On engineering students, their motivations, and their job aspirations:

How can we grow and retain the next generation of our engineering workforce?

Prof. Annalisa L. Weigel, Ph.D.
Massachusetts Institute of Technology
alweigel@mit.edu, +1.617.253.1207
April 2010
Generational Poll

- 1946 – 1964: Baby Boomers
- 1926 – 1945: Silent Generation
- 1916 – 1925: Greatest Generation
Take Aways

• This Millennial generation of engineering students is different:
  – Expect mobility and frequent change
  – Want to excel and move ahead quickly
  – Value “killer” lifestyle, diversity, friends
  – Assume technology, internet, constant connectivity
  – Multitask fast
  – Institutions are irrelevant
  – Rewrite the rules
  – Optimistic / realistic
  – Nurtured as children

• If we understand them better, we can design engineering work and organizations that will attract and retain them.
Survey of Aerospace Student Attitudes

- **Motivation**
  - Replace anecdotes and hand wringing with real data

- **Goals**
  - Assess student perceptions about their education and the aerospace industry, motivations for studying aerospace, job and career aspirations, and job offers and acceptance
  - Explain why students take job in the aerospace industry
  - Over time, create a true longitudinal data set spanning college and early career stages

- **Survey population**
  - Sophomores and seniors (or their equivalents) in aerospace engineering
  - Eventually, students 2 and 5 years out from graduation

- **Web-based survey takes 30 minutes**

- **2009 response characteristics**
  - ~600 students from 23 schools participated in spring of 2009
  - 80% male, 20% female
  - 96% US Citizens, 4% foreign nationals
  - 73% caucasian, 27% non-caucasian
Results Agenda

• Pre-College Experiences

• College/University Undergraduate Experiences

• Job and Career Expectations
How old were you when you first became interested in aerospace? (n=426)

- 5-9 years old: 35%
- 10-13 years old: 27%
- 14-17 years old: 30%
- 18-22 years old: 7%
- 22+ years old: 1%
Does Engineering Run in the Family?

How many family members or close family friends are engineers? (n=431)

- 0 people: 40%
- 1-2 people: 42%
- 3-4 people: 12%
- 5-6 people: 4%
- 7-10 people: 1%
- 10-15 people: 0%
- 15+ people: 1%

1-2 people: 42%
3-4 people: 12%
5-6 people: 4%
7-10 people: 1%
10-15 people: 0%
15+ people: 1%
0 people: 40%
Before applying to college, which activities did you participate in? (check all that apply) (n=554)
Results Agenda

- Pre-College Experiences
- College/University Undergraduate Experiences
- Job and Career Expectations
How has your college time contributed to your skills and experiences in the following areas? (n=506)

- Ability to frame problems
- Analytical skills
- Basic research
- Math and science
- Business practices
- Economic development
- Entrepreneurship
- Ethical and/or social issues
- Hands-on experiences
- Innovation, creativity, and flexibility
- Inventions and industrial applications
- Policy implications of engineering
- Leadership
- Risk taking
- Effective teamwork
- Writing skills
- Verbal communication skills

Legend:
- Somewhat contributed
- Significantly contributed
- Didn’t contribute
- Negatively contributed
Please indicate whether each of the following has influenced your desire to work in aerospace: (n=515)
Results Agenda

- Pre-College Experiences
- College/University Undergraduate Experiences
- Job and Career Expectations
How long would you expect to stay with the first company / organization you work for after graduation?  (n=480)

- At least 10 years: 11%
- At least 1 year: 35%
- At least 5 years: 52%
- At least 6 months: 2%
I want to work for different companies or organizations over the course of my career. I want to work in a management capacity for at least half of my career. I want to work on a different project every year.
Job Expectations: “Mobility”

How often you will switch jobs in the same company.

- Every 6 months or less, 1%
- Every 6 months to 1 year, 13%
- Every 1 to 5 years, 65%
- Never, 3%
- Every 5 to 10 years, 15%
- Every 10+ years, 3%

How often you will switch careers.

- Every 6 months or less, 1%
- Every 6 months to 1 year, 0%
- Every 1 to 5 years, 4%
- Every 5 to 10 years, 9%
- Never, 55%
- Every 10+ years, 31%
- Every 5 to 10 years, 47%
- Every 6 months to 1 year, 0%
- Every 1 to 5 years, 18%
- Never, 7%
- Every 10+ years, 28%

How often you will switch companies in the same career.

- Every 6 months or less, 0%
- Every 6 months to 1 year, 0%
- Every 1 to 5 years, 13%
- Every 5 to 10 years, 0%
- Every 10+ years, 28%
- Never, 7%
- Every 1 to 5 years, 18%
- Every 5 to 10 years, 47%
Job Expectations: “Moving Up”

How often you will gain new engineering responsibility.

- Every 6 months or less: 14%
- Every 6 months to 1 year: 32%
- Every 1 to 5 years: 39%
- Every 5 to 10 years: 12%
- Every 10+ years: 2%
- Never: 1%

How often you will get salary raises.

- Every 6 months or less: 4%
- Every 6 months to 1 year: 13%
- Every 5 to 10 years: 9%
- Every 10+ years: 1%
- Never: 0%

How often you will gain promotions.

