



University of Waterloo

Clean Snowmobile Challenge Team



Competition Goals



The three main goals for the 2009 clean snowmobile competition are:

- Reduce Emissions
- Reduce Noise
- Maintain or Exceed OEM Performance

Strategy

The University of Waterloo Clean Snowmobile Team has taken a different approach than other competitors by not modifying a stock snowmobile.



2005 Bombardier Ski-Doo MXZ-X

+



2006 Yamaha Genesis 120

Emissions

Reduction in emissions were accomplished through four separate methods:

- Flex fuel capable fuel system (E10-E85)
- Engine Replacement (Two-Stroke to Four-Stroke)
- Catalytic Converter
- Custom Semi-Direct Fuel Injection

Noise



Reduction in snowmobile noise was accomplished through three separate methods:

- Forced-Induction System Silencing
- Exhaust Silencer
- Engine Compartment Silencing

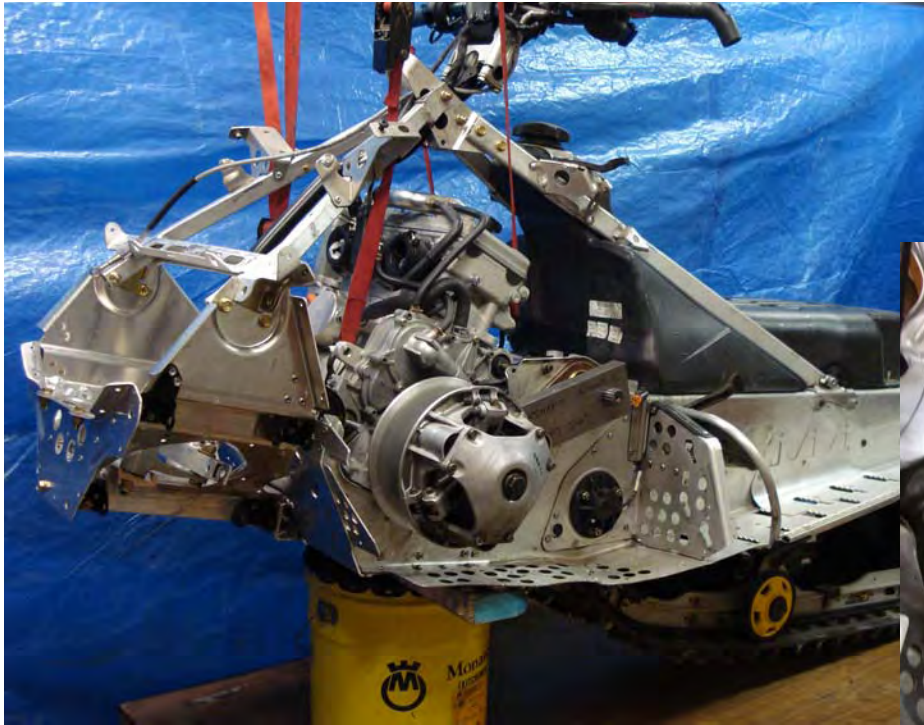
Performance

Snowmobile performance was improved through the addition of:

- Forced-Induction System (Turbocharger)
- Larger Displacement Four-Stroke Engine (973cc vs. 600cc)
- Custom Semi-Direct Fuel Injection System and Air Intake
- Flex Fuel Cold Start System
- High Performance Battery

