

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

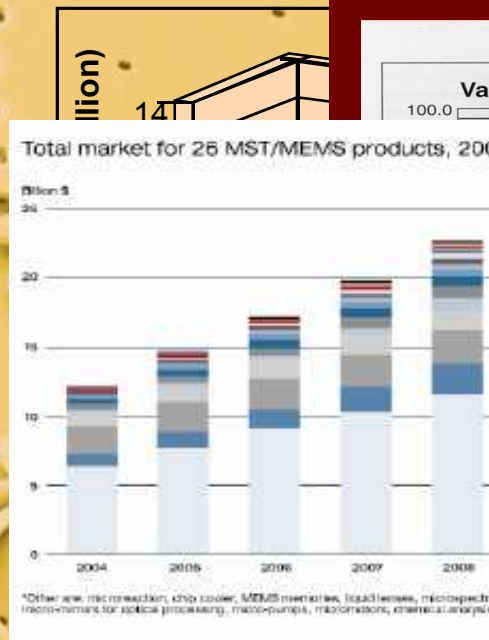
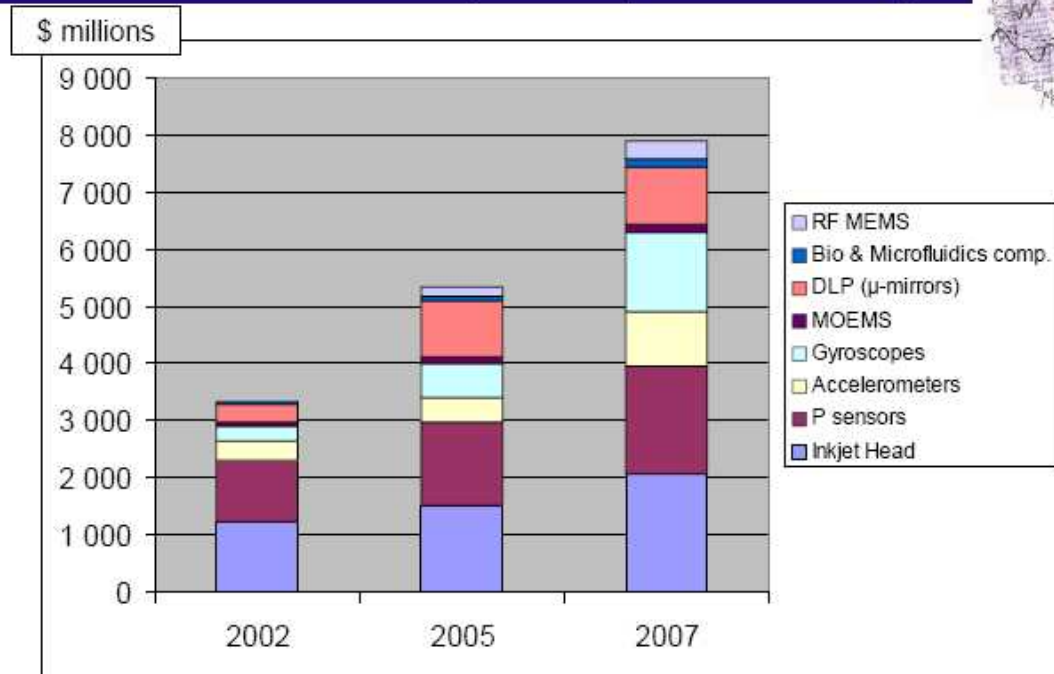


Fig. 1. Stua

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chart (Fig.

The 2002-2007 MEMS market in \$ millions (all MEMS devices)



