A Few Practices of Modern Engineering

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http://rotorlab.tamu.edu
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28 years experience in engineering and research in rotating machinery: small and big, slow and fast, power generation and thrust for aircraft engines and rocket engines.

A reason to develop this lecture?

Old enough to see the engineering world change & plenty of time to make too many mistakes and to learn from them.
Based on a series of lectures + (young) guests:

Singapore (NUS) 2009
S Korea (KIST) 2010
Texas A&M University 2010-2013
Mexico (CIATEQ, ETU) 2012 → 2018
China (Xi’an, Changsha, Harbin, Shanghai) 2012 → 2016, 2018
Aim

An Introduction to the practices of modern engineering:

a) application of the sciences (mathematics and physics) and engineering principles to satisfy needs, and

b) other tracts that will ensure the engineer’s survival and continued success in the profession

focus of this seminar!
What does an engineer do?

Engineers make products to satisfy a need. They solve problems!

From the Latin word *ingeniato*:*r*: ingenious, to devise in the sense of construct (*engines*), or craftsmanship. Other related word is *ingenuity*.
Engineering Basics

Who is an engineer?

The knack!

Extreme intuition for all things electrical & mechanical and other social ineptitude!

Common (misleading) perception
What does a modern engineer do?

Engineers **anticipate needs!**

Create opportunities for further development and prosperity.

Exercise design creativity and inventiveness with keen understanding of economical, ethical, social & ecological constraints.
A modern engineer is NOT a NERD, a MATH wizard ISOLATED from his/her surroundings. A lone inhabitant in an IVORY TOWER: self – interested.
A modern engineer MUST

Interact with others: be a team player & leader.

Be responsible for actions impacting society & environment

Be a seasoned communicator.

Ready to learn (always more).
I will converse about the various skills that an engineer exercises daily in his/her work, the dos & don’ts of practical engineering, the competitive advantages that will keep you ahead and in the game....
The four dimensions of engineering
The Four Dimensions of Engineering

- **Human Sciences**: Engineer as humanist
- **Basic Sciences**: Engineer as scientist
- **Design**: Engineer as designer
- **Crafts**: Engineer as crafts worker

**Axes**
- **People Society**
- **Matter Energy Information Life**
- **Theory Practice**
The Four Dimensions of Engineering

Engineer as scientist

Application of the natural and exact sciences, with logic and rigor, through analysis & experimentation. Drive to discover first principles

→ Application: R&D
The Four Dimensions of Engineering

Engineer as humanist

Not just a technologist, but also a social expert, manager and business person recognizing social complexity of world and markets and of the teams they belong to.

→ Application: creation of social & economic value (satisfy needs).
The Four Dimensions of Engineering

**Engineer as crafts worker**

*(homo faber)* The art of getting things done.

→ **Application:** The ability to change the world and overcome resistance to ambiguity (uncertainty).
Values system thinking more than analytical thinking.

**Design** includes compromising, non-scientific thinking, and decision when knowledge is incomplete with the help of intuition and experience.
Modern Engineers

Must learn to traverse these trans-disciplinary space to generate constructive processes.

Explore all spaces and build your own configuration.

All dimensions + a focus of GLOBAL issues make a modern engineer.
A Few Practices of Modern Engineering

Re-engineering
Engineering Education
Desired Attributes of Young Engineers

1. A good understanding of engineering science and fundamentals
2. A good understanding of design & manufacturing processes
3. Good communication skills
4. A multi-disciplinary, systems perspective
5. A basic understanding of the context in which engineering is practiced
6. A profound understanding of the importance of team work

Vision 2020:
To enhance the nation's economic productivity and improve the quality of life worldwide, engineering education in the US must anticipate and adapt to the dramatic changes of engineering practice.

