Design of a Rain Simulator for Compact Utility Tractors

Overview
John Deere needed a rain simulator to test their compact utility tractors in Augusta, Georgia. Their previous set-ups could only test individual components, leading to the possibility of unexpected water intrusion.

Objectives
Our sponsor’s initial requirements for a rain simulator were:
- 0-6 inches/hour of rain (+/- 1 inch/hour)
- Can mimic 0-30 mph wind
- 0-45° angle of rainfall
- Filter and recycle water
- Minimum dimensions of 6’ x 8’ x 12’
- Maximum storage dimensions of 3’ x 4’ x 5’.

Approach
- We held an initial teleconference with John Deere representatives to establish customer needs.
- We ranked the importance of needs according to our research and information from John Deere.
- We individually created concepts based on these ranked needs.
- Concepts were critiqued by the team, and a common initial design was created.
- The team created a Deliverables Agreement and Statement of Work for our sponsor.
- We began system-level design by establishing and purchasing a list of materials.
- We tested our concepts for droplet formation, a feature crucial to our design.
- We refined our design and created a Detailed Design Report for our sponsor.
- We ordered the remaining components and began construction of our Alpha prototype.
- We transported our prototype to Augusta, Georgia for testing at John Deere’s facility.
- We further refined our design based on testing and the recommendations of our sponsor.
- We completed our Beta prototype, and performed final testing.
- Our final project was displayed at the Engineering Showcase, and the Final Report was delivered to John Deere.

Outcomes
As a result of our project, John Deere will:
- Be able to accurately test full-scale prototypes for long-term rain proofing and durability.
- Reduce chances for unforeseen water intrusion in new compact tractors.
- Be able to easily transport and modify the simulator for multiple locations and future weather testing needs.