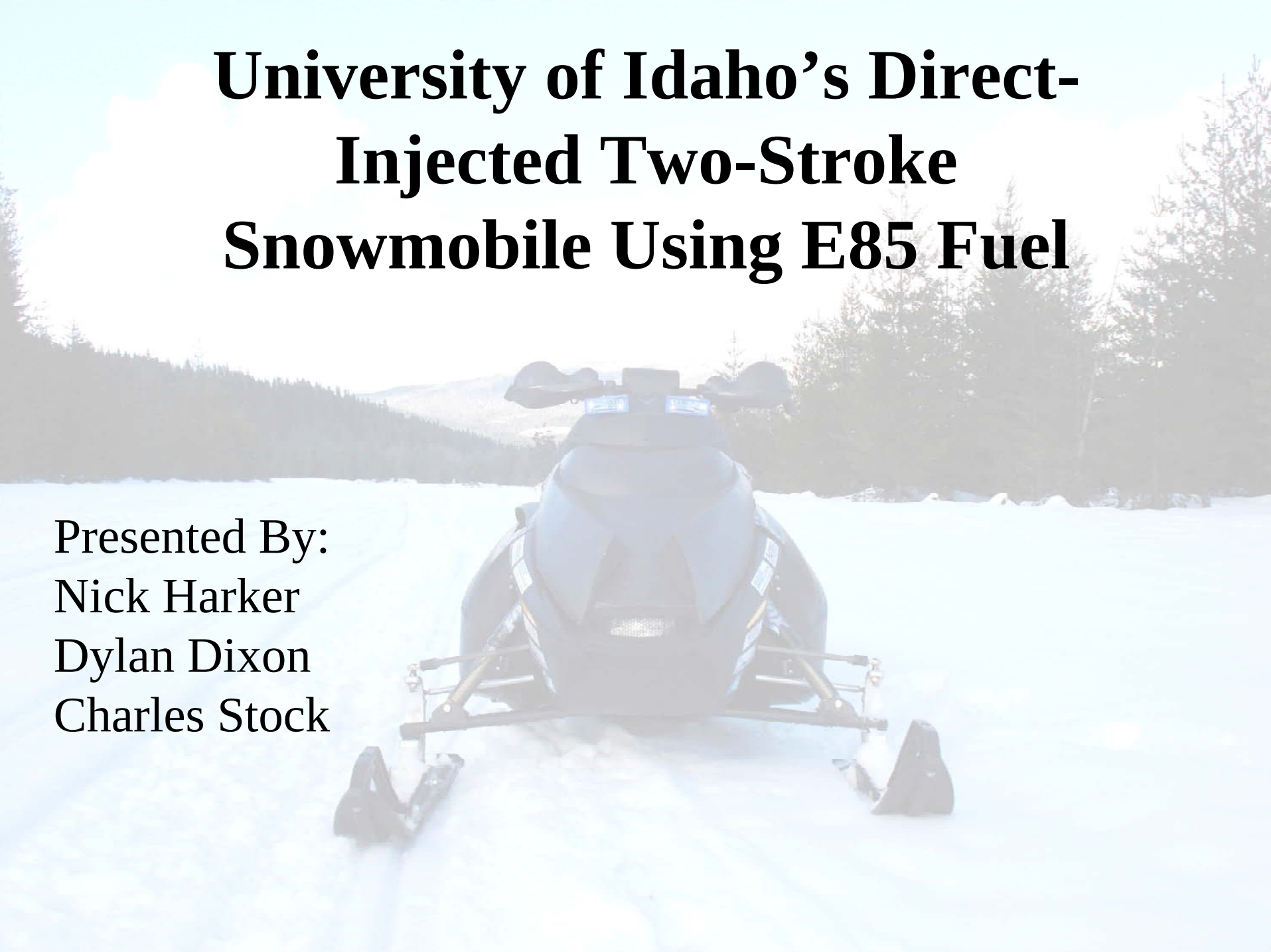
University of Idaho's Direct-Injected Two-Stroke Snowmobile Using E85 Fuel



Presented By:
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UI CSC Design Goals

- Achieve NPS emissions standards
  - Noise (73 dBA J192)
  - Emissions (E-Score 170 with catalyst)
- Optimize Fuel Economy
- Maintain Stock Power
- Maintain 2-stroke Riding Experience
- Deliver OEM Packaging
- Minimize Cost

