

DEVELOPING ENGINEERING
PROFESSIONALISM:
*YOU GOT THE GIG NOW MAKE SURE YOU
HAVE THE CHOPS!*

Mark J McCready
April 7, 2017

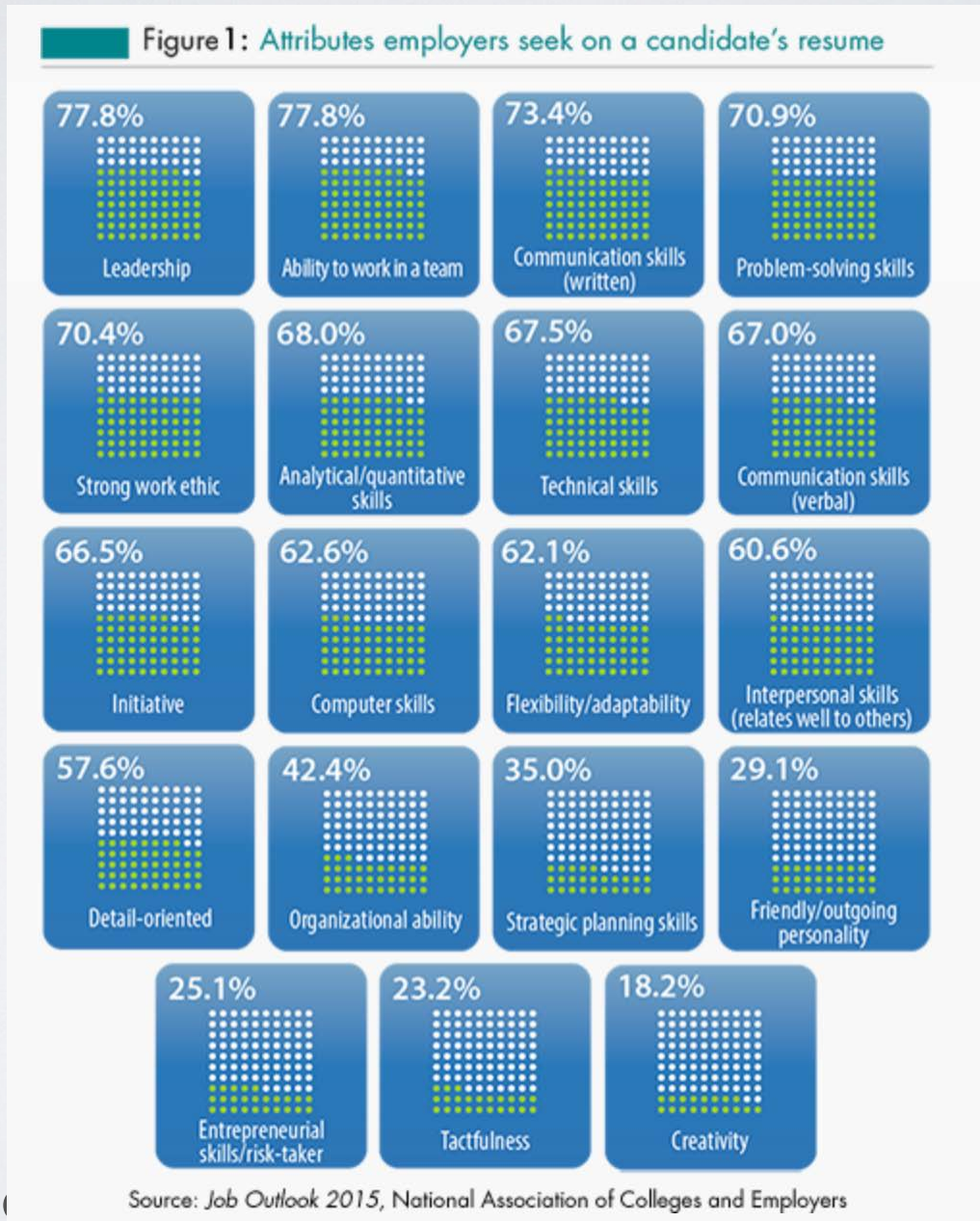
TOPIC TODAY....

