

Mission 2018

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My background

- Mentor for several Mission Classes (Floods, Fish, SW Water, Air, Food, Biodiversity, Rare Earths)
- MIT SB/SM Course 2
- Engineering Consultant (Primarily in energy/power production)
- Mission Cheerleader
- Why do I do this?

Mission Problem vs. Classical Problems

- Classical: Often well defined, deterministic or close. Needed input is clear. Final solution is quantifiable and usually verifiable.
- Mission: Often open ended, underdefined, nondeterministic, not quantifiably verifiable. Often long time scale.

Mentors

- The alumni mentor group is like a consulting company for Mission teams
- A lot of experience, not necessarily in topic
- Eager to help, but don't know "the answer"
- Hoping to be asked to play

How mentors can help

- Critique logic of teams
 - Suggestions in the context of experience
 - Listen to ideas
 - Sanity checks
-
- But: we are not usually subject matter experts
 - We shouldn't be proof readers
 - We can't do the project. You will (already!) know a lot more than we do.

Working with Consultants

- Consultants are usually experts in some narrow area.
- Their job is to answer questions or advise
- Effectiveness depends on how well questions are asked
- Consultants should listen before answering
- Should avoid giving you the answer you want to hear, instead of best judgment

Mission “Life Cycle” (my perception)

- September 1-15: Class and topic introduction, team formation
 - (They haven’t told me how to do this, but I’m sure they will soon.)
 - Remote view: Lectures, resources posted. Not much communication with class.
- September 16-30: Team meetings, Mini-project assignment, Library and other resources
 - (So, team, what are we supposed to do? Let’s make some task assignments.)
 - Remote view: Some teams post and talk a lot.

Look familiar?



Life Cycle (cont.)

- October 1-31: Complete mini-project, web design
 - (Post more stuff on wiki. 8.01 problem sets are killing me. Better focus on that. I don't actually have to do the Mission stuff today.)
 - Remote view: Things get really quiet on e-mail.