All While Running E85

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Winter Blend E85

- ~ 72-78% Corn Ethanol
- ~ 27% Less Energy Content than Gas
- Additional Hazardous Emissions
  - Formaldehydes
  - Acetaldehydes
- Reduced Measured Emissions (CO & HC)
- Poor Shelf Life (<90 days)
- Corrosive

UICSC History

UICSC Has Proven that Both Two and Four Stroke Snowmobiles Can Meet Competition Goals

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Two-Stroke Vs. Four-Stroke

- Fuel Consumption Using E85
  - 2008 UI 2-stroke: 14mpg
  - 2007 CSC best 4-stroke: 11.23mpg
- Power-to-Weight
  - 2008 UI 2-stroke: 0.16 hp/lb
  - 2007 CSC best 4-stroke: 0.11 hp/lb
- Oil Consumption
  - Comparable between no loss and total loss

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2008 Design Strategy

- E85 Compatible
  - Fuel System Upgrades
  - Engine Tuning/Calibration
- Exhaust Emissions
  - DI System
  - Catalyst
  - E85 Fuel
- Noise Reduction
  - Sound Deadening Material
  - Custom Intake and Oversized Body Panels

Chassis and Engine

- Chassis
  - Ski-Doo MXZ
    - Performance Oriented
    - Proven Rider Comfort
    - Improved Handling
- Engine
  - Rotax 593cc H.O. Two-Stroke
    - Carbureted, Reed Valved, and Loop Scavenged
    - Variable Exhaust With Tuned Pipe
    - High Power-to-Weight Ratio

DI Design

- Adapts the E-Tec DI system
- Custom Cylinder Head
- Existing Port and Crankcase Design
- 55 Volt System with No Battery
- Inductive Ignition
- Uses Electronic Oil Pump
  - Less than half the oil consumption of typical carbureted two-stroke

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E10 to E85 Conversion

Required in 2008 for Spark Ignition Sleds

- **Fuel System**
  - Pump
  - Filter
  - Fuel Lines
- **Engine Tuning/Calibration**
  - Power
  - Fuel Economy
  - Emissions
  - RIDEABILITY

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Ethanol Tuning Strategy

- Fuel Quantity
  - Compensate for low energy content
- Fuel Timing
- Spark Timing
  - Utilize Octane of E85

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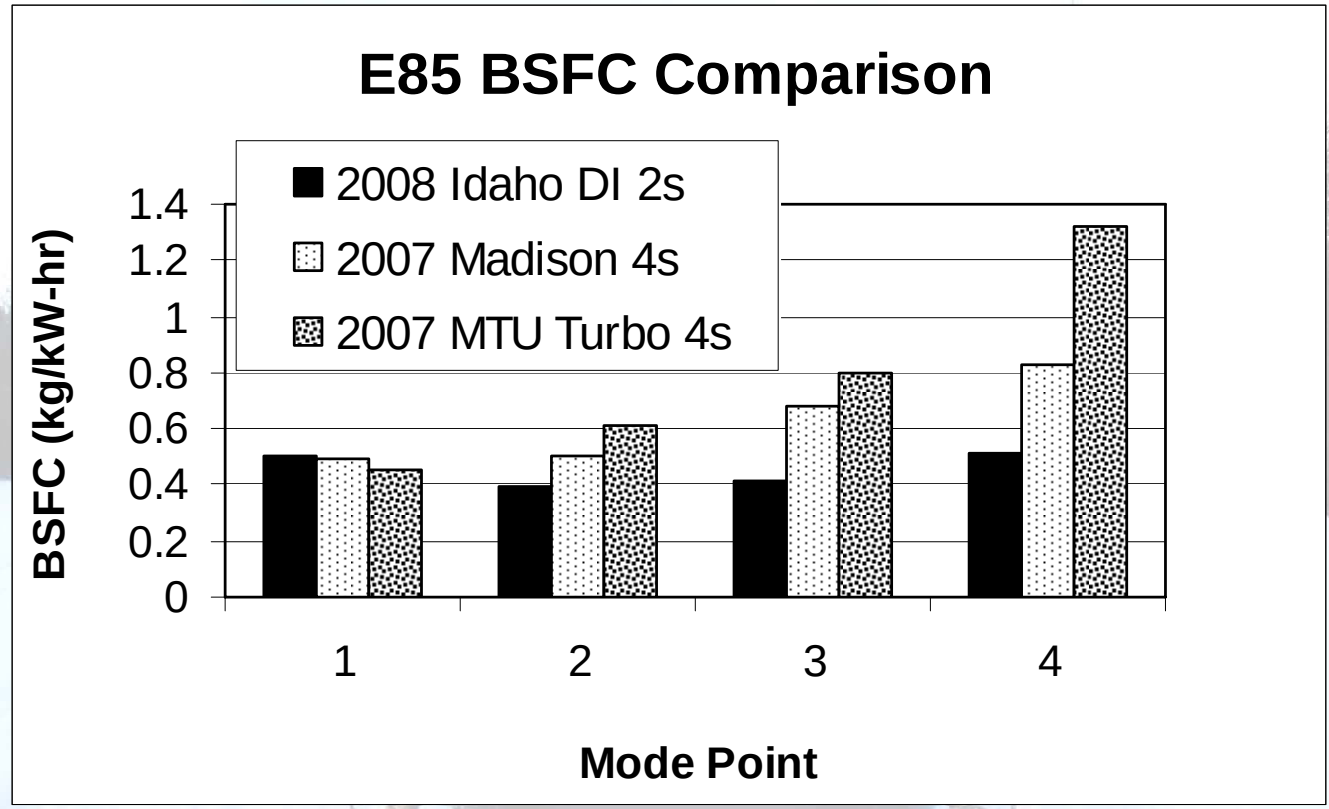
BSFC Comparison



