

# Kettering University



## Clean Snowmobile Challenge

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# Base Snowmobile



Picture Courtesy of Yamaha Corp.

- Yamaha V-Max 600
  - 600cc carbureted 2-stroke engine
  - Standard continually variable transmission (CVT)
  - Limited adjustability rear suspension



# Snowmobile Modifications



- Daihatsu 659cc engine
- Stock engine cooling
- No chassis modifications
- Modified Oil Pan for lower installation height
- CVT and bearing adaptor to engine flywheel



# Snowmobile Modifications

- Wiring harness
- Sporty hood appearance
- Exhaust system design
- E-85 compatibility



# Suspension and Final Drive



- Team Fast M-10, long travel, highly adjustable suspension
- Camoplast 1.0" rear track
- Lightweight components



# Preliminary Results

- > 80% noise reduction (-10 dBA)
- > 99% THC reduction
- > 96% CO reduction
- Performance and cost comparable to 600cc class snowmobile



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# Questions?



# Lettering CSC Objectives

- Reduce noise
- Reduce emissions
- Maintain overall performance
- Cost effective
- Ease of manufacturability
- Reliable



# Desired Drivetrain Characteristics

- Fuel Injection
  - Electronic engine control
  - Automatic altitude adjustment
- Minimal use of custom parts
- Comparable power to 600cc two-stroke



# Why not other motors?

- Direct injection two-stroke
  - Complex control mechanism
  - Undesirable emissions characteristics (max. 75% reduction)
- Rotary engine
  - Lack of availability
  - Undesirable emissions characteristics



# Why not other motors?

- Marine four-stroke
  - Physical engine layout incompatibility
  - Undesirable emissions characteristics
- Motorcycle four-stroke
  - High mechanical noise emissions
  - Potential for undesirable emissions characteristics



# Daihatsu Mira 659cc 4-stroke



- OEM 659cc displacement
- Meets stringent Japanese 2006 vehicle emissions standards
- OEM fuel injected
- OEM turbocharged/intercooled
- OEM electronic engine control
- OEM integrated catalyst