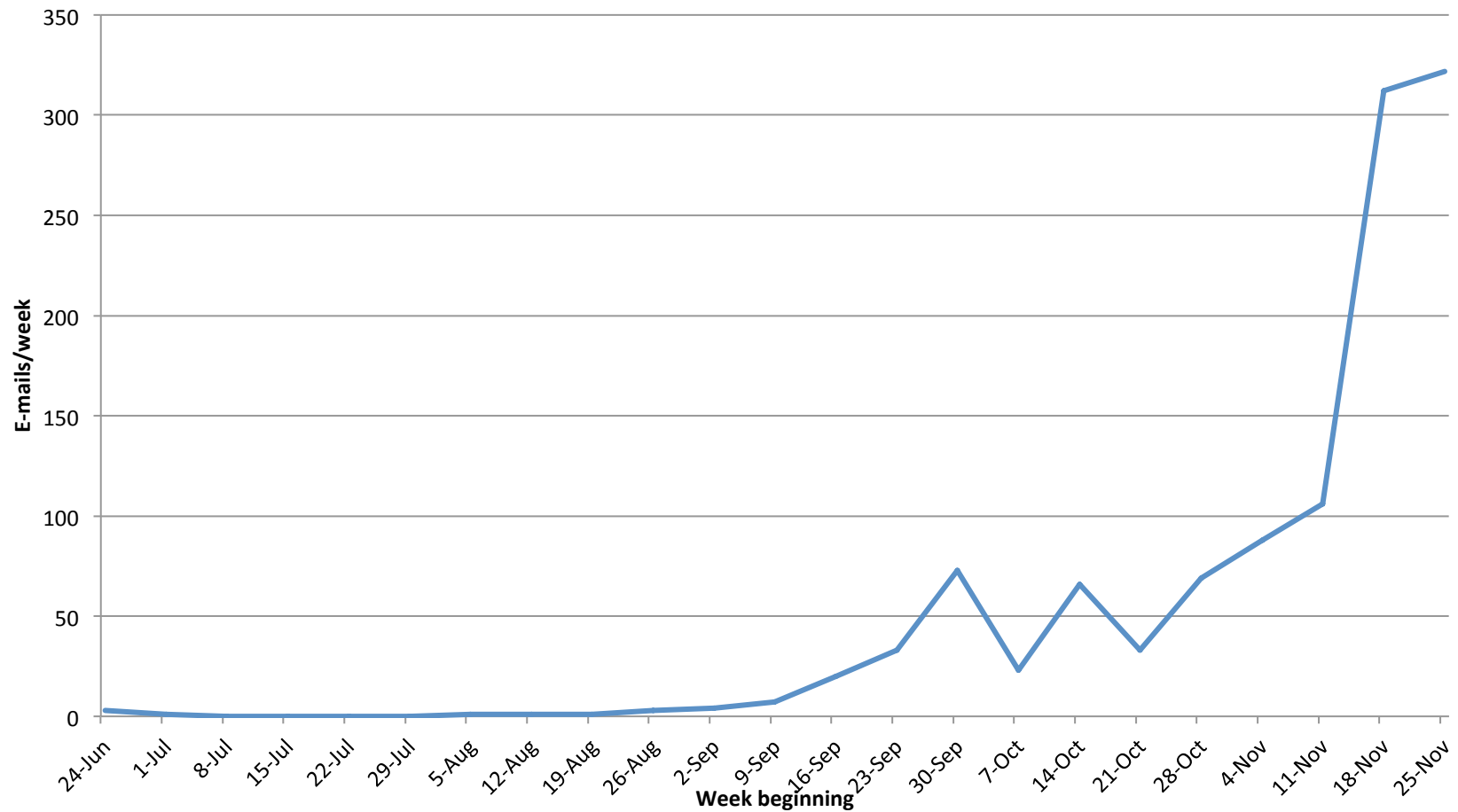
Life Cycle

- November 1-8: Your final presentation is in a month. Your website is due before Thanksgiving.
 - (Class and team leaders: Please get your input in, we're trying to pull things together.)
 - Remote view : Some drafts are sent for review. Increasing e-mail traffic, sense of looming panic.

Life Cycle

- November 9-18: “It’s 2 am, we’re working in the Terrascope room, and we have FOOD. Please join us!”
- “We need your input NOW”
 - (What? In TWO WEEKS? AAARGH)
 - Remote View: Increasing panic. Team leaders and UTFs try to encourage and gently motivate (or butt kick). Intense e-mail traffic

Mission 2016 Activity (e-mails per week)



Life Cycle

- November 19-30: Thanksgiving Break
 - “We are going to be working non-stop over this whole break to get website and PowerPoint drafted and revised, and we STILL don’t have input from these people. We have Food and BROWNIES in Terrascope. *PLEASE COME HELP!*”
 - Remote View : E-mail at 2 am: “I’m sorry to bother you, but would you please review this? We’re trying to get it done before morning”

Life Cycle

- Presentation week: “Rehearsals and Q&A sessions tonight and tomorrow, until we’re done.”
 - “Guys, wear shoes AND socks – not white”.
 - “Girls, if you’re wearing heels, practice walking in them”
 - Remote view: What’s the webcast address?

Life Cycle

- The presentation was brilliant. Thunderous applause. (That never happens with an 8.01 P-set)
- Faculty and UTFs are actually smiling.
- Remote view: Like watching the Super Bowl, for mentors and other Mission groupies. Pass the wine.
- **What? Finals are in 10 days?**

Oh, Dam!



Suggestions

- Start defining your problem early. Build a time line by working backwards. Stick to it. (EXAMPLE)
- What pieces are essential to a solution?
- How will you know when your solution is complete?
- Each person is part of a chain of activities. If you delay your part, you delay the people “downstream”. Everyone is on critical path.

Build on individual work



Suggestions 2

- Use October well: That tends to be lower activity
- Call for help when you need it: Team, Class, UTFs, Mentors
- Help out with things other than your own assignments.

Suggestions 3

- Think about the life cycle of whatever you are studying
 - Example: How long does it take to design, license build a nuclear plant? How long does it last?
- Think about developing a systematic structure
- Validate your results as well as you can
- Consider opposing viewpoints.
- Recognize Biases

There's more than one viewpoint



Suggestions 4: Presentation

- The Expert Panel are, well, EXPERTS.
 - Don't BS
 - “I don't know” is sometimes the right answer
- During a presentation, try never to say the words:
 - “I know you can't read this slide, but...”
- Avoid using all of the whiz-bang that PowerPoint allows

Caution 1: Data

- You'll know a lot about the topic as a group.
- Each person and group will be an expert on some piece.
- INTEGRATE and SYSTEMATIZE: The final project is not a huge data dump from everyone.
- It's more about defining a process than about the immensity of unconnected data.

Caution 2: Numbers

- Understand and validate any numbers you use, where they come from, and what they mean
- Your audience are mostly technical types. They LIKE numbers. If you state a number that doesn't make sense, they will jump all over that.
- DO a critical sanity check.

Numbers - Example

- During the typical Mission Fall Term, over 3×10^{14} Brownies are consumed
(Ridiculous? Yes. Have we seen similar claims? Also yes.)

Caution 3: References

- Be very critical of what references you cite: we (your audience) will.
- Having a statement in print, or on the internet or even in Wikipedia doesn't make it true.
- A single source doesn't prove anything. Is your information broadly supported?
- Pedigree of sources: How published? Credible source? Peer reviewed?

