Successful Virtual Design Team Formation and Collaboration

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Movie of Scott yelling "Yahoo!" and or pictures of teams holding UAV's
AersosPACE 2013-2014

- Blended Wing Body
- Identify diseased crops
- Easy to operate

Mission Altitude 100’ – 1000’ AGL
Mission Area (60 acres)
Launch & Recovery (100’ x 100’)
Loiter (15 min)
Cruise (1 mile)
Cruise (1 mile)

http://modernfarmer.com/2014/01/precision-hawk/
“Raw Materials”

34 students  4 Universities  3 time-zones

1 Request for Proposals

‘Demonstrate a blended-wing-body (BWB) unmanned aerial vehicle (UAV) to assist farmers in identifying diseased and other crops to conserve water and increase crop yields to help feed a growing population, especially in third world countries.’
Other Collaboration Tools

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http://corpu.com/
http://excursives.files.wordpress.com/2011/05/logo2.gif
http://canadianoutages.com/status/webex
http://commons.wikimedia.org/wiki/File:Google_Drive_Logo.svg
Video of NXC demo
NXConnect: Basic Architecture
Proposed Advantages of Multi-User Design

- Enhance awareness
- Help catch mistakes sooner
- Reduce design time
- Enhance collaborative problem-solving
- Shorten feedback loops
- Enhance mentoring
Multi-User Design: Lessons Learned

• Training is essential to tool adoption
• Importance of communication
How to Form the Teams?

How to group 34 students?
• Common Approaches
  • Mostly ad-hoc
  • Hierarchical
  • Draft or other

• Proposed Approach
  • “Intelligent” team formation
Hypothesis: A given team will be more successful if its members are selected in a way which tends to maximize the characteristics desired for that team’s work.
What to Measure?

Team Members:
- Social Skill
- Technical Skill
- Motivation
- Leadership
- Logistics

Access to Tools

http://sweetclipart.com/multisite/sweetclipart/files/check_mark_green.png
How to Measure it?

Possible Methods:
- Self-reporting surveys
- Tests
- Peer Evaluation
- Observation

http://www.qualtrics.com/wp-content/uploads/2013/05/q_logo_vertical.png
Teams and IPT Organization Strategies:

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All Students

Team 1
- Structures IPT
- Aero IPT
- Controls IPT
- Etc.

Team 2
- Structures IPT
- Aero IPT
- Controls IPT
- Etc.

Team 3
- Structures IPT
- Aero IPT
- Controls IPT
- Etc.

Made as similar as possible

Hierarchical

“Intelligent”

Ad-hoc
Other Team Formation Guidelines

• Each team must have:
  • A “core” group of 6 students from one university
  • The same number of graduate students on each team
  • At least one girl on each team
  • Include at least 3 of the 4 universities on each team
  • Avoid having only one student on a team from one university
  • At least one “expert” in each critical technical area
  • At least a couple leaders on each team
  • As even as possible distribution of the fundamental skills among the teams
Examples:

- Technical
  - “Rate your abilities (1-5) in the following CAD skills…”
  - “How much experience have you had with rapid prototyping?”
- Social
  - “How do you feel about working in teams?” (1-5)
- Motivation
  - “Why did you decide to take this class?”

http://commons.wikimedia.org/wiki/File:Microsoft_Excel_2013_logo.svg
Forming the Teams

Teams Compared

<table>
<thead>
<tr>
<th>Team #</th>
<th>Score</th>
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<tbody>
<tr>
<td>1</td>
<td>60.0%</td>
</tr>
<tr>
<td>2</td>
<td>40.0%</td>
</tr>
<tr>
<td>3</td>
<td>50.0%</td>
</tr>
</tbody>
</table>

- motivation
- Social
- Technical
- CFD
Measuring Success

• What is success?
  • Achieving Technical Objectives
  • Satisfaction With Team

• Team 2: First team to fly working UAV
## Measuring Success: Statistical Analysis

### Oneway Analysis of Average Satisfaction By Team 

<table>
<thead>
<tr>
<th>Team</th>
<th>Team</th>
<th>p-Value</th>
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<tbody>
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Future Work

• Continue studying multi-user design teams in variety of situations, including in industry
• Refine team formation measurement criteria and methods
• Apply team formation method in other situations
• Identify other teaming factors
Questions?

Thank You!