- Goal is to provide useful, (differentiating) insights that don't come from anywhere else in our curriculum or even in your internships.
- You are still developing as a person
 - Many “revelations” are yet to come!
- I will be providing ideas and considerations for you, as you take charge of defining who you will be!
 - If you are interested, here is my modest contribution.

CONVENTIONAL WISDOM

- (disclaimer before I pass along any bad habits!)
- <https://www.naceweb.org/about-us/press/class-2015-skills-qualities-employers-want.aspx>

WHAT EMPLOYERS “THINK” THEY WANT!



PREMISE

- The day you are hired, you are not worth what they pay you.
- Only by the best efforts of the genius, rock star, CEO (who by definition is worth every penny of the \$15 mil she/he is paid!), that the company that the company can afford you.
- However, they are not going to promote you to the next job if you can't justify your cost.
- I am trying to help you get there (sooner)!

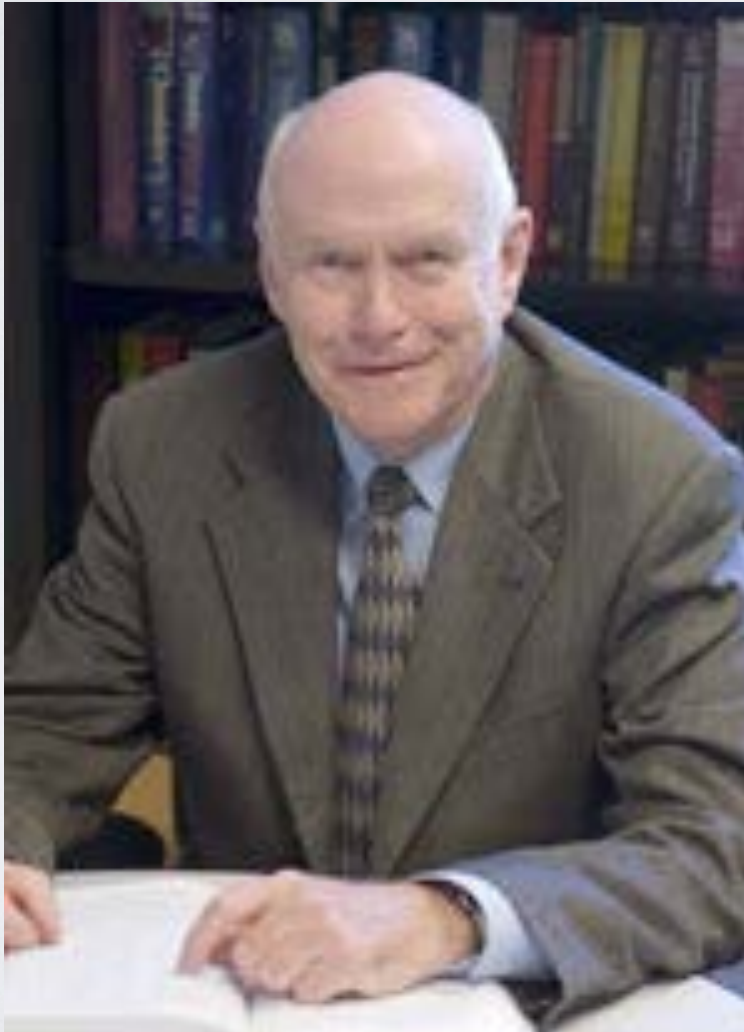
FOUNDATION FOR THIS TALK

- I always look for connections between different topics, ideas and mediums of expression.
- I like to use analogies to illustrate points.
- Some statements I hear stand out as having meaning well beyond what was initially intended.
 - ...or the person who said did have such intentions!

OUTLINE

- Quotes that define Engineers
- Developing who you are
 - Self assessment
 - Integrity
 - Intellect — even from the beginning you could make a key contribution!
 - Personality
- Developing what you can do
 - Communicate effectively — say interesting things
 - Look for opportunities — grab them
 - Take responsibility for your “gig”

“YOU HAVE TO KNOW WHAT PROBLEM YOU ARE SOLVING!”