Some useful nuclear references

- Nuclear Regulatory Commission: www.nrc.gov
- Nuclear Energy Institute: www.nei.org
- International Atomic Energy Agency:
www.iaea.org

Caution 4: Understand Biases

- ALL sources are biased.
- A biased source doesn't make it an unusable source
- Know your own biases
- Look for hidden agendas
- Try for objectivity: Compare sources with different viewpoints

Example: My Biases (A few)

- I've "engineered" in the nuclear industry for nearly 40 years
- I work on industry committees with international consensus participation
- I've been trained to challenge critically
- My nuclear career has put my children through college
- I went to MIT - Twice

Caution 5: Care for your team

- Recognize your own constraints
(Commitments, schedule, state of mind)
- Acknowledge the constraints of others
- Be sensitive to the condition (physical, mental, emotional) of yourself and others
- Let people know early if something is going on that affects you or the team
- RECREATE!


Finally

- Enjoy this process.
- This thought process, though frustrating, undefined, intense, will develop abilities that will be valuable through your academic and professional careers
- After you survive, put a bullet on your resume about the mission effort. I hire people. I look for the kinds of abilities you are developing. Others do too.

This can be fun!



Today's Nuclear Power Plant Status

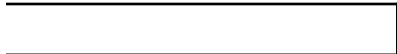


| Unit | Power |
|---------------------|-------|
| Beaver Valley 1 | 100 |
| Beaver Valley 2 | 100 |
| Calvert Cliffs 1 | 100 |
| Calvert Cliffs 2 | 100 |
| FitzPatrick | 0 |
| Ginna | 100 |
| Hope Creek 1 | 100 |
| Indian Point 2 | 100 |
| Indian Point 3 | 100 |
| Limerick 1 | 100 |
| Limerick 2 | 100 |
| Millstone 2 | 100 |
| Millstone 3 | 100 |
| Nine Mile Point 1 | 100 |
| Nine Mile Point 2 | 100 |
| Oyster Creek | 0 |
| Peach Bottom 2 | 93 |
| Peach Bottom 3 | 100 |
| Pilgrim 1 | 100 |
| Salem 1 | 100 |
| Salem 2 | 100 |
| Seabrook 1 | 100 |
| Susquehanna 1 | 100 |
| Susquehanna 2 | 100 |
| Three Mile Island 1 | 100 |
| Vermont Yankee | 96 |

| Unit | Power |
|----------------|-------|
| Browns Ferry 1 | 84 |
| Browns Ferry 2 | 100 |
| Browns Ferry 3 | 100 |
| Brunswick 1 | 100 |
| Brunswick 2 | 100 |
| Catawba 1 | 100 |
| Catawba 2 | 100 |
| Farley 1 | 100 |
| Farley 2 | 96 |
| Harris 1 | 100 |
| Hatch 1 | 100 |
| Hatch 2 | 100 |
| McGuire 1 | 0 |
| McGuire 2 | 100 |
| North Anna 1 | 100 |
| North Anna 2 | 0 |
| Oconee 1 | 100 |
| Oconee 2 | 100 |
| Oconee 3 | 100 |
| Robinson 2 | 100 |
| Saint Lucie 1 | 100 |
| Saint Lucie 2 | 100 |
| Sequoyah 1 | 100 |
| Sequoyah 2 | 100 |
| Summer | 100 |
| Surry 1 | 100 |
| Surry 2 | 100 |
| Turkey Point 3 | 100 |
| Turkey Point 4 | 0 |
| Vogtle 1 | 100 |
| Vogtle 2 | 0 |
| Watts Bar 1 | 100 |



| Unit | Power |
|------------------|-------|
| Braidwood 1 | 100 |
| Braidwood 2 | 100 |
| Byron 1 | 100 |
| Byron 2 | 0 |
| Clinton | 98 |
| D.C. Cook 1 | 0 |
| D.C. Cook 2 | 100 |
| Davis-Besse | 100 |
| Dresden 2 | 100 |
| Dresden 3 | 93 |
| Duane Arnold | 87 |
| Fermi 2 | 100 |
| La Salle 1 | 100 |
| La Salle 2 | 100 |
| Monticello | 63 |
| Palisades | 100 |
| Perry 1 | 100 |
| Point Beach 1 | 100 |
| Point Beach 2 | 100 |
| Prairie Island 1 | 100 |
| Prairie Island 2 | 100 |
| Quad Cities 1 | 100 |
| Quad Cities 2 | 100 |



| Unit | Power |
|-----------------------------|-------|
| Arkansas Nuclear 1 | 100 |
| Arkansas Nuclear 2 | 100 |
| Callaway | 100 |
| Columbia Generating Station | 100 |
| Comanche Peak 1 | 100 |
| Comanche Peak 2 | 100 |
| Cooper | 0 |
| Diablo Canyon 1 | 100 |
| Diablo Canyon 2 | 100 |
| Fort Calhoun | 100 |
| Grand Gulf 1 | 100 |
| Palo Verde 1 | 100 |
| Palo Verde 2 | 100 |
| Palo Verde 3 | 100 |
| River Bend 1 | 100 |
| South Texas 1 | 100 |
| South Texas 2 | 100 |
| Waterford 3 | 100 |
| Wolf Creek 1 | 100 |