Resulting in 13 mpg

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Exhaust Emissions

No Catalyst

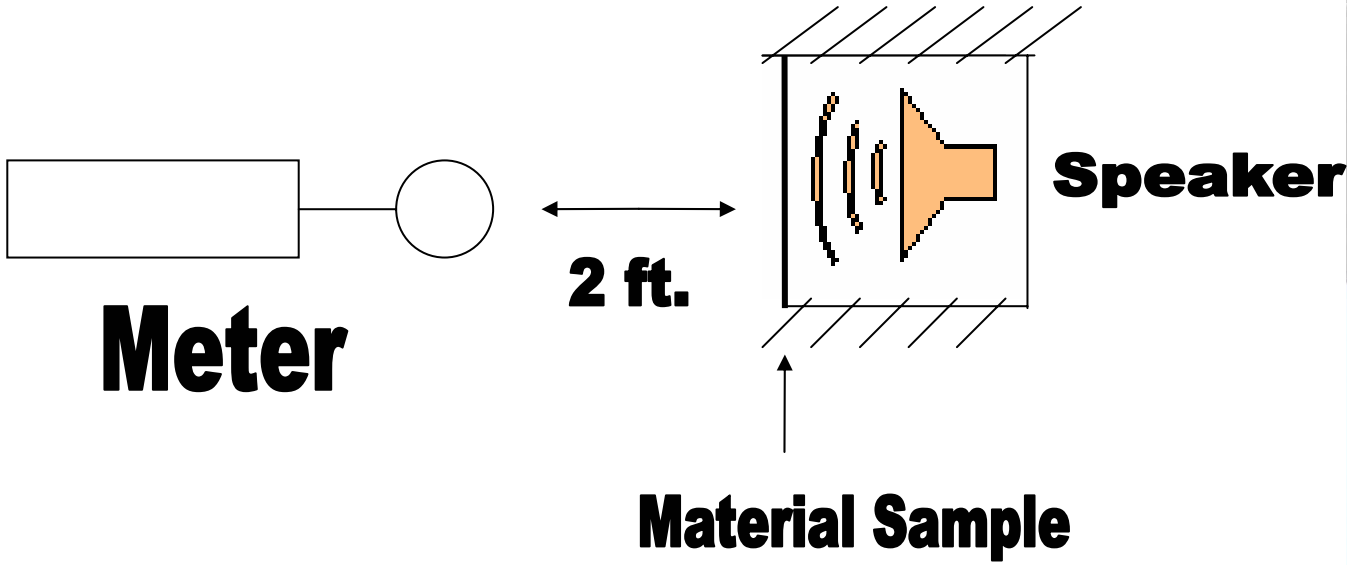
- 2008 E85
  - E = 175
  - UHC = 2.2 g/kW-hr
  - CO = 150 g/kW-hr
- 2007 E10
  - E = 158
  - UHC = 25.5 g/kW-hr
  - CO = 127 g/kW-hr

