

Engineering

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Shaping the Future NSF Advisory Committee Report

- Changing world and economy.
- Rising expenditures and growing financial constraints.
- Undergraduate education today.
- Barriers to improvement.
- Lowering the barriers and meeting new expectations.

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Changing World and Economy

- *End of cold war*: less concern for SE&T
- *Global economy*: fewer manufacturing jobs more service jobs.
- *Job bifurcation*: high pay for SE&T grads
- *Life-long learning*: Individual must retool not corporation

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Rising Expenditures and Growing Financial Constraints

- Cost of undergraduate education grew at a rate 2.7% higher than inflation from 1980-early 90s.
- Many institutions have larger classes, TA's or adjunct faculty teaching many classes, much higher tuition
- SE&T at UNR is a great deal!

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Undergraduate Education Today

- More than 88% of Federal funding for SE&T went to 125 institutions.
- Research Universities have 16% of undergraduates in fall 1992.
- 67% of female 60% of male HS grads enter college within a few months of graduation.
- Another 10-15% of adults in their 20s will enter college a few years after finishing HS

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Barriers to Improvement

- **Widely varying** student ability and preparation for SE&T studies.
- Lack of **interdisciplinary courses**.
- Ineffective use of **instructional technology**.
- Faculty **reward system**.
- Lack of **resources**.
- **Resistance** to change.

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Lowering the Barriers and Meeting New Expectations

- Motivate early student preparation for SE&T studies.
- More team teaching.
- Faculty training.
- Reward teaching excellence.
- Outside funding for education.
- Educate faculty.

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Student Preparation for SE&T Studies

- Science literacy for all.
- Partnership between universities and K-12.
- Redesign the undergraduate curriculum.

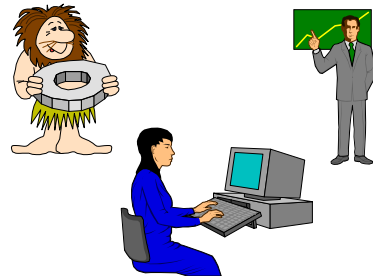
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Engineering and Technology

- HS teachers have background in science, math, education. Engineering and technology are, in general, less familiar.
- Society glorifies sports stars and doctors, not engineers!
- Students have no engineers as role models and do not know what engineers actually do.

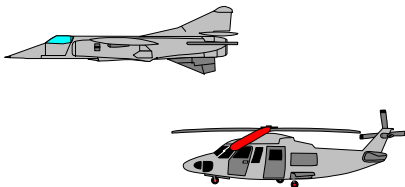
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What do engineers do?



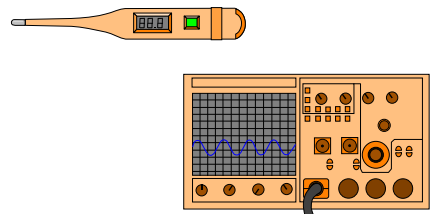
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Aeronautical Engineers



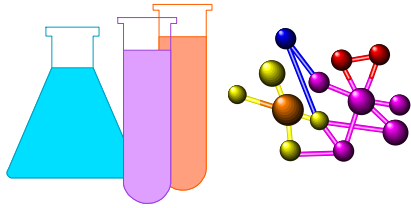
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Biomedical



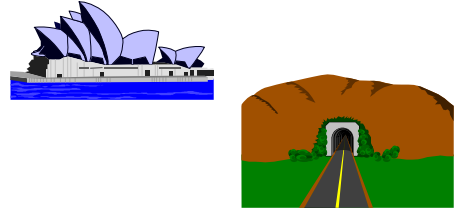
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Chemical Engineers



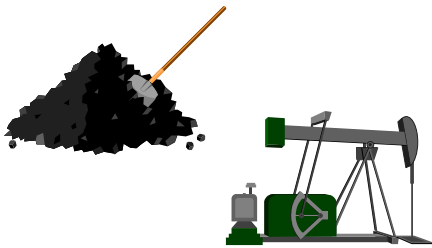
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Civil/Architecture



