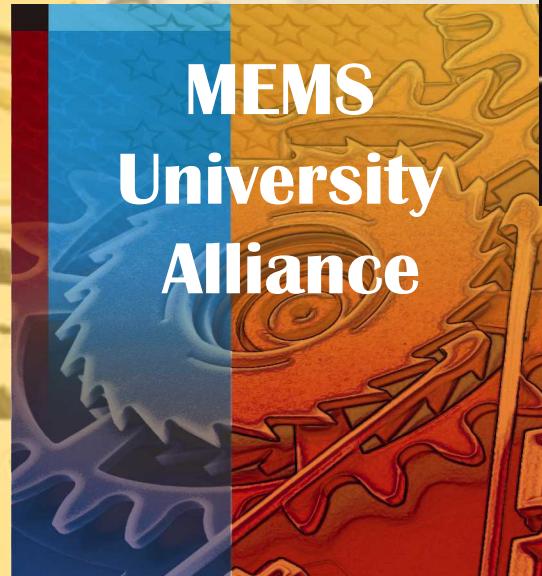
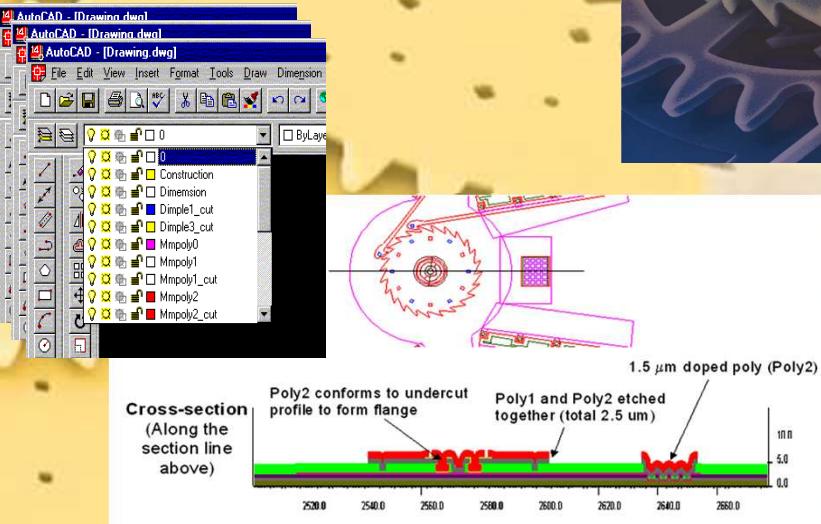
**Sandia's MESA  
Institute**