Expected CO Catalyst Reduction of 50%

Additional E85 Emissions: Acetaldehydes & Formaldehydes

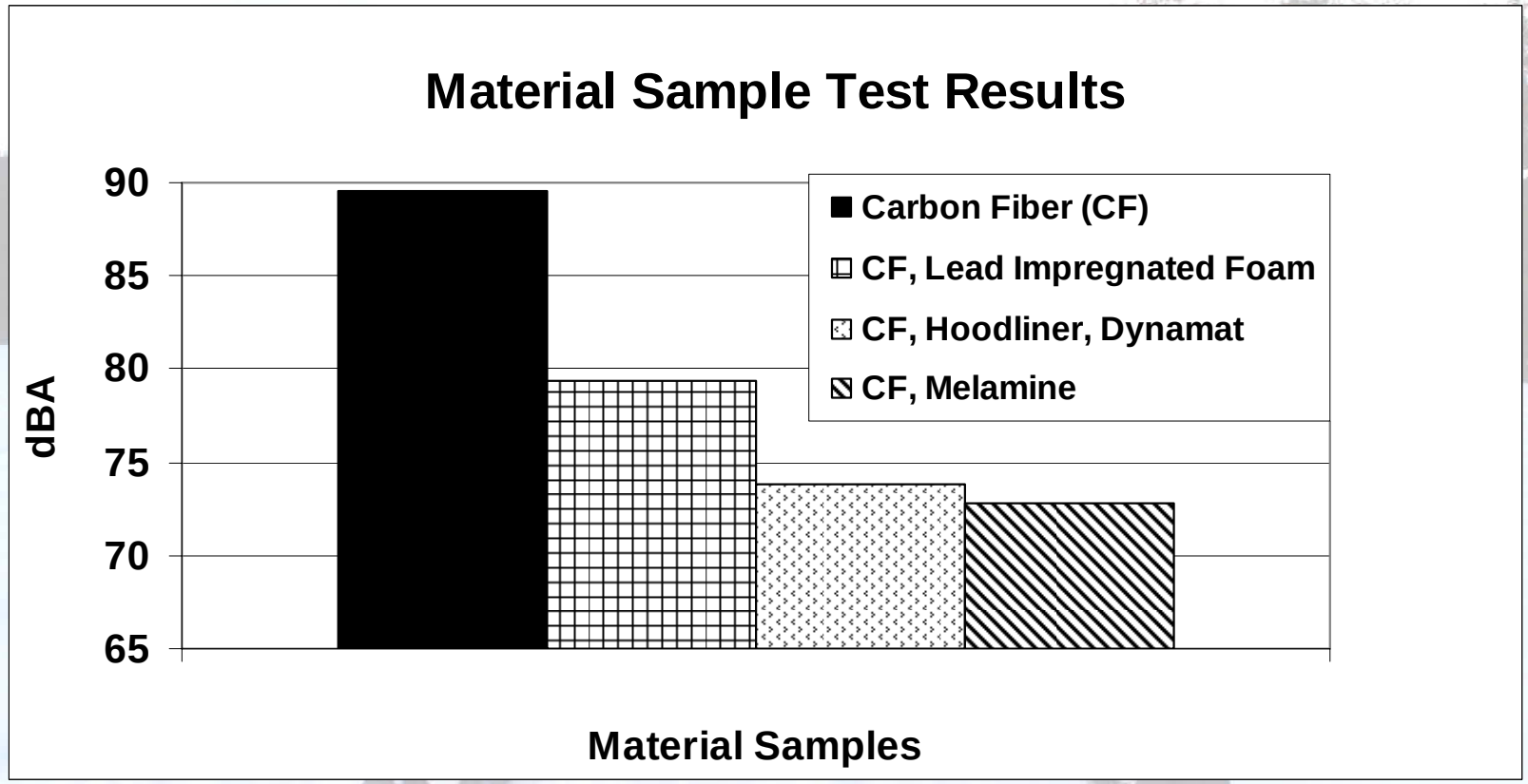
Noise Reduction

