



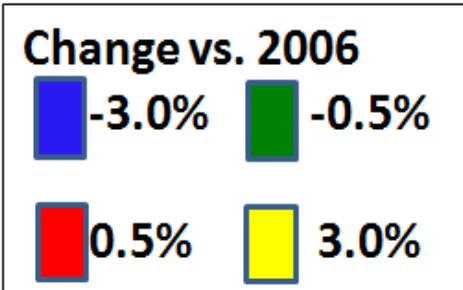
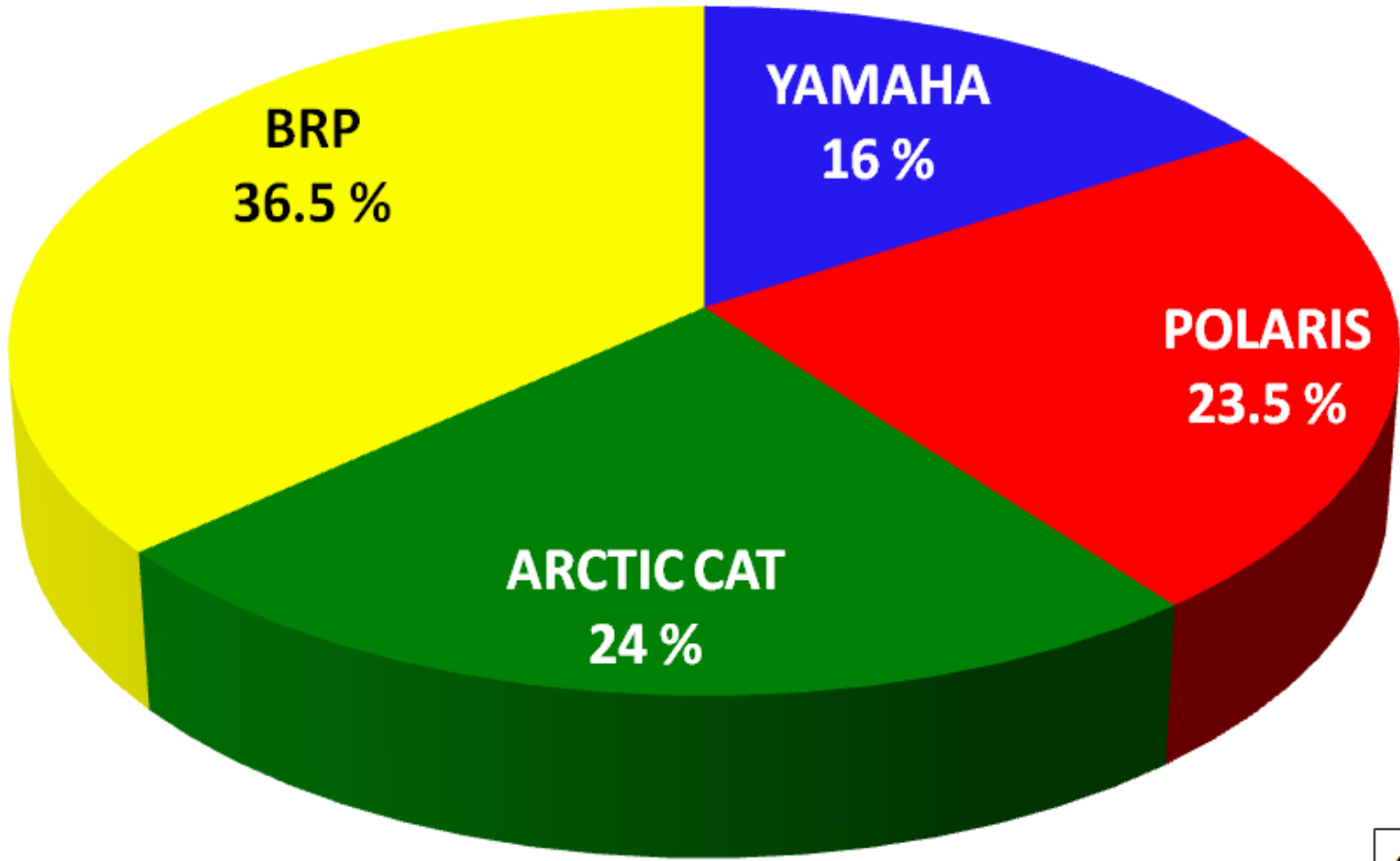
# University of Wisconsin-Platteville 2010 SAE Clean Snowmobile Challenge

