



ОТКРЫТЫЙ УНИВЕРСИТЕТ  
Сколково

MIT Skoltech Initiative

ГЕНЕРАЦИЯ  
ИДЕЙ

ИДЕИ, ЗАСЛУЖИВАЮЩИЕ ВНИМАНИЯ:  
**НАВЫКИ КОМАНДНОЙ РАБОТЫ  
В БЫСТРОРАЗВИВАЮЩИХСЯ ПРОЕКТАХ**

**23 ОКТЯБРЯ**  
**НАЧАЛО В 19:00**

**ДЖЕННИФЕР КРЭЙГ**

ПРЕПОДАВАТЕЛЬ  
МАССАЧУСЕТСКОГО ТЕХНОЛОГИЧЕСКОГО ИНСТИТУТА

**ЦЕНТРАЛЬНЫЙ ДОМ  
ПРЕДПРИНИМАТЕЛЯ**

Ул. Покровка, 47/24 стр.1 (м. Курская / м. Красные ворота)



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October 23, 2013



Flight Vehicle Engineering students and two UAVs, designed and built in the course

## **Ideas worth sharing:** Helping Students Learn Team Skills in Fast-paced Projects

**Five (5) team skills that we expect our students in  
the Department of Aeronautics and Astronautics at  
MIT to practice**



## My plan for our time together

Why the Department of Aeronautics and Astronautics helps students learn team skills

What are the key skills we focus on: decision-making, conflict management, project management, interpersonal behavior, and oral communication

How we do it and how you could transfer these skills to your own classroom or your work

Discussion and questions



MIT students testing software in a microgravity environment.



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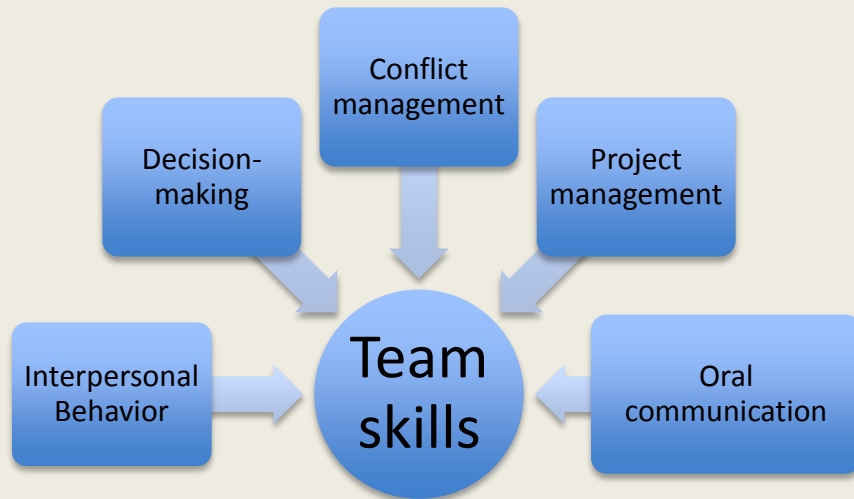
"Teamwork is the ability to work together toward a common vision. . . It is the fuel that allows common people to attain uncommon results."

Andrew Carnegie

- **Why** do we expect our students to learn and to practice team skills?
  - Technical projects are complex and multi-disciplinary.
    - No one person can be the expert in all facets of a project.
  - Projects are often international or distributed.
    - No one can be everywhere!
  - Poor team skills waste time and contribute to poor results.

# What skills do we focus on? How do we help students strengthen them?

We focus on skills that students have told us are important.



- We teach concepts in project-based courses in short modules.
  - In this presentation, modules are combined.
- We give students opportunities for practice.
- We give constructive feedback.
- We model what we teach.

# A skill develops when it is integrated into experience and then practiced with feedback from mentors.

- With behavioral skills,
  - First, we have to become aware of the skill.
  - Then, we have to assess our ability.
  - Then, we can begin to shape and practice that skill.
- Skills that are practiced become stronger.
  - This is why we actively shape students' skills. We don't want them to practice 'bad' team habits.



[http://mindblogs.smartandstrong.com/davide/assets\\_c/2010/05/Thinking-597.html](http://mindblogs.smartandstrong.com/davide/assets_c/2010/05/Thinking-597.html)

I invite you to apply these concepts to your own experience in teams!

- If you are a professor, think about how you already teach these skills to students.
  - What team skills do they need?
  - Think about your own use of team skills.
- If you are a student, think about how you use team skills in a course, a project, or in other work.

# Positive team dynamics result from specific skills, not from luck.

- What skills produce positive results?
- Let's reflect for a moment on your experience
  - Think about a successful team on which you felt respected and necessary.
    - What dynamic produced that feeling?
  - Then, can you think of a time when you did not feel connected to a team.
    - Again, what dynamic produced that feeling?





