UND Lunabotics

Prof. Jeremiah Neubert

University of North Dakota
Reasons for the UND Lunabotics Program

• Create undergraduate interest in robotics

• Generate graduate students with the skills needed for robotics research

• Form working relationship between NASA and the UND Robotics and Intelligent Systems Lab
Funding for the Competition

- $4000 NASA
- $6000 North Dakota Space Grant
- $5000 UND
- $5000 Private funds
Lunabot 2010
What Went Wrong in Year One?

- Electrical system lacked robustness
- Failure to adequately test system
- Did not understand regolith
- Design is not robust to regolith intrusion
- Overly complicated regolith collection and deposit mechanism
Objectives of Year Two

• Keep it simple
  – Minimize moving parts
  – Limit risk of failure
  – Reuse good best designed components from 2010

• Collect 150kg of regolith in 15 minutes

• Cost under $5000

• Less than 170 pounds
Designing the Robot

- Research the problem
  - Mining
  - Regolith
- Get input from all members
- Form consensus on final design
- Limit design changes
Allow Failure

• This is not the mentor’s project
  – Inquiry based learning
  – Force students to defend choices
    “Engineering is not random”

• Project ownership

• Let them make bad choices
  – We learn from failure
Final Design
Major Improvements/Obstacles Overcome

- Electrical system self-resets
- Componentized robot (system of systems)
- Improved mining technique
  - Limited areas for dust intrusion
  - Reduced number of moving parts
  - One system for digging and dumping
- Wheel design optimized
- Increased feedback from robot
Testing

- Leave about six weeks for testing
- Simulate conditions of competition
- Identify flaws in design
- Identify and implement solutions
- Repeat
Outreach

• Mentored FIRST robotics team
• Conducted week long class with first graders
• Presented at the state science fair
• Appeared in homecoming parade
Outreach
Arrival at the Competition

Four students, one robot, 1,886 miles, 32 hours
The Competition
The Competition
The Competition
Disaster
Result of Mining Competition

174 kg
Results

- Joe Cosmo Award for Excellence
  - $1500 to travel to Desert R.A.T.S.
  - Two NASA internships
  - Tickets to see final shuttle launch

- 2\textsuperscript{nd} in Mining ($2500)
- 2\textsuperscript{nd} Outreach
- 2\textsuperscript{nd} Sportmanship
Fun After the Competition
Alumni Guided Tour
Shuttle Launch
Desert R.A.T.S.
Secretes to Mentor Success

• Read competition rules
• Defining clear objectives
• Breaking big problems into small solvable pieces
• Recognizing challenges
Questions?
Allow Failure

• This is not the mentor’s project
• Direct students thinking through questions
• Force students to defend choices
  – Engineering is not random
• Let them make bad choices
  – We learn from failure
  – Project ownership
• Become involved only when absolutely necessary
Making a Diverse Team Work

• Recognize others’ contributions
• Good communication
  – Frequent meeting
  – Common workspace
• Put personal agendas aside
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