**Presented by:**  
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# Design Objectives

- Increase overall efficiency
- Reduce emissions
  - Exhaust
  - Noise
- Maintain performance
- Maintain comfort

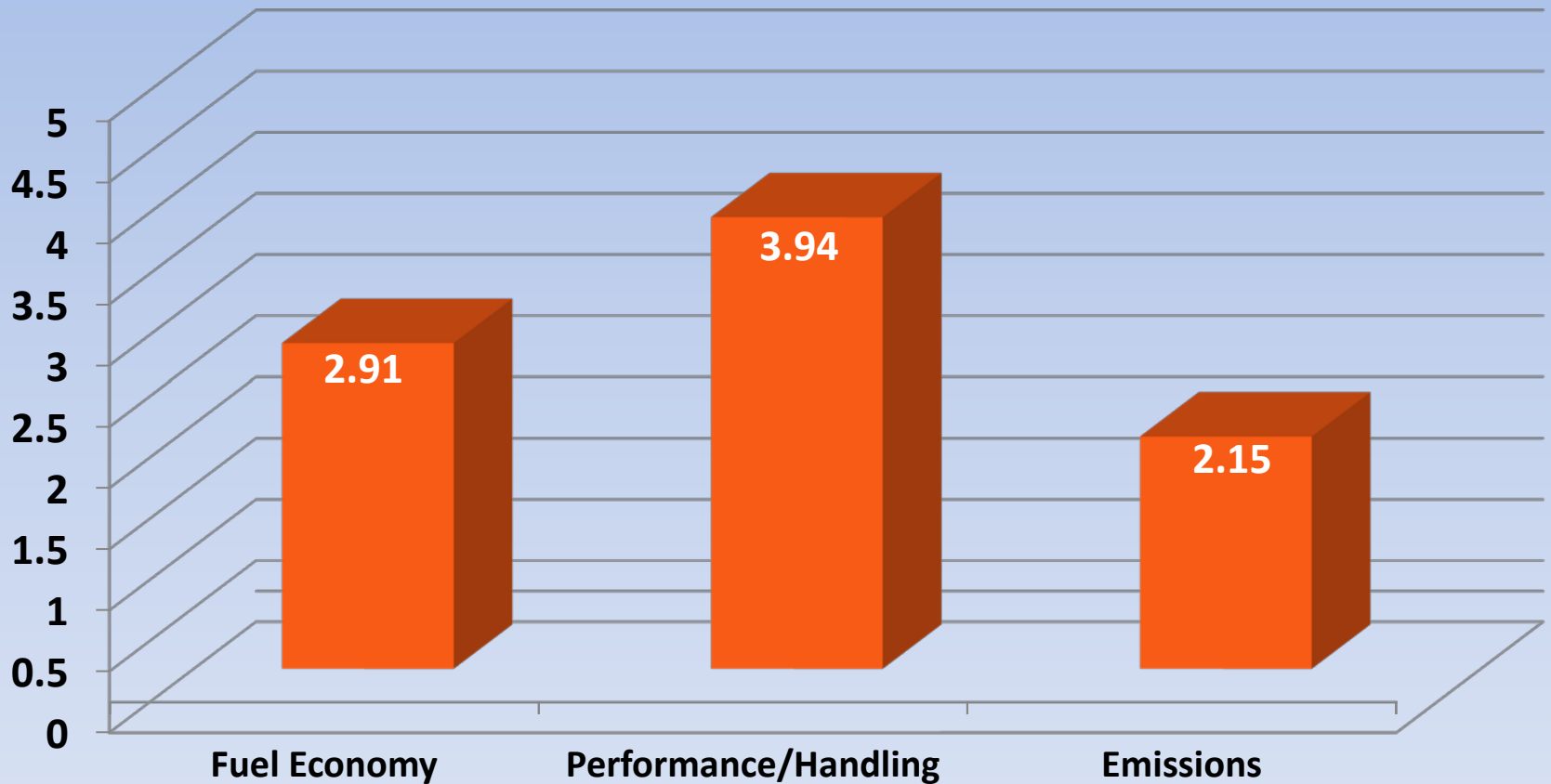
# 2007 NORTH AMERICAN MARKET SHARE



Source: Dealernews Estimates

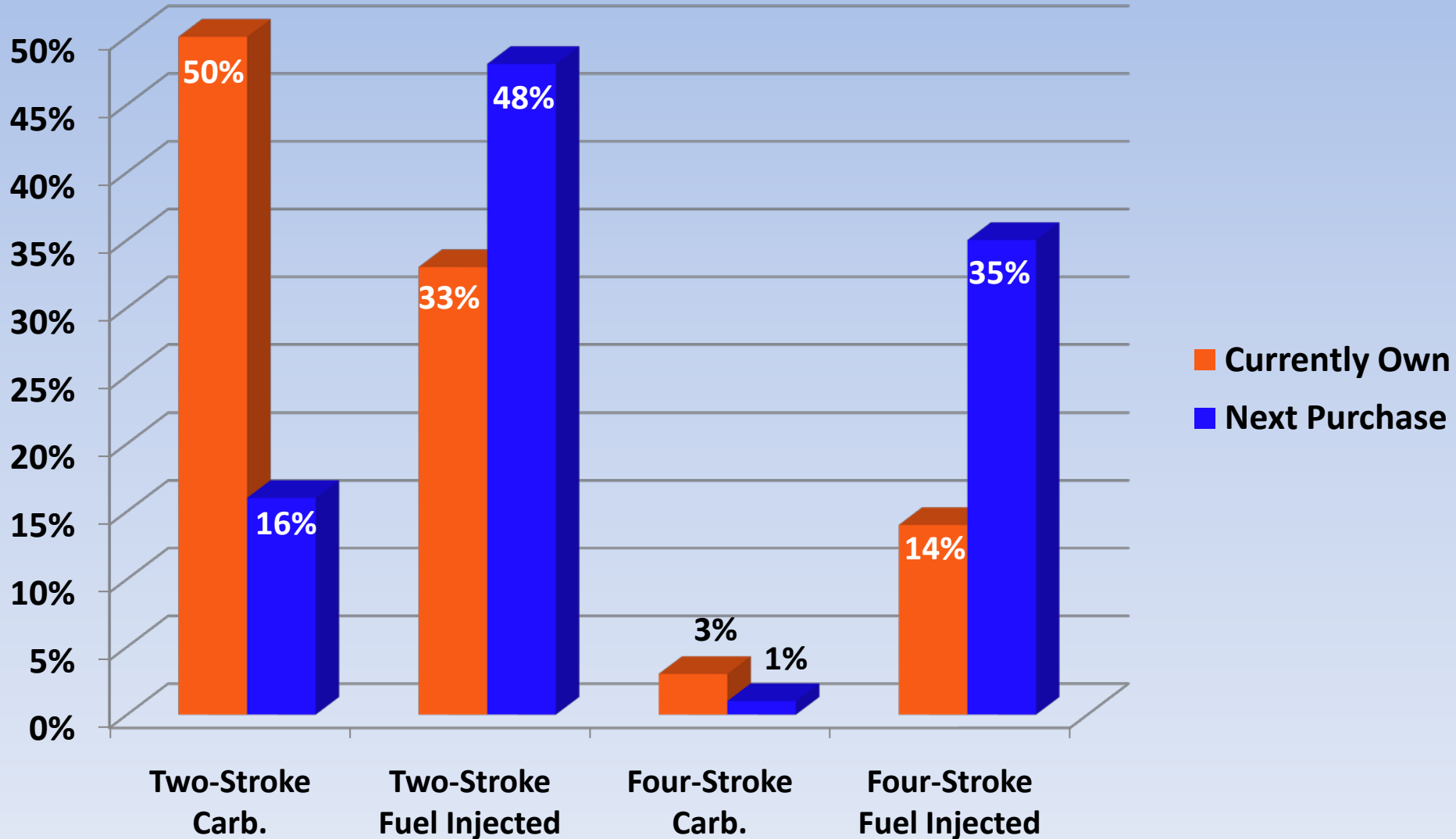
# HCS Survey

## Most Important Attributes When Purchasing a New Snowmobile



# HCS Survey (cont'd)

Snowmobile Engine Preference (given equal price and performance)



# Final Decision

- Chassis: 2008 Ski-Doo REV-XP
- Engine: Rotax 600 Semi-Direct Injected (SDI)

Engine Type	Two-Stroke