Besides the necessary technical skills, what else is needed from US engineers?
Vision EC 2020: Skills to succeed

- Prepared for global competency.
- Superb communication skills (written & oral).
- Trained in teams that work and deliver.
- Ready for open-ended multidisciplinary problems with no unique answer.
- Ready for innovation and to embrace change.
- Show absolute professional integrity.
- Do more with less
- Do things right the first time

Educating the Engineer of 2020 (NAE)
The 3-corners of Eng Vision 2020

Superb Engineering
(Maths, Physics, Science)

Arts
Creativity &
Innovation,
Design,
Communication

Entrepreneurship,
Philanthropy,
Ethics

NAE: Educating the Engineer of 2020
A Few Practices of Modern Engineering

Educating the modern engineer

Higher Education is the only business where the customer wants to be cheated

Not any more
Traditional engineering education focuses on delivering information with students as mere uncritical receptors of knowledge.
Engineering Criteria 2000
What engineering students must be able to do when finishing school...

- Learn to learn
- Listen and solve problems
- Practice critical thinking
Demonstrate an ability to

1. identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics

2. apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors

3. communicate effectively with a range of audiences

4. recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal context

5. ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives

6. ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions

7. ability to acquire and apply new knowledge as needed, using appropriate learning strategies.
## Transforming Engineering Education

### 5XME Heads Workshop (2017)

- **Broad grounding in fundamentals**
- **Flexibility and agility**
- **Innovation & creativity to benefit society**
- **Global focus**
- **Teamwork & leadership**
- **Communication skills**

<table>
<thead>
<tr>
<th>Traditional Engineer</th>
<th>Modern Engineer</th>
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<tbody>
<tr>
<td>Problem Solver</td>
<td>Problem finder and solver</td>
</tr>
<tr>
<td>Excellent mastery of tech skills</td>
<td>Combines tech and soft skills</td>
</tr>
<tr>
<td>Understands tech content of work</td>
<td>Also understands the market</td>
</tr>
<tr>
<td>Happy to work in one country</td>
<td>Thrives on international relations and business opportunities</td>
</tr>
<tr>
<td>Reports up the management chain to MBS</td>
<td>Hires MBAs</td>
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What skills are important?

Questionnaire to recent (10 y) graduates at a large Midwestern (public) University to rate how important are 12 ABET competencies.

ABET competencies – what is important?

Teams
Communication
Data analysis
Problem solving
Life-long learning & ethics

ABET Competencies a-k

Notes
Ratings
5 = "extremely important"
4 = "quite important"
3 = "somewhat important"
2 = "slightly important"
1 = "not at all important"

All competencies in this study have mean ratings greater than "somewhat important".

Tie lines show 6 statistically distinct levels of importance (studywise $\alpha = 0.05$). Horizontal "tie lines" above the data "tie together" competencies whose ratings are not significantly different. (Specifically, each respondent’s ratings were ranked from 1 (highest rating) to 12 and differences were tested between the mean rank for each competency over all respondents.)

ABET skills or competencies

Engineering employers value a

a) Top cluster (teamwork, communication, data analysis and problem solving)

b) Intermediate cluster (math, science and eng skills, ethics, learning, design and engineering tools)

c) Bottom cluster (contemporary issues, experiments, & understanding impact of one’s work).

Clusters stable over time –spanning 18 graduation years and over a period of zero to ten years after graduation

Employer Perceptions

Who gets a job?

2012, Chronicle of Higher Education (Survey to 50,000 employers)
Internships and employment during college are the most heavily weighted attributes considered by employers.

How are Chinese students doing?

2012, Chronicle of Higher Education (Survey to 50,000 employers)
Top Skills of Recent Graduates

Need, Have & College Responsibility

2012, Chronicle of Higher Education (Survey to 50,000 employers)
Employer Perceptions
Who keeps a job?