T.W. Fraser Russell
Allan P. Colburn Professor of
Chemical Engineering
University of Delaware

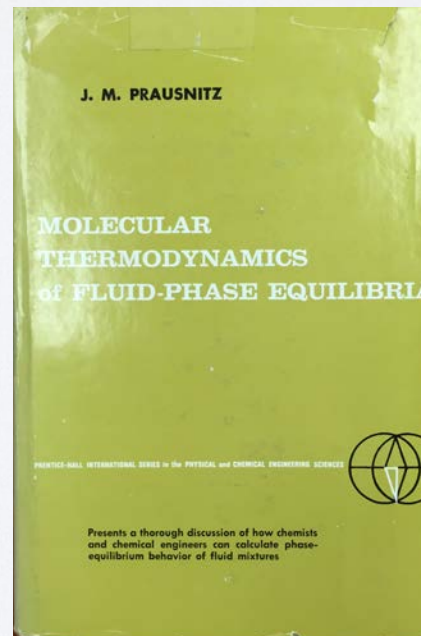
A defining statement for an Engineer:
Why are we here?
What are we trying to accomplish?

IDEAS

- ... In fact, one of the outstanding characteristics of great contributors to modern science has been their ability to distinguish between what is essential from what is incidental) ..."
- From: Molecular Thermodynamics of Fluid Phase Equilibria

6.1 The Ideal Solution

The history of modern science has shown repeatedly that a quantitative description of nature can often be achieved most successfully by first idealizing natural phenomena, i.e., by setting up a simplified model, either physical or mathematical, which crudely describes the essential behavior while neglecting details. ((In fact, one of the outstanding characteristics of great contributors to modern science has been their ability to distinguish between what is essential and what is incidental.)) The behavior of nature is then related to the idealized model by various correction terms which can be interpreted physically and which sometimes can be related quantitatively to those details in nature which were neglected in the process of idealization.



- John M. Prausnitz
- Professor of Chemical Engineering UC Berkeley
- An "academic uncle of mjm"

WIDE SCOPE AND IMPACT

- A memorable quote from my past:
 - “The more that you know, the better engineer you will be!”
- You can bring everything about yourself to your job...
- and you might need it all!



Hans Haug, formerly of DuPont

THE "GUESTS" (FOR THIS TALK)



WHO YOU ARE

YOUR PERSONAL IDENTITY?

- My way!
- The company way



<https://www.youtube.com/watch?v=DAacUTsOjv4>



<https://www.youtube.com/watch?v=NhXSH6fYlvE>

SENSE OF SELF: THE START

- Honesty, integrity, reliability, really are noble traits...
- Embrace them!

Volkswagen to Pay Up to \$14.7 Billion to Settle Diesel-Emissions Claims

The settlement comprises vehicle buybacks or fixes



Volkswagen has settled emissions claims with regulators and owners of about a half million diesel-powered vehicles. The settlement terms were announced Tuesday by environmental regulators. The WSJ's Lee Hawkins explains.



KEY POINT OF “SELF”

- Always have a “mirror” handy!
- In any situation of conflict, first ask: Could I have done something differently? Should I have been better prepared? Is the result my responsibility?

MAXIMIZE YOUR (EFFECTIVE) INTELLECT

- To the extent possible, prepare for meetings and your job function in general ahead of time
- Haug Corollaries:
 - The more that you know, the smarter you will appear!
 - The more that you know about the topic of the moment, the less you will have to figure out on the fly!
- You are smarter than you think... and you may often be smarter than the people around you.
- “I” am also convinced that you increase your real intellectual capacity by “thinking” through complex ideas and figuring out what they really mean
- e.g., Carnot cycle
 - “heat” to work
 - how exactly is this occurring?
 - why is the efficiency a function of the temperatures?
 - could you build the cycle and actually use it for anything?