**Advanced Materials  
Laboratory at UNM**



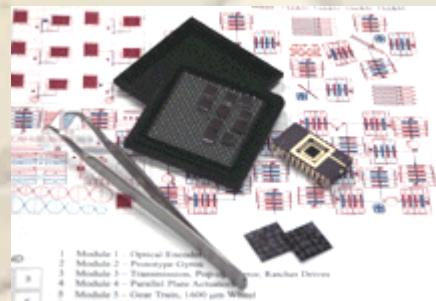
# Leveraging Sandia's SAMPLES Program



# Sandia's SAMPLES™ Program Offers Ready, Comprehensive Access to SUMMiT V™ Technology:



Education



Prototype Fabrication



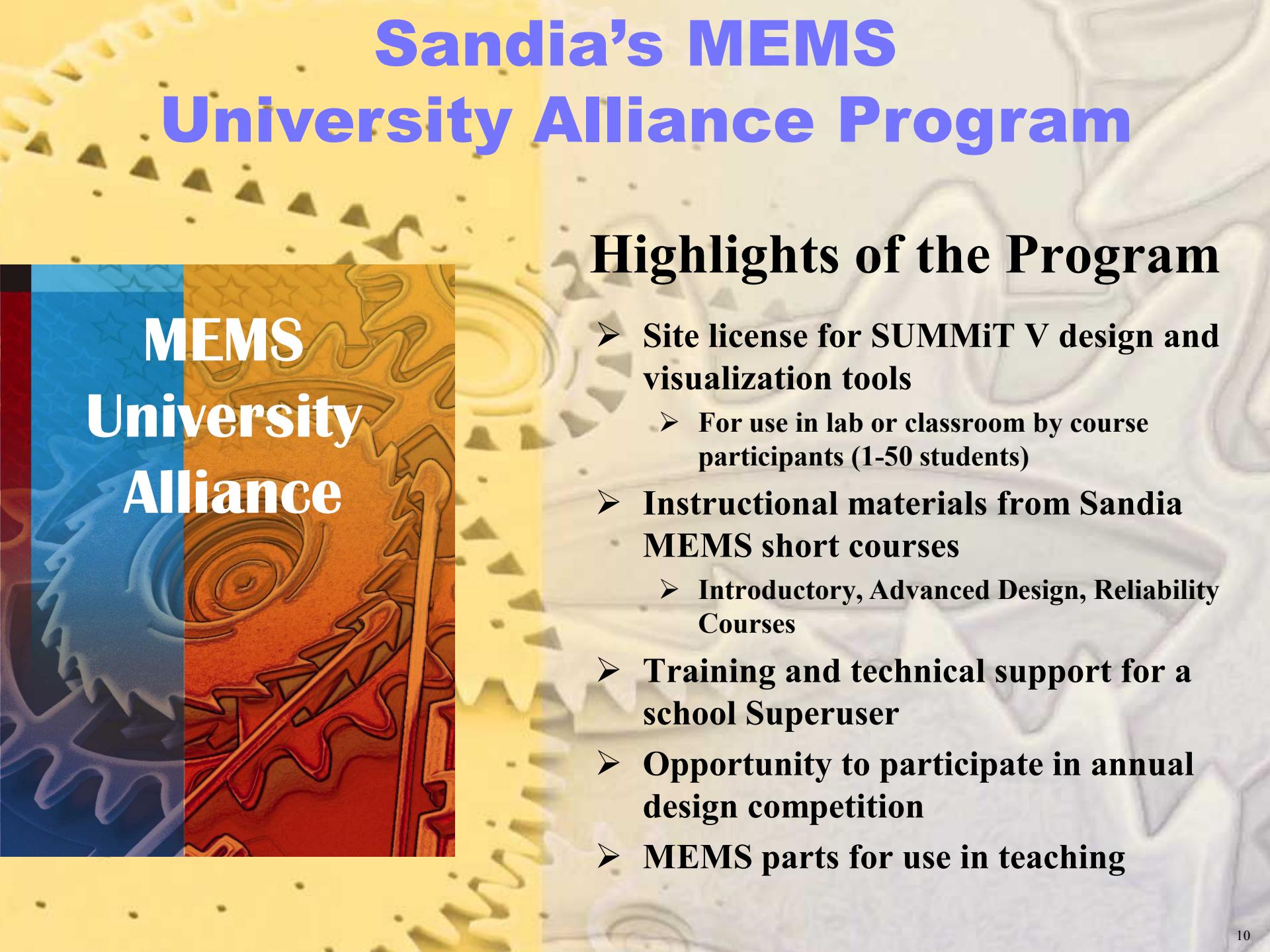
Design Tools



Services

**SAMPLES™: Sandia's Agile MEMS Prototyping, Layout Tools, Education, and Services**

# **Sandia's MEMS University Alliance Program**



**MEMS  
University  
Alliance**

## **Highlights of the Program**

- Site license for SUMMiT V design and visualization tools
  - For use in lab or classroom by course participants (1-50 students)
- Instructional materials from Sandia MEMS short courses
  - Introductory, Advanced Design, Reliability Courses
- Training and technical support for a school Superuser
- Opportunity to participate in annual design competition
- MEMS parts for use in teaching

# **Sandia's MEMS University Alliance Program**

## **Participating Schools**

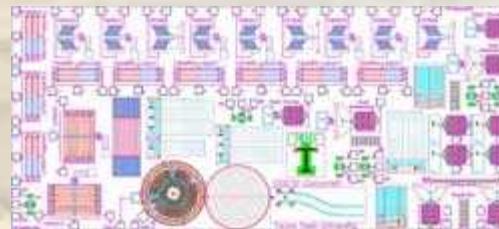
University of Oklahoma	H. Stalford
Worcester Polytechnic Institute	R. Pryputniewicz
Austin Community College	J. Tiede
Central NM Community College (TVI)	F. Lopez/M. Pliel
UNC-Charlotte	H. Estrada
Chemeketa Community College	C. Watkins
University of Utah	I. Harvey
Luna Community College	G. Gallegos
Texas Tech University	T. Dallas
University of Wisconsin-Platteville	J. Osama
Texas State University	G. Spencer
University of Florida	G. Wiens
New Mexico State University (pending)	T. Burton
North Dakota State College of Science (pending)	M. Burke
Cleveland State University (pending)	B. Thomas