Engine Details	Liquid Cooled, eR.A.V.E.
Cylinders	2
Displacement	594 cc
Bore x Stroke	72 x 73 mm
Ignition	Siemens
Exhaust	Single
Fueling	Electronic SDI
Compression Ratio	12:1

# Design Strategy

- Efficient
  - Fuel mapping
  - Drivetrain Upgrades
- Clean
  - Exhaust
    - Pre-Burn Catalyst
- Quiet
  - Sound deadening material
  - Custom exhaust
- User friendly
  - Reverse
  - Ergonomical Riding Position
  - Trail-performance oriented
  - OEM controls

# How it appeals to snowmobilers

- Reduced emissions
  - Exhaust
  - Noise
- Smooth Ride
- Enjoyable for all skill levels



REV  
REV-XP



# Dealer/Outfitter Perspective

- Sales
  - Clean/Quiet performance
- Maintenance
  - Integrated pre-burn catalyst/muffler. Bolt-in replacement.
- Rider Comfort
  - OEM seat, suspension, handlebars, and reduced noise
  - Overall improved ride

# Engine Control

- Boondocker Fuel Management System
  - Fuel injection controller



# Engine Calibration

- DYNomite Water-Brake Dynamometer
- Innovative wide-band Controller
- Emissions System, Inc.
  - HC, CO, NOx Analyzer
- Feedback from Bosch O<sub>2</sub> sensor



# Driveline Improvements

- Replaced 7 inch stock wheels with 10 inch billet wheels
  - High quality bearings
  - Reduced angular acceleration
- Replaced stock 8-tooth drivers with 10-tooth drivers



