

ME, ECE, IE Capstone Design Programs

Team #43: Electric Beach Wheelchair

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Objective

Produce a powered wheelchair that enables Cheslyn to experience an enjoyable beach vacation with her family

Measurable Engineering Specifications

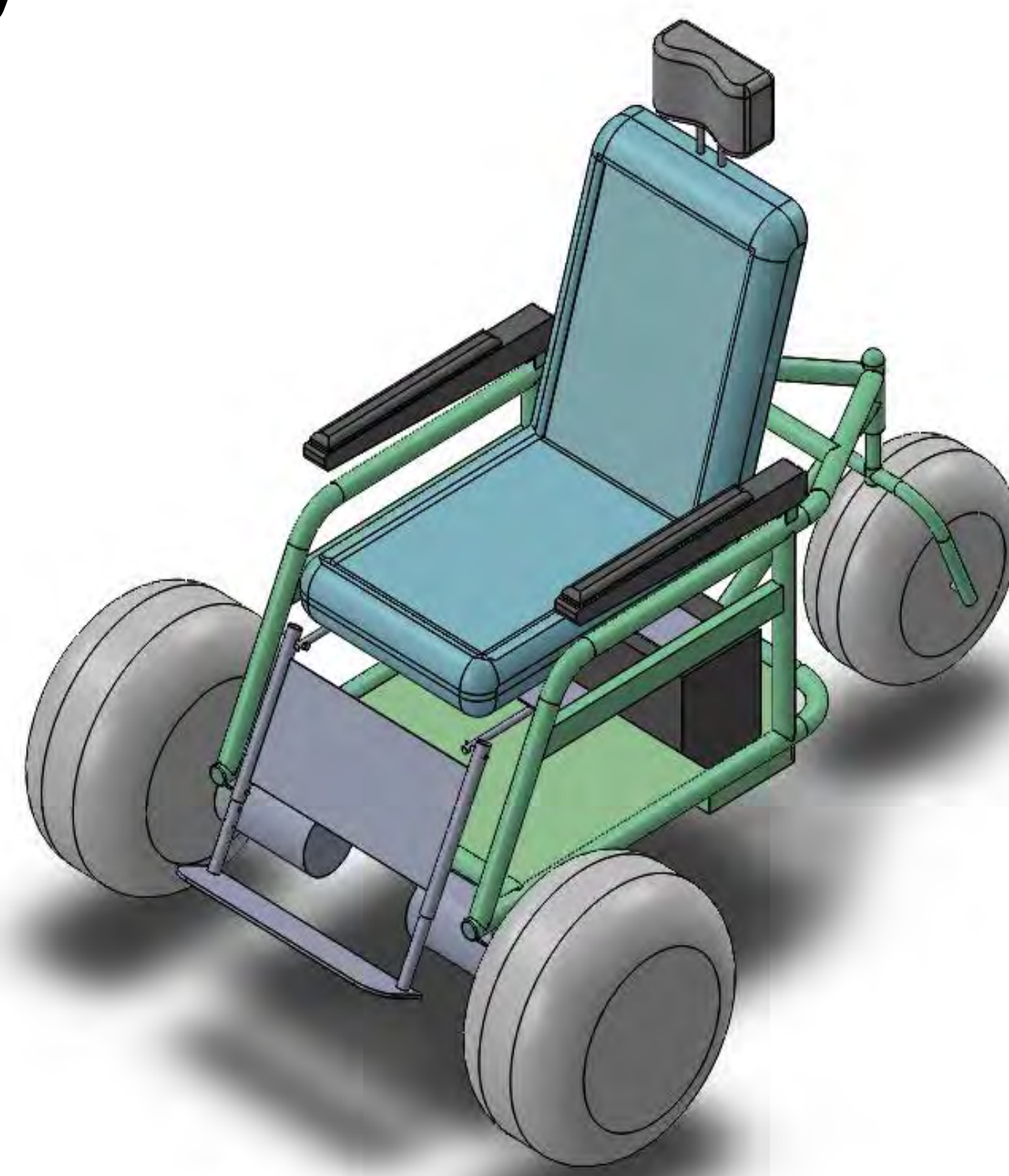
Engineering Specifications	Required Value	Result
Cost	\$6,000	\$5,350
Force to manually move chair	≤50 lbf	43 lbf
Maximum component weight	≤100 lbs	75 lbs
Range on sand	>1 mile	13 miles*
Continuous runtime	>1 hour	4.8 hours*
Max amp draw	110 Amps	60 amps
Tipping angle	25°	38.1°

