

# Michigan Technological University

## *Energizing the Future: Rear Driven E-Rush*

*Zero Emissions Team Leader:  
Mike Rittenour*

*Zero Emissions Team Member  
Davin Peterson*

March 10th, 2011



**Fueling Performance through Innovation**



# Topics for Discussion

- Design Intent
- Chassis and Key Features
- Electrical Design
- Future Developments
- Conclusions and Questions



*Fueling Performance through Innovation*



# Design Intent

- Maximize Range
- Reduce Noise
- Maximize Pulling Capability
- Reduce Weight
- Maintain Ride ability
- Reasonable Price
- Serviceability



*Fueling Performance through Innovation*



# *Chassis Update*

- 2010 Polaris Rush
  - Lightweight 2-Stroke Chassis
  - Improved Ergonomics
  - Modern Styling and Design
  - Innovative Progressive Rate Rear Suspension



*Fueling Performance through Innovation*



# *Key Features*

- Innovative Rear drive design
- Polaris Pro-Ride rear suspension

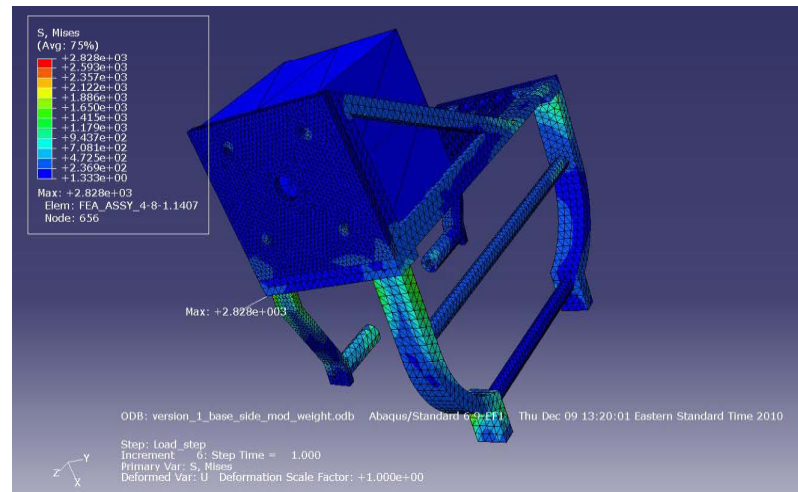


*Fueling Performance through Innovation*



# Motor Mount

	Max Stress (psi)	Max Displacement (in)	Yield Stress (psi)	Factor of Safety	Weight
Design 1	3,106	0.01136	36,000	11.5	48.06
Design 2	2,726	0.001636	36,000	13.2	36.26
Mod Design 2	2,828	0.001871	36,000	12.7	25.75

