MAE
Industrial Advisory Meeting

Rice Room, 6764 Boelter Hall
February 10, 2006
Chair’s Report and Strategic Plan
Outline

- Goals
- Guides for Strategic Planning
- Benchmarking
- Faculty
- Students
- Staff
- Courses and Classes
- Research
- Curricula
- Facilities
- Partnerships
- Appendix: The Engineer of 2020
Goals

• Offer a holistic undergraduate education
• Offer a leading-edge graduate education
• Be a leader in focused research areas.
• Undergraduate
  – ABET Outcomes
• Graduate
  – U.S. News & World Report Ranking Methodology
• Overall
  – “The Engineer of 2020,” NAE Publication
• Benchmarking
  – Top 6 Engineering Schools
  – UC Berkeley
  – Univ. of Michigan
  – Georgia Tech
Benchmarking
(2004-2005)
## Top 6 Engineering Schools

<table>
<thead>
<tr>
<th>Rank</th>
<th>School Name</th>
<th>Total</th>
<th>Peer</th>
<th>Recruiter</th>
<th>Quant. GRE</th>
<th>Accept.</th>
<th>PhD Students/Faculty</th>
<th>NAE</th>
<th>Total $M</th>
<th>$k/ Faculty</th>
<th>PhD/Faculty</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Massachusetts Institute of Technology</td>
<td>100</td>
<td>4.9</td>
<td>4.8</td>
<td>770</td>
<td>25.30%</td>
<td>4.1</td>
<td>12.70%</td>
<td>$216.50</td>
<td>$614.90</td>
<td>0.59</td>
</tr>
<tr>
<td>2</td>
<td>Stanford University (CA)</td>
<td>95</td>
<td>4.9</td>
<td>4.7</td>
<td>774</td>
<td>35.50%</td>
<td>5</td>
<td>14.50%</td>
<td>$130.40</td>
<td>$665.40</td>
<td>1.17</td>
</tr>
<tr>
<td>3</td>
<td>University of California–Berkeley</td>
<td>87</td>
<td>4.8</td>
<td>4.5</td>
<td>766</td>
<td>16.20%</td>
<td>4.7</td>
<td>19.00%</td>
<td>$119.90</td>
<td>$477.80</td>
<td>0.65</td>
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<tr>
<td>4</td>
<td>Georgia Institute of Technology</td>
<td>83</td>
<td>4.5</td>
<td>4.3</td>
<td>755</td>
<td>31.60%</td>
<td>4.2</td>
<td>5.1%</td>
<td>$205.30</td>
<td>$430.50</td>
<td>0.52</td>
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<tr>
<td>4</td>
<td>University of Illinois–Urbana-Champaign</td>
<td>83</td>
<td>4.6</td>
<td>4.4</td>
<td>769</td>
<td>17.80%</td>
<td>4.3</td>
<td>2.7%</td>
<td>$175.10</td>
<td>$428.10</td>
<td>0.42</td>
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<tr>
<td>6</td>
<td>University of Michigan–Ann Arbor</td>
<td>79</td>
<td>4.5</td>
<td>4.2</td>
<td>768</td>
<td>36.90%</td>
<td>4.4</td>
<td>4.2%</td>
<td>$165.30</td>
<td>$519.70</td>
<td>0.58</td>
</tr>
<tr>
<td>15</td>
<td>University of California–Los Angeles (Samueli)</td>
<td>68</td>
<td>3.8</td>
<td>3.9</td>
<td>760</td>
<td>29.60%</td>
<td>5.4</td>
<td>11.00%</td>
<td>$80.7</td>
<td>$580.50</td>
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<tr>
<td>MAE</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>766</td>
<td>45.0%</td>
<td>3.4</td>
<td>6.70%</td>
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<td>591.00</td>
<td>0.90</td>
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<tr>
<td>Rank</td>
<td>AE</td>
<td>ME</td>
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<td></td>
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<tr>
<td>1</td>
<td>MIT</td>
<td>MIT</td>
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<td></td>
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</tr>
<tr>
<td>4</td>
<td>Georgia Tech (GT)</td>
<td>UC Berkeley (UCB)</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>5</td>
<td>Univ. of Michigan (UM)</td>
<td>Univ. of Michigan (UM)</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>13</td>
<td>MAE</td>
<td>MAE</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>AE Rank</th>
<th>Univ.</th>
<th>Score</th>
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<tbody>
<tr>
<td>1</td>
<td>MIT</td>
<td>4.8</td>
</tr>
<tr>
<td>4</td>
<td>Georgia Tech (GT)</td>
<td>4.3</td>
</tr>
<tr>
<td>5</td>
<td>Univ. of Michigan (UM)</td>
<td>4.3</td>
</tr>
<tr>
<td>13</td>
<td>MAE</td>
<td>3.4</td>
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</table>

