

Abstract:

During the past several decades, the development of high efficiency, high power density engines has been a major goal of the automotive industry. Among the technologies needed to achieve this goal is turbocharging. With this in mind, a project was established that focused on both the design of a test stand and the development of a high power density single-cylinder powerplant for the Formula SAE team at The Cooper Union. The project was discretized into three phases in order to streamline implementation.

The first phase of the project involved the construction of the test stand. As only a bare mounting plate existed, the process required structural design and fabrication, fluid routing, and electrical telemetry development. The key design philosophies of this phase were modularity and upgradeability, to ensure that various aspects of the test stand could be offered as future projects for the ME curriculum.

The second phase of the project was the development of a battery of virtual engine development studies. By using tools to analyze both vehicle level and engine level system performance, recommendations could be made to guide the physical engine development. These virtual studies also laid the groundwork for future studies, but required physical validation to maximize their accuracy.

The final phase was engine validation. This phase saw the generation of the preliminary AFR tune. However, numerous engine failures occurred along the way. With the limited amount of data gathered, preliminary comparisons were made between the virtual results and the on-stand performance. Nonetheless, it is hoped that this preliminary work will serve to facilitate future research and development of high performance single-cylinder engine technology at The Cooper Union.