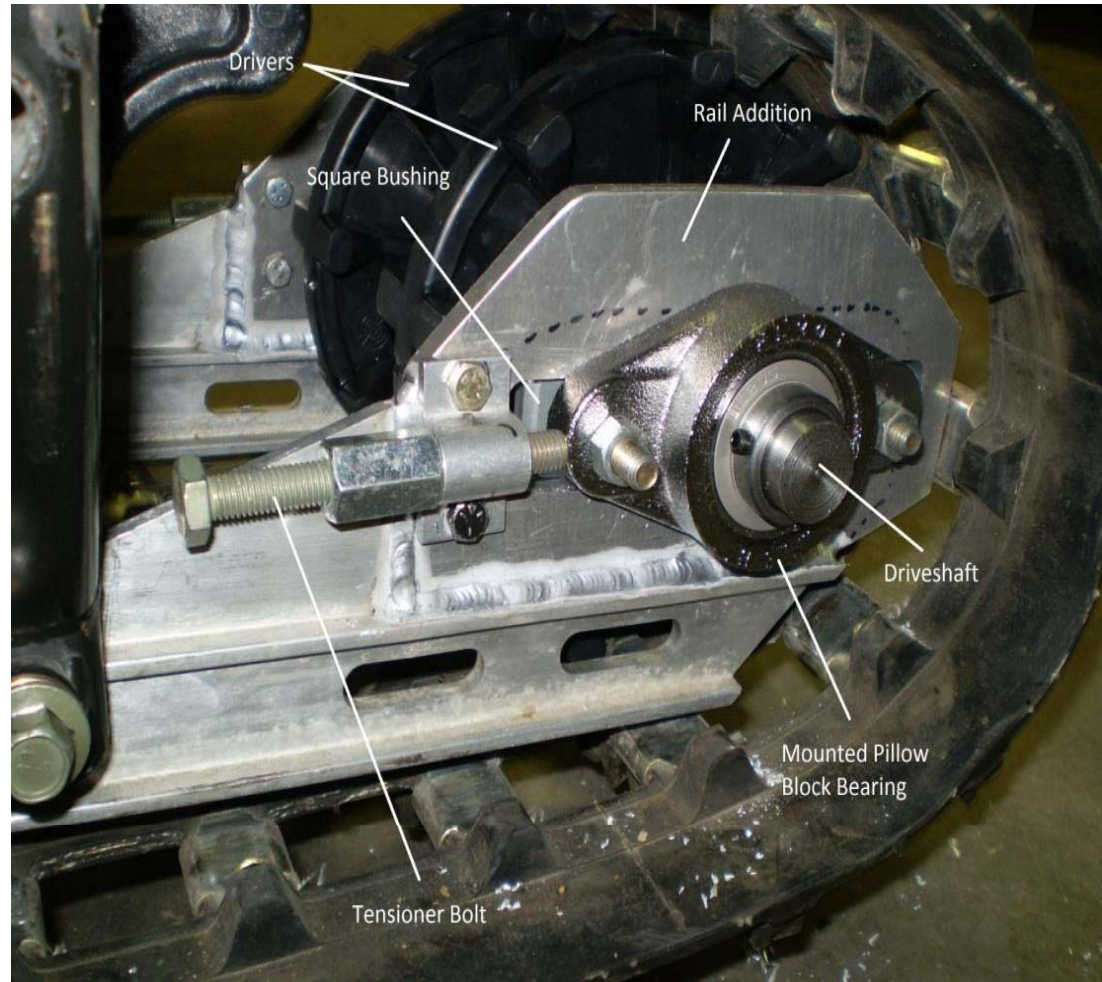


**Fueling Performance through Innovation**



# Rear Drive

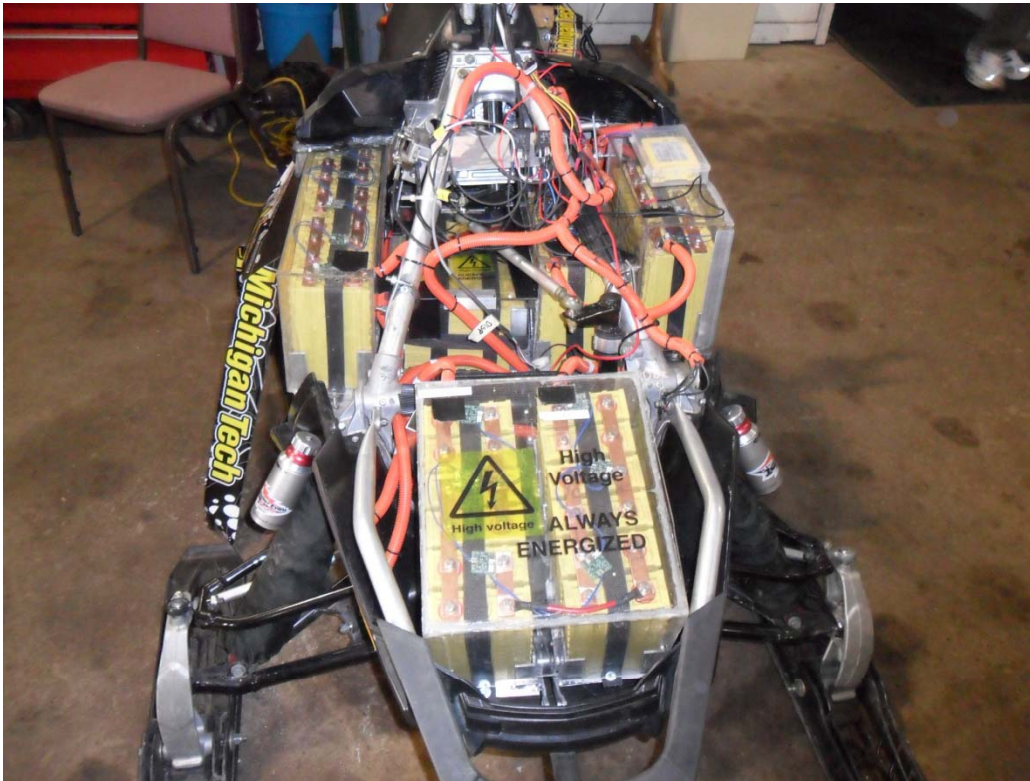
- Implemented for increased driveline efficiency
- Puts the straight portion of track in tension
- Creates more options for battery packaging