- 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

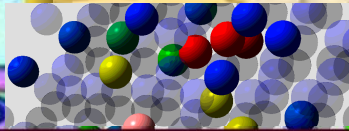
Business
Synergies

**Skilled Technical
Workforce**

Skilled
Business
Community

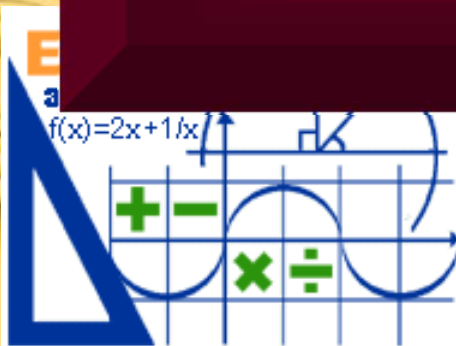
Challenges

MEMS

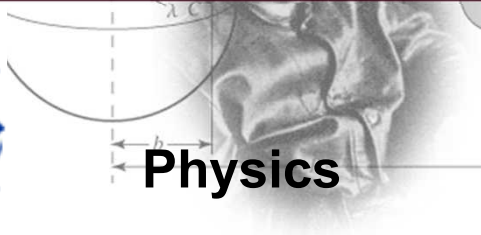


Engineering

Cross-disciplinary Skills Needed



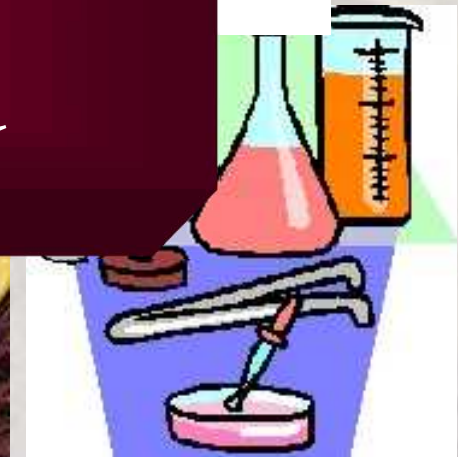
Mathematics



Physics



CAD



Chemistry

Challenges

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EDUCATION - US

"If
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**Declining # of
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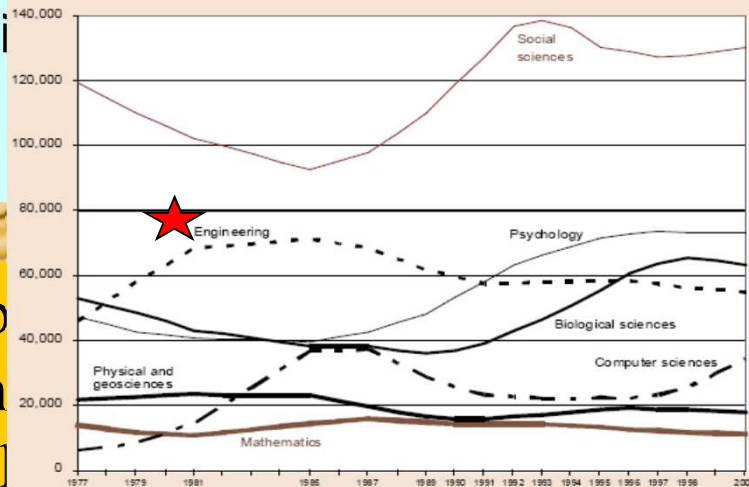
"The number of

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

-- NSB Report, 2003

FIGURE 1

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



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>

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- NSB Task Force Chairman :
America's Potential

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Labor Statistics

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Sandia Recognizes the Importance of Education and Critical Skills Development

MEMS University Alliance

Extensive K-12

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



Integrated Manufacturing Technologies Laboratory Complex (IMTL)