Material Testing Method



Noise Reduction

Custom Carbon Panels



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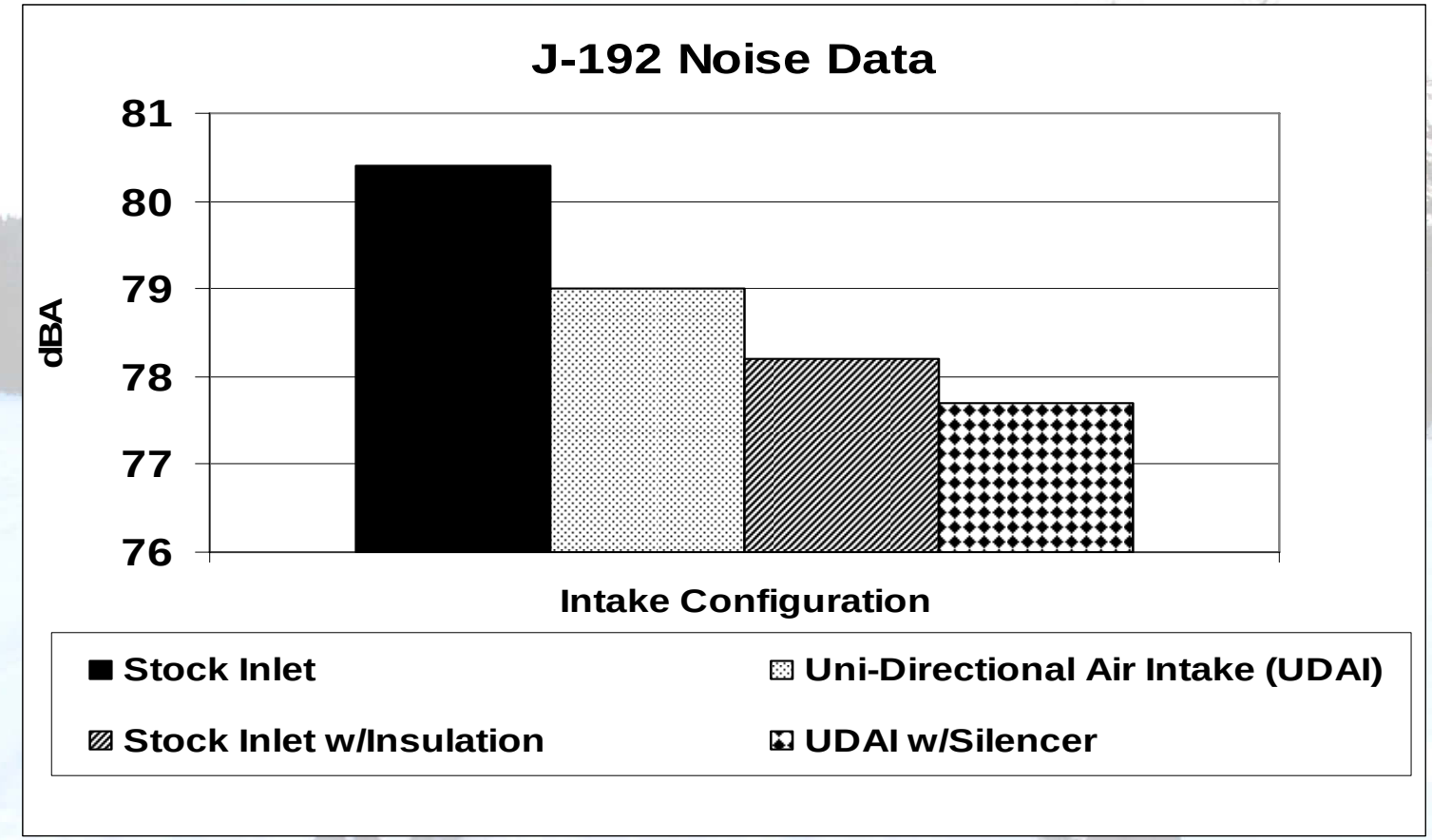
Noise Reduction

