South Dakota School of Mines & Technology

Zero Emissions Team

Presented by: John Job & Ashten Breker

Introduction

- In the CSC for 5 years
- A Part of CAMP at SDSM&T
- Interdisciplinary team
  - Mechanical
  - Electrical
  - Computer
  - Industrial

SOUTH DAKOTA SCHOOL OF MINES & TECHNOLOGY

Improvements from Last Year

- Series Wound DC motor switched to 3 phase AC
  - 142 lb DC motor switched to 48 lb AC motor
  - 82% Motor/Controller efficiency increased to 89%
  - Lighter weight motor mounting
- Battery arrangement
  - 2 battery enclosures for weight management
- EM-CVT
  - Allows for engagement at zero RPM
  - Controlled shift points/speeds for electric motor
  - Optimized clamping for efficiency

SOUTH DAKOTA SCHOOL OF MINES & TECHNOLOGY

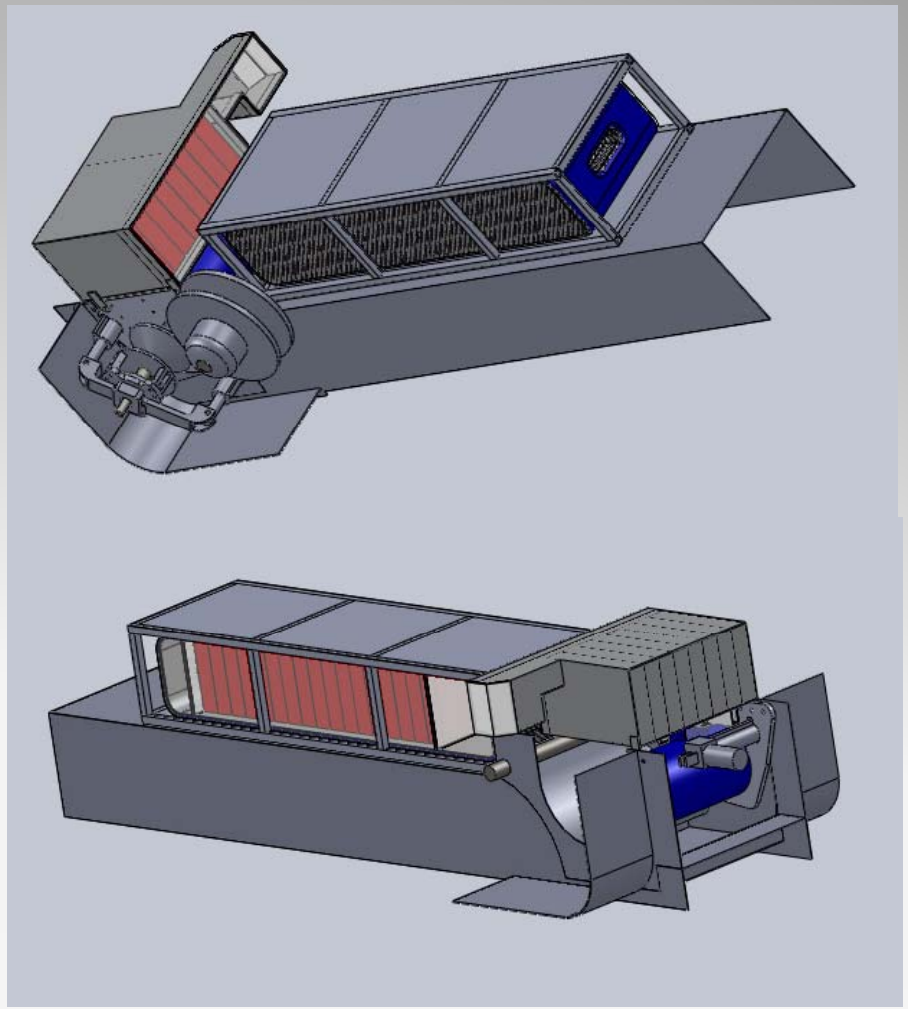
Mechanical System Overview

- 6061-T6 Aluminum Motor Mount
  - Designed to mount into chassis without modification
- Split Battery Boxes
  - Helps in Balancing battery weight
  - Helps in repair and diagnosis of problems
- Electro-Mechanical CVT
  - Controlled via Motor RPM and Current Draw
  - Linear actuators
  - Manufactured parts to use stock Polaris clutches

SOUTH DAKOTA SCHOOL OF MINES & TECHNOLOGY

Mechanical System CAD

TOP:
Left Rear view of chassis



BOTTOM:
Right Front view of chassis

SOUTH DAKOTA
SCHOOL OF MINES
& TECHNOLOGY

Electrical System Overview

- Energy System – 8kWh
  - AC -20 Motor Package
    - Curtis 1238 Motor Controller
    - 10hp Continuous 56hp Peak
  - Tenergy LiFePO4 Batteries
    - Peak 300A
  - NG1 Charger
- CVT Control System
  - Seeeduino Mega
  - Qik Dual Serial Motor Controller
  - Linear Actuators – PA-02

SOUTH DAKOTA SCHOOL OF MINES & TECHNOLOGY

Performance Added

- Top speed approaching 70 mph
- 200 lbf-ft of Torque Pushing track
- ~700lbs giving great traction
  - Special care given to handling of 700lb snowmobile
- Improved performance in 25-45 mph range
  - Lower motor RPM for higher torque at higher speeds
- Increased efficiency over entire system
  - Maximum efficiency can be spread over wide range
- Full monitoring of all functions
  - Allows any rider to ride electric snowmobile without worry

SOUTH DAKOTA SCHOOL OF MINES & TECHNOLOGY

Economic Value

- Commercially available parts
- Stock modified chassis for easy conversion
  - Lower priced chassis with desired performance handling
- Battery replacement not needed for 3,000+ cycles
  - LiFe PO_4 Batteries
- Ability to access areas previously banned
  - State/National Parks
  - Landowners worried with noise

SOUTH DAKOTA SCHOOL OF MINES & TECHNOLOGY

Environmental Value

- No Emissions
  - No Burning Fossil Fuels
- Quiet
  - Allows for use in noise limited regions
- Research
  - Atmospheric Testing in Summit Station
  - Clean Atmosphere for Transportation
- National Parks

SOUTH DAKOTA SCHOOL OF MINES & TECHNOLOGY

Summary

- Changes from Last Year
- Mechanical System
- Electrical System
- Performance Added
- Economic Value
- Environmental Value

SOUTH DAKOTA SCHOOL OF MINES & TECHNOLOGY

Questions?


TEAMS BUILDING
CAMP
AT SDSM&T


THUNDERSTRUCK
MOTORS


POLARIS


TENERGY


SAE Clean Snowmobile Challenge


SOUTH DAKOTA
M
SCHOOL OF MINES
& TECHNOLOGY