*Fueling Performance through Innovation*



# Electrical Design



- Electrical design goals
  - Simplicity
  - Efficiency
  - Effectiveness
- Electrical Drive System Packaging
  - Motor, Motor Controller, Information Display Packaged together
- Energy Storage System
  - Batteries, Battery Charger, and Charging Management System Packaged Together



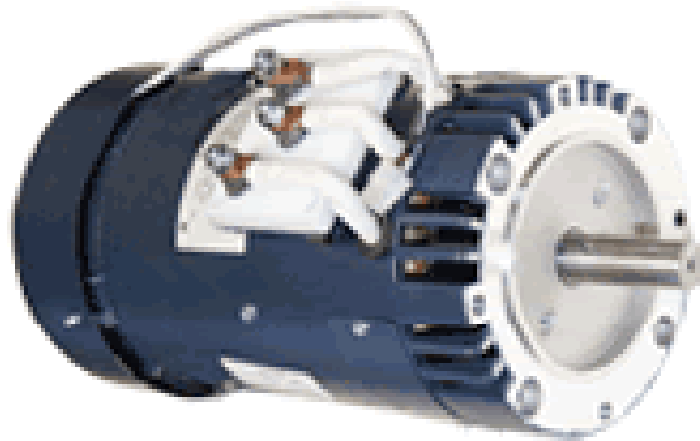
**Fueling Performance through Innovation**





# *Motor*

- Hi-Performance EVs AC-20
- AC Induction motor
- Can Package in rear of snowmobile
  - Peak HP 75
  - Peak TQ 105 ft lbs
  - Motor Weight 53lbs



*Fueling Performance through Innovation*



# *Motor Controller*

- Curtis 1238
- Fully Programmable
- Inverts DC voltage to AC voltage in the controller
- Cooled by snow on tunnel



*Fueling Performance through Innovation*



# Batteries

- Thundersky 40 Ahr 3.3V Batteries
- Lithium Iron Phosphate Chemistry
- 60 Batteries
- 96V Operating Potential
- 7.68 kWhr
- 12V system operates relays, headlights, and taillights
- 7 Different boxes to distribute weight



*Fueling Performance through Innovation*



# Charging System

- On Board Charging System
  - Linked to battery management system
  - Battery management system automatically operates charger when plugged in
  - Can plug in and charge anywhere that 120 AC power is available



***Fueling Performance through Innovation***



# Future Developments

- Refine Drive system
- Relocate the brake to the rear driveshaft
- Change the front attack angle for improved efficiencies
- Redesign battery packs to accommodate serviceability and packaging
- Testing on snow to improve efficiency and pulling capability



*Fueling Performance through Innovation*



# ***Conclusion***

- Converted a Polaris Rush to rear drive
- Testing in the future
- Significant weight reduction
- Improved rider ergonomics and rider comfort
- Reasonable MSRP



***Fueling Performance through Innovation***



# **-Questions-**