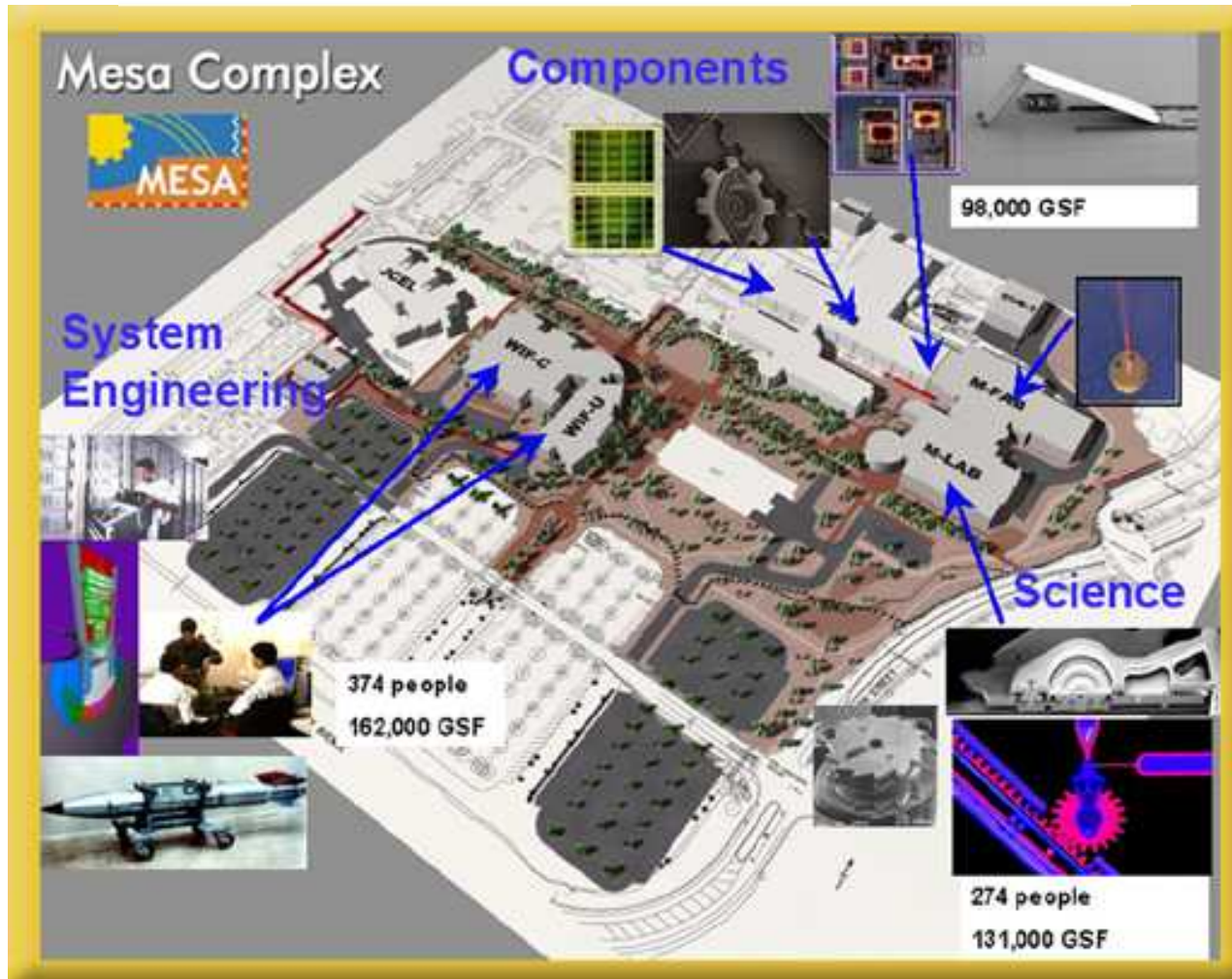
Processing and Environmental Technology Laboratory (PETL)