# Driveline Improvements (cont'd)

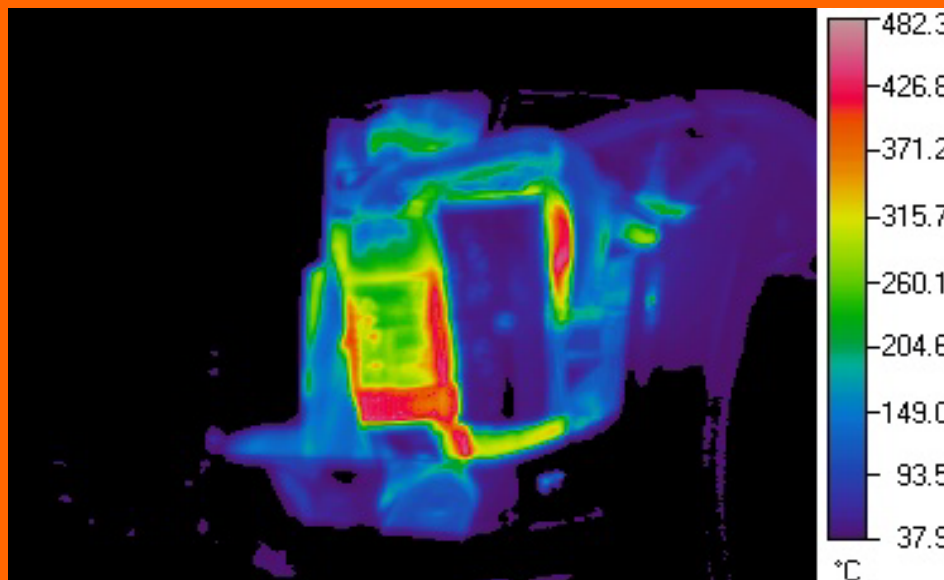
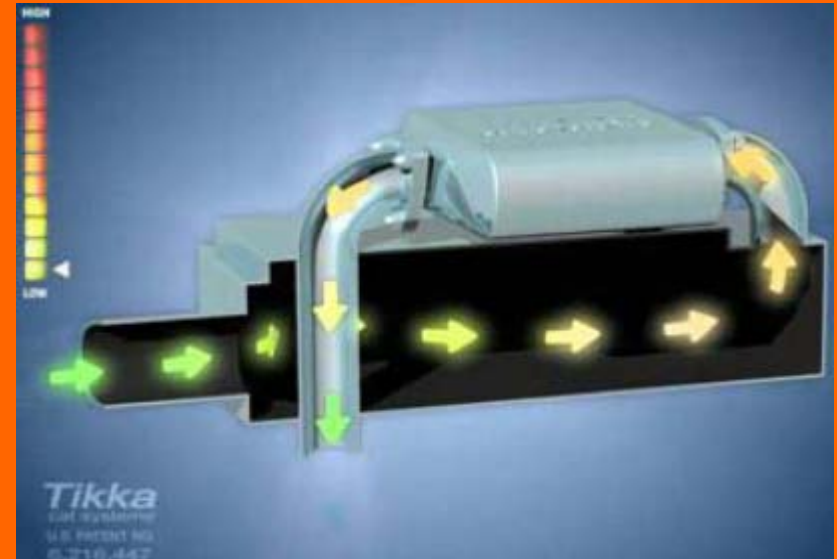
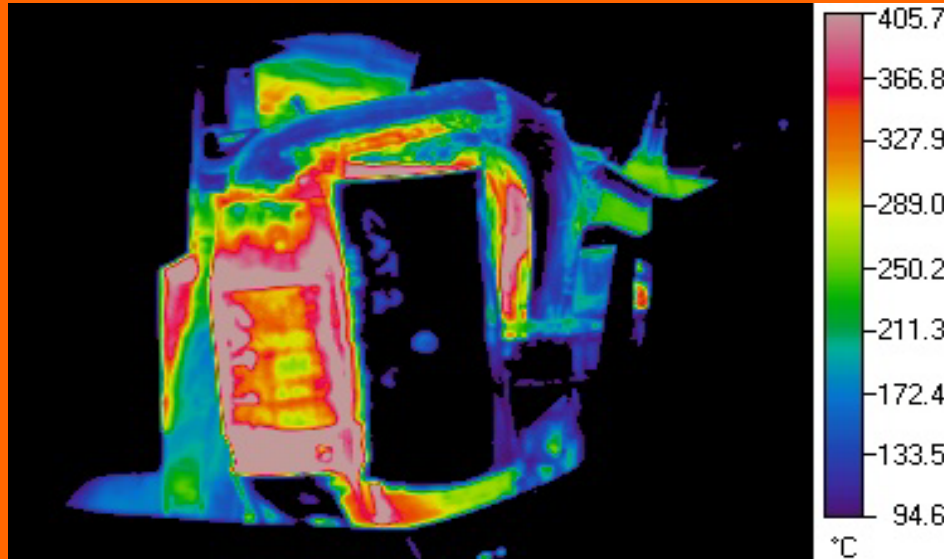
- Replaced OEM track (120"x15"x1") with 128"x13.5"x1" quiet track
- Total driveline improvements showed an increase in fuel efficiency
  - Stock setup: 14 mpg
  - After driveline improvement: 22 mpg
- Drill Test  $\text{Horsepower Lost} = (115 \text{ Volts}) * (\text{Amps}) \left( 0.001341 \frac{\text{Hp}}{\text{Watts}} \right)$ 
  - 33% more efficient

