A Model For University-Industry Collaboration: The Center for Analog and Mixed Signal Integrated Circuit Design at WPI

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Presentation Overview

- Background
- Industry-University Partnership
- Center Overview
- Operational Details
- Advice
- Conclusion
# Background: Personal

<table>
<thead>
<tr>
<th>Year Range</th>
<th>Position / Degree, Institution</th>
</tr>
</thead>
<tbody>
<tr>
<td>1979-1983</td>
<td>A.B. Engineering, Dartmouth College</td>
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<tr>
<td>1983-1986</td>
<td>Design Engineer, Analogic Corp.</td>
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<tr>
<td>1990-1991</td>
<td>MSEE, University of Rochester</td>
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<tr>
<td>1991-1994</td>
<td>PhD, Boston University</td>
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<tr>
<td>1994-2004</td>
<td>Assistant / Associate Professor, WPI</td>
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### Background: WPI

- **Founded 1865**
  - USA's 3rd-oldest technological university
- **Located in Worcester, Massachusetts**
  - 1 hour from Boston
- **Full-time enrollment:**
  - ~2700 Undergrad, ~500 Grad (~220 FT Faculty)
  - Small size allows close faculty interaction
- **University with core focus on science, engineering, and management of technology**
- **Grants bachelor's, master's and doctoral degrees in 30+ disciplines**
Background: Curriculum

- "Technological humanist"
  - Prepare students for entire career and life path
- Projects (Close collaboration with faculty mentor)
  - Humanities Project
    - Express creativity in nontechnical fields
  - Interdisciplinary Project
    - Society-technology interface.
    - Option: Global sites from London to Bangkok
  - Disciplinary Project (Capstone)
    - Obtain professional-level design experience
    - Integrate, apply, knowledge
    - Solve “real-world” problems
Presentation Overview

- Background
- Industry-University Partnership
  - Goals
  - Traditional Research Model
  - Collaborative Design Center
- Center Overview
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## Industry / University Partnership: Goals

<table>
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<tr>
<th>Goals</th>
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<tbody>
<tr>
<td><strong>Industry</strong></td>
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<tr>
<td>- Technical</td>
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<tr>
<td>- Stay current with &quot;cutting edge&quot; research</td>
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<tr>
<td>- Explore / develop &quot;back burner&quot; ideas</td>
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<tr>
<td>- Human Resources</td>
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<tr>
<td>- Identify good engineers to hire!</td>
</tr>
<tr>
<td><strong>University</strong></td>
</tr>
<tr>
<td>- Intellectual Mission (Research)</td>
</tr>
<tr>
<td>- &quot;Create knowledge&quot;</td>
</tr>
<tr>
<td>- Customer Service (Education)</td>
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<tr>
<td>- Instruction, research relevant to needs of student, industry constituencies</td>
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</table>

**Traditional Research Model**

- **Targeted**
  - Support 1 graduate student
  - Single project

- **Disadvantages:**
  - High cost
  - Lost opportunity
Collaborative Design Center

- Consortium
  - Take advantage of common interests
  - Free flow of information, contact among members
  - Pooling resources allows reduced entry cost

Presentation Overview

• Background
• Industry-University Partnership
• Center Overview
  – Organization
  – Benefits for Students
  – Benefits for Sponsors
  – Choices for Faculty
• Operational Details
• Advice
• Conclusion
<table>
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<tr>
<th>Center Overview</th>
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<tbody>
<tr>
<td>• The Center for Analog and Mixed Signal IC Design at WPI conducts graduate research and undergraduate projects in all aspects of mixed signal IC design.</td>
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<tr>
<td>• These activities are conducted in an environment that supports the complete &quot;real world&quot; integrated circuit design process.</td>
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<tr>
<td>• The Center is supported by contributions from member companies, who help to determine the direction of Center research.</td>
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Design Center Overview: Organization

<table>
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<tr>
<th>Membership: Company pays $35,000 annual fee</th>
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<tr>
<td>Student / faculty participation:</td>
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<td>- 16 students/year: 4 capstone teams, 4 MS</td>
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<td>- 4 faculty involved</td>
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<tr>
<td>Advisory Board</td>
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<tr>
<td>- Representatives from member companies</td>
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<td>- One-day meetings in fall, spring</td>
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<tr>
<td>- Review progress, choose future projects</td>
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<tr>
<td>- Direct interaction with students</td>
</tr>
<tr>
<td>Project Ideas</td>
</tr>
<tr>
<td>- Proposed by companies, faculty</td>
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<tr>
<td>- Sponsors select (Advisory board vote)</td>
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</table>
Benefits to Students

• Better Project Quality/Definition
  – Project credibility
  – "Customer" = Easier to motivate students

• Real World Constraints
  – Professor not the bad guy
  – Compete with sponsor's competitors
  – Students live with real cost / budget constraint

• Networking
  – Talk to "real engineers"
  – Better exposure in hiring process

• Grad-Undergrad Interaction
  – "Analog lab" environment
Benefits to Corporate Sponsors