Engineering – What You Don’t Necessarily Learn in School,
David Wisler, 2003 ASME Paper
Twelve tracts for a successful career

1. learn to be business oriented;
2. expect tough, multi-disciplinary problems;
3. learn to work and network in the new multi-cultural and multi-national environment;
4. understand the differences between academe and industry;
5. learn to differentiate all over again;
6. understand the values and culture of your particular company or organization;
7. be open to ideas from everywhere;
8. have unyielding integrity;
9. make their manager a success & manage owns’ career;
10. support their university and technical society;
11. have fun!

How different is academe from industry?
## Differences

<table>
<thead>
<tr>
<th>University</th>
<th>Industry</th>
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</thead>
<tbody>
<tr>
<td>1. More individual oriented</td>
<td>1. More team oriented</td>
</tr>
<tr>
<td>2. Is it original work?</td>
<td>2. Can we leverage existing work?</td>
</tr>
<tr>
<td>3. Does it contribute to science?</td>
<td>3. Does it contribute to the business?</td>
</tr>
<tr>
<td>4. Will it make archival publication?</td>
<td>4. Will it make it into production?</td>
</tr>
<tr>
<td>5. Is it interesting to do?</td>
<td>5. Is it worthwhile financially?</td>
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</tbody>
</table>

## Differences

<table>
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<tr>
<td>6. Develop the equations, analysis, etc. from first principles</td>
<td>6. Fit a curve through the data and/or anchor the existing analysis</td>
</tr>
<tr>
<td>7. Is it original and complete from scientific (physics) perspective?</td>
<td>7. Is it institutionalized into the system from an engineering perspective?</td>
</tr>
<tr>
<td>8. Graduate when thesis finished</td>
<td>8. Meet schedule and budget</td>
</tr>
<tr>
<td>9. Publish, publish (or perish)</td>
<td>9. Customer, customer, customer</td>
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## Differences

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<tr>
<td>10. Sound scientific process</td>
<td>10. Design practices, templates</td>
</tr>
<tr>
<td>11. Non-profit institution</td>
<td>11. Profit institution</td>
</tr>
<tr>
<td>12. Solve roadblock issues as they occur</td>
<td>12. Identify &amp; manage risks carefully up front with risk abatement plan &amp; critical path scheduling</td>
</tr>
<tr>
<td>13. (Tenured) Professors are independent</td>
<td>13. Formal management process → up to shareholders</td>
</tr>
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Myths on Career Development

1. Do a good job and the Company will “take care of you”, or better yet, “take care of you for life.”
2. It’s not what you know, but whom you know that counts.
3. Career planning is my manager’s job.
5. You only get ahead if you work in the current “high visibility” area.
6. I would rather be lucky than good.
7. Just tell me the career path I need to be on to reach my goal.

Manage your career: control your destiny!

In real estate, there are three + things people consider about buying a piece of property — location, location, location.

Likewise in your engineering career; people will notice your attitude, attitude, attitude.

Work on a positive, can-do attitude. It is an important key to success. There are few things, aside from downright incompetence, that can hinder you as rapidly as a bad attitude.

How to Capture the Four E’s

**ENERGY:** You can do things \(\rightarrow\) deliver!

**ENERGIZE** others around common goals \(\rightarrow\) yes, we can do!

**EDGE:** Show your knack in a + measurable way. You can make though yes & no decisions.

**EXECUTE:** Deliver on your promises!

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One of the most eye-opening portions of the paper is a table that compares industry and academia. A major insight that can be gleaned from this table is:

In academia, technical work is to some extent an end in itself; whereas in industry, technical work is merely a means to an end, namely, making a company profit.
Modern engineers must strive to add value to themselves whenever an opportunity arises. A smile and pleasant attitude are an easy way to enhance a career.

if you have fun and love what you do, you will never work a day in your life.

Nothing is fun until you’re good at it,
“Battle Hymn of the Tiger Mother,”
Amy Chua, 2010
But …
How to get the work done?
Working in groups
Responses to the December Question of the Month: How often do you work with cross-disciplinary engineering teams?

