

SAE CSC 2011

Houghton, Michigan

University of Waterloo
Clean Snowmobile Team

Team Strategy

- Install a low displacement, high output 4-stroke engine in a very light, sport chassis
- Low weight and high output improve performance and efficiency



Chassis Selection

- Ski-Doo Rev XP chassis
- Originally from MXZ Renegade (long track)
 - Offers appealing platform for cross-over riding
- One of the lightest chassis on the market

Engine Selection

- 2006 Arctic Cat T660 turbocharged 4-stroke
- 110 hp rating stock (105 hp on test stand)
- Originally from Suzuki Alto (a microcar in Japan), albeit naturally-aspirated
- Good balance of power, fuel economy, emissions, and noise.

Engine Mounting

- Semi-rigid mounting scheme
 - Aluminum and hard rubber
 - Allows for more efficient transfer of power from primary clutch to secondary

Air Intake System

- Custom intake needed to fit chassis
- Designed to increase air capacity and power
- Throttle body relocated to improve air flow characteristics
- Aluminum construction to minimize weight



Fuel Injection System

- Peak and hold injectors used to improve fuel economy and avoid wasting fuel
- Higher volume injectors used to maintain performance and efficiency when using ethanol fuel

Exhaust

- Redesign
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- Lighte
- Ceram
compa



Performance

for

to engine

Catalytic Converter

- 3-way caesium catalytic converter
- Selected on performance, size and weight
- Slightly more expensive than basic catalytic converters
 - Much better gains in performance and emissions results expected

Oil System

- Wet sump system
- Oil pan redesigned to fit within chassis
- Maintains stock oil capacity
- Baffles used to decrease undesired oil movement within oil pan
- Oil filter relocated to fit chassis, improve serviceability

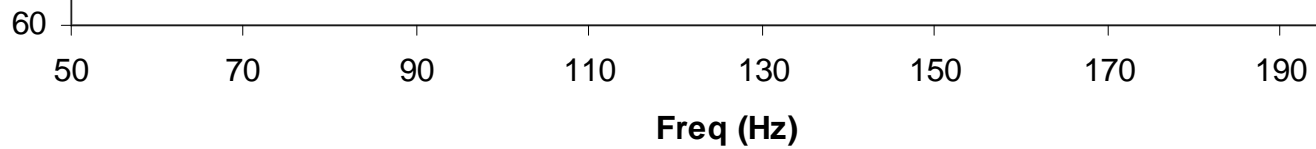
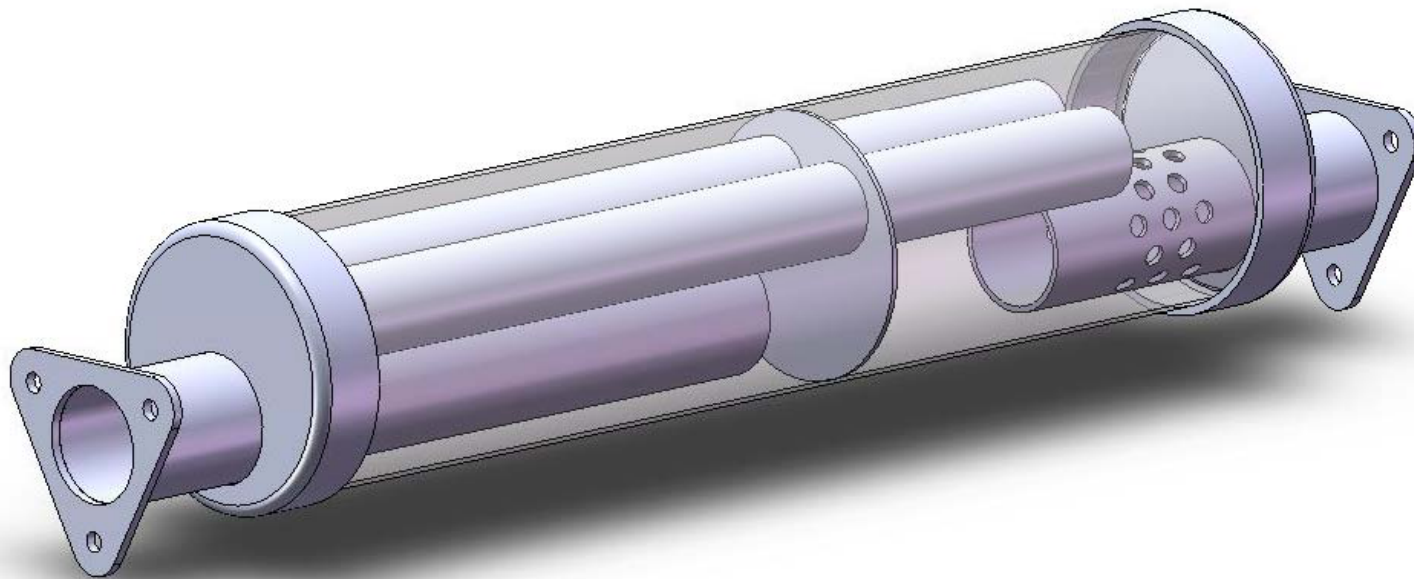
Flex Fuel Management System

- Ethanol sensor and piggyback ECU added
 - Siemens
 - Dynojet CMD
- Sensor reads ethanol level in fuel and CMD adjusts fuel tables on the fly
- CMD allows for USB computer attachment for servicing and tuning with minimal effort

Exhaust Silencing

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Passed Sound in Operating Range



Additional Features

- Electric Start stock to Arctic Cat T660
 - Adds consumer value, ease of operation
- Under-Cowl Thermal Protection
 - Insulation and foil added under cowl to decrease convective and radiative heat transfer
 - Improves performance and efficiency
- Engine Compartment Silencing
 - Sound insulation added in engine compartment to provide additional sound level decrease

Additional Features (cont'd)

- Snow-cooled Intercooler
 - Low-mounted intercooler allows for additional thermal dissipation through melting of snow
 - Cowling with rigid aluminum frame to protect intercooler
- Hand guards, warmers, etc.

Suggested Retail Price

- MSRP for the snowmobile in this configuration is approximately \$14,000
- Appealing price for consumers for a high feature, high performance snowmobile
- Competitive with similarly featured commercially available snowmobiles

Conclusions

- Compact design
- High end-user value with appeal for wide demographic range
- Excellent balance of environmentally friendly features and performance capabilities

Thank You For Your Time

- Any questions?

