University of Wisconsin -Platteville- 2012 Clean Snowmobile Team

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Design Objectives

- Create Efficient Snowmobile Fueled by E-10 to E-39
- Emissions Reductions
  - Noise
  - Exhaust
- Maintain Stock Riding Qualities
  - Performance
  - Comfort

Consumer Appeal

- Comfort
- Weight
- Reliability
- High Performance
- Low Maintenance
- Low Operating Cost
  - Fuel Mileage
  - Oil Mileage
- Ease of Operation

Dealer Appeal

- Sales and Service
  - Clean
  - No Added Maintenance
  - Reliable
- Rider Comfort
  - OEM Seat, Handlebar Controls
  - Improved suspension
  - Reduced Noise

Snowmobile Choice

- Chassis: 2009 Ski-Doo Rev-XP
- Model: 600 E-TEC

Engine Type	Two-Stroke
Engine Details	Liquid-cooled, eR.A.V.E.
Cylinders	2
Displacement	594.4 cc
Bore x Stroke (mm)	71 x 74
Exhaust	Single
Fueling	Electronic DI

Design Strategy

- Efficiency
  - Engine Management
  - Driveline Improvements
- Clean
  - Engine Selection
  - Exhaust
- Quiet
  - Sound Deadening Material
  - Muffler Design
- User Friendly
  - Ergonomic Rider Position
  - Trail Performance Related
  - Simple Display and Controls
  - Easy Starting
  - Suspension

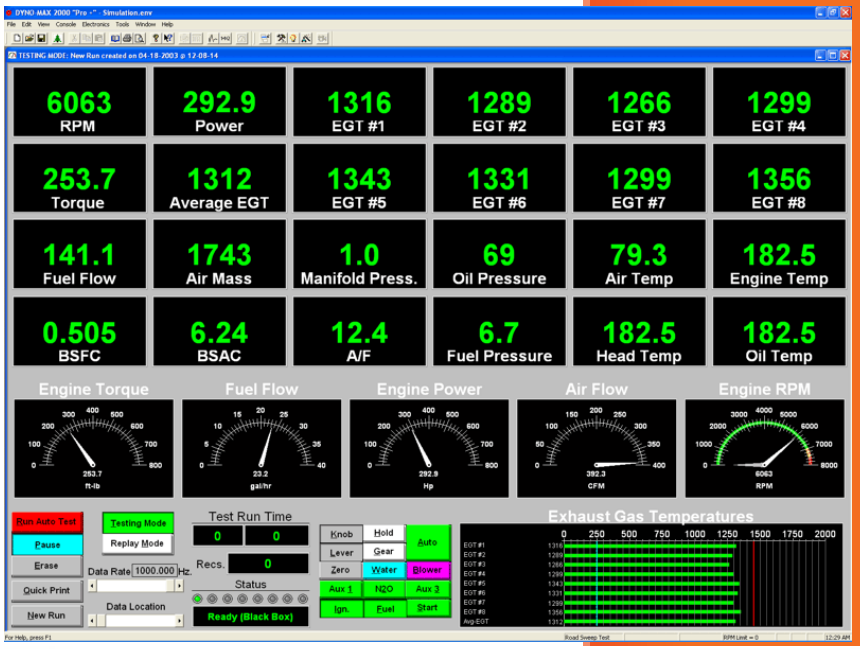
Engine Management

- Stock EMM and DI Injection System

- Microsquirt Secondary ECU and Modified Injection System

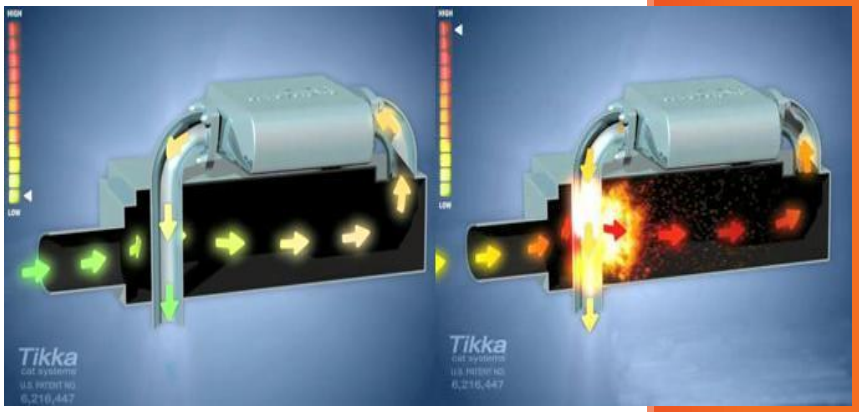
Engine Tuning and Calibration

- DYNOmite Water-Brake Dynamometer
- Prosport Wide Band AFR Monitor
- Exhaust Gas Temperatures
- EMS Emissions Analyzer