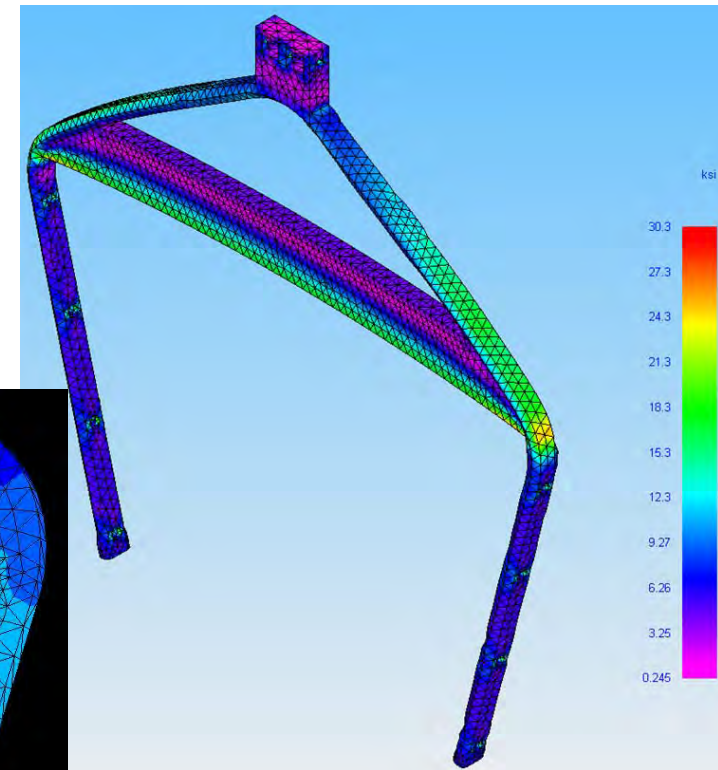
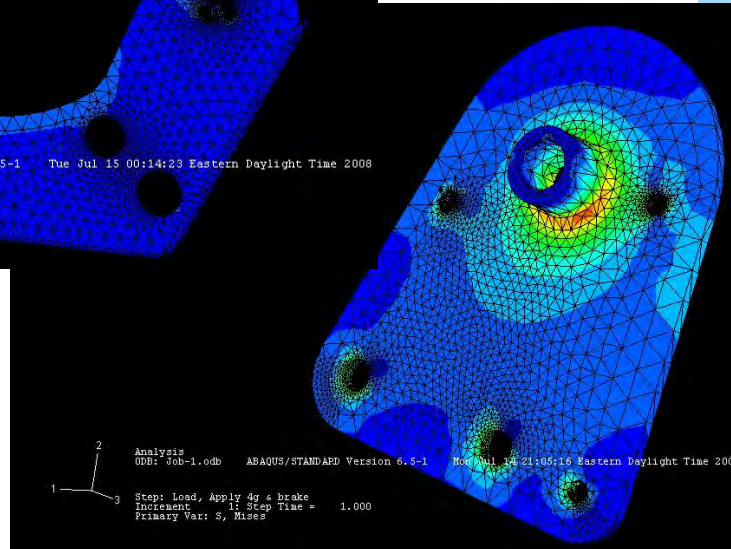
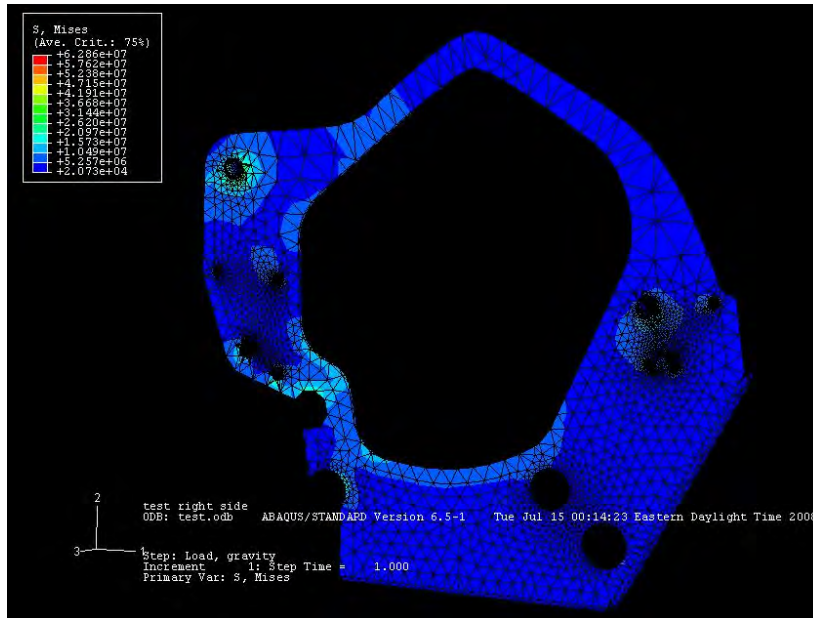
Engine Retrofit

