Clarkson University Electric Knights

SAE Clean Snowmobile Challenge 2013

Overview

Clarkson UNIVERSITY
defy convention

- Design Goals
- Specifications
- Ergonomics and Emissions
- Drive System
- Battery choice
- Maintenance
- Conclusion

Design Goals

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- Maximum comfort and reliability to user
- Sufficient power and range
- Easy to maintain and operate in remote artic environments
- Stock appearance and user controls
- Reduce weight for easy shipping, transport, and increased range
- Reliable and simplified circuitry

Specifications

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- 2012 Ski Doo MXZ Sport
- Capacity of battery pack is 7.19 KWh
- Two stage gear reduction
- 48 packs of 18 cells in parallel (864 batteries)
- Motor provides 17.4 HP continuous and 40 HP peak

Ergonomics and Environment

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- Weight and form factor are similar to a stock snowmobile.
- Familiar controls (i.e. throttle, brakes, lights, and speedometer) that any novice snowmobile rider can operate.
- Still have stock hand warmers!
- No effects to pristine environments
  - Stable battery chemistry
  - Converted belt drive to eliminate need for oil

Drive System

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- Two stage gear reduction system
- Gates Poly Chain GT Carbon belts
- Overall gear ratio of 3.47:1
- Innovative pivoting motor mount that allows for easy serviceability

Drive System

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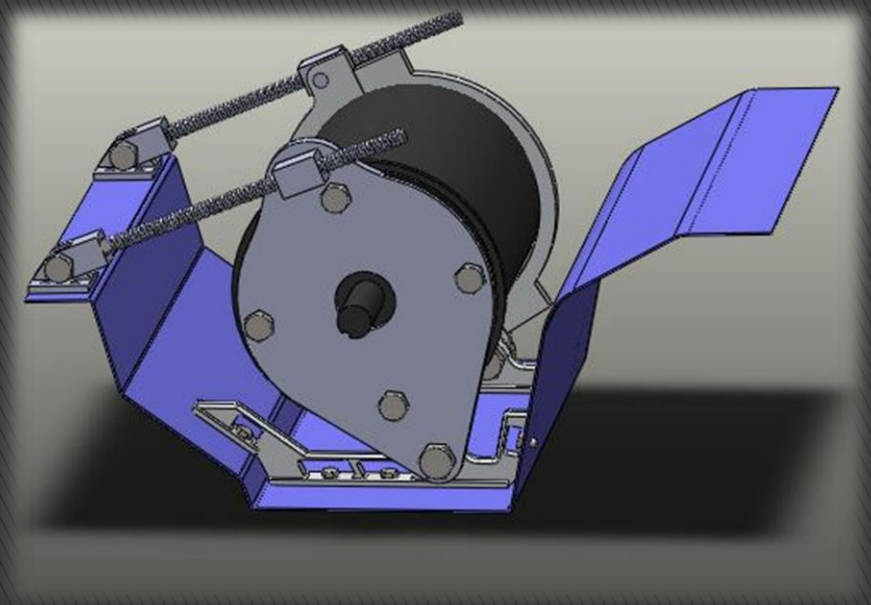
- Custom designed tensioner for use with stock chain case
- Wide range of gear selection due to adjustable motor.



Battery Choice

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- Used LiFePO4 batteries
- We chose K2 Energy 26650P Cells
- Energy Density: 103 Wh/kg
- Power Density: 795 W/kg
- Nominal Voltage: 3.2 V
- Energy Per cell: 8.32 Wh
- Cell life: >2000 cycles