The majority of readers—62 percent—said they work every day with colleagues who are not mechanical engineers. As for the success of these types of teams, one reader wrote, “It all depends on communication. If the team members communicate, there is a much higher probability of success. However, another issue is to remember that not everyone on the cross-disciplinary team has a good understanding of the work done by the other members. It is important for each member to have a basic idea of what each discipline does and contributes to the project.”

Another reader noted that cross-disciplinary teams can be very effective, “especially when technical personnel who are not engineers are involved. Often, skilled trades individuals offer surprising insights into new solutions.”

The next Question of the Month will be posted Jan. 2.
Fact #1 As each bird flaps its wings, it creates uplift for the bird following. By flying in a "V" formation, the whole flock adds 71% greater flying range than if one bird flew alone.

Lesson Learned People who share a common direction and sense of community can get where they are going quicker and easier because they rely on the strength of one another.
Fact #2 Whenever a goose falls out of formation, it suddenly feels the drag and resistance of trying to fly alone and quickly gets back into formation to take advantage of the lifting power of the bird immediately in front.

Lesson Learned If we have as much sense as geese, we will stay in formation with those who are ahead of where we want to go and be willing to accept their help as well as give ours to others.
Fact #3 When the lead goose gets tired, it rotates back into the formation and another goose flies at the point position.

Lesson Learned It pays to take turns doing the hard tasks and sharing leadership.
Teambuilding Lessons Learned From Geese

Fact #4 The geese in formation honk from behind to encourage those up front to keep up their speed.

Lesson Learned We need to make sure our honking from behind is encouraging, and not something else.
Be aware of this, It’s easier to do than you think!

Poor planning on your part does not constitute an automatic emergency on my part.
About writing and presentations

I’m sorry I wrote you such a long letter. I did not have time to write you a short one.”

-Blaise Pascal
About writing

Practicing engineers (around the world) spend a fair amount of their work time (25% to 40%) documenting their work. Documentation includes:

- preparing reviews of material (test data and predictions from models),
- assessing prototypes and troubleshooting hardware; and
- compiling (writing) technical reports or memoranda for customers, upper management, etc.
The qualities of a good technical report

A technical report must be

a) interesting,

b) with a clear narrative from the introduction, through the work carried out to a clear expression of substantial conclusions and recommendations,

c) of sufficient significance and relevance to the professional community that it will be referred to and used by other workers in the field.

Read/practice document “The qualities of a good technical report”. Posted on http://rotorlab.tamu.edu/me489
Stage-Fright

• Presentations are inevitable – be prepared!
• How do you prepare?
• What makes a good presentation?
  – What makes a bad presentation?

… and a typical engineering presentation →
The longest title I could come up with so this slide seems really important and consequently draws attention away from me.

- I think we can all agree that this is an example of a bad presentation.
- There is so much text on this slide that it’s hard to make anything out.
- Plus, I’m reading this slide to you so 1) I’m not even facing you, and 2) don’t lie, you’re trying to read this while I’m reading it to you.
- So why am I even up here talking? You’re not listening to me and there’s no reason to listen to me because I’m not adding anything to this slide. I could just as easily have given you the slide to read yourself and you would have gotten the same amount of information from it.

Example by Ash Maruyama – Sulzer Turbo for PME (2011-14)
About technical presentations

*Art of the Start*, by Guy Kawasaki *(Business)*

Kawasaki’ rule on presentations: 10-20-30

10 slides, 20 minutes, and size 30 font

free download

The Enemy of Good...

- Perfection does not exist.
- Learn to define and accept “acceptable.”

Example by Ash Maruyama – Sulzer Turbo for PME (2011-14)
Words from Sir Francis Bacon

pioneer of the modern experimental sciences [1600’s]

Reading maketh a full man. Conference a ready man, and Writing an exact man

English author, courtier, & philosopher; advocate of inductive reasoning in science; wrote "Advancement of Learning" 1605, "Novum Organum" 1620, "New Atlantis" 1627
A Few Practices of Modern Engineering

Ethics in the workplace and elsewhere....