- ❑ Custom jig system to align the Yamaha Engine
- ❑ Placement of Engine for optimal weight balance



Chassis Modifications

- ❑ Design and fabrication of engine brackets to suit Yamaha engine
- ❑ Pyramid support structural reinforcement

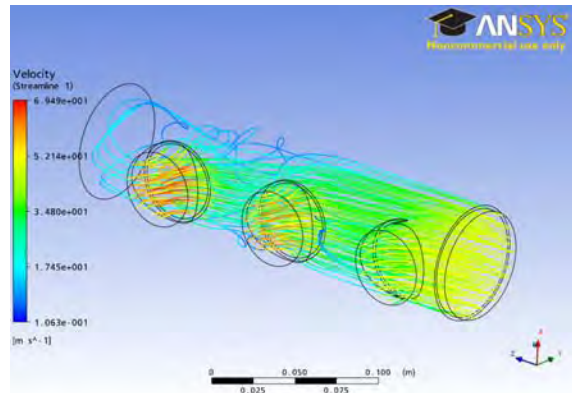


Custom Fuel Injection

The original carbureted system was converted to a custom designed plenum and semi-direct fuel injection system to reduce emissions and improve fuel economy through:

- ❑ Sequential fuel injection control (better fuel economy)
- ❑ Controlled combustion for increased catalytic efficiency
- ❑ Optimal fuel atomization for precise combustion

1. Air Intake System



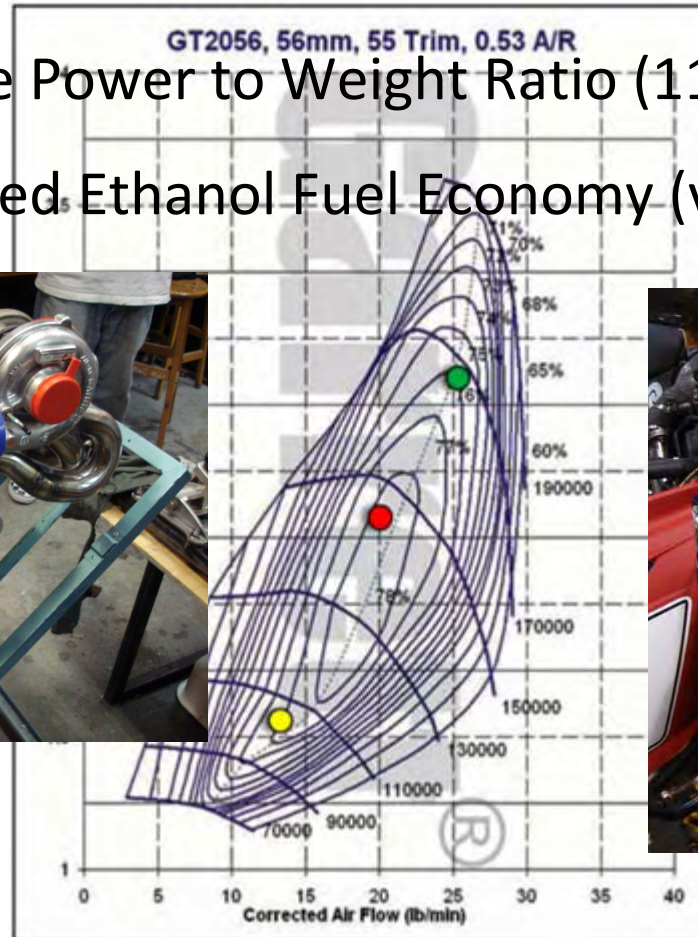
2. Fuel Injection and Air Intake



Turbocharger

The turbocharger has three purposes:

