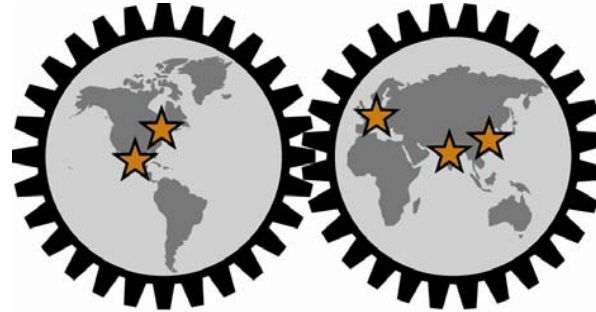


# Introduction to Undergraduate GEARE Program

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## GEARE

**Global Engineering Alliance  
for Research and Education**

**Eckhard A. Groll**

Professor of Mechanical Engineering

Director of the Office of Professional Practice

Purdue University

School of Mechanical Engineering

West Lafayette, Indiana 47907

Office Hours: Room ME 364 on MWF 2:30 – 3:30 am

Phone: 765-496-2201; E-mail: [groll@purdue.edu](mailto:groll@purdue.edu)

# Defining the Global Engineer

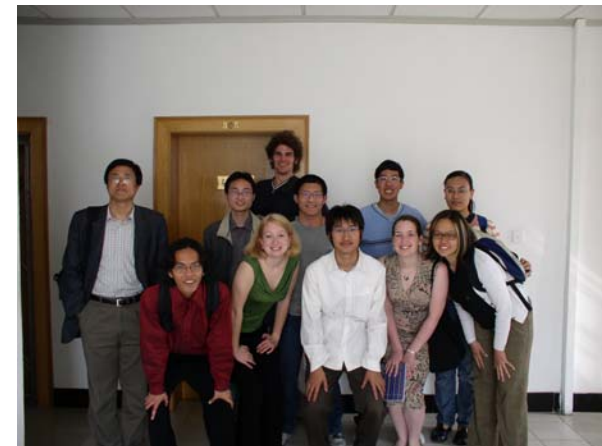
- *“U.S. engineers must become global engineers. They will have to know how to replenish their knowledge by self-motivated, self-initiated learning. They will have to be aware of socioeconomic changes and appreciate the impact of these changes on the social and economic landscape in the United States and elsewhere.”*



The National Academy of Engineering, “Educating the Engineer of 2020: Adapting Engineering Education to the New Century” (2005)

# Defining the Global Engineer

- The Global Engineer is ...
  - » Prepared for globalization of manufacturing industry
  - » Able to function on global teams
  - » Understands Engineering in global context (environment, sustainability, economics, etc.)
  - » Versed in global product platforms
  - » Appreciative of other languages and cultures
  - » Proficient in tech-based global enterprise culture
  - » Prepared for/desires international assignments



(Groll and Hirleman, ASEE GCEE, Istanbul, Oct. 2007)

# State of Student Globalization

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- Very small percentage of U.S. Engineering and Science university students have substantial international professional experiences before graduating (~3%)
- The barriers, real and perceived, are:
  - » Cost
  - » Time to graduation
  - » Loss of community (language, leave family and friends, fear of unknown)
- Innovative programs must be integrated into the “regular” engineering curriculum so that students will reach a substantial level of global professional competency before they graduate

# Program Design Issues

- Time to graduation – no impact
- Financial costs to students – no impact or benefit
- Co-located and intercultural teams – a priority
- Global workplace engineering experience – a priority
- Engineering design opportunities – a priority
- Second-language competencies – integrated in available curricular options



# Overview of Undergraduate GEARE Program

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- Key features:

- » Minimum of four semesters of foreign language before going abroad
- » Orientation in foreign culture before going abroad
- » Domestic internship first
- » Subsequent international internship with the same company
- » One semester of study abroad with fully transferable course credits
- » Two-semester design team project
  - One semester abroad, one semester at Purdue
  - Multi-national, multi-university design teams working on industry-inspired projects