<table>
<thead>
<tr>
<th>ME Rank</th>
<th>Univ.</th>
<th>Score</th>
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<tbody>
<tr>
<td>1</td>
<td>MIT</td>
<td>4.9</td>
</tr>
<tr>
<td>2</td>
<td>UC Berkeley (UCB)</td>
<td>4.6</td>
</tr>
<tr>
<td>4</td>
<td>Univ. of Michigan (UM)</td>
<td>4.4</td>
</tr>
<tr>
<td>14</td>
<td>MAE</td>
<td>4.0</td>
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</tbody>
</table>
Faculty
UCLA Faculty Size

<table>
<thead>
<tr>
<th>University</th>
<th>Number</th>
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</thead>
<tbody>
<tr>
<td>GT A</td>
<td>29</td>
</tr>
<tr>
<td>UM A</td>
<td>20</td>
</tr>
<tr>
<td>UM M</td>
<td>44</td>
</tr>
<tr>
<td>UCB M</td>
<td>42</td>
</tr>
<tr>
<td>MAE</td>
<td>28</td>
</tr>
</tbody>
</table>

Number of Faculty by University and Gender

- GT A: 1M, 29F
- UM A: 0M, 20F
- UM M: 7M, 37F
- UCB M: 4M, 38F
- MAE: 2M, 26F
<table>
<thead>
<tr>
<th></th>
<th>GT A</th>
<th>UM A</th>
<th>UM M</th>
<th>UCB M</th>
<th>MAE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full M</td>
<td>18</td>
<td>15</td>
<td>25</td>
<td>38</td>
<td>22</td>
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<tr>
<td>Full F</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Assoc M</td>
<td>8</td>
<td>5</td>
<td>9</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Assoc F</td>
<td>1</td>
<td>0</td>
<td>7</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Asst M</td>
<td>3</td>
<td>0</td>
<td>10</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Asst F</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
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<tr>
<td>Total M</td>
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<td>20</td>
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<td>Total F</td>
<td>1</td>
<td>0</td>
<td>7</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>30</td>
<td>20</td>
<td>51</td>
<td>46</td>
<td>30</td>
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</table>
2010 Plan for Faculty Recruitment

![Bar chart showing the number of faculty recruited each academic year from 2006 to 2010. The chart indicates a steady increase in the number of meetings and discussions held, with a significant rise in 2010.](chart.png)
## Recruitment Areas

