

Yama-Doo '09



Welcome to the Second Edition!

The 2009 University of Waterloo Clean Snowmobile Team is off to a great start. The team is refreshed from a well deserved holiday break, and ready to go!

This semester, the team has the unique pleasure of working cohesively with both Mechanical Engineering Classes—this is the first time in four years that we

have been together. Be prepared for newly invigorated group with the goal of getting the 2009 Sled in a top-ten finish.

About the Old Sled...

We currently have various individuals on the team to get the old sled running. This sled was the one that was modified for past competitions. Team members are essentially starting fresh with this sled, and gutting it to get it back to basics. This sled will be used as a training vehicle to teach team members how to ride a

snowmobile. We will also be bringing the sled to the competition to show off our teams dedication and handy-work. Look out for updated progress pictures of the sled, as well as pictures of our team-members learning how to snowmobile!



Flex Fuel Sensor and ECU Programming

The upcoming installation of the flex fuel sensor is an essential part of the clean snowmobile's fuel system. Its purpose is to detect the amount of ethanol that is present in the fuel blend being injected into the cylinders. The sensor being considered is used by General Motors, in current Flex Fuel Vehicles.

Having this sensor will allow the team to further optimize the combustion process by factoring in the ethanol content to the base fuel maps. These base maps are used by the snowmobile's

ECU to tell the fuel injector how much fuel to inject into each cylinder based on the engine's RPMs and the applied throttle. Careful studies are underway into the appropriate air-fuel ratios for the required ethanol content range (0-85%) and proper tuning procedures.

Looking ahead, the team will have to work hard to optimize the fuel maps for performance and emissions. The tweaking and tuning efforts will rely on the information provided by the sensors. Therefore time will

need to be spent verifying the accuracy and proper functioning of these sensors, as the overall performance of the sled rests heavily on the decisions programmed into the ECU, which in turn are based on information received from the sensors.



Special Points of Interest

- > Taking a Closer Look at some of the Design Solutions
- > Please look forward to these newsletters, which are available at our newly developed website on a monthly basis

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Throttle Body Assembly and Plenum Design

The purpose of the throttle body and plenum assembly is to control and uniformly distribute the pressurized air to the intake ports on the three cylinders.

The initial design utilizes three cast aluminum throttle bodies acquired from '91 Polaris Snowmobile. A plenum size of approximately 2-litres has been calculated. A series of designs have been completed and analyzed using computational fluid dynamics.

The throttle body and plenum interface connections are almost complete. Future works include connection of the throttle bodies to the engine intake and frame.

the level of safety associated with the components. The new design incorporates the intake flange with integrated fuel injection ports that are orientated in a manner that allows for direct fuel injection into the engine intake ports.

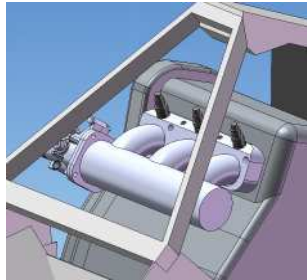
expected that the assembly will be fully integrated into the snowmobile by the first week of February.



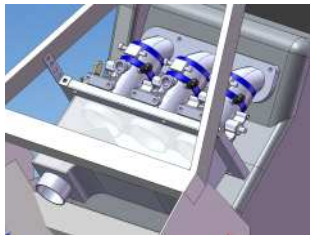
With this design in place, it is possible for the fuel injection system to be constructed. The Fuel Rail will sit on top of the plenum assembly and bolt on as required. See the next section for further details on this project!



We may have started with nothing...but we have ended up with something!



By utilizing this design, it allows for increased fuel economy and overall performance compared to the original design. Instead of utilizing three cast aluminum throttle bodies, a single throttle body will be used to further reduce the overall size of the assembly. The plenum size has also be slightly reduced. The components for this assembly have been fabricated on site (in the University of Waterloo Machine Shop) and are currently being welded together. It is



After further deliberation, the original throttle body and plenum design was modified to increase

A Tribute to the Sled...



Fuel System

The fuel system is an integral part of the snowmobile as it ensures that the engine receives an adequate supply of fuel during operation. The main challenge of the design was converting the carbureted system to a fuel injected system. The fuel system features six key components – the fuel injectors, low pressure fuel pump, high pressure fuel pump, fuel regulator, fuel rail and fuel lines.



A major challenge of parts procurement was ensuring compatibility with E85. As a result of this unique challenge, it was determined that the optimal solution would be to utilize components that are currently being used on the market. At this time, we would like to thank Saisan Motors for donating fuel injectors to the team, as well as

KW Fuel Injection for confirming functionality. A high pressure fuel pump was purchased from DL Motorsports (in Burlington) at a reduced rate, with the assistance of Accel who confirmed compatibility of the pump with E85. A custom fuel rail is currently being machined on site from an aluminum extrusion. Holes will be drilled into the fuel rail to allow for the installation of three fuel injectors as well as the fuel feed. The fuel lines to be utilized to tie the system together are 3/16" inner diameter, stainless steel braided hose with a Teflon inner tube.

When assembling the high pressure fuel pump, we wanted to utilize the fuel pump assembly that came stock with the sled. The high pressure fuel pump that was ordered was of similar dimensions to the stock fuel pump and fit into the fuel pump assembly just perfect.

All of the parts have now been received and the installation of the components is currently underway. The complete installation of the fuel system is scheduled for the first week of February.



Old Fuel Pump



New Fuel Pump



We couldn't do it without the contributions of our Sponsors. Thank you!

Sponsors!

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**University of Waterloo
Clean Snowmobile Team**
200 University Ave. West
Waterloo, Ontario
N2L 3G1

Phone: 519-888-4567 x 35610
www.eng.uwaterloo.ca/~sled
E-mail: pmt@mhtl.uwaterloo.ca