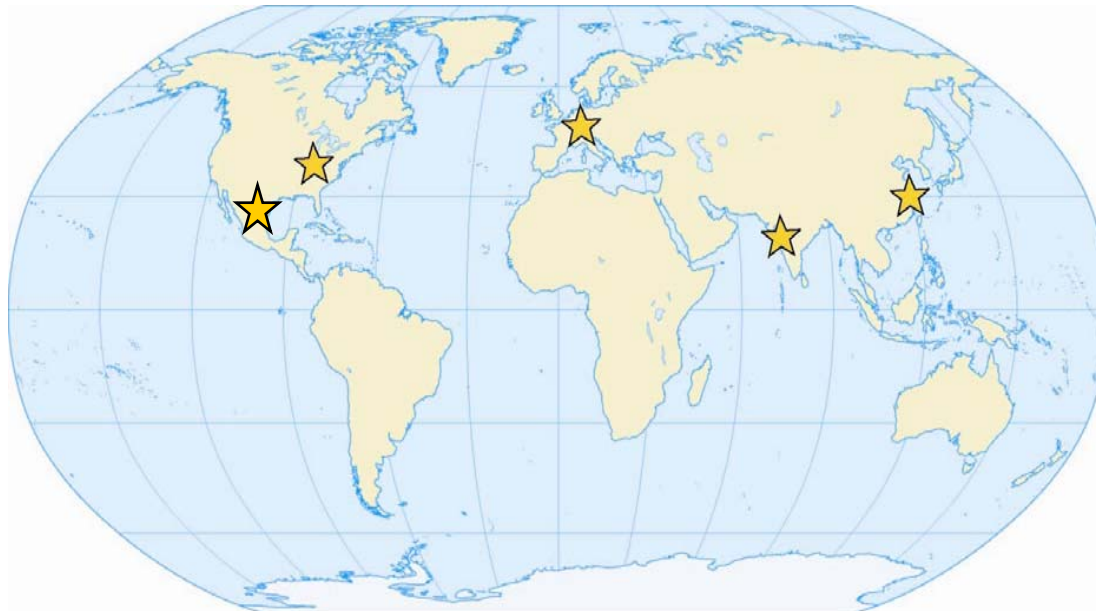
# Schedule of Undergraduate GEARE Program

## For Purdue Students

| 1st Sem.                  | 2nd Sem.   | 1st Sum.   | 3rd Sem.   | 4th Sem.   | 2nd Sum.  | 5th Sem.  | 6th Sem.   | 3rd Sum. | 7th Sem.                | 8th Sem.  |
|---------------------------|--|--|--|--|---|---|--|----------|-------------------------|---|
| Regular Freshman Semester | Regular Freshman Semester<br><br>GEARE Selection | May-semester course at Partner Univ.<br><br>Foreign Language 1 | Regular Sophomore Semester<br><br>Foreign Language 2 | Regular Sophomore Semester<br><br>Foreign Language 3 | Domestic Intern-ship with Strategic GEARE Partner | Regular Junior Semester<br><br>Foreign Language 4<br><br>Cultural Orientation | Internat'l Intern-ship with Strategic GEARE Partner<br><br>Study Abroad Semester<br><br>1st Semester of Global Design Team Project |          | Regular Senior Semester | Regular Senior Semester<br><br>2nd Semester of Global Design Team Project |

# Strategic University Partners

- Purdue University, West Lafayette, Indiana, USA
- Universität Karlsruhe, Karlsruhe, Germany
- Shanghai Jiao Tong University, Shanghai, China
- IIT Bombay, Mumbai, India
- Tec de Monterrey, Monterrey, Mexico



# Strategic Global University Partners

## Universität Karlsruhe, Germany



# Strategic Global University Partners

## Shanghai Jiao Tong University, China

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# Strategic Global University Partners

## IIT Bombay, Mumbai, India



# GEARE Industry Partners and Supporters

- **Current Partners:**

- » **Cummins**
- » **John Deere**
- » **DOW**
- » **Ford**
- » **GM**
- » **Shell**
- » **Siemens**
- » **United Technologies (Otis, Pratt & Whitney, Carrier, etc.)**



