

# University at Buffalo Clean Snowmobile Team

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# Overview

- 2011 Polaris IQ Chassis
  - M-10 Air suspension
- Daihatsu DM950DT diesel engine
  - Honeywell Garrett GT15V VNT Turbocharger
  - Water to Air Intercooler system
  - Radiator based cooling system
- Team Industries Primary and Secondary clutches
- Belt Drive System

# Snowmobile Operator Perspective

- Appeal
  - This snowmobile is intended to reach operators in the fuel economy, alternative fuel, and diesel enthusiast fields.
    - The engine has a BSFC of 260 g-kw/h from 1600 rpm to 2400 rpm, then increasing to a max of 300 g-kw/h at 3600 rpm.
    - The Bosch VE type injection pump can handle biodiesel and even straight vegetable oil.
    - The last group is reached simply because it is an “Oil Burner”

# Snowmobile Operator Perspective

- Handling
  - Fox Floats and the M10 Air suspension allow for the added weight to be handled.
  - Improvement over last year largely because of lower engine position.
- Performance
  - At the current time performance is not improved upon only held steady.

# Snowmobile Operator Perspective

- Ergonomics
  - During the build of this snowmobile, ergonomics was not a main design consideration.
  - Primary concerns are heated hand grips and mirrors to make a comfortable trail snowmobile.
  - The current air suspension besides being adjustable, makes for a much smoother ride.

# Snowmobile Dealer Perspective

- Durability
  - The engine has a longer life than gas engines.
    - CARB rates the engine at 5000 useful hours, if average speed is equal to 30 mph, this is equal to 150,000 miles.
  - Parts do not need regular replacing unless showing signs of failure.
  - Service items such as oil filters, fuel filters and all belts are readily accessible with removal of the protective covers.

# Snowmobile Dealer Perspective

- Dealer Attractiveness
  - On initial release dealers would not be attracted due to the need to learn a new technology and service methods. This technology would be pulled through the dealers from consumer demand.
- Rider Comfort
  - As noted before, comfort was a minor consideration, now to be a larger consideration.

# Environmental Perspective

- Engine out emissions
  - In stock form with no after treatment based off of CARB emissions testing, the snowmobile would have an E-score of 205.
  - Last years catalyst setup has not been changed. Therefore emissions will be similar to last year which was an E-score of 199.
  - Areas of anticipated improvement is in NOX production because of significantly lowered intake temperatures.



# Environmental Perspective

- Noise
  - The turbo and the catalyst work well as a muffler for the engine.
  - On the subjective noise test, the majority of the noise was from the track, not the engine.
  - Traditional studs have been replaced with a pre-studded Camoplast track.
  - Last year we passed the Objective sound test 1 dB lower than the next closest snowmobile and were much quieter than the majority of the other teams.

# Environmental Perspective

- Smell
  - The use of the Diesel Oxidation Catalyst removes almost all signs of a foul diesel smell.
  - This smell is removed by the conversion of the un-burnt aromatic hydrocarbons.
  - This was a concern of snowmobilers at a New York State Snowmobile Association convention.

# Design Intentions

- Belt Drive System
  - Adjustable gear ratio with different drive pulley.
  - 50% lighter and 96 to 98% efficient.
  - Main advantage is the adjustable gear ratio helping the diesel motor stay within the power-band for a longer period of time.

- Intercooler System

- The intercooler system was changed from an air to air intercooler to an air to water intercooler.
- Lowered air intake temperatures increase the density of the charge air, which increases fuel efficiency while decreasing emissions.
- More compact system overall results in an extremely small pressure drop.

- Radiator System

- Front tunnel cooler deleted and rear used for intercooler system.
- Radiator used for cooling engine solely.
- More reliable system.

# Closing Thoughts

- Overall packaging, performance and individual system reliability was increased.
- Future projects will include an EGR system, new exhaust manifold for better packaging, NEA (Nitrogen Enriched Air system), more chassis development and a new common-rail diesel motor for increased efficiency.