Designing an On-line Certificate Program in Microelectronics Manufacturing
Agenda

• Background and Context
• Role and Goals of Certificate Program
• Design Process
• Status
• Next Steps
• Proposition 301 *(The Funding)*
• Arizona Regents’ University *(The Vehicle)*
• Arizona Master’s of Engineering Degree Program *(The Prototype)*
Proposition 301

- Approved as ballot proposition in November 2000 statewide general election
- Targeted to improve Arizona public education
- Incremental statewide sales tax projected to raise $500 M/yr
- 12% allocated to Technology and Research Initiative Fund to be administered by ABOR
TRIF Funding Targets

- Promote university research, development and technology transfer related to the knowledge-based economy
- Expand access to education for time-bound and place-bound students
- Implement recommendations from Governor’s Task Force on Higher Education
- Develop programs that prepare students to contribute in Arizona High Tech industries
Governor’s Task Force Key Strategies

1. Increase Participation
   Raise the level of participation for traditional and continuing learners in higher ed

2. Increase Research and Business Development
   Increase amount of targeted research, technology transfer and business development provided by higher ed

3. Increase Capacity and Productivity
   Enhance the human, physical, and technological capacity of institutions of higher ed
Arizona Regents’ University

- Virtual University
- Managed by Project Management Team and Board of Regents’ ARU subcommittee
- $2M budgeted annually from Prop 301
- Framework for expanding access to university education via technology
ARU will provide highly accessible educational opportunities that will result in a continuously improving, better-educated workforce, and that will lead, thereby, to personal prosperity for our citizens and to a strong economy for Arizona.
Mission

ARU’s mission is to raise the overall level of educational attainment in the state by collaborating to provide access to university education for time-bound and place-bound students of the state.
**ARU Foundations**

**Infrastructure**

Internet

Strong statewide connectivity via ASPIN, NAUNet, AZTelemedicine

**Baseline Programs**

Spring 2001: 165 web-delivered and 150 interactive TV courses

12 degree programs and 7 certificates offered in business, education, engineering, nursing, and technology

Over 40 new or expanded programs proposed under 301

**Services**

All student services migrating to web for on- and off-campus students

Possibility of centrally provided services and/or better coordination

---

[Images of ARU and NAU logos]
ARU Logistics

- Each degree-seeking student selects a “Home” university
- Student is admitted to the Home University
- Home Catalog lists courses from other partners
- Home University handles registration, financial aid, tuition & fee collections
- Revenue shared using negotiated formula
ARU – The Primary Challenge

*How do the universities coordinate and communicate so that:*

- services and processes are “seamless” from a student point-of-view
- course offerings are optimal from a market and scheduling viewpoint
NATURE OF THE PROGRAM

Arizona's three state universities, Arizona State University, Northern Arizona University, and University of Arizona, are collaborating to offer the Tri-University Master of Engineering program. This graduate degree program is designed to meet the educational needs of practicing engineers by offering courses via distance delivery. With input from industry professionals, the three universities are offering courses that develop the skills, fundamental knowledge and understanding that are critical to today's practicing engineers.

http://www.TriUniv.engr.arizona.edu/
## Degree Requirements

<table>
<thead>
<tr>
<th>Category*</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Applied Engineering Mathematics</td>
<td>3</td>
</tr>
<tr>
<td>Engineering Management / Business</td>
<td>3</td>
</tr>
<tr>
<td>Major requirements and electives</td>
<td>18-24</td>
</tr>
<tr>
<td>Practice-oriented Project</td>
<td>0-6</td>
</tr>
<tr>
<td>Total</td>
<td>30</td>
</tr>
<tr>
<td>Final examination as determined by the advisory committee</td>
<td></td>
</tr>
</tbody>
</table>

*specific curricular tracks or unique program of study*
Role of Certificate Program

Certificate Program:
Conversant Skills in Focused Area

Single Courses:
Refresher / Introduction

Transformational or Advanced Degree
Certificate Program Goals

• Target Microelectronics Manufacturing
• Design to be:
  ➢ responsive to industry needs
  ➢ fluid to meet changing technology and edu needs
  ➢ flexible to create tailored topical areas
  ➢ aligned with continuing edu market
  ➢ dovetailed into MEng Degree Program