Modified Intake



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Benefits of 2008 UI DI

- Rider
  - Lightweight, Easy, and Fun to Ride
  - Fuel Economy(13 mpg) and Oil Economy
  - Competitive Cost ($9989)
- Dealer/Outfitter
  - Low Fuel Use and Maintenance
  - Easy to Sell
- Environmental
  - NPS Exhaust Emissions
  - Noise Emissions

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Summary

- Fun to Ride DI 2 Stroke fueled with E85
- Meets NPS Emissions Standards (E score of 175)
- Meets EPA Noise Emission Standard (J192 score of 78 dBa)
- Fuel Economy (13 mpg) on E85
- Maintains a High Power-to-Weight Ratio

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THANK YOU

Questions?

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MSRP Break Down

- Base Price $8799
- Chassis Modifications $950
- Engine Modifications $240

- Total MSRP **$9989**

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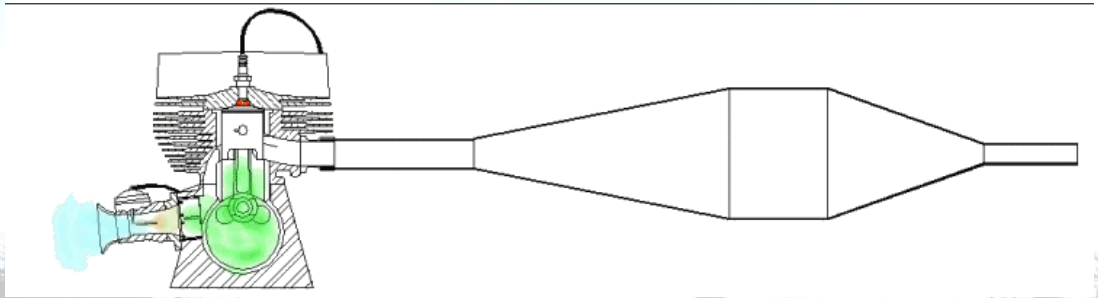
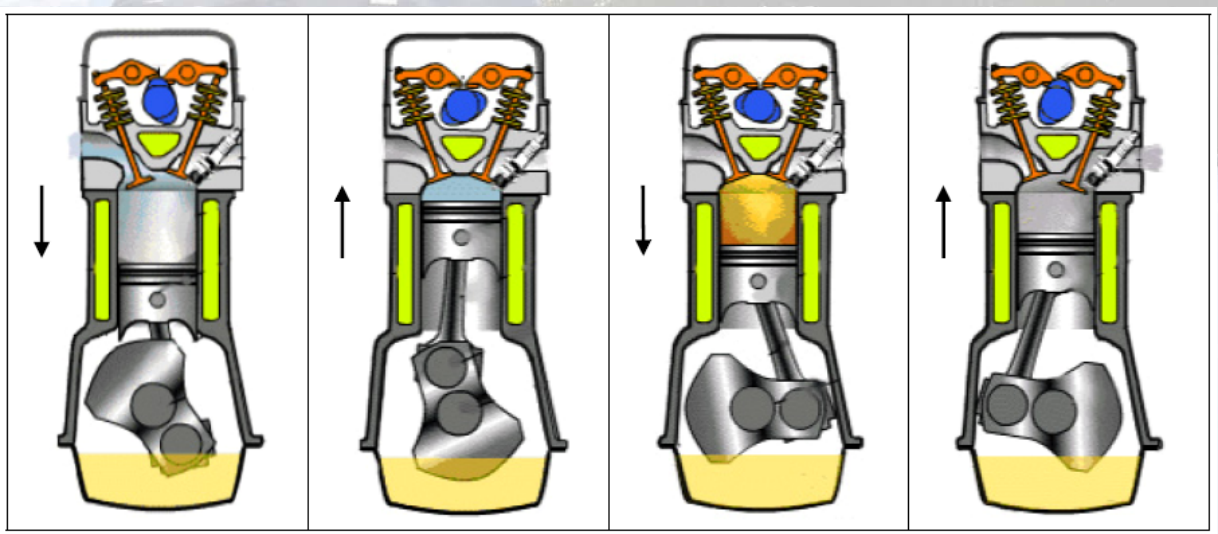
Two-Stroke Vs. Four-Stroke





Intake Compression Power Exhaust

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