CNG Fuel Injection System

The need:

Snowmobiling is an important part of the Maine economy. One study calculated that the sport provides more than 3000 full time equivalent in the state. While the modern snowmobile is a dramatic improvement in noise and emissions than machines from only a decade ago, they still represent a significant source of pollution in often pristine areas. The use of ethanol blend in the fuel has also presented problems for snowmobiles used in forest service and rental operations due to condensation and the resulting negative impact on pollution. In spring term of 2014 the first CNG snowmobile in Maine was demonstrated. The converted snowmobile was both a challenge and a success. The outside of the box thinking that came with this system told a compelling story about what students can do in a niche area.

The biggest single barrier to operation has been the inability to tune the snowmobile. Part of that problem is due to the lack of reliable injector curves and lack of support from the industry for odd-applications. The 2014-15 injector team worked on the development of a basic system for characterizing CNG injectors. The outcome of the project was that the current system of two injectors cannot be used to maintain a stoichiometric mixture over the full RMP range of a small high revving CNG engine. This project will focus on the construction of a system which can deliver fuel to a high revving small displacement CNG engine. This project is a clean sheet, waiting for input and good ideas from the design team. Options include alternative injectors (which would need to be characterized, a single injector at low speeds and dual injectors at high speed as well as a three injector system. Design and production of an intake manifold with good flow characteristics will also be required.

The key project design objective:

This team will provide an intake manifold for the CNG snowmobile which can deliver a stoichiometric mixture over the full operating range of the engine. The injectors must be demonstrated to operate given a input signal to deliver the required amount of fuel.

Who is the final customer for this device?

The customer for this project will be the CSC team.

Who will be supervising and evaluating the outcome of the project:

The primary supervision of the project is by Professor Peterson. The results will be reviewed by a Chrysler engine development engineer and an experienced engine tuner. Additional input from Prof. Poland on the design of internal combustion engines.

UMaine Mechanical Engineering technical contact point:

Professor Peterson will provide primary oversight on the goals and objectives of the project. Additional technical support will come from other faculty in the other relevant technical areas.

Core Mechanical Engineering classes required as background:

- Controls
- Thermodynamics
- Design I and II
- Fluids

Resources available:

Extensive build and test facilities are available in Crosby Lab. Infrastructure includes an engine test cell, engine dyno, chassis dyno as well as additional build and test area. Fabrication and assembly areas are available. Basic software is available for analysis

End of year deliverables:

This group will deliver a fully documented and properly designed CNG intake manifold with injectors that can deliver a stoichiometric fuel mixture to the cylinders over the full operating range of the engine.