Department of Mechanical and Materials Engineering

SENIOR DESIGN PROJECT SYNOPSIS – Fall 2013

Race Engine Optimization

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Formula SAE is a competition in which university teams compete with formula-style, open-wheel race cars that are designed and constructed by students. The competition rules strictly regulate the design for homologation purposes. Among these restrictions are the requirements that all engines displace less than 610cc per cycle and that all intake air pass through a 20mm restrictor. Our design objective is to adapt a motorcycle engine to properly function under the competition operating conditions.

The competition rules allow for 100-octane fuel to be used. This fuel allows for a higher compression ratio to be reached before mixture detonation occurs. The street-legal motorcycle engines typically adapted for this competition are designed with compression ratios optimized to run on widely-available "pump" fuels rated as low as 87-octane. The addition of the 20mm intake restrictor further lowers the effective compression ratio. These competition regulations result in combustion conditions being far from optimized to extract maximum power from the fuel available.

Problems encountered at initial dynamometer testing due to the introduction of the intake restrictor led to the alteration of the project's scope from compression ratio optimization to the design and fabrication of a manifold to restore the smooth torque curve characteristics lost due to airflow disruption.

Several manifold prototypes will be developed in software and tested via computational fluid dynamic analysis. The manifold with the best performance characteristics will then be refined, to further improve these characteristics. The final design will be fabricated via three-dimensional printing process.

The engine is to be modified with the anticipation that it will be adapted for use in the next car designed by the Panther Motorsports FSAE team. The accompanying documentation will be written to facilitate its use by future teams for the optimization of *any* comparable engine.