# Emissions Reduction

- Tikka Race pre-burn catalyst



# Emissions Reduction (cont'd)



# Emissions Results

- Maintains stock backpressure
- Lean/Rich switching maximizes catalyst efficiency



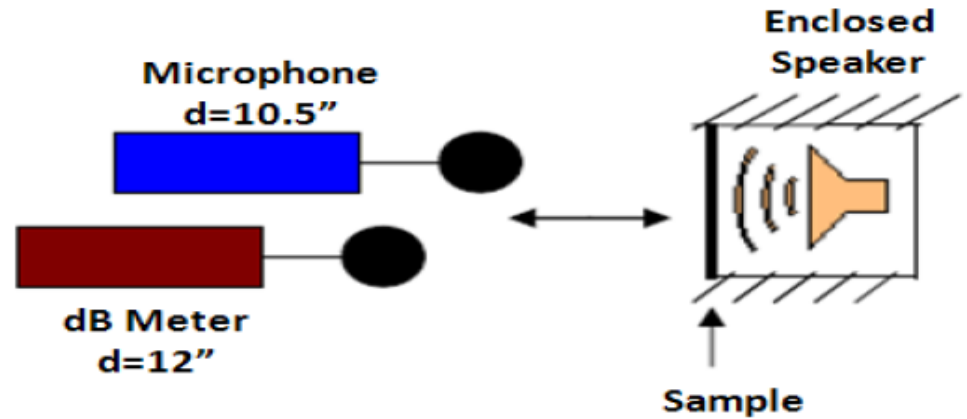
## Emissions (parts per million)

Mode Points	Speed (RPM)	Untreated		With TR Catalyst	
		HC	NOx	HC	NOx
1	6800	5000	530	1000	70
5	1500	4500	58	1	30