- **Current Supporters:**

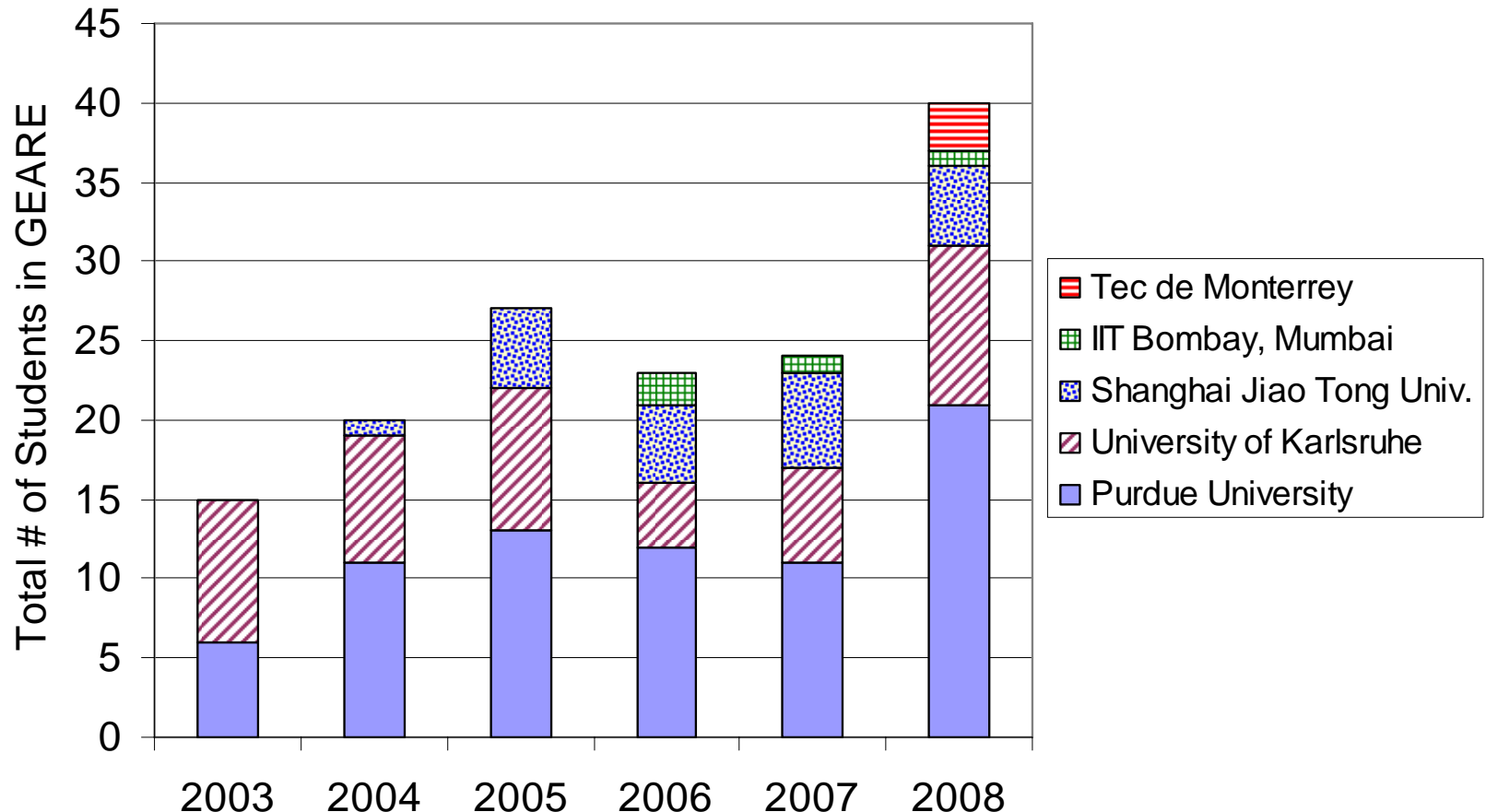
- » **Formerly Daimler-Chrysler**
- » **GE**
- » **Kimberly-Clark**
- » **Bosch**
- » **Rolls-Royce**