- Every 6 months or less: 2%
- Every 5 to 10 years: 19%
- Every 6 months to 1 year: 13%
- Every 1 to 5 years: 62%
- Every 10+ years: 2%
- Never: 0%
Desired Job Attributes

Please rank your top four job attributes. (n=476)
Perception of Aerospace Compared to Other Industries

How does aerospace compare to other industries on the following job attributes? (n=460)

- Salary
- Benefits
- Location
- Job security
- Educational opportunities
- Flexible schedule
- Work/life balance
- Project variety
- Challenge
- Excitement
- Work environment / culture
- Leadership opportunities
- Recognition of personal achievements
- Sense of direct contributions
- Working with hardware
- Other

More favorably
Less favorably
Contrasting Sources of Jobs

Recruiting Avenues for Aerospace Job Offers (n=74)

- Career fair: 60
- Internship: 40
- Knew someone that worked there: 10
- Online application: 30
- College career office: 5
- Other: 5

Recruiting Avenues for non-Aerospace Job Offers (n=48)

- Career fair: 15
- Internship: 10
- Knew someone that worked there: 20
- Online application: 5
- College career office: 5
- Other: 15
Post-Undergraduate Plans

• Of graduating aerospace engineering students
  – 80% took aerospace-related jobs
  – Leadership opportunities, excitement, challenge, benefits were the top four ranked factors for accepting a job outside aerospace
  – Salary, location, challenge, work environment were the top four factors for accepting a job in aerospace

• 56% have seriously considered working outside their major field of study

• 59% desire to go to graduate school
Take Aways

• This Millennial generation of engineering students is different:
  – Expect mobility and frequent change
  – Want to excel and move ahead quickly
  – Value “killer” lifestyle, diversity, friends
  – Assume technology, internet, constant connectivity
  – Multitask fast
  – Institutions are irrelevant
  – Rewrite the rules
  – Optimistic / realistic
  – Nurtured as children

• If we understand them better, we can design engineering work and organizations that will attract and retain them.
Backups
Survey Observations

• Aerospace engineering sophomore and senior students
  – 78% see themselves entering the aerospace industry upon graduation, and 78% see themselves as likely or highly likely to remain in the aerospace industry for their whole career
  – Over 70% want to work for more than one company/organization over the course of their career
  – Almost 60% want to work in a management capacity for at least half their career
  – Over 60% want to work on more than one project each year
  – 45% expect to gain new engineering responsibility at least every year
  – 45% expect to switch careers at least every 10 years
Aerospace is Exciting…Literally!

Using the first one, two, or three words that come to mind, how would you describe the aerospace industry? (n=528)
Please indicate how you feel about the following statements:
(n=483)

- I want to work for one company or organization for my whole career.
- I want to work for different companies or organizations over the course of my career.
- I want to work in a technical capacity for my whole career.
- I want to work in a management capacity for at least half of my career.
- I want to work on a different project every year.
- I want to work on one project for many years.

- Agree  |  Strongly agree  |  Disagree  |  Strongly disagree
What are your expectations about: (n=470)

- How often you will switch jobs in the same company: 10% every 6 months or less, 30% every 6 months to 1 year, 40% every 1 to 5 years, 15% every 5 to 10 years, 5% every 10+ years, 5% Never.

- How often you will switch companies in the same career: 20% every 6 months or less, 40% every 6 months to 1 year, 30% every 1 to 5 years, 10% every 5 to 10 years, 1% every 10+ years, 8% Never.

- How often you will switch careers: 20% every 6 months or less, 40% every 6 months to 1 year, 30% every 1 to 5 years, 10% every 5 to 10 years, 3% every 10+ years, 4% Never.

- How often you will gain new engineering responsibility: 10% every 6 months or less, 25% every 6 months to 1 year, 35% every 1 to 5 years, 20% every 5 to 10 years, 15% every 10+ years, 0% Never.

- How often you will gain promotions: 10% every 6 months or less, 20% every 6 months to 1 year, 40% every 1 to 5 years, 25% every 5 to 10 years, 15% every 10+ years, 0% Never.

- How often you will get salary raises: 15% every 6 months or less, 30% every 6 months to 1 year, 40% every 1 to 5 years, 15% every 5 to 10 years, 10% every 10+ years, 0% Never.
Instrument Design and Data Collection

• Data gathered in 6 areas
  – Initial interests in aerospace (pre-college)
  – College experiences
  – Career expectations
  – Desired job attributes
  – Perception of aerospace industry
  – Demographics

• Survey population
  – Sophomores and seniors (or their equivalents)
  – Eventually, students 2 and 5 years out from graduation

• Web-based survey takes 30 minutes

• 2009 response characteristics
  – ~600 students from 23 schools participated in spring of 2009
  – 80% male, 20% female
  – 96% US Citizens, 4% foreign nationals
  – 73% caucasian, 27% non-caucasian
Demographics

- 27% are the first in their family to go to a 4-year college
- 56% have seriously considered working outside their major field of study
- 59% desire to go to graduate school, 19% do not wish to pursue graduate school, balance are undecided