<table>
<thead>
<tr>
<th>Area</th>
<th>No. of Hires</th>
<th>Timeline</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Energy</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Renewable energy</td>
<td>1 Senior</td>
<td>Year 1*: 1 Senior</td>
</tr>
<tr>
<td>resources</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Energy for deep space</td>
<td>1 Senior</td>
<td>Year 3: 1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Aerospace</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UAV</td>
<td>1 Senior / 1 Junior</td>
<td>Year 1: 1 Senior</td>
</tr>
<tr>
<td>Deep space exploration</td>
<td>1 Senior / 1 Junior</td>
<td>Year 2: 1 Junior</td>
</tr>
<tr>
<td>Advanced propulsion</td>
<td>1 Senior / 1 Junior</td>
<td>Year 3: 1 Senior</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Year 4: 1 Junior</td>
</tr>
<tr>
<td><strong>Multi-scale Science</strong></td>
<td>2 Senior / 1 Junior</td>
<td>Year 1: 1 Senior</td>
</tr>
<tr>
<td>From nano to macro</td>
<td></td>
<td>Year 2: 1 Junior</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Year 3: 1 Senior</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Year 4: 1 Senior</td>
</tr>
<tr>
<td><strong>Biosciences</strong></td>
<td>2 Senior / 1 Junior</td>
<td>Year 1: 1 Senior</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Year 2: 1 Junior</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Year 3: 1 Senior</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Areas of Opportunity</strong></td>
<td>2</td>
<td>Year 4: 2</td>
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<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>13 (7 Senior / 3 Junior / 3 Unspecified)</td>
<td>Year 1: 4 Senior</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Year 2: 3 Junior</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Year 3: 3 Senior</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Year 4: 3 Unspecified</td>
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</tbody>
</table>
Students
Students per Faculty

<table>
<thead>
<tr>
<th>University</th>
<th>Number</th>
<th>BS</th>
<th>MS</th>
<th>PhD</th>
</tr>
</thead>
<tbody>
<tr>
<td>GT A (4)</td>
<td>24.8</td>
<td>6.7</td>
<td>7.4</td>
<td></td>
</tr>
<tr>
<td>UM A (5)</td>
<td>12.2</td>
<td>2.7</td>
<td>4.0</td>
<td></td>
</tr>
<tr>
<td>UM M (4)</td>
<td>10.7</td>
<td>4.1</td>
<td>5.7</td>
<td></td>
</tr>
<tr>
<td>UCB M (2)</td>
<td>12.3</td>
<td>1.2</td>
<td>5.9</td>
<td></td>
</tr>
<tr>
<td>MAE (13-14)</td>
<td>18.9</td>
<td>4.8</td>
<td>3.4</td>
<td></td>
</tr>
</tbody>
</table>
2010 Plan for Student Enrollments

Academic Year | Students
--- | ---
2006 | 550 BS, 170 MS, 136 PhD
2007 | 550 BS, 185 MS, 167 PhD
2008 | 550 BS, 200 MS, 200 PhD
2009 | 550 BS, 215 MS, 237 PhD
2010 | 550 BS, 215 MS, 258 PhD

BS/Faculty = 13 (2010), MS/Faculty = 5, PhD/Faculty = 6 (2010)
2010 Plan for Undergrad. Scholarships

• 2005
  – Boeing Scholarships: 5@$5,000
  – Chevron Scholarship: $2,000
  – Honeywell Scholarship: $2,000
  – Joseph Beggs Foundation Scholarship: $5,000

• 2010
  – Additional Scholarships: 10@$5,000
2010 Plan for Grad. Scholarships

- **2005**
  - Cost of a Grad. Student Researcher (GSR)
    - Resident: $20,688 (Salary)+$7,199 (Tuition & Fees)+Benefits ($436) = $28,323
    - Non-resident: $28,323+$14,694 (NRT) = $43,017
  - Grad. Division & HSSEAS
    - 22 Resident GSRs + 28 TAs
  - Needed Admissions
    - 72 MS + 34 PhD
- **2010**
  - Grad Division & HSSEAS
    - 42 Resident GSRs, 28 TAs
  - Needed Admissions
    - 108 MS + 86 PhD
  - 40 Additional Research Assistantships needed for PhD Students
  - More External Fellowships
Staff
Courses and Classes
### Classes Taught