# Sandia's MEMS University Alliance Program

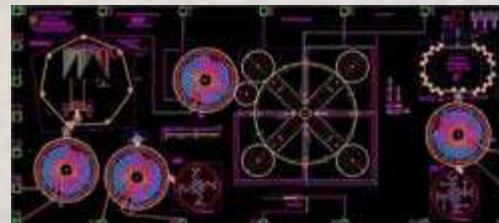


## 2006 Design Competition

- ✓ Texas Tech University – Winner in Characterization/Reliability Physics Category



- ✓ Central New Mexico Community College (formerly TVI) – Winner in Novel Design Category

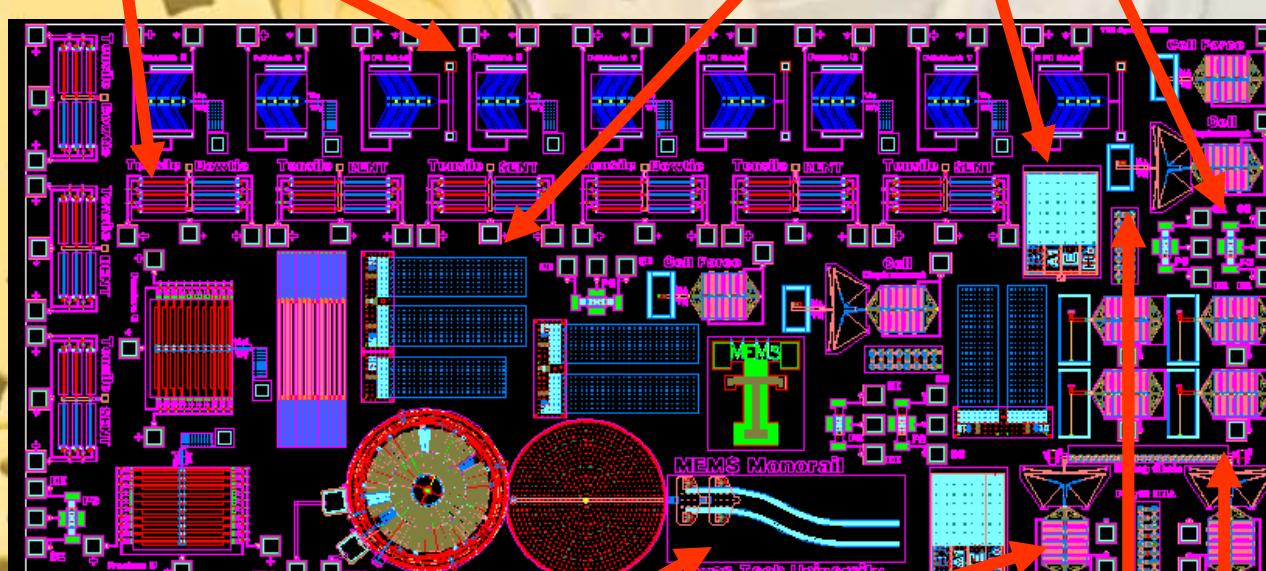


# TTU is leveraging Design Competition success

MEMS Probes of Nano-phenomena

Fracture mechanics

Physisorption/Chemisorption



Friction/Stiction

Biomechanics

# What some of our UA partners are saying...

**“We have jumpstarted a MEMS program at the University of Oklahoma.... It’s putting us on the map in terms of education, and also in terms of helping to make us competitive in winning research awards at the national level.”**

**- Dr. Harold Stalford, Univ. of Oklahoma**

**“When the tools are so simple to use, you focus your energy on understanding the concepts and principals behind making a micro-system device and that’s a key element.”**

**- Dr. Matt Pleil, Albuquerque Technical Vocational Institute**

**“The Sandia University Alliance is a BEST PRACTICE to help jumpstart MEMS programs at US Institutions.”**

**- MEMS Educational Workshop, MEMS2005**



# Sandia's MEMS University Alliance Program

## Contacts

➤ MEMS University Alliance Web Site -  
<http://www.sandia.gov/mstc/education/alliance/>

➤ Email:

[memsua@sandia.gov](mailto:memsua@sandia.gov)

or

[memsinfo@sandia.gov](mailto:memsinfo@sandia.gov)