Reducing Emissions

- Tikka PPC
  - (Pipe Pressure Control)
- Pre-Burn Catalyst



Emissions Results

Emissions (ppm)					
Mode Point	**Speed (RPM)**	**Untreated**		**With PPC Catalyst**	
		HC	**NO_x**	**HC**	**NO_x**
1	**8000**	3000	**530**	25	34
5	**1200**	1000	58	7	0

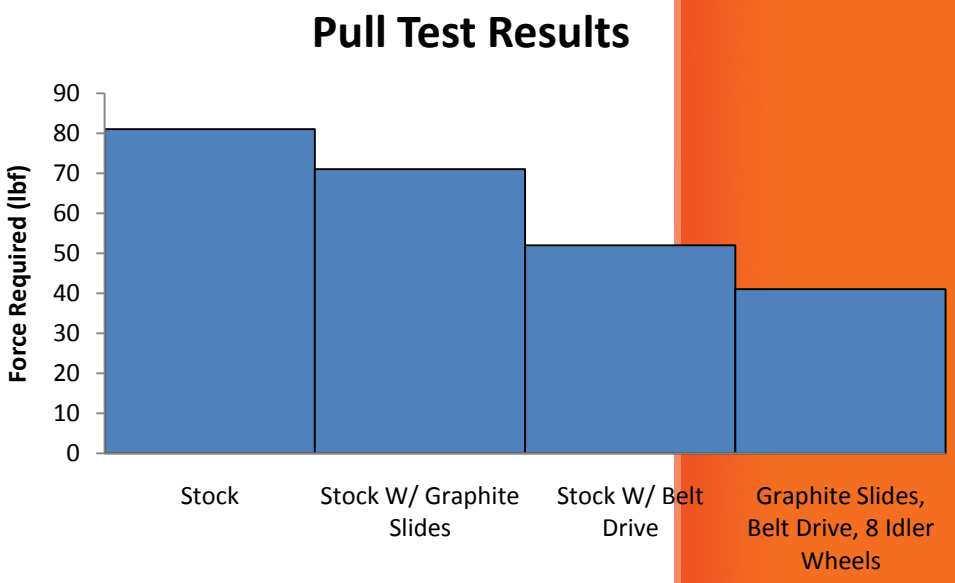
- Advantages
  - Maintains Stock Back-Pressure
  - Replaces Stock Muffler
  - No Maintenance

Driveline Improvements

- Replaced Stock Rear Idler Wheel with larger 10 Inch Diameter Billet Wheels
- Added Idler Wheels (8)
- Replaced 8 Tooth Drivers with 10 Tooth Drivers
- Belt Drive vs. Chain Drive

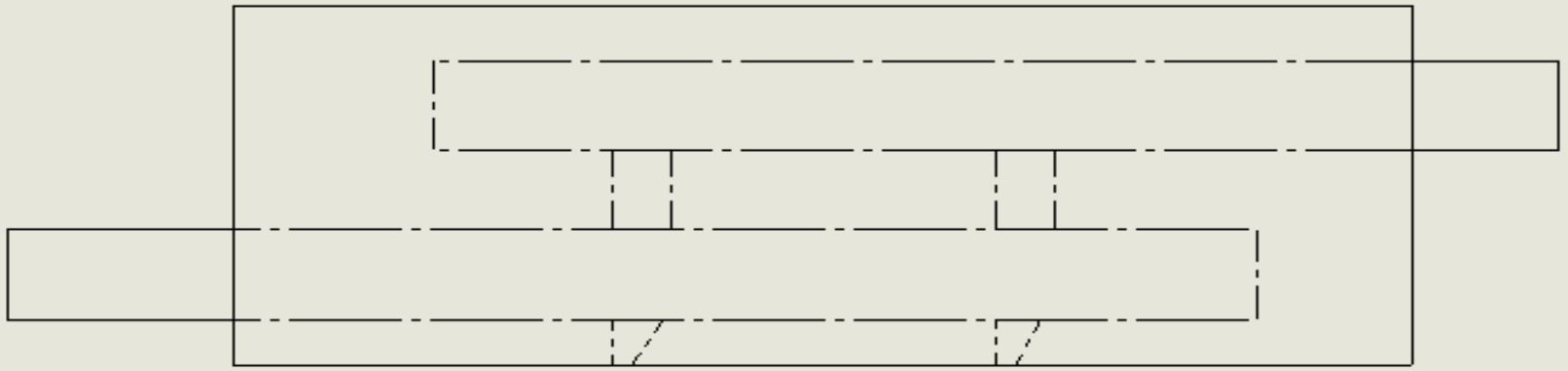
Driveline Improvement Results

- Varying Driveline Configurations
- Drill Test
  - Hp lost = (115 Volts)*(Amps)* (0.001341 Hp/W)
  - 33% More Efficient
- Increased to 22 mpg
- Pull Test