GENERATE IDEAS

- First key is that you need to know as much as possible the subject, process, system that you are responsible for or involved in
- You need to develop a way that works for you to create new ideas.
 - I like to know how different kinds of people think.
 - I always look for connections between something that I know and something else that is the technical field of interest.
 - I also look at research/technology and specifically at what the innovations were/are.
- Even simple ideas can have significant impact



GENERIC “TOOLS”

- Address any unknown by considering what happens in the limits.
- For any question in the middle of a problem, go back to the overall question.
 - Say, we need to make a profit, what scenario enables this... now, how does the set of objectives for saving on raw materials impact this.
- $\$/\text{yr} = \$/\text{kg} * \text{kg}/\text{yr} = \$/\text{kg} * \rho V_k$

EVERYTHING THAT WE **KNOW** IS NOT CORRECT!

- Some things we thought we knew:
 - Margarine was considered a health food
 - Left-handed people die sooner because of the hazards of the right-handed world.
 - Stomach Ulcers are caused by stress
 - Plants absorb CO₂ and emit O₂
 - The adult brain has no capacity to regenerate itself
 - Komodo Dragons bit their prey and waited for them to succumb to bacterial infections
 - We used to think that there were few or no other “Goldilocks” planets that could support life as we know it.

MUCH OF WHAT IS BEING PUBLISHED IS PROBABLY NOT CORRECT!

Essay

Why Most Published Research Findings Are False

John P.A. Ioannidis

Over half of psychology studies fail reproducibility test

Largest replication study to date casts doubt on many published positive results.

Monya Baker

ESSAY

Why Most Clinical Research Is Not Useful

John P. A. Ioannidis^{1,2*}

Studies show only 10% of published science articles are reproducible. What is happening?

Posted on May 3, 2012 by Moshe Pritsker

Studies show a very low reproducibility for articles published in scientific journals, often as low as 10-30%. Here is a partial list:



PAST, PRESENT AND NOW FUTURE! (HUH?)

A study of about 28,000 expert geopolitical predictions over 20 years found that most were only slightly better than chance, especially when predicting events more than a year off, according to Philip Tetlock, a professor at University of Pennsylvania's Wharton School of Business who studies forecasting.



- Yes, predictions are hard, particularly about the future!

“If you can’t make an accurate forecast, who do you hold accountable for results? It bedevils managers and investors,” says Eric Ries, a management consultant who helps startups and established firms like **General Electric** Co. navigate uncertainty.

- Some people place the ability to assign blame as paramount in an organization!

THE WALL STREET JOURNAL.

BUSINESS | MANAGEMENT | MANAGEMENT & CAREERS

In Uncertain Times, CEOs Lose Faith in Forecasts

From Brexit to rise of Donald Trump, business leaders say recent events have made them wary of expert predictions

