College of Engineering
Department of Mechanical & Industrial Engineering

College of Engineering
School of Electrical Engineering & Computer Science

To Predict ▶ To Design ▶ To Perform

ME, ECE Capstone Design Programs

Team #30 University Student Design and Applied Solutions

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Jack Rettig

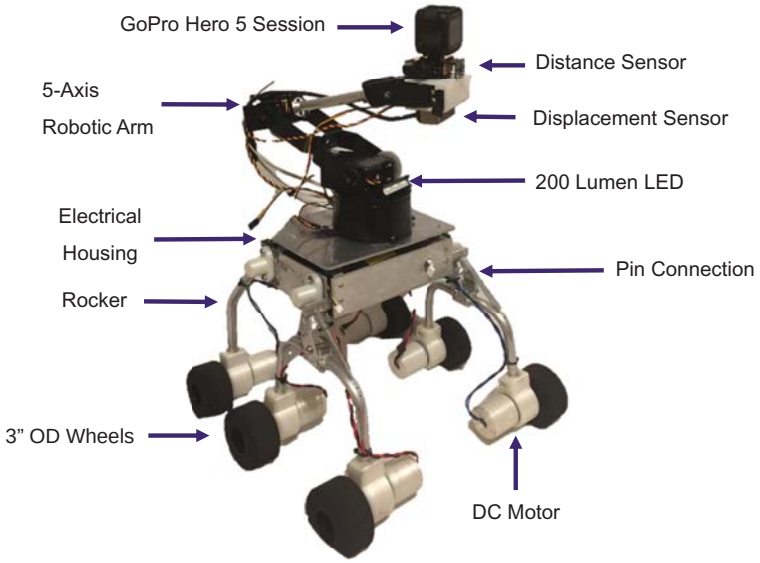
NACE INTERNATIONAL

Inspection Methods

Type	Method	Function
Visual Inspection	• High Resolution Camera • Distance Sensor	• Corrosion Sizing • Corrosion Location • Corrosion Type
Depth Measurement	• OD Mini Displacement Sensor	• Thickness and extent of corrosion damage

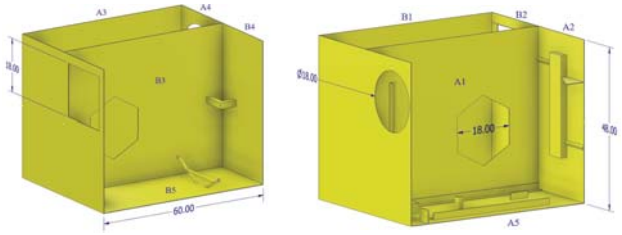
Engineering Specifications

Specification	Target	Actual
Weight	≤ 10 lbs.	10 lbs.
Size	< 18 in. Dia.	17 in
Obstacle Climbing Height	> 3 in.	5.5 in
Sizing Efficiency	≥ 80%	85% per Picture
Location Efficiency	≥ 80%	85% per Picture
Corrosion Sizing Accuracy	≤ $\frac{3}{64}$ in	$\frac{3}{64}$ in
Corrosion Location Accuracy	≤ 1 in	$\frac{3}{64}$ in
Corrosion Depth Measuring Accuracy	≤ $\frac{3}{64}$ in	.00394 in
Cost	≤ $5,000.00	$3,172.92



Project Scope & Objective

- The challenge for the 2018 USDASC Competition is to develop a system for corrosion inspection in difficult-to-access areas.
- The project objective is to design a remote controlled robotic system to:
  - Inspect Confined Spaces
  - Identify Corrosion Related Defects
  - Quantify Corrosion Related Defects



Units in inches
Competition Structure: 3/16" thick A36 Carbon Steel.

Competition Results

LSU Team #30 Placed 2nd Overall in USDASC


Initial Image

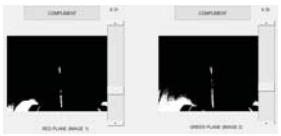

Segmented Image


Image Region Analyzer

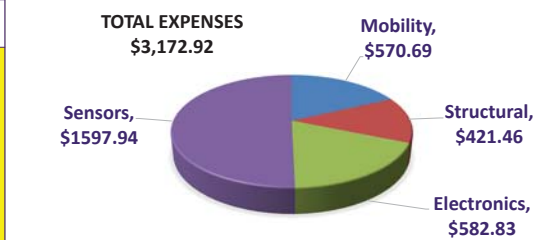
Safety

- Controlled Current and Power Flow from Battery Sources
  - Implemented Fuses and Mechanical Switches to Prevent Hazards
- Li-Po Battery Sources Stored in Heat Resistant Bags during Charging.
- Designed for Nondestructive Inspection of Surfaces
  - Robotic Arm utilizes digital inputs for precise controlled movements
  - Inspections do not require contact with surface of structure
  - Max velocity of 0.22 ft/s reduces impact forces with surroundings

Timeline

	Jan 7-13	Jan 14-20	Jan 21-27	Jan 28-Feb 3	Feb 4-10	Feb 11-17	Feb 18-24	Feb 25-Mar 3	Mar 4-10	Mar 11-27	Mar 18-24	Mar 25-31	Apr 1-7	Apr 8-14	Apr 17-18
Manufacturing	Machine/print all special parts and begin unit assembly			Complete Manufacturing and Assembly											COMPETITION
Preparation	Develop control logic/code		Develop code for sensors		Build Test Structure										
Testing/ Analysis				Test and Calibrate Sensors				Test system dynamics/obstacle clearance			Competition Simulation				
Modifications						Sensor Modifications			Locomotive Modifications		Final major modifications		Fine Tuning		

Expenses



Sponsors: Jack Rettig, Kim Ray - NACE International

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