*Modular courses (1-2 semester unit each)*
Certificate Program Key Players

Sally Clement  
Education Coordinator  
CEBSM, U of A  
520-626-6781  
sclment@erc.arizona.edu

Ingrid St. Omar  
Asst. Professor  
Director of the Advanced Microelectronics Lab  
520-523-4809  
ingrid.stomer@nau.edu

Dr. Susan Haag  
Director of Assessment and Evaluation  
CEAS, ASU  
480-965-7219  
shaag@asu.edu

Kim Ogden  
Assoc. Professor  
Chm & Env Eng, U of A  
520-621-9484  
ogden@chip.erc.arizona.edu

Greg Raupp  
Professor and Assoc. Dean for Research  
CEAS, ASU  
480-965-3895  
raupp@asu.edu
Program Design
Industry Input Process

Focus Group
→ Focus Group Outcomes
→ Industry Surveys
→ Survey Outcomes

Initial Certificate(s) Structure
→ Module-by-module Learning Objectives
→ Content and Pedagogy

Industry Input
Focus Group

• Systematic questioning of many individuals from a cross-section of the industry in an informal setting
• Single session identified multiple perspectives of participants as well as commonalities
• Revealed participants’ perceptions of the “ideal” education for their employees
Focus Group Findings: What are we doing right?

- Cutting edge research, problem solving, exposure to industry problems, practical training (e.g., Cleanroom, Safety)
- Strong semiconductor / microelectronics focus
- Collaboration with industry
- Engaging / communicating to understand needs
Focus Group Findings: Principal Issues & Recommendations

• Focus on convenient, flexible, delivery methods
• Ability to time-shift classes/learning to your own time most critical (although university semester structure is acceptable)
• Educational “business” success factors:
  ➢ Customer service orientation key differentiator
  ➢ Competitive Cost-for-Value
  ➢ Niche technical areas blended with practical skills
  ➢ Technically current, relevant, leading edge
  ➢ State-of-the-art distance learning pedagogy
Focus Group Findings:
Customer Service Recommendations

• “Under-promise and Over-deliver – make it easy, slick. Do it right.”

• Logistics:
  ➢ Ease of entry (application/admission)
  ➢ Ease of enrollment (registration)
  ➢ Ease of payment
  ➢ Responsive advising
  ➢ Responsive Tech Support
Focus Group Findings:

Key Unmet Educational Needs

- Technical Communication
- Teamwork
- Business Knowledge
- Global Understanding
- “Hot” Topics (e.g., optoelectronics, molecular electronics, MEMS)
Attributes of the Master Practitioner

- People skills
- Technical/Business Knowledge
- Technical/Business Know-How
- Integrated Skills
- Competency
- Communication Skills
- Teamwork
- Creativity
- Practical Experience
- Business Savvy
Industry Surveys

- Two parallel versions:
  - Manager
    [Link to manager survey](https://intraweb.eas.asu.edu/forms/manager_survey/)
  - Engineer
    [Link to engineer survey](https://intraweb.eas.asu.edu/forms/engineer_survey/)
- Web accessed / data-based
- Sent to 22 CTOs/VPs/Managers at 17 companies
Survey Question Areas

- Perceived reasons for continuing education
- Delivery issues
- Content Areas
  - Processing: fundamentals, processes, fab tools
  - Process flow, process integration and manufacturing
  - Materials Issues
  - Semiconductor devices: theory, simulation, modeling
  - Cross-cutting technical issues (e.g., EHS, metrology, Cleanroom)
  - Global Context (e.g., Markets, Supply Chain, ROI, EHS, IP)
  - Hot Topics
  - Professional skills (e.g., communication, teamwork, ethics)

- Certificate Areas
**Survey Response Rate Low**

**Solutions?**

- **Increase response rate:**
  - Identify champions
  - Send surveys directly to current/past students
  - Include monetary incentive
  - ?

- **Obtain information by alternative paths:**
  - Meetings with key industry reps
  - Available independent industry needs assessment studies
  - ?
### Future Input Needs

**What:**
- Learning objectives
- Relevant problems
- Case Studies

**How:**
- Competency and Learning Teams (CLTs)
- Industry co-Instructors
- ?

![Badges](image-url)