YOUR PERSONALITY

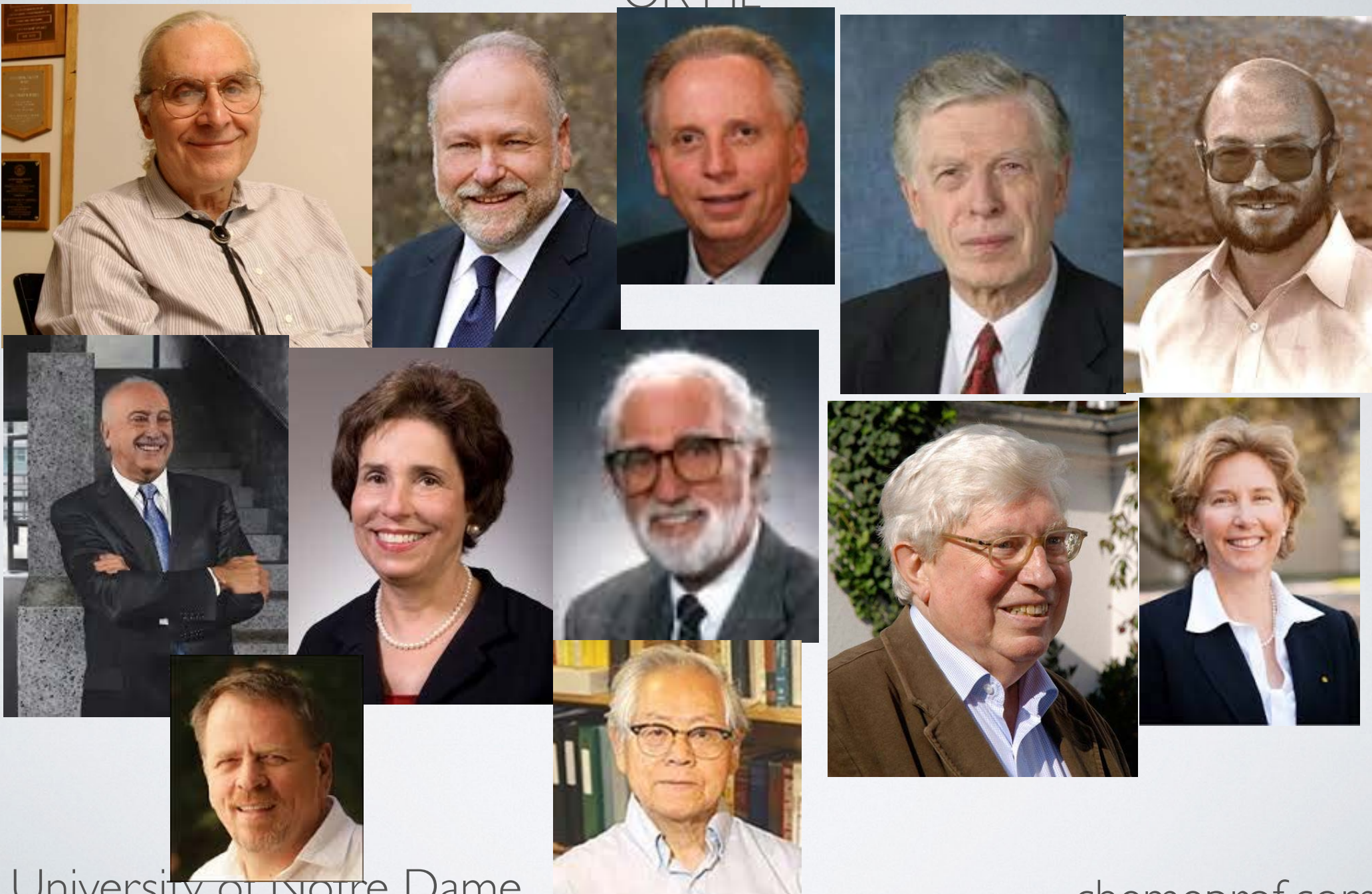
- You might hear the universal advice...
 - Be yourself!
- No, sorry.. “Oh you must be kidding!”
 - Be an energetic, positive, interesting person!
 - When something happens: “get over it!”



PERSONALITY

- Be a good friend, cultivate friends
 - But don't expect friends to do anything illegal, unethical, inconsistent with the rules of the company.
 - Often you just need to listen (in confidence) and agreeing could be great, but you might need to sometimes say:
 - "I hear what you are saying and I understand, but I wonder if it is possible that "X" is not 100% wrong?"
- When you get a chance, do someone a favor...
 - it feels good.... even if they never know!

A SAMPLING OF PEOPLE WHO HAVE DONE FAVORS FOR ND OR ME



University of Notre Dame

chemeprof.com

SKILLS: WHAT YOU CAN DO

“HAVE A TAKE....”



- On both societal issues and the important questions for your company, develop a well thought-out position that you can explain to others.
 - On societal issues this makes you, if nothing else.. an “interesting person”
 - Whatever you do, don’t repeat “talking points” from other people!
- If you observe that in discussions everyone is coming from the same point of view, express the counter:
 - “group-think” and “echo chambers” really are not a good way for organizations to make decisions.
 - Plus, there is a satisfying intellectual challenge to be able to express the counter point, particularly if it is not the position you would be inclined to back!
- It is also extremely valuable to be the one person in the room who can articulate a path to success in the face of significant difficulty.