# #1. Interpersonal skills are the foundation of team skills.

- Strong interpersonal skills help develop mutuality.
  - A strong sense of respect for the work of others.
  - A sense that we are working on a task that we could not accomplish alone.
- Mutuality is correlated with high-functioning teams.
  - Teams without mutuality often struggle to succeed.

In our research, students identified these interpersonal skills as important.

- Courteous, professional language
- Active listening
- Receiving and giving constructive feedback
- Being honest, ethical, and reliable

# The way we speak with one another helps build mutuality.

- When we are under pressure, we sometimes speak abruptly or harshly.
  - Email can make this worse!
- Courteous, professional language is constructive while still being honest and direct.



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*“...sometimes it's the smallest things that end up making the biggest difference.” Marissa Burt*

# Active listening shows respect for our peer and improves our understanding.

- How do we pay attention?
  - Are we multi-tasking? On our ‘screens’?
- How do we show that we’re listening?
  - Make eye contact. Use body language to show understanding.
- Try not to interrupt.
  - The speaker needs your feedback. But wait until you understand completely.



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# Giving constructive feedback is essential.

- But how do we do that?
  - Avoid judgment and focus on specifics
  - Focus on project objectives
  - Use evidence to support suggestions or observations
- For example. . .
  - You might say to a teammate, *I understand the technical decision that you made—and it may be the right one---but the analysis you show is not clear to me.*



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# Receiving feedback is also a skill.

- Most of us don't enjoy criticism or evaluation of our work even when it is constructive and well-meant.
- Receiving constructive feedback involves active listening.
  - Focus on the comments.
  - Restrain ourselves from responding until we understand.
  - Value that feedback as a way to improve work on the project.

# Being honest, ethical, and reliable builds trust and shows leadership.

- Honesty, ethical behavior, and reliability build mutuality on a team.
  - Challenging to be honest in a constructive way.
  - Sometimes a challenge to behave ethically.
  - Challenging to do what we say we will do.
- The behaviors are the foundation of trust and part of the way in which we lead.
  - Once this trust is broken, it is difficult to repair.



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# Example: Short case study helps students discuss concept

- We lecture very little about teamwork.
- But we DO ask students to problem-solve in small groups.
- These discussions allow faculty to contribute but the students lead the discussion.
- James is always 10 minutes late to team meetings. Because of this, he misses the part of the discussion. His teammates try to summarize what has gone on, but they are not happy about this.
- What might be the consequences of James' late behavior?
- How could his team deal with this behavior?
- Should the professor take action?

## #2. Effective decision-making requires strong interpersonal skills.

- Let's pause again to reflect on decision-making as you see it practiced in teams.
- Thinking of teams that you work in,
  - How are decisions made?
  - How did your team arrive at that model?
  - Do you think this process is effective? Not effective?



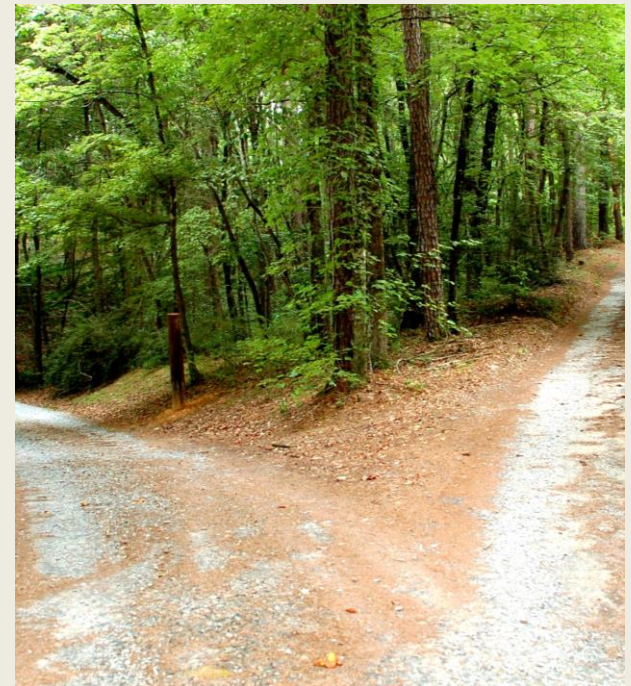
# Ineffective decisions have a long lasting effect on a team.

- Poorly made or unclear decisions can
  - Be the source of team conflict
  - Waste team members' time
  - Slow down the progress of a project.
  - Or result in project failure.
- But what does it take to make an effective, clear decision that nearly everyone supports?