# Role of Industry Partners

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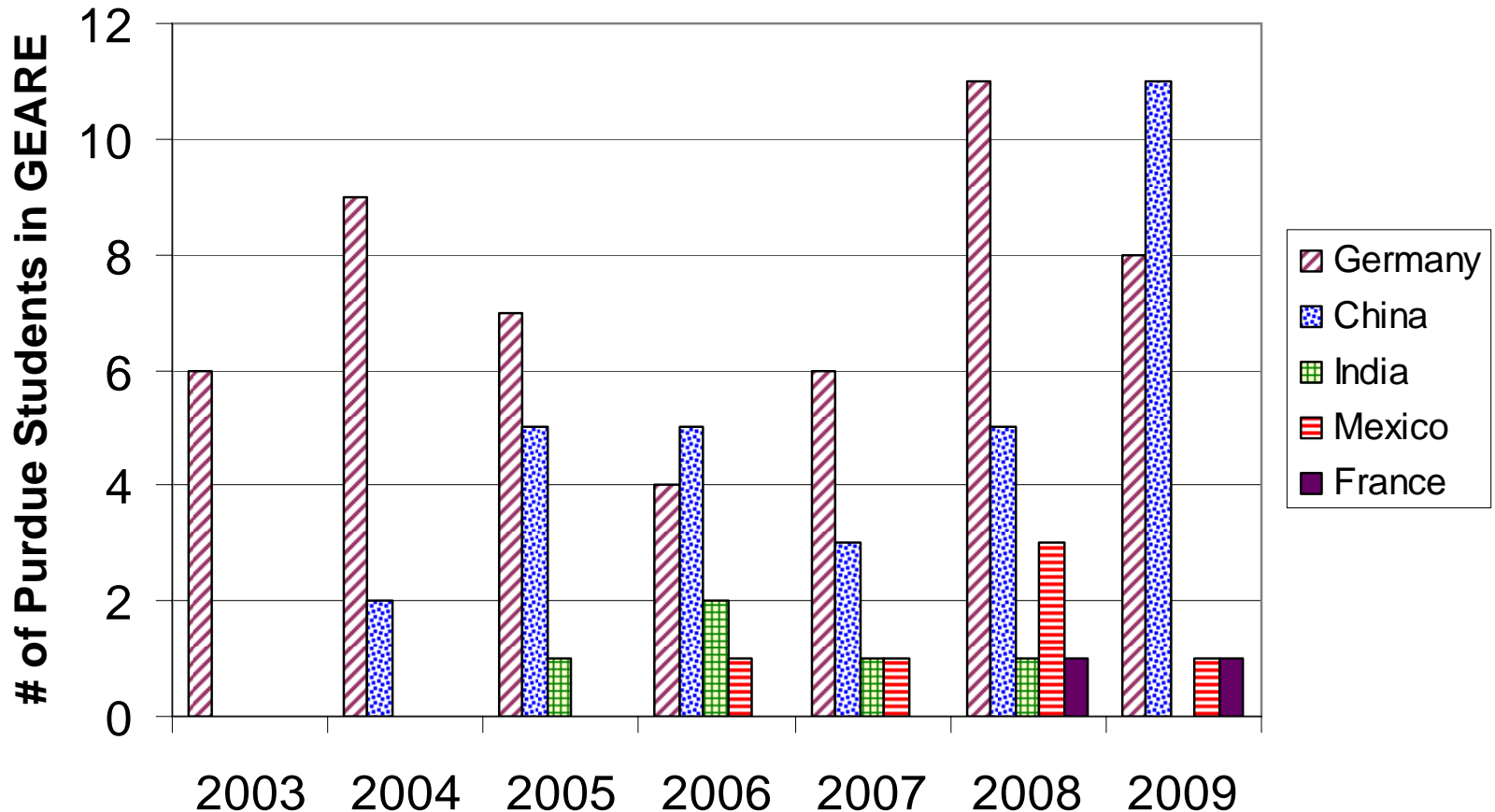
- Commit to help us globalize student experiences
- Offer suitable projects plus mentoring for the global design team courses
- Recommend students for the program from pool of interns
- Provide domestic and international internships to 1+ Purdue student per year
- Provide domestic and international internships to 1+ Int'l Univ. partner student per year
- Provide financial support (scholarships, short courses, faculty exchange, administration)

# Overall U-Grad Student Participation



- Notes:
- 2008 Purdue University data is based upon students currently accepted to go abroad. Final number depends on students' meeting academic requirements.
  - 2008 partner universities data is estimate. Student selection will be made by end of 2007 or beginning of 2008.