<table>
<thead>
<tr>
<th>Quarter</th>
<th>Ladder</th>
<th>Temp.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall</td>
<td>8</td>
<td>14</td>
</tr>
<tr>
<td>Winter</td>
<td>17</td>
<td>8</td>
</tr>
<tr>
<td>Spring</td>
<td>17</td>
<td>15</td>
</tr>
<tr>
<td>Year</td>
<td>42</td>
<td>37</td>
</tr>
</tbody>
</table>
TAs per Class

- Fall: 1.3 Ladder, 1.3 Temp.
- Winter: 1.2 Ladder, 1.3 Temp.
- Spring: 1.6 Ladder, 1.1 Temp.
- Year: 1.4 Ladder, 1.2 Temp.
MAE Courses

- Undergraduate
  - Regular: 5 lower division, 54 upper division
  - Special/Research: 1 lower division, 3 upper division
- Graduate
  - Regular: 70
  - Seminars/Special Topics: 13
  - Research: 6
- MAE 194: Research Group Seminars
  - 44 students
- MAE 199: Directed Research
  - 38 students
Technical Support

- Support for Laboratory and Design Courses
  - Fall Quarter: 157, 162B, 163A, 183
  - Winter Quarter: 157, 162B, 162M, 172
  - Spring Quarter: 157, 157A, 162C, 162M, 131AL, 183
  - MAE 199, 194

- Summer: Lab Maintenance
2010 Plan for Courses and Classes

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2005 2010

<table>
<thead>
<tr>
<th></th>
<th>2005</th>
<th>2010</th>
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</thead>
<tbody>
<tr>
<td>U Course</td>
<td>59</td>
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<tr>
<td>U Class</td>
<td>75</td>
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<tr>
<td>G Course</td>
<td>70</td>
<td>70</td>
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<tr>
<td>G Class</td>
<td>42</td>
<td>56</td>
</tr>
<tr>
<td>G Class</td>
<td>32</td>
<td>46</td>
</tr>
<tr>
<td>Faculty</td>
<td>30</td>
<td>43</td>
</tr>
</tbody>
</table>
Research
2010 Plan for Research Expenditures

- Total, $M: 17.7, 29.5, 59.1, 68.5
- $10k/Faculty: 0.0, 20.0, 30.0, 40.0

3% Increase/Year
• ME
  – Berkeley Wireless Research Center
  – Berkeley Nanosciences and Nanoengineering Institute
  – Berkeley Sensor & Actuator Center: NSF I/U CRC
  – Center for Information Technology Research in the Interest of Society
  – Institute of Transportation Studies: State Support
  – Partners for Advanced Transit and Highways: State Support
• AE
  – FXB Center for Rotary and Fixed Wing Vehicle Design: FXB Foundation

• ME
  – Center for Aluminum Metallurgy and Processing
  – Automotive Research Center: Army
  – Center for Automotive Structural Durability Simulation
  – Center for Dimensional Measurement and Control in Manufacturing: NSF I/U CRC
  – Center for Intelligent Maintenance Systems
  – Center for Laser Aided Intelligent Manufacturing
  – Center for Lasers and Plasmas for Advanced Manufacturing
  – NSF Engineering Research Center for Reconfigurable Manufacturing Systems
  – S. M. Wu Manufacturing Research Center
  – Wilson Student Team Project Center
• MAE
  – California NanoSystems Institute
  – Center for Energy Science and Technology (CESTAR)
  – Center for Scaleable and Integrated Nanomanufacturing (SINAM): NSF
  – Center for Systems, Dynamics and Control (SyDyC)
  – Fusion Science and Technology Center (FSTC)
  – Institute for Cell Mimetic Space Exploration (CMISE): NASA
  – Wireless Internet for Mobile Enterprise Consortium
2010 Plan for Research Centers