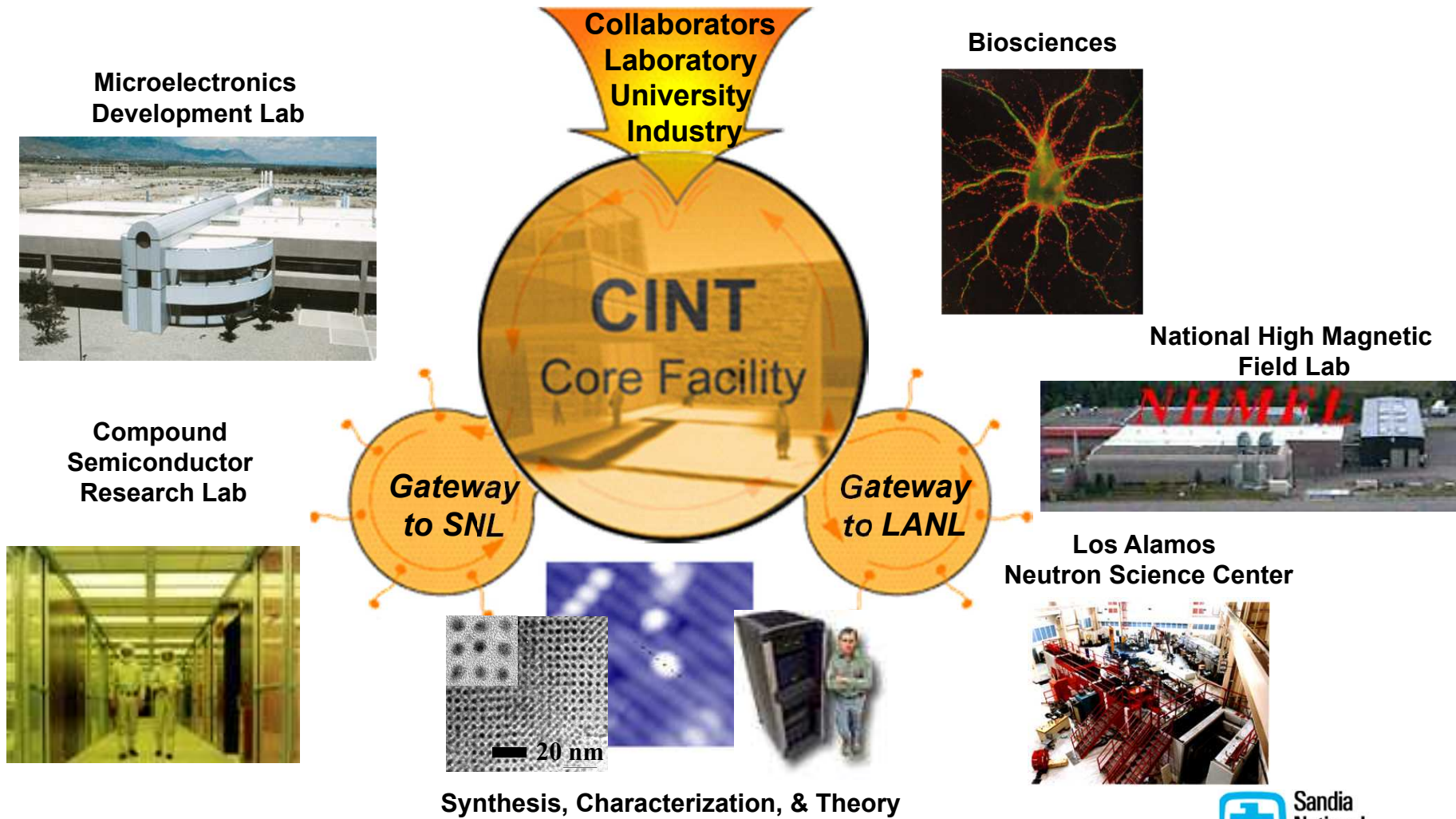
Robotics Manufacturing, Science, and Engineering Laboratory

New Facilities

Sandia Investment in Microsystems



New Facilities



One scientific community focused on nanoscience integration.

Established Post-Secondary Programs



**CNM (TVI)
MEMS
Program**

**MEMS University
Alliance**

**UNM Manufacturing
Training &
Technology Center**

MESA
Microsystems and Engineering
Sciences Applications Complex

**Sandia's MESA
Institute**

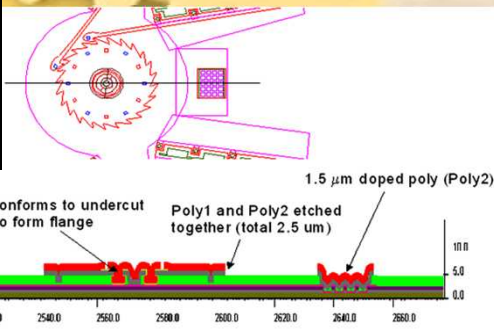
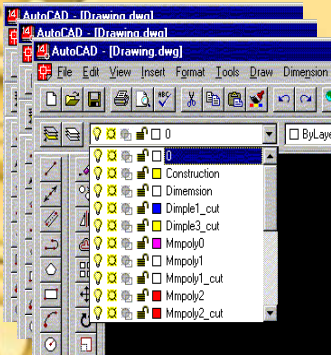
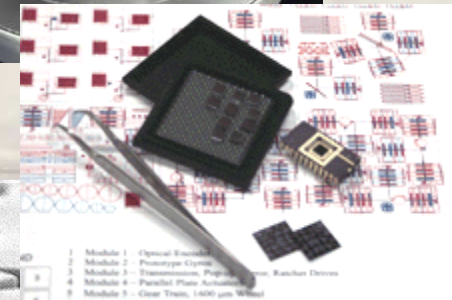
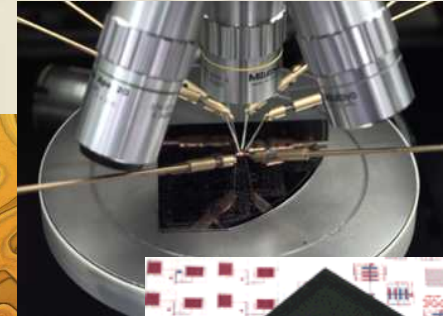
**Advanced Materials
Laboratory at UNM**