*Found by extrapolating from testing results

Safety

Hazards	Mitigations
Safety of customer when using chair	Four-point harness, lap belt, torso supports, horn
Driving ability at night	Multiple light attachments
Unstable travel	Speed control
Electrical controller shortage	Emergency stop

Design Overview



SolidWorks model



Final product

Codes and Standards

Rehabilitation Engineering and Assistive Technology Society of North America (RESNA) WC1 and WC2

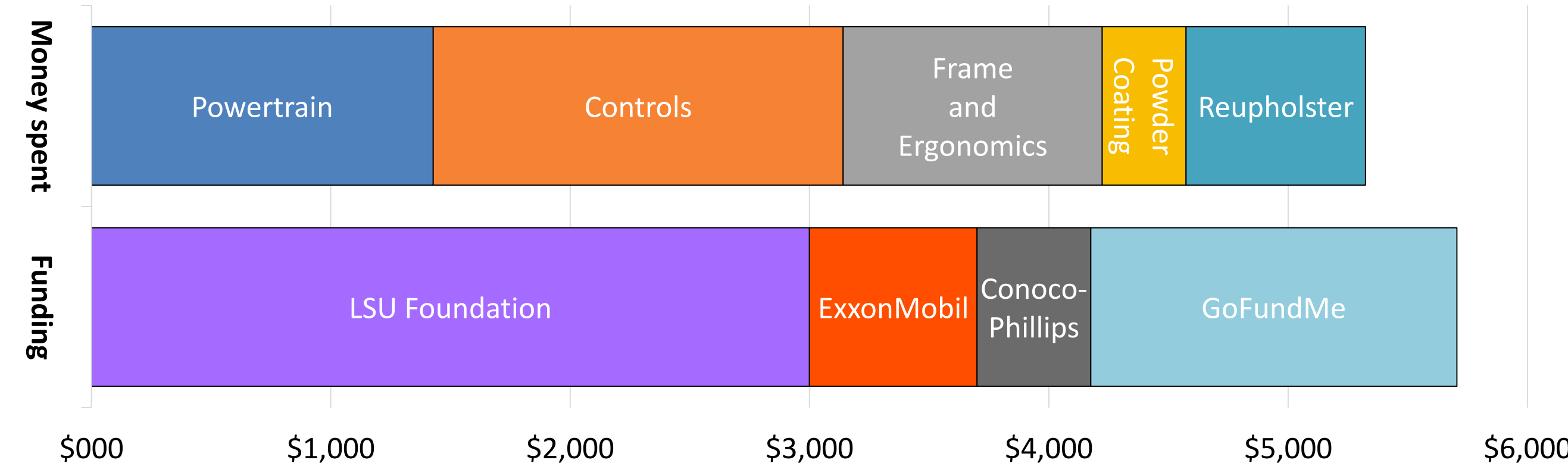
Analysis

- Finite Element Analysis (FEA)
- Static balancing analysis
- Power analysis
- Dynamic/Impact analysis
- Estimation of run time
- Safety analysis (FMEA)

Testing

Test	Goal	P/F
Static Stability	25° tipping angle	Pass
Dynamic Performance	110 amp max, 15° climb angle, 0-4 mph adjustable speed	Pass
Traverse Loose Sand	Does not get stuck	Pass
Manual Pull Test	50lbf to move or less	Pass
Component Weight	Heaviest component <100lbs	Pass
Cost	<\$6000	Pass
Range	>1mile of continuous use	Pass
Control by User w/ MD	User w/ MD can use with limited to no help	Pass

Budget



- | | | | | | | | | |
|---|---|---|--|---|---|--|--|---|
| <ul style="list-style-type: none"> • Identify scope • Generate concepts • Select concept | <ul style="list-style-type: none"> • Finish preliminary analysis • Begin SolidWorks | <ul style="list-style-type: none"> • Finish SolidWorks • Material analysis • FEA | <ul style="list-style-type: none"> • Begin ordering parts • Frame building • Parts arrive | <ul style="list-style-type: none"> • Finish frame • All parts arrived • Assemble prototype | <ul style="list-style-type: none"> • Static testing • Dynamic testing • Reupholster seat | <ul style="list-style-type: none"> • Customer testing • Adjustments made • Powder coating | <ul style="list-style-type: none"> • Final quality check • Product completely finished | <ul style="list-style-type: none"> • Turn over to customer for immediate use |
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Sponsors: Shannon Simpson

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