- **Aerospace Institute**
  - Jason Speyer

- **Center for Aerospace Nanotechnology**
  - Tom Hahn

- **National Coalition for Manufacturing Innovation**
  - Tom Hahn
Curricula
<table>
<thead>
<tr>
<th>MAE Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Ability to apply knowledge of mathematics, science, and engineering.</td>
</tr>
<tr>
<td>b. Ability to design and conduct experiments, as well as to analyze and</td>
</tr>
<tr>
<td>interpret data.</td>
</tr>
<tr>
<td>c. Ability to design a system, component, or process to meet desired</td>
</tr>
<tr>
<td>needs.</td>
</tr>
<tr>
<td>d. Ability to function on multi-disciplinary teams.</td>
</tr>
<tr>
<td>e. Ability to identify, formulate, and solve engineering problems.</td>
</tr>
<tr>
<td>f. Understanding of professional and ethical responsibility.</td>
</tr>
<tr>
<td>g. Ability to communicate effectively.</td>
</tr>
<tr>
<td>h. Broad education necessary to understand the impact of engineering</td>
</tr>
<tr>
<td>solutions in a global and societal context.</td>
</tr>
<tr>
<td>i. Recognition of the need for, and an ability to engage in life-long</td>
</tr>
<tr>
<td>learning.</td>
</tr>
<tr>
<td>j. Knowledge of contemporary issues.</td>
</tr>
<tr>
<td>k. Ability to use the techniques, skills, and modern engineering tools</td>
</tr>
<tr>
<td>necessary for engineering practice.</td>
</tr>
<tr>
<td>l. Knowledge of aerodynamics, aerospace materials, structures, propulsion,</td>
</tr>
<tr>
<td>flight mechanics, and stability and control.</td>
</tr>
<tr>
<td>m. Knowledge of some topics from orbital mechanics, space environment,</td>
</tr>
<tr>
<td>attitude determination and control, telecommunications, space structures,</td>
</tr>
<tr>
<td>and rocket propulsion.</td>
</tr>
<tr>
<td>n. Design competence which includes integration of aeronautical or</td>
</tr>
<tr>
<td>astronautical topics.</td>
</tr>
<tr>
<td>o. Knowledge of chemistry and calculus-based physics with depth in at</td>
</tr>
<tr>
<td>least one.</td>
</tr>
<tr>
<td>p. Ability to apply advanced mathematics through multivariate calculus</td>
</tr>
<tr>
<td>and differential equations.</td>
</tr>
<tr>
<td>q. Familiarity with statistics and linear algebra.</td>
</tr>
<tr>
<td>r. Ability to work professionally in both thermal and mechanical systems</td>
</tr>
<tr>
<td>areas including the design and realization of such systems.</td>
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</tbody>
</table>
Outcome Data Analysis

- Curriculum Content
  - 0 (none), 1 (somewhat relevant), 2 (relevant), 3 (highly relevant)

- Importance
  - 0 (none), 1 (somewhat important), 2 (important), 3 (very important), 4 (extremely important)

- Preparedness
  - 0 (none), 1 (somewhat prepared), 2 (prepared), 3 (well prepared), 4 (very well prepared)

- Normalized to 0 - 4
MAE Curriculum

ABET Outcome

Score

a. Fundamentals
b. Experiments
c. Aeronautics
d. Design
e. Problem Formulation
f. Ethics
g. Statistics/Algebra
h. Broad Education
i. Life-long Learning
j. Current Issues
k. Modern Tools
l. Aeronautics
m. Astronautics
n. Teamwork
o. Chemistry/Physics
p. Advanced Math
q. Communication/r. ME Systems
s. Advanced Math
t. Adv. Math
u. Physics/v. Systems
w. Elec.

