2015 Clean Snowmobile Challenge Enterprise
Internal Combustion Snowmobile Overview

• 2014 Yamaha Phazer
• Performance Electronics engine control Unit
• Belt drive system
• Yamaha Viper skid
• Larger idler wheels
• Custom exhaust
• Hayes anti-lock brakes
• Lizard Skin coating on tunnel

• 2015 Competition Objectives
  • Fuel 16% - 32% Iso Butanol
  • Emissions
  • Noise
  • Efficiency
Engine Calibration

- Alpha – N tuning
  - Throttle Position (TPS %)
  - Engine Speed (RPM)
- Tune to Lambda 1.1
  - Air – Fuel Ratio
  - Measured in exhaust
  - Lambda 1 = stochiometric
- Emissions testing
- Ethanol content analyzer
- On snow tuning
  - Acceleration
  - Deceleration
Skid Replacement and Big wheel Kit

- 2014 Yamaha Viper Skid
  - Allowed larger idler wheels
  - Better suspension geometry
- Larger idler wheels
  - Custom made in house upper idler wheels
  - Tested 3-D printed upper idlers
  - Greater wrap angle increases efficiency
  - Decrease in noise
Exhaust

• Metal alloy catalytic converter
• Custom made silencer pack
• Dual automotive mufflers
• Shield for exposed exhaust
Learned from competition

• 6th Place Overall finish
• 44 Points behind 3rd place
• Excellent platform snowmobile for future years
• Cold start issues
• Excellent emissions
• Noise improvements
• Efficiency improvements
• Handling improvements
Zero Emissions Overview

- 2014 Yamaha Viper
- Converted to 100% electric power
- 96 Volt Lead-Acid Battery Pack
- AC20 High Performance motor
Battery Pack

• Holds 8 Deep Cycle Lead-Acid batteries wired in series
• 96 Volts and 55 Amp-Hours
• Battery Management System monitors instantaneous voltage and temperature of every battery

• Mounted on top of the tunnel
• Primary construction of 3/8” Polycarbonate
• 1/8” Aluminum Cradle, lid, and 1/16” aluminum Firewall.
BMS and Charger

- Manzanita Micro MK3 Pba BMS System
- one BMS unit per battery, 8 total
- monitors both voltage and temperature of each individual battery

- Delta-Q QuiQ Charger
- can Charge all lead-acid technologies and lithium ion
- Charges to 96V at 8.5A
- LED charge indicators
- programmable
Motor And Controller

- Curtis 1238-7601 Controller
- 650A Peak Current over 120s
- 55A continuous
- 65 Peak HP
- 82 Lb-Ft of torque
Belt Drive

• Direct belt drive system from motor to drivers for improved efficiency and noise reduction
• Single speed, ______ Final Drive Ratio
• Simpler and lower maintenance. Uses no oil, and reduces the number of moving parts.
Chassis Modifications

- heavier duty rear touring skid to handle the added weight
- aluminum rails welded to chassis for motor mount
- Aluminum motor mount with support pucks.
- turnbuckles to adjust belt tension