Professional integrity
Ethics

The principles of right and wrong that are accepted by an individual or a social group.

DOING THE RIGHT THING WHEN NO ONE IS WATCHING
Engineers uphold and advance the integrity, honor and dignity of the engineering profession by:

I. using their knowledge and skill for the enhancement of human welfare;

II. being honest and impartial, and serving with fidelity their clients (including their employers) and the public;

III. and striving to increase the competence and prestige of the engineering profession.
Ethics – Working Principles

treat people fairly;
keep your promises;
do your best;
tell the truth;
don't take what isn't yours;
appearances count!
Ethics plays a role in your work?

Honesty & professional integrity are ethical assets. Moral soundness & honor are the most treasured human values.

You live to practice it (24 h & 7 day & 365 day).
Still in a Research Environment, How do I Get the Work Done?
Work leading towards an advanced graduate degree is designed to give the student a thorough and comprehensive knowledge of his or her professional field and training in methods of research. The final basis for granting the degree shall be the student’s grasp of the subject matter of a broad field of study and a demonstrated ability to do independent research. In addition, the student must have acquired the ability to express thoughts clearly and forcefully in both oral and written forms. The degree is not granted solely for the completion of course work, residence and technical requirements, although these must be met.
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The ability of student (INDIVIDUAL) to perform INDEPENDENT & ORIGINAL work with demonstrated COMMUNICATION SKILLS

Texas A&M Graduate Catalog, p. 151
Conditions for research

• **Stability**  Financial support (economic), Personal, family & peer support (emotional)

• **Resources**  Equipment, Computers, Tools and Space conducive to work. Library, Expertise from peers and faculty.

• Desire to learn & appreciation of past work.
• Desire to serve others.
• Fierce Independence &
• Ability to be a team player.
Human knowledge

elementary school
high school
B.S. degree
M.S. degree

... Push some more...

.... and push a few more years

Matt Might, matt.might.net
Keep pushing….

the boundary gives way!!!

and keep pushing!

PhD Thesis

Dream big!

Matt Might, matt.might.net
But the world has not changed
Don’t forget the big picture

Keep pushing!
And, the best way to do science is through graduate students!

Even one child suffering is too many

The only way to end *this kind of suffering* is science

And, the best way to do science is through graduate students!
How to push boundaries and leave a mark?
Is research really original?

All research is **INCREMENTAL**. It adds to the vast published knowledge. Students must master what was done before.

**Originality** relates to novel, faster and more reliable procedures for measurement and prediction. Engineering research strives to solve problems and to create opportunities (innovation).
Research for industry

Research no longer intends to educate students and to show “a best effort” advancing science and engineering.

Academic research is a business!
To stay in business one needs to satisfy the customer, anticipating his needs, delivering on time, exceeding expectations, etc. Furthermore, industry, to remain competitive, demands more work with less resources and in record time.

Creativity and innovation are a must to remain competitive.
Industry has a choice! If not satisfied, a customer goes elsewhere where the work can be conducted as requested, probably at a lower cost and in less time.

The information age and globalization make a fierce competition for resources.

What skills do our graduates need to keep a “research job” during the next 10+ years?
How to Get the Work Done?

• Set goal(s) of research
• **Compile written tasks**
• Develop time table for completion
• **Remain focused**
• Strive for excellence
• **Read technical literature**
• Ask questions when necessary
• **Document work throughout**
How to Get the Work Done?

- Divide ultimate research goal into tangible objectives
- Prioritize objectives
- List the individual tasks to achieve each objective.
- Prepare a timetable to complete tasks
- Read and learn from literature
- Deliver as planned!

The greatest obstacle to discovery is not ignorance - it is the illusion of knowledge. Daniel J. Boorstin
1. Poor planning on one’s part does not constitute automatic emergency from others.