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2010 Plan for Undergraduate Curricula

• Increased Non-technical Contents
  – h. Broad education necessary to understand the impact of engineering solutions in a global and societal context.
  – d. Ability to function on multi-disciplinary teams.
  – i. Recognition of the need for, and an ability to engage in life-long learning.
  – j. Knowledge of contemporary issues.
  – f. Understanding of professional and ethical responsibility.
  – g. Ability to communicate effectively.
  – n. Design competence which includes integration of aeronautical or astronautical topics.
2010 Plan for Undergraduate Curricula

- Increased Independent Research Opportunities for Undergrad Students
  - MAE 194, 199
- Increased Opportunities for Student Projects
  - National Competition
2010 Plan for Graduate Curriculum

- 2005
  - On-line MS Degree Program Proposed by HSSEAS
- 2010
  - On-line MS Degree Program offered in All 6 Major Fields
    - Fluid Mechanics
    - Heat & Mass Transfer
    - Manufacturing & Design
    - MEMS/Nanotechnology
    - Structural & Solid Mechanics
    - Systems, Dynamics & Control
Facilities
2010 Plan for Offices and Laboratories

- Aerospace Engineering Laboratory
  - $100k Gift from Kevin Hall

- Additional Offices
  - Faculty: 9
  - Staff: 3
  - Students: 37

- Additional Laboratories
  - 17154 ft²
Industrial Advisory Board/Industrial Affiliates*

- BEI Technologies, Inc.
  - Dr. Asad Madni*

- Honeywell
  - Mr. Roger Murry*

- Boeing
  - Mr. Jason Hatakeyama*

- ExxonMobil
  - Mr. Truman Bell*

- Raytheon
  - Mr. Chris Cox*

- The Aerospace Corporation
  - Dr. Wayne Goodman

- Lockheed Martin
  - Mr. Rick Baker*

- NASA
  - Dr. Webb Marner

- Capstone
  - Dr. Jeff Willis

- Northrop Grumman
  - Mr. Gary Ervin*

- TechFinity
  - Mr. John Armenian*

- ConocoPhillips
  - Mr. Herschel Evans*

- Pratt & Whitney
  - Mr. Jim Paulsen*

- RAND Corporation
  - Ms. Natalie Crawford

- Dryden Flight Research Center
  - Dr. Kevin Peterson

*indicates primary affiliation
## Industrial Affiliates

- Membership Fee: $10,000
- Membership Status

<table>
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<tr>
<th>Affiliate Name</th>
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<td>Techfinity</td>
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2010 Plan for Industrial Partnerships

• Research Collaboration
  – Alvar Kabe, Aerospace Corp.

• Expansion of Industrial Affiliates Program
  – Rajit Gadh

• HSSEAS Annual Research Review
  – Rajit Gadh

• Summer Internships
  – Honeywell
• Funded by KAIST
• 1\textsuperscript{st} Workshop at UCLA, Jan. 2005
  – 17 KAIST Faculty + 15 UCLA Faculty
  – Thermosciences, manufacturing, micro/nanotechnology, Structural mechanics, system/dynamics/control
• 2\textsuperscript{nd} Workshop at KAIST, Sept. 2005
  – 14 KAIST Faculty + 7 UCLA Faculty
• 3\textsuperscript{rd} Workshop at UCLA, Jan 2006
  – 24 KAIST Students + 4 KAIST Faculty
  – MEMS/Nanotechnology
2010 Plan for Global Partnerships

• KAIST/UCLA Program
  – Funded by BK 21 Phase II Program in Korea
  – Global Teamwork
  – Co-advising of Students
  – Joint Projects

• Other Universities
  – Self-supporting
2010 Plan for Alumni Partnerships

• 2005
  – Alumni Advisory Committee

• 2010
  – Alumni Network Database
  – Outstanding Alumni
  – Alumni Scholarships
Summary

• Goal
  – Top 10 Department

• Resources Needed
  – Additional Faculty
  – More Scholarships/Fellowships
  – Additional Facilities
The Engineer of 2020
Contents

• Technical Context of Engineering Practice
• Societal, Global, and Professional Contexts of Engineering Practice
• Aspirations for the Engineer of 2020
• The Engineer of 2020
Technological Context of Engineering Practice

