Enhancing Global Citizenship Through a Senior Design Project

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Mechanical and Materials Engineering
OUTLINE

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Engineering Education 1900 - 2010

Computers are integrated into engineering education

Students are **TECHNICALLY** well prepared for industries’ needs
Global operations 1900 - 1940

Local manufacturing.

Engineering education to prepare trained workforce these companies.

Limited shipment of the products
Global operations 1960 -2010

International trade increased

Establishment of voluntary trade limits

Growth of independent suppliers in the developing countries


http://www.cameraquest.com/NRFOne.htm

http://blogs.wsj.com/searealtime/2012/12/20/hon-hai-eyes-expanding-to-indonesia/
Global operations - Engineers

- Manufacturing products
- Manage factories in foreign countries
- Giving orders to suppliers
- Working for foreign companies in US
- Selling foreign manufacturers products

Expectations from engineers

- Demand for cost cutting
- Increasing legal and regulatory requirements
- Decreasing development times
- Global competition
- Automation – isolation from the operation
- Capital movement to software and health care
Expectations from engineers

Toyota’s 'unintended acceleration,' instances
“Toyota Motor Corp. agreed to pay about $1.1 billion to settle a class-action lawsuit stemming from complaints of unintended acceleration in its vehicles that soured its reputation for quality and undermined its sales globally.”

http://online.wsj.com/article/SB10001424127887324669104578203440990704994.html

Deepwater Horizon oil spill:
“BP will pay $4.5 billion in fines and other payments (to US federal government)”

“According to The Wall Street Journal the U.S. government and Gulf Coast states have prepared an offer to BP for $16 billion settlement.”

http://en.wikipedia.org/wiki/Deepwater_Horizon_oil_spill
Global knowledge, awareness, perspective, and engagement are essential for engineers. State limits the number of required credits.

Global Learning were integrated into the following courses:

- EML 4551 Ethics and Design Project Organization
- EML 4905 Senior Design Project
Included material into the courses:

- Showing the 36 min long movie: “Incident at Morales”
- Asking students to write an essay on the American Society of Mechanical Engineers’ (ASME) violated principles and canons
- To include the following materials into their Senior Design reports:
  - Review of literature - including foreign publications
  - Identification of major manufacturers in the world which make similar products
  - Include the calculations with international units
  - Select components which would also work in other countries for example power supplies with 110/220 options
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Incident at Morales:

A French company’s engineers in US
- Determine to open a factory in Mexico for a new product line
- Hire an engineer who designed a factory for their competitor
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Incident at Morales:

Product and manufacturing process are defined
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Incident at Morales:

Required cost cuts force selection of cheap components and electronics

Everything is at the borderline
Incident at Morales:

- Discussing professional issues with family increases environmental awareness of the engineer.
- Something good came out of it in the movie.
- It is an ethics violation.
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Incident at Morales:

Major pressure
- For cost cutting
- Reduction of development time and
- Following chain of command
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Incident at Morales:

- The operating conditions are changed to achieve the targeted product quality
- Higher temperatures and pressures are selected for the process
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Incident at Morales:

System leaks at the new operating conditions and they notice it.
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Incident at Morales:

The movie finishes with an accident in which the operator dies and an investigation starts in Mexico.
Conclusion

- Engineering is a very demanding profession
  - Reduce cost
  - Develop products in very short time
  - Satisfy continuously increasing legal and ethical expectations
- Preparation of students for the today’s global engineering operations is a challenge
  - State restricts the number of credits students can take
  - Many technical courses are required to prepare the students
  - Faculty has no time and experience to include broad aspects of global operations
- Global Learning helped us to prepare our students better for their professional life.