2. Know corporate structure + follow chain of command.

3. The inquisitive idiot: must ask, but think first.

4. Own your project or assignment: anticipate needs.

5. Less is more: work smarter, not harder.

6. The enemy of good is perfect: learn when to stop.

7. Keep a paper trail, write more and write well. It is not what you know, it is what you can prove.

8. Leave work at work.

9. Mistakes are inevitable: GIGO.

10. Save money early, pace yourself.
A Few Practices of Modern Engineering

Innovation & technology paths
Inspiration is fine, but above all, innovation is a management process.

The process of innovation begins with invention, and is only realized when a market develops.
All technologies (innovations) evolve to satisfy a need. At the start, performance growth rate is fast. However, as time passes, the technology matures to reach its limit. The more mature the technology, the more resources to enable gains in performance unless.....
Moore’s Law

1965: Transistor density on integrated circuits doubles every two years

![Graph showing the trend of transistor density over time](https://upload.wikimedia.org/wikipedia/en/9/9d/Moore%27s_Law_Transistor_Count_1971-2016.png)


The data visualization is available at OurWorldData.org. There you find more visualizations and research on this topic. Licensed under CC-BY-SA by the author Max Roser.

Moore’s Law

Performance measurement

Hard Disk Drive Capacity

Technology shifts

Performance measurement

Paradigm shifts

Time

Moore’s Law is too simple. Leaps in performance demand paradigm shifts.

B replaces A
C replaces B, etc.
Technology shifts: hard drives

Performance measurement

A: tape storage

B: HD storage (speed, track spacing, drums, head height)

C: Solid State storage

D: Molecular (nano) storage
Technology shifts: aircraft engines

A: reciprocating IC engines
B: Jet gas turbine engines
C: High bypass fan engines
D: e-hybrid ducted engines

Performance measurement vs. Time
Types of Innovations (technologies)

**Sustaining technologies** improve marginally existing products or services (quality of CDs, storage in HDs, IC engine cars), require gradual change as they retain Status Quo.

**Disruptive technologies** change the nature of a market or business (iPod, mobile phones, digital photography and sound, solid state memory, on-line retailing)
Sustained Innovation

• Makes better products & sold for $$$$ to attractive customers → optimization.

• Addresses to specific customer needs.

• Incumbents almost always prevail: more resources, bigger profits.

Examples: PDAs, Cell phones, Cars, Engines, Power generation
Disruptive Innovation

Performance

Disruptive technology

Most demanding use

High quality use

Medium quality use

Low quality use

time
Disruptive Innovation

• Simpler, more convenient product that sells for less $$ and appeals to new or unattractive customers.

• **Entrants likely to beat incumbents.** Cost structure is low.

• **Ex:** Ikea, Dell, Embraer Airplanes

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It comes from listening to your customers – not what they say, but about what they do
Innovation is risk

Experience shows that the ability to sell ideas is the critical factor in enabling technical people, indeed anyone, to “make a difference.”

Innovation involves new ideas and requires change. Change is risky. However it may be riskier NOT to change. (Change or perish!)

PRISM, 2002, Selling Innovation, Ronald J. Bennett, Ph.D.. Engineering and Technology Management, University of St. Thomas, St. Paul, Minnesota
Selling Innovation

Why it is necessary to “sell” innovation:
1. There is nothing that cannot be done or made better.
2. No new discovery or idea (invention) has value to others until it is applied (innovation).
3. Every new idea meets resistance.
4. **People buy for their reasons, not yours.**
5. It is an obligation of leadership to take others where they wouldn’t go by themselves.
6. **It is goal of lifelong learning to become consciously competent at whatever we do.**
7. To be effective and to get support from others, technical professionals need to be able to “sell” their ideas in terms that resonate with their buyers.

PRISM, 2002, *Selling Innovation*, Ronald J. Bennett, Ph.D.
Engineering and Technology Management, University of St. Thomas, St. Paul, Minnesota
Innovation

Is a national priority, central to economic growth in an increasingly fast-paced, + competitive, and global environment.