- Technological Change
- Breakthrough Technologies
  - Biotechnology
  - Nanotechnology
  - Materials Science & Photonics
  - Information & Communications Technology
  - The Information Explosion, Logistics
- Technological Challenges
  - Physical Infrastructure in Urban Settings
  - Information & Communications Infrastructure
  - The Environment
  - Technology for an Aging Population
- Implications for Engineering Education
  - The Technology Explosion
  - The Pace of Change
Societal, Global, and Professional Contexts of Engineering Practice

• Social Context
  – Population and Demographics
  – Health and Health Care
  – The Youth Bulge and Security Implications
  – The Accelerating Global Economy

• Professional Context for Engineers
  – The Systems Perspective
  – Customerization
  – Public Policy
  – Public Understanding of Engineering
  – Building on Past Successes and Failures

• Implications for Engineering Education
  – An aging Population
  – The Global Economy
  – The Five- or Six-Year Professional Degree
  – Immigration and the Next Generation of U.S. Engineering Students
  – Building on Past Successes and Failures
  – Education Research
  – Teamwork/Communication/Public Policy
Aspirations for the Engineer of 2020

• Our Image and the Profession
  – By 2020, we aspire to a public that will understand and appreciate the profound impact of the engineering profession on sociocultural systems, the full spectrum of career opportunities accessible through an engineering education, and the value of an engineering education to engineers working successfully in nonengineering jobs.
  – We aspire to a public that will recognize the union of professionalism, technical knowledge, social and historical awareness, and traditions that serve to make engineers competent to address the world’s complex and changing challenges.
  – We aspire to engineers in 2020 who will remain well grounded in the basics of mathematics and science, and who will expand their vision of design through a solid grounding in the humanities, social sciences, and economics. Emphasis on the creative process will allow more effective leadership in the development and application of next-generation technologies to problems of the future.
Aspirations for the Engineer of 2020

• Engineering Without Boundaries
  – We aspire to an engineering profession that will rapidly embrace the potentialities offered by creativity, invention, and cross-disciplinary fertilization to create and accommodate new fields of endeavor, including those that require openness to interdisciplinary efforts with nonengineering disciplines such as science, social science, and business.
  – By 2020 we aspire to engineers who will assume leadership positions from which they can serve as positive influences in the making of public policy and in the administration of government and industry.
  – We aspire to an engineering profession that will effectively recruit, nurture, and welcome underrepresented groups to its ranks.
Aspirations for the Engineer of 2020

• Engineering a Sustainable Society and World
  – It is our aspiration that engineers will continue to be leaders in the movement toward use of wise, informed, and economical sustainable development. This should begin in our educational institutions and be founded in the basic tenets of the engineering profession and its actions.
  – We aspire to a future where engineers are prepared to adapt to changes in global forces and trends and to ethically assist the world in creating a balance in the standard of living for developing and developed countries alike.
Attributes of Engineers in 2020

- Guiding Principles
  - The pace of technological innovation will continue to be rapid (most likely accelerating).
  - The world in which technology will be deployed will be intensely globally interconnected.
  - The population of individuals who are involved with or affected by technology (e.g., designers, manufacturers, distributors, users) will be increasingly diverse and multidisciplinary.
  - Social, cultural, political, and economic forces will continue to shape and affect the success of technological innovation.
  - The presence of technology in our everyday lives will be seamless, transparent, and more significant than ever.
Attributes of Engineers in 2020

• Desired Attributes
  – Strong Analytical Skills
  – Practical Ingenuity
  – Creativity
  – Communication Skills
  – Business and Management Principles
  – Leadership Abilities
  – High Ethical Standards
  – Professionalism
  – Dynamism, Agility, Resilience, and Flexibility
  – Life-long Learners

• What attributes will the engineer of 2020 have?
  – He or she will aspire to have the ingenuity of Lillian Gilbreth, the problem-solving capabilities of Gordon Moore, the scientific insight of Albert Einstein, the creativity of Pablo Picasso, the determination of the Wright brothers, the leadership abilities of Bill Gates, the conscience of Eleanor Roosevelt, the vision of Martin Luther King, and the curiosity and wonder of our grandchildren.