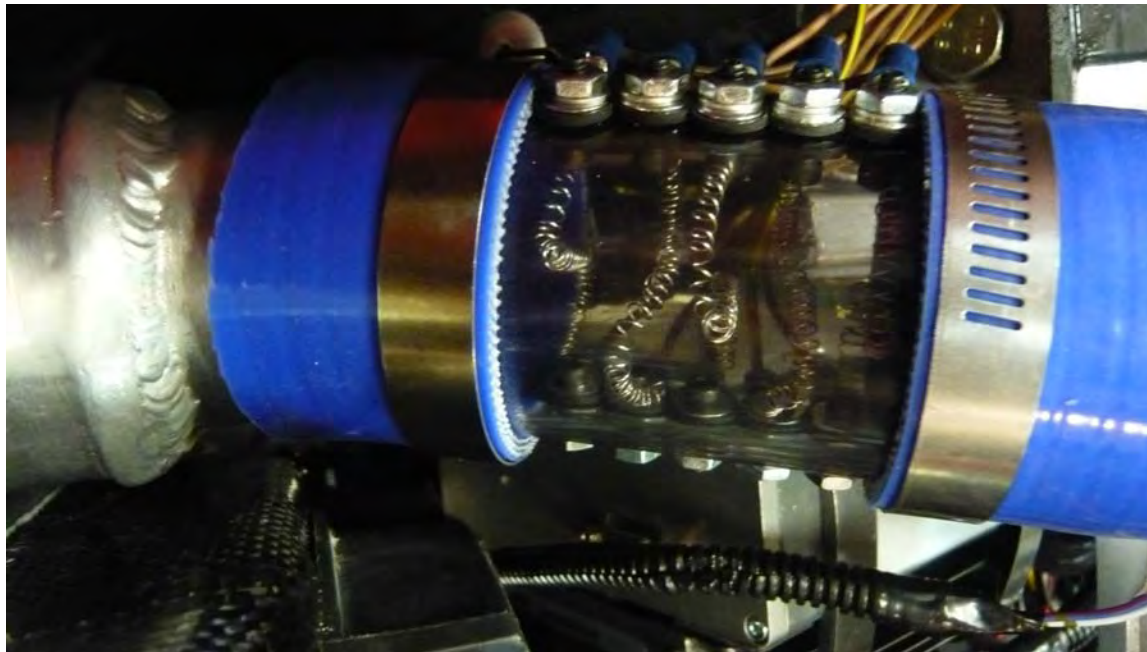
- Negate Power Losses (due to flow restrictions)
- Increase Power to Weight Ratio (115hp to 180-200hp)
- Increased Ethanol Fuel Economy (variable boost)



Cold Start System

The flex fuel cold start system improves combustion during cold weather by increasing combustion air temperature by 2°C/s

- ❑ Custom designed and fabricated nichrome wire heaters
- ❑ Located between intercooler and air plenum



Forced-Induction Silencer

The forced-induction silencing system reduces the additional noise created by the turbocharger:



Exhaust Silencer

The exhaust silencing system reduces the noise generated by the engine through four separate components

1. First Diffuser



3. Second Diffuser



2. Side-Resonant



4. Absorption Silencer



Overall Changes

We performed the following modifications to the original 2005 Ski-Doo MXZ-X snowmobile:

BEFORE

AFTER

Two-Stroke 600cc Engine → Four-Stroke 973cc Engine

Naturally Aspirated → Forced-Induction System

Carbureted Fuel System → Custom Semi-Direct Fuel Injection

Regular 87 Octane Gasoline → Flex Fuel (E10-E85)

Straight Exhaust → Catalytic Converter

Straight Exhaust → Exhaust Silencer

The Fruits of Our Labor





FOR SALE:

MSRP : \$16, 200 CND