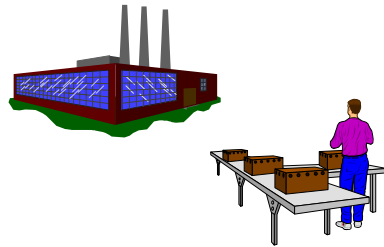
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Geological/Mining Engineers



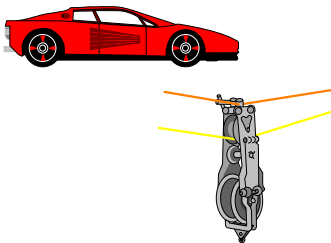
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Industrial/ Manufacturing Engineers



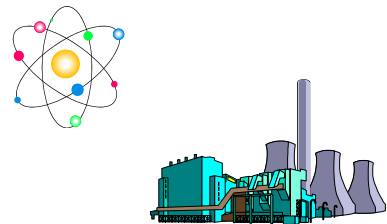
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Mechanical/Materials Engineers



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Nuclear Engineers



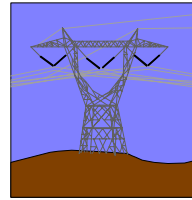
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Electrical Engineers

- Power and machines
- Telecommunications (radio, TV)
- Electromagnetics (antennas, radar)
- Electronics
- Optical (fiber optics)
- Computer/computer science
- Control, signal processing

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EE: Power and Machines



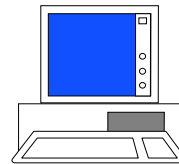
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EE: Communications



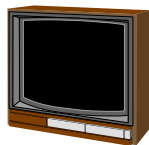
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EE: Computers



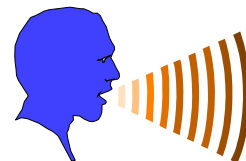
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EE: Electronics



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EE: Signal Processing



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Industries

- Aerospace & Defense
- Medical products
- Chemical
- Construction
- Transportation
- Computers
- Telecommunication
- Utilities and Power
- Electronics
- Metals and mining
- Manufacturing

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Job Market (BLS info)

- **Opportunities** arise from turnover of existing positions as well as growth
- **Hot Area:** Computer applications
- **Computer engineering** is the fastest growing engineering specialty (software/hardware).
- **Jobs** are available even in area where the total no. of jobs is declining

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Job Market (cont.)

- **Engineering:**
 - one of the largest professions in US
- **Largest discipline :** Electrical/electronics
- By 2005 **computer engineering** will exceed mechanical engineering, the 2nd largest
- Growth in “**engineering service contractors**” as opposed to “in-house” personnel
- Growth in number of **small companies**

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Courses for Freshmen & HS Educators

- **Freshman** need to know more about what engineers do.
- **Innovation and entrepreneurship** must be introduced early.
- Interaction with **HS educators** can prepare and motivate our prospective students better.
- Engineering applications **motivate** learning mathematics and science.

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Engineering Practice

- Creative problem solving
- Teams of engineers
- Economics and business
- Life-long learning

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Students	Faculty	Industry
1	1	1-Problem Solving
4	5	2-Communication Skills
9	6	3-Ethics & Professionalism
7	7	4-Open Mind/Positive Attitude
3	2	5-Math/Science Proficiency

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Students	Faculty	Industry
5	4	6-Technical Skills
6	5	7-Motivation to Continue Learning
8	10	8-Business/Management Practices
2	8	9-Computer Literacy
10	9	10-World Affairs & Cultures

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Economics & Business

- **Market survey**

Are there people out there who are willing to buy this product?

- **Cost analysis**

How much is this product going to cost?

Can we make money selling it?



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Course Policies

- **Avoid** complex math and theory
- Encourage **creative problem solving**
- Emphasize **teamwork**

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Conclusions

- The **world is changing** and science & math education need to change with it.
- We need to start early, working hand-in-hand with **high school teachers**.
- Develop **new classes** for Freshmen and high school teachers.

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