Battery Test Results

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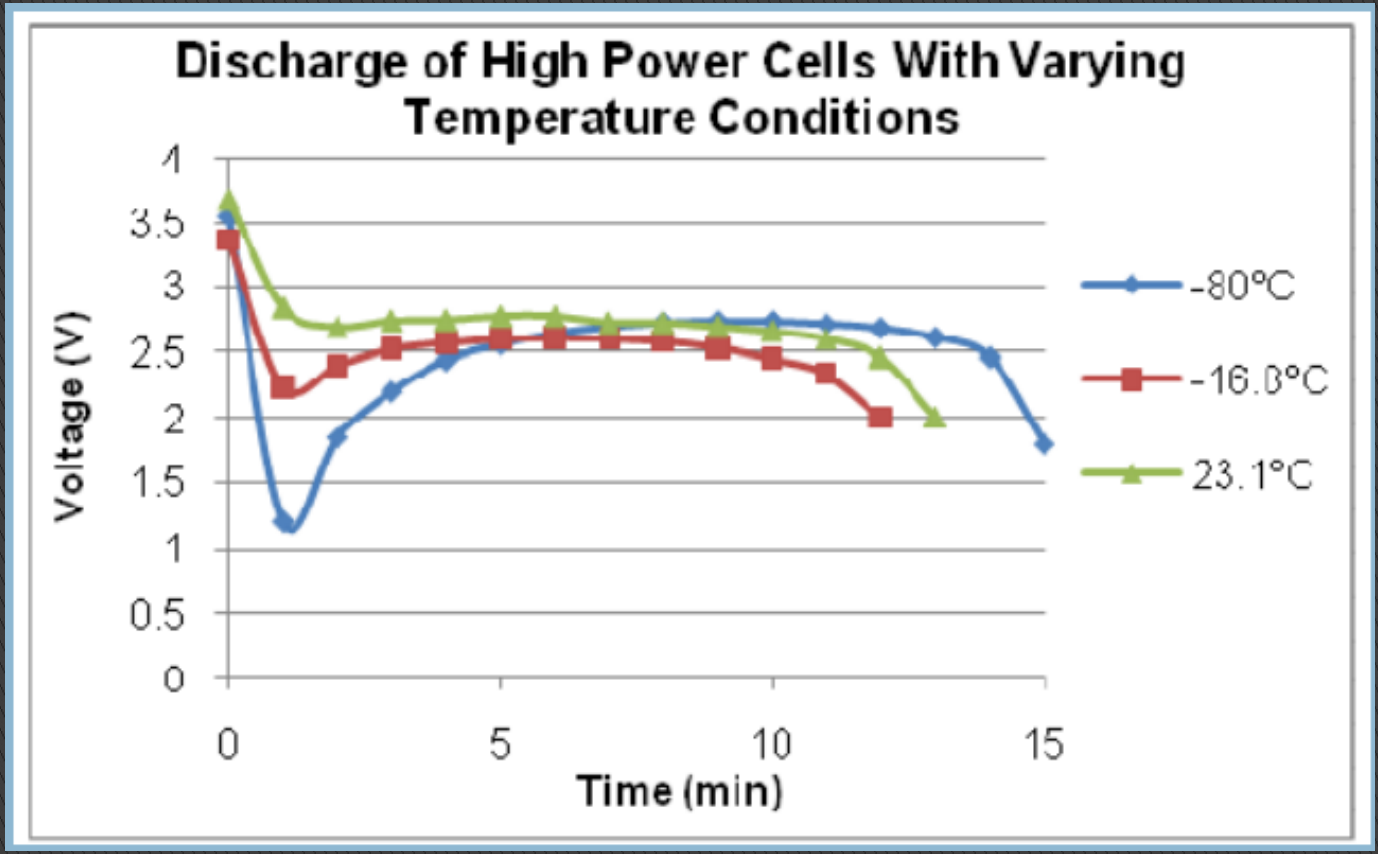
- Performance at low temperatures



Maintenance

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- Durable batteries require no in service maintenance.
- Use of Gates Poly Chain GT Carbon Drive lasts 3 times as long as a convectional chain drive.
- Use of analog safety system for simplicity.
- Standard Ski Doo parts were kept on the snowmobile.
- Snowmobile can be charged by a standard 120 V / 60 Hz outlet.

Conclusion

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- Maintained stock parts to aid in ergonomics, structure, and aesthetics.
- Provided sufficient power and range through a two stage gear reduction in near maximum capacity pack.
- Easy to maintain and operate in remote artic environments by novice users.
- Used analog and simplified circuitry for dependability.

Questions??

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