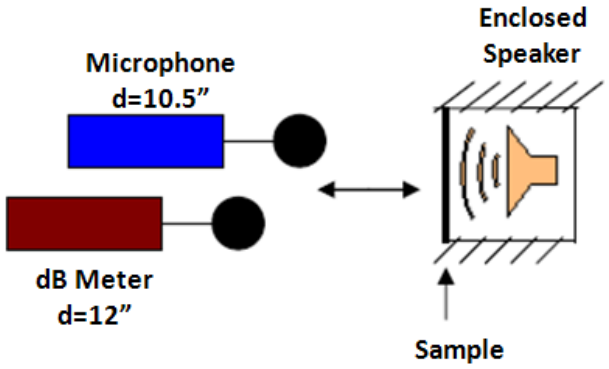
Muffler Design

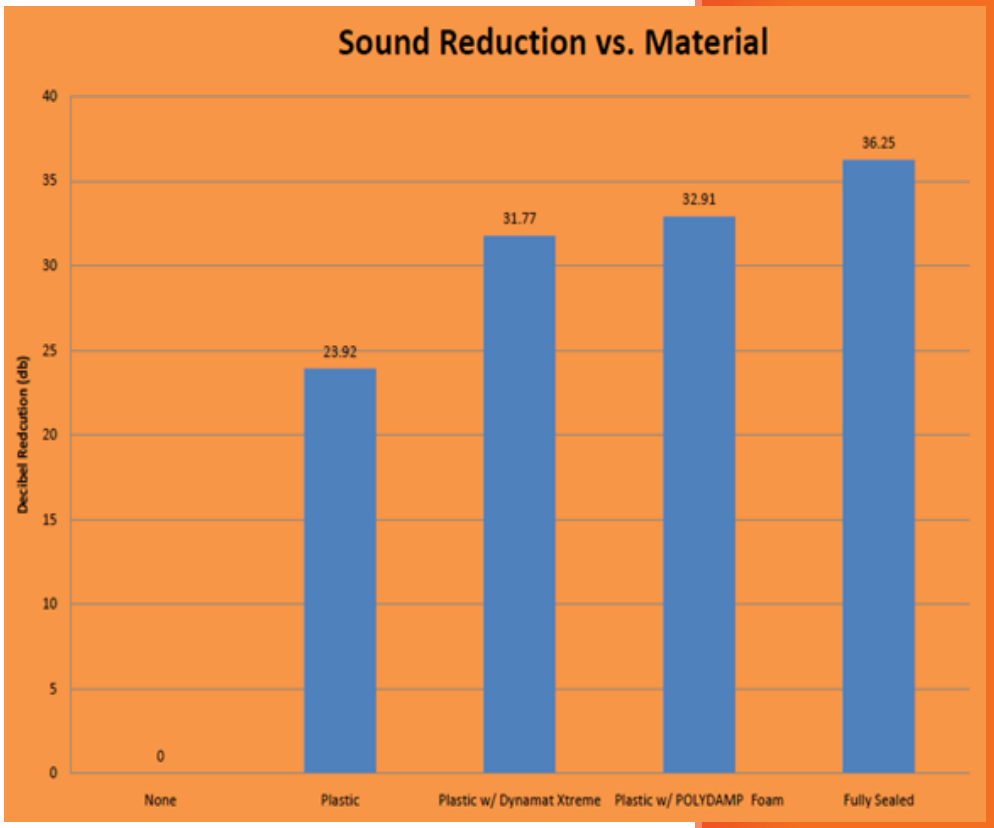
- Perforated exhaust tubes with flanges separating the resonant chambers
  - Decibel Drop of 6 dB



Sound Deadening

- Engine Compartment
  - XR Panels
  - Polymer Technologies Acoustical Barrier with Absorber





Suspension

- Easily Adjustable Front and Rear Suspension
  - Capable of being tuned for various riding styles
- HyGear Dual Rate Springs
  - Improved Control in Small and Large Bumps

Summary

- Consumer Benefits
  - Comfortable
  - Light weight
  - Two-Stroke
  - Easy and fun to ride
  - Competitive Cost
    - $13,554.30 USD MSRP
- Dealer Benefits
  - Low Maintenance
  - Aesthetically Appealing
  - Easy to Sell Options
- Environmental Benefits
  - Low Emissions
  - Quite Exhaust

THANK YOU

Questions?