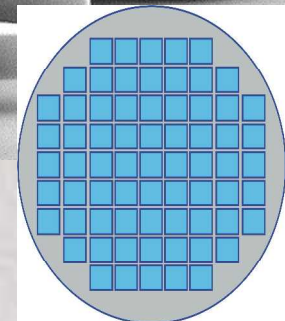
Leveraging Sandia's SAMPLES Program



MEMS University Alliance



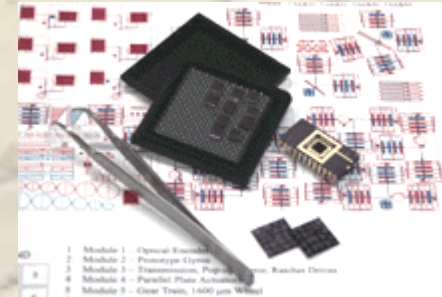
Module 4	Module 8
Module 3	Module 7
Module 2	Module 6
Module 1	Module 5



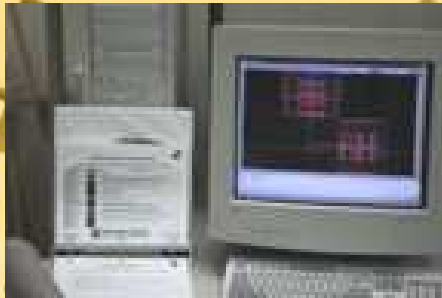
Sandia's SAMPLES™ Program Offers Ready, Comprehensive Access to SUMMiT V™ Technology:



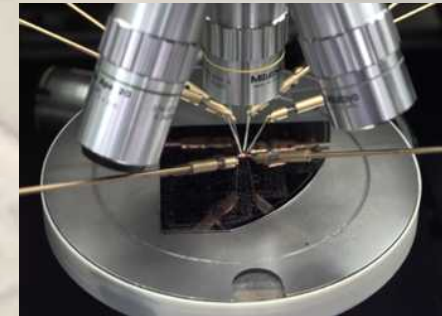
Education



Prototype Fabrication



Design Tools



Services

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

Sandia's MEMS University Alliance Program

The logo for the MEMS University Alliance is a vertical rectangle divided into two halves. The left half is blue with a white gear pattern. The right half is orange with a white gear pattern. The text "MEMS University Alliance" is written in white, bold, sans-serif font across the center of the rectangle.

**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

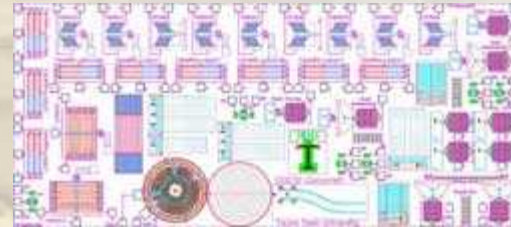
University of Oklahoma	H. Stalford
Worcester Polytechnic Institute	R. Pryputniewicz
Austin Community College	J. Tiede
Central NM Community College (TVI)	F. Lopez/M. Pliel
UNC-Charlotte	H. Estrada
Chemeketa Community College	C. Watkins
University of Utah	I. Harvey
Luna Community College	G. Gallegos
Texas 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

MEMS University Alliance Design Competition

2006 Design Competition

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



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



MEMS Probes of Nano-phenomena

Physisorption/Chemisorption



Biomechanics

Texas Tech University Module 2006

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

The logo is a vertical rectangle divided into three colored sections: blue on the left, orange in the middle, and red on the right. The text "MEMS University Alliance" is written in white, bold, sans-serif font across the center. The background of the entire slide features a large, stylized gear with a yellow-to-orange gradient, and a smaller, more detailed gear in the bottom left corner.

**MEMS
University
Alliance**

- **MEMS University Alliance Web Site -**
<http://www.sandia.gov/mstc/education/alliance/>
- **Email:**
memsua@sandia.gov
or
memsinfo@sandia.gov