COMMUNICATION

- In writing or speaking:
 - Get to the point!
- You wish to be “nice”, but also be focused and respectful of other people’s time!
- You may need to practice you skills for crafting a persuasive case — it is essential to have the facts on your side but you also need clarity (moral high ground is also nice).
 - I have always thought if I could make a really good case, this suggested action would be the one selected by the group (or “boss”).
- Even better if you can do this extemporaneously in conversation or at meetings.
- If you can’t state the main ideas clearly, you may come across as “evasive” which might be admirable for a politician but is not acceptable for an engineer.



James N. Tilton DuPont, UD

NOT AN ENGINEER.... FOR SURE!

"As a law professor, I don't think I've ever read an unambiguous statute," he said. "That's just the limits of human language. All policy requires some ambiguity and some discretion. If a person feels as though a law-enforcement officer has violated their First Amendment right, I suppose they can go to court, but we try to keep things from escalating to that level."

- Sorry, but no!

INTERACTIVE COMMUNICATION

- email: In many organizations, this is the main mode of communication. You will need to become good at efficient writing that makes exactly the point you want.
 - A particular challenge is to arrange wording such that a contentious issue can be discussed without causing personal ire or uncomfortableness.
- You have to accept that this is time-consuming. But the value is that you have a chance, perhaps at your best timing, to express exactly what you want to say.

OPPORTUNITIES

- The current “style” in good management practice is that your supervisor will be looking out for your career advancement and gradually assign you increased responsibilities
 - The idea is that employee development is important to the health of the organization and may not happen efficiently without some forcing
- As could be said...
 - “Yes, but....”

AT SOME POINT, AN OPPORTUNITY
WILL PRESENT ITSELF: GRAB IT!



<https://www.youtube.com/watch?v=Lambljkkamg>

IF ITS YOURS: OWN IT!

- Whatever you “produce” or advise or direct, take (personal) responsibility
 - know everything possible about it!
- This includes the “process” and the people who go with it.
- If change is needed, seek to make this as efficient and painless as possible.
 - from your ideas and the ideas of others, what alternatives exist for all/any of the functions and tasks?

"You need to take care of your peeps"

Bill Witsken
Local businessman



IF ITS YOUR RESPONSIBILITY...

- You need to do what is “right”!
- <https://www.youtube.com/watch?v=cq9AogwLvow>

IN THE MEAN TIME: IF YOU HAVE A PROBLEM WITH YOUR BOSS!

- <https://www.youtube.com/watch?v=ZQ11Ws3tqP0>
- (thanks to Dave McCready)!



SELF AWARENESS COMPARED TO OTHERS

- Cr number
 - ratio of how smart you are to how smart you think you are
- Ch number
 - ratio of how smart you are to how smart you would have to be for us to put up with you
- “TO” number:
 - Ratio of how good you are to how good you would have to be for us to keep you on the team!
- Don't be high maintenance!

ROLE MODELS

- My background is such that I never needed to see an example of what I wanted to do to prove I could do it.
- However I always considered that various traits or views of other people could be useful to consider adopting.

SUMMARY

- Make yourself into a better *person*... pick good characteristics.
- Maximize your intellectual prowess.
 - Learn as much as possible — think about interesting, deep concepts
- Generate ideas and be able to effectively express them orally and in written form.
 - “Trust me”... we don’t know everything!
- By observing others, (and reflecting), learn how to effectively relate to coworkers, bosses and subordinates
- Grab opportunities as they arise and take responsibility for your “gig”!

STAR — COMMON MAN



- <https://www.youtube.com/watch?v=C3Oa2tLrWqY>

DIMENSIONLESS CHINESE PROVERB

$$Cr \equiv \frac{\textit{How Smart You Are}}{\textit{How Smart You Think You Are}}$$

- He who knows not and knows he knows not is a child, teach him, $Cr \sim 1$
- He who knows not and knows not he knows not is a fool, shun him, $Cr \ll 1$
- He who knows and knows not he knows is asleep, awaken him, $Cr \gg 1$
- He who knows and knows he knows is wise, follow him $Cr \sim 1$