# Purdue U-Grad Student Participation



- Notes:
- 2008 data is based upon students currently accepted to go abroad. Final number depends on students' meeting academic requirements.
  - 2009 data is based on current applications. Final number depends on students' meeting academic requirements.

# Quality of Student Participants

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- Three 4.0's, two 3.9, and three 3.8 GPAs, ~3.7 avg. GPA
- Outstanding Graduating Engineer 2004
- Purdue President's Leadership Class (30 of 7,144)
- Mauzy Emerging Leaders Program (60 of 7,144)
- National Merit and Indiana Top Resident Scholar recognition
- 4 Class Student-of-the-year Awardees, 2 HS class Presidents, 1 student rep of local HS Board (1 of 1200)
- Some in Honors program
- Average of 4.5 semesters of university-level language courses by the time they study abroad, 4 lived abroad
- ~26% women, compared with 13% overall in ME

# Student Feedback

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- Cultural differences had significant impact on their interactions
- Ability to accommodate to changes in a foreign environment improved with experience
- As they became more confident in new environment, productivity increased
- Foreign students likely to adapt more readily to cultural differences due to familiarity with US culture through mass media
- US students, in contrast, emphasized a much greater personal change due to adaptations to cultural differences
- English was the language of last resort in communications between members of both groups.
- US students indicated that foreign language skills improved considerably in both social and business settings
- Overall, development of communication skills was considered best outcome

# Faculty Participation in GEARE

|              | <b>Universität<br/>Karlsruhe</b> | <b>Shanghai Jiao<br/>Tong University</b> | <b>IIT Bombay,<br/>Mumbai</b> | <b>Tec de<br/>Monterrey</b> |
|--------------|----------------------------------|--|-------------------------------|-----------------------------|
| 2003         | Eckhard Groll                    |  |                               |                             |
| 2004         | Chuck Krousgrill                 | -  |                               |                             |
| 2005         | Peter Meckl                      | George Chiu                              | -                             |                             |
| 2006         | -                                | -  | -                             | -                           |
| 2007         | Steve Wereley                    | Bin Yao                                  | -                             | -                           |
| 2008         | Paul Sojka                       | -  | Tim Fisher                    | -                           |
| <b>Total</b> | <b>5</b>                         | <b>2</b>                                 | <b>1</b>                      | <b>0</b>                    |

# Financial Support

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- Endowment of \$600,000 by retired Siemens VP
- Seed grants from International Office at Purdue
- Industry partners pay yearly participation fee
- Funds are spent on:
  - » GEARE Stipend for students
    - \$0 to \$5000 depending on location
    - Compensate travel expenses
    - Equalization of student internship salaries to make different GEARE locations equally attractive
  - » Administration
  - » Travel by administrators

# Global Design Team Projects

- 2003/2004:  
Design and fabrication  
of a fully-functional,  
portable, four-person  
carousel



- 2004/2005:  
Design and construction  
of an autonomous off-  
road vehicle prototype



# Global Design Team Projects, cont'd

- 2005/2006:  
Design and construction  
of a tennis ball throwing  
machine



# Minor in Global Engineering Studies

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- Upon completion of all of the following requirements, students will receive the certificate:
  - » Successful completion of 12 credit hours in one foreign language program
  - » One semester of study abroad at a GEARE university partner
  - » One three-month domestic internship at a GEARE industry partner
  - » One subsequent three-month international internship preferably, but not necessarily, at the same GEARE industry partner
  - » Successful participation in two-semesters of co-located global design team projects: one semester conducted at GEARE university partner and one semester conducted at Purdue University
  - » A grade of “C” or better in all courses that are counted towards the minor requirement

# Application to Undergraduate GEARE Program

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- Application form
- Resume
- Transcript
- Statement of interest
- Two letters of reference
- Proposed plan of study
- A GPA of 3.0 or higher