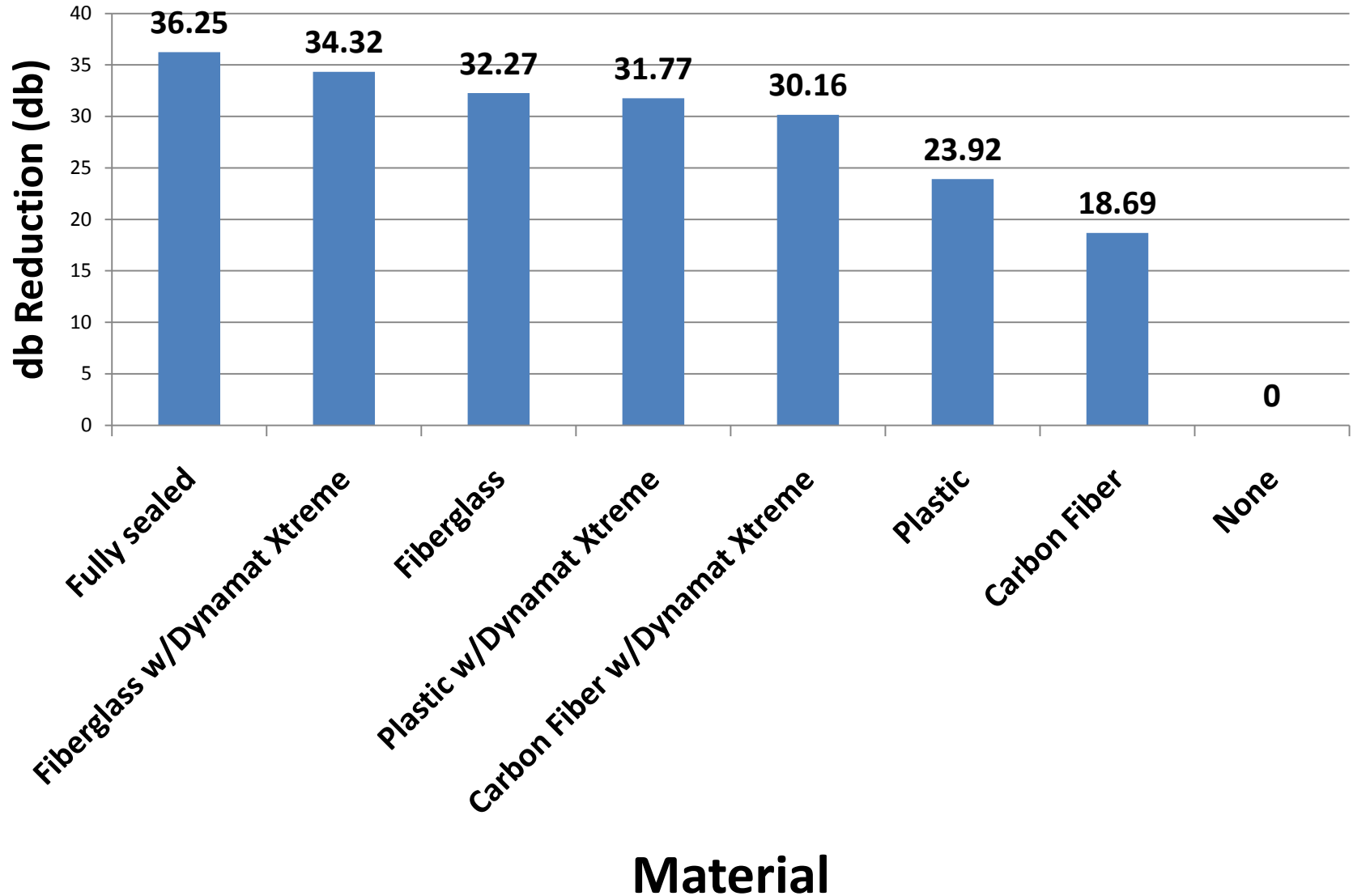


# Sound Reduction

- Engine:
  - Panels
  - Pre-burn muffler
  - Catalysts
  - After-burn muffler



# Sound Reduction vs. Material



# Sound Reduction (cont'd)

- Tunnel wrap

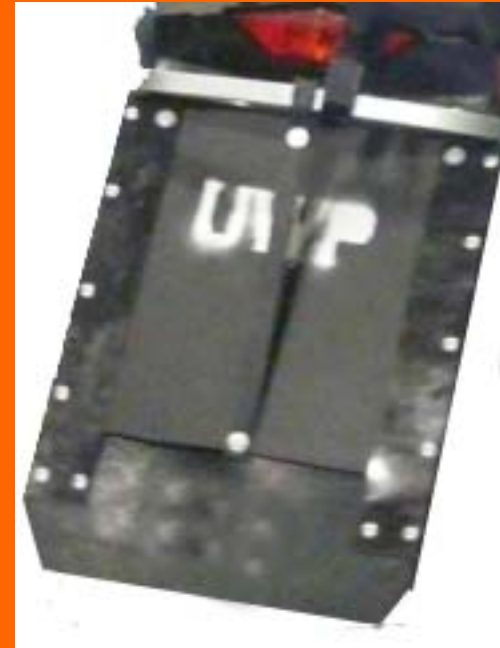


- Quiet Track



- Snow Flap

- 3/8" thick Koneta Rubber



# Benefits of UWP CSC

- Consumer

- Fun, easy to ride, light weight
- Competitive cost (MSRP = \$14,823)

- Dealer

- Low maintenance
- Aesthetically appealing
- Easy to sell

- Environmental

- Reduced exhaust emissions
- Reduced noise levels

# Thank You



Questions?