# Decision-making is a 'trade' between options.

- What we have to consider:
  - How important is the decision?
  - How much time is available to make the decision?
  - What is the best method to make the decision
  - Who should be involved?



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# Often, we transfer our own style into team decision-making.

- Do you tend toward the fast, intuitive style?
- Are you more methodical?
- Do you take a long time to decide on something?
- Prefer to be quiet and let others decide for you?
  
- What is your style and does it work in a team context?



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# How to choose the effective method for a decision?

- Individual decision?
  - The method can work when the decision must be made quickly or it is not very important.
    - This method can cause many problems on a team.
- Minority control?
  - When a decision is based on expert knowledge, then those who are knowledgeable have more influence.

# How to choose the effective method for a decision?

- Majority control?
  - When the decision is not based on expert knowledge, then the majority of team members have more influence.
    - Many process decisions are made with this method after there has been thorough discussion.
- Consensus?
  - This method works well to engage as many team members as possible.
    - It doesn't always mean 100% agreement, but it means that nearly all team members can accept the choice.

# Example: Short case study to help anchor concept

A team of students is designing a space satellite.

- The Structures team wants the most aerodynamic shape so as to minimize the demands on power and propulsion.
- However, Jenny is the head of the Avionics subsystem. She knows that the avionics package requires X amount of physical space, and it must be in a certain location to reduce the amount of wiring.
- She insists on a design, but that design will reduce aerodynamic efficiency and increase demand on power and propulsion.



# Discussion questions for the decision-making exercise

- How important is this decision ?
- Should the Structures team have the most control in this decision?
- Should Jenny as the lead of the Avionics subsystem team have more control?
- What about Power and Propulsion? What effect does their “expert” opinion have on the decision?
- How much time do you think is required to make this decision? Who else should be involved?

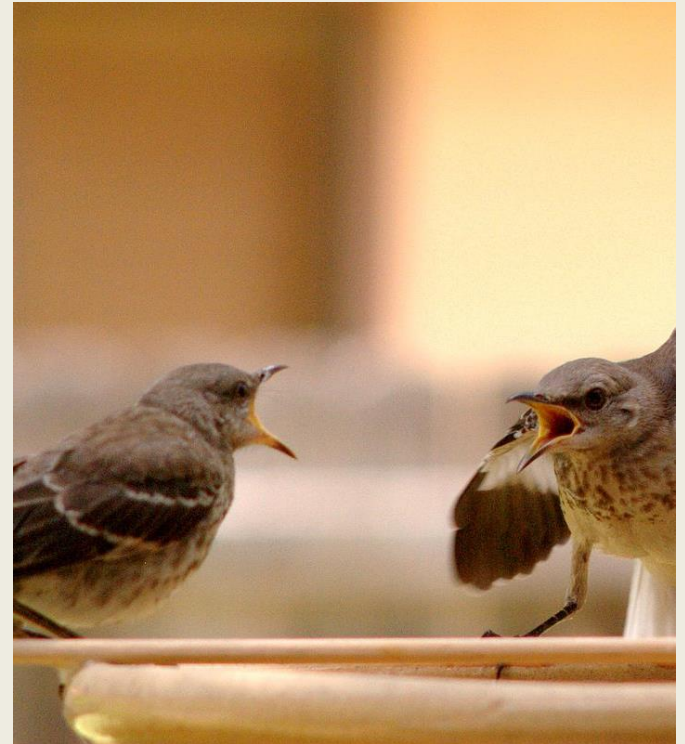
# #3. Decisions often lead to conflict.

- Conflict is unavoidable, and we have all learned ways to manage it.
  - Taught by our parents and teachers
  - Influenced by mentors
  - Learned by painful experience
- What do you do and how does it work for you?



# All teams have conflict; the problem is conflict that is not managed well.

- Conflict has a wide range.
  - Creative or constructive conflict can add value.
- A strong team is that a team that knows how to manage and resolve that conflict and move forward.
  - Requires effective interpersonal skills and communication skills.



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# Conflict management is a 'trade.'

- Conflict management is not just about your personal style; it's a set of decisions.
- In effective conflict management, we consider
  - the importance of the relationship with the person or people
  - the goal of the work
  - how much time is available for this work.
- Based on our assessment, we then decide on the appropriate method.

# Common methods for managing conflict

- Withdrawing from, ignoring, or smoothing over the conflict
  - Effective when the relationship is important and the source of the conflict is not so important
- Forcing or confronting
  - Effective when the source of the conflict is important and the relationship with others is less important.
- Compromising or negotiating.
  - Effective when both the relationship and the source of the conflict are important.