• Access to graduating seniors, M.S. students
• Better evaluation of engineering competence
  – Lab vs. interview situation
• Increase pool of students with mixed signal IC design experience
• More awareness of sponsor's company among all students in ECE
• Influence direction of research
• Awareness of and access to new technologies
• Influence curriculum development
• Networking
<table>
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<th>Benefits Choices for Faculty</th>
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<tr>
<td><strong>Advantages</strong></td>
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<tr>
<td>• Better projects for project-based curriculum</td>
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<tr>
<td>• Recruit best students into your program</td>
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<tr>
<td>• &quot;Real world&quot; relevance</td>
</tr>
<tr>
<td>• Like winning a grant every year</td>
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</table>
• Looks like stock market!
• Difficult for companies to spend money on "recruiting" during layoffs ...
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  - Communication
  - Intellectual Property Policy
- Advice
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## Communication: Fall Meeting

- **Poster presentations: Status of work in progress**
  - Graduate projects
    - Progress: 6 months
    - "Critical design review"
  - Undergraduate projects
    - Progress: 1 month
    - Feedback / "course correction"
- **Determining General Research, Project Priorities**
  - Input from members, faculty
  - General research direction
  - Specific project proposals for recruiting students
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<th>Communication: Spring Meeting</th>
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<td>• Poster presentations: Completed work</td>
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<tr>
<td>– Direct sponsor interaction with students</td>
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<tr>
<td>– Assess technical, communication skills</td>
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<tr>
<td>– Open to all students (recruiting)</td>
</tr>
<tr>
<td>• Choosing Research/Projects for Upcoming Year</td>
</tr>
<tr>
<td>– Faculty</td>
</tr>
<tr>
<td>• Present proposed projects for coming year</td>
</tr>
<tr>
<td>• Provide results of recruiting, student interest</td>
</tr>
<tr>
<td>– Advisory Board</td>
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<tr>
<td>• Vote on which projects will be carried out</td>
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## Intellectual Property Policy

- Research results equally available to all members
  - Consortium NOT for proprietary research!
- Members may request nominal delay in publication of results
  - Not a problem: JOURNAL >> CORPORATE
- Ownership of discoveries, inventions, etc.
  - Whoever pays for patent expenses
  - WPI and/or subset of interested sponsors
- All members entitled to non-exclusive, royalty free license
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• Advice
  – Starting a Center
  – Industry Contacts
  – Selling to Sponsors
  – Recruiting Students
• Conclusion
Starting a Center

• Talk to / get ideas from as many people as you can:
  • People at your institution doing something similar
  • People at other institutions doing something similar
    – Acknowledgment: Terri Fiez, CDADIC, OSU
• Contacts at potential sponsors / member companies
• Consider teaming with other faculty
  – Within department:
    Cover several subdisciplines
  – From other departments:
    Interdisciplinary
Starting a Center: Industry Contacts

Quantity Rules

• To get 1 good idea, you need 10 bad ideas
• To make 1 sale, you need to live through 10 rejections
• To get 1 sponsor ...

• If a potential contact isn’t producing, spend time elsewhere!
Industry Contacts: Where to get them?

- Anywhere and everywhere!
  - Former students
  - Former employers/employees
  - Your PhD advisor's contacts
  - Help from colleagues in your department
  - People who see your publications
  - People who see you at ...
    - Conferences
    - Local professional society talks
Selling Your Center To Sponsors

- Any contact to get you in the door
  - Engineering, Human Resources, anything
- Work your way up corporate food chain
  - "This will make you look good for your boss"
  - Find the person in organization who can say "This is a good idea - let’s spend $35,000 on it!"
  - Title different depending on organization
- Work your way back down corporate food chain
  - Whoever’s actually interested in technical work
  - Point of (frequent) contact once work is happening
"$35,000 is a lot of money"

- Compare to cost of hiring process
  - Key: Sponsor access to students with experience, interest in company's field
  - Curriculum, research less important
  - Cheap compared to recruiting / headhunter cost

- Don't be afraid to ask for a lot of money
  - Sponsor's attitude:
    - Little money committed = low priority
  - Find good partners; OK if bad partner says no!
Educating Sponsors: Expectations

• Be aware of industry biases / constraints
  – Ideal: Instant, cost-free product development
  – 18 months = eternity

• Manage sponsor expectations
  – Cultivating long term relationship
  – Not product development
  – Not on critical path

• Example: Educational mission of capstone project
  – Teach design process
    • Time for students to brainstorm, research, ...
  – Not "get something done"
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  - Analog Lab T-shirts
Recruiting Students

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  – Invite students in department to presentations
  – See ongoing projects; cool place to work
Recruiting Students

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• Two more words: FREE CLOTHING
  – Analog Lab T-shirts
• Another two words: OPEN HOUSE
  – Invite students in department to presentations
  – See ongoing projects; cool place to work
• Teach courses in your area with enthusiasm
  – Frequently mention related, high quality, sponsored projects
  – Lecture examples from industry / project work
• Most important: Student word-of-mouth, positive peer "buzz"
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Conclusion

• Collaborative Design Center
  – Serves needs of constituencies: Students, Sponsors, Faculty
• Selling to Sponsors
  – Benefits not features!
  – Know their needs, constraints
  – Be clear about your educational mission
    • Sometimes "no" is the right answer!
• Working with Students
  – Create environment that attracts best students
  – Expect success: Believe in your students