Innovation (1) can be taught, (2) can be managed, and (3) can be stimulated.

Creativity

an indispensable quality for engineering! Invention is the beginning……..

American engineers lead the world in two fundamental ways: innovation and the ability to recognize and improve systems.

While India may be good at writing specific computer code, Germany excels at precision, and Japan at continuous improvement, American engineers excel at creativity, “About the time we begin to lose jobs overseas, we change the game, and it makes the argument irrelevant.”
Closure
Reality check

The world changes rapidly and US Engineering education must also evolve simultaneously.

The economic realities of global competition & broadband communications drive entry-level and more routine jobs overseas.

US engineers need more dimensions of knowledge to compete and for the US to maintain its role as world leader in technological innovation.

Either the engineering profession will broaden greatly or the society will suffer because the matching (between society and technology) will be too haphazard”….

“A greater engineer needs to evolve”.. it will come to embrace much more of the issues at the technology-society interface.”

Simon Ramo (NAE)
Closure

But I have promises to keep,
And miles to go before I sleep,
And miles to go before I sleep.

Robert Frost, “Stopping by Woods on a Snowy Evening”

Thanks!
Timeless advice for young engineers
Lyn’s Engineering Laws

A short list of business and professional rules made from bad experiences

Lyn Greenhill, PE, DynaTech Engineering, Inc
http://www.dynatechchomgr.com/

A contribution by a real engineer, a pro!
1. Start all projects with a clear vision of what the final product and your customer’s expectations are. Try to deliver something a little better than what you promised.

2. Don’t ask for help solving a problem unless you have at least one solution (and preferably more) already thought out.

3. Never promise what you can’t deliver, and try to deliver early.

4. There is no such thing as a dumb question, but on the other hand, don’t ask other people to think for you. Well thought out, insightful, and specific questions are always appreciated.
Lyn’s Eng. Laws

A short list of business and professional rules made from bad experiences

5. **Check your work!** There is always some simple calculation that can be applied to determine if an answer is reasonable. Don’t expect your boss to check your work.

6. **Never lose sight of the fact** why a company is in business is to make money. If you are not making money for the company you are expendable.

7. **If you see brake lights, turn!** There is always more than one way to reach a destination, don’t get stuck in traffic with a single route.

Lyn Greenhill, DynaTech Engineering, Inc
Lyn’s Eng. Laws

A short list of business and professional rules made from bad experiences

8. It is OK to criticize the boss as long as you don’t mind the boss criticizing you. Better yet, try to foster a mutually beneficial relationship.

9. Keep in mind you may never know who your next boss will be.

10. If a problem or situation gets personal, it is time to get out.

11. Negotiations are never ultimatums. If you can’t see both sides of an opportunity or decision, you’re not looking hard enough.

Lyn Greenhill, DynaTech Engineering, Inc
A short list of business and professional rules made from bad experiences

12. If the sole reason why you are working at a particular job is to earn a paycheck, you are not working at the right job. Have passion for what you are doing.

13. Life is a learning experience. If you are not constantly learning, you are stagnating. If you think you know it all, you don’t.

14. Be prepared. Don’t expect someone else to bail you out if things get rough.

15. The best lessons come from mistakes, but don’t repeat the same mistakes.

Lyn Greenhill, DynaTech Engineering, Inc
A short list of business and professional rules made from bad experiences

16. Business is about relationships. Strive to maintain good ones. Occasionally, there will be times when a relationship needs to be broken. Do it kindly, and then move on.

17. Leave personal emotional baggage outside the front door.

18. Avoid swimming upstream. Salmon swim upstream right before they die.
You probably wish to know which rule or law is the most important. Lyn replies “……………. most important law, well, that is tough, but I think probably #2 is my favorite closely followed by #5.

2. Don’t ask for help solving a problem unless you have at least one solution (and preferably more) already thought out.

5. Check your work! There is always some simple calculation that can be applied to determine if an answer is reasonable. Don’t expect your boss to check your work.
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