# Example: Short case study in conflict management

- A team is working on a design project, but Robert is absent. He has gone to New Zealand to participate in a electric car competition. He'll be gone for 10 days just as they are trying to prototype their concepts.
- Moreover, Robert did not discuss this with them; he just left campus and then sent an email.
- After 10 days, Robert appeared in class again.
- The team members are still annoyed with him. He will get the same grade that they get on the project, but he did less work.
- What are some of the ways that the team might manage this conflict?

## #4. Active project management makes a team more effective and efficient.

- When work is actively managed, teams
  - Have enough time to make clear, strong decisions.
  - Divide work among teammates effectively.
  - Have enough time to integrate work of various members at end of project.
  - Know what decisions have been made and why.
- In fast-paced projects, management of time and work is essential.

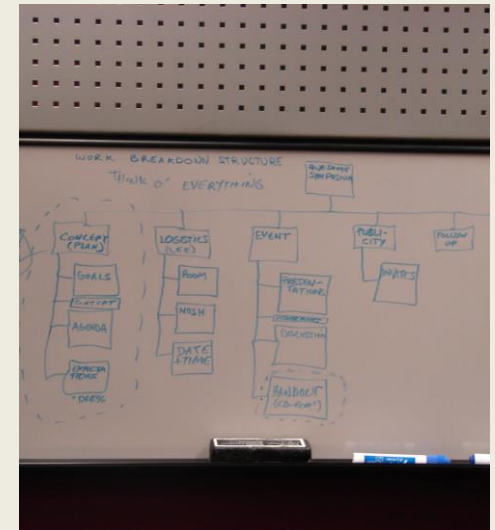
# Project management skills are tied to decision-making and conflict management.

- We all have some project management skills.
  - Which skills work for you? Which ones don't?
- Focus on key skills: task identification, work division, scheduling, documentation



# Task identification and work division are skills that we can use individually or on a team.

- Identify individual tasks and understanding the sequence of those tasks.
- Know what skills are necessary to complete that task.
- Divide the work by assigning the right amount of work to the person who has the skills (or can learn them quickly).



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# Effective teams know how to schedule work.

- Estimate the time each task will take.
- Decide whether the tasks must be done sequentially or perhaps they can be done in parallel.
- Include buffer time to account for delays or unforeseen problems.
- At the end, schedule enough time for the different tasks to be integrated.

# Effective teams document their work.

- There are many decisions to be documented.
  - Work distribution
  - Schedule
  - Decisions
- Documentation methods can vary, but the source should be accessible to the whole team.
  - What methods work well for you?

# Short active learning exercise to learn project management skills

- We might ask students to identify the tasks involved in the next stage of work and estimate the time necessary to do those tasks, and then schedule those tasks.
- We review their lab notebooks every 4 weeks.
- We might ask them what project management techniques they use in their meetings with their project advisor.



# #5. Oral communication skills help all team processes.

- In teamwork, we must be able to communicate effectively in informal, interactive situations.
  - Informal briefings, bench reviews, oral progress reports
- Think about how often you use these informal oral communication skills.
  - How are those skills different than formal presentation skills?
  - How do you prepare?
  - Do you find it stressful?



# Strong informal oral communication is based on focus, critical thinking, and organization.

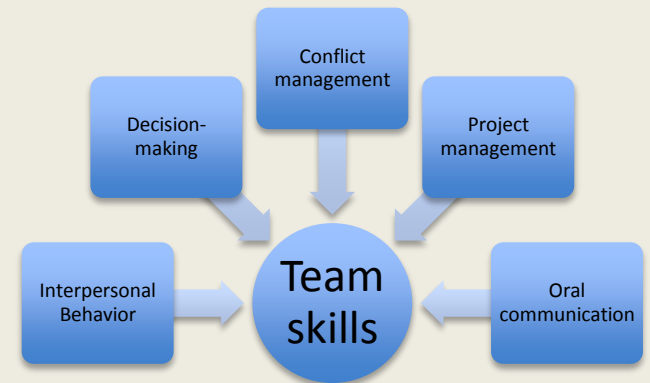
- We have to be ready to explain our work to someone!
  - Understand our listeners and their objectives.
  - Understand our own purpose in speaking.
  - Understand the material well and be informed about current status of project.
  - Organize our thoughts in a clear, coherent manner.

# Active learning exercises that help students practice informal oral communication

- We lead workshops IN class; students teams brief the class about various aspects of their project.
- Students lead team meetings twice each term.
- Students brief their project advisor weekly.

What is our objective? to develop strong, confident engineers who can work effectively and efficiently in teams.

- Their confidence comes from repeated experience in various contexts.
- We create multiple opportunities for practice and for feedback.
- Through students' hard work and our mentoring, we achieve our objectives.



# Thank you for your time!



# Contact information

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