

Fluid Prefilming in Fuel Injectors

Marty Y. Chang (216-754-2360)

Undergraduate Student, 2006 Fellowship

Case Western Reserve University



Introduction

- Academic advisor
 - Dr. Alexis R. Abramson
- Industrial mentor
 - Dr. Adel B. Mansour
- Industrial site
 - Mentor (Ohio) Facility
 - Gas Turbine Fuel Systems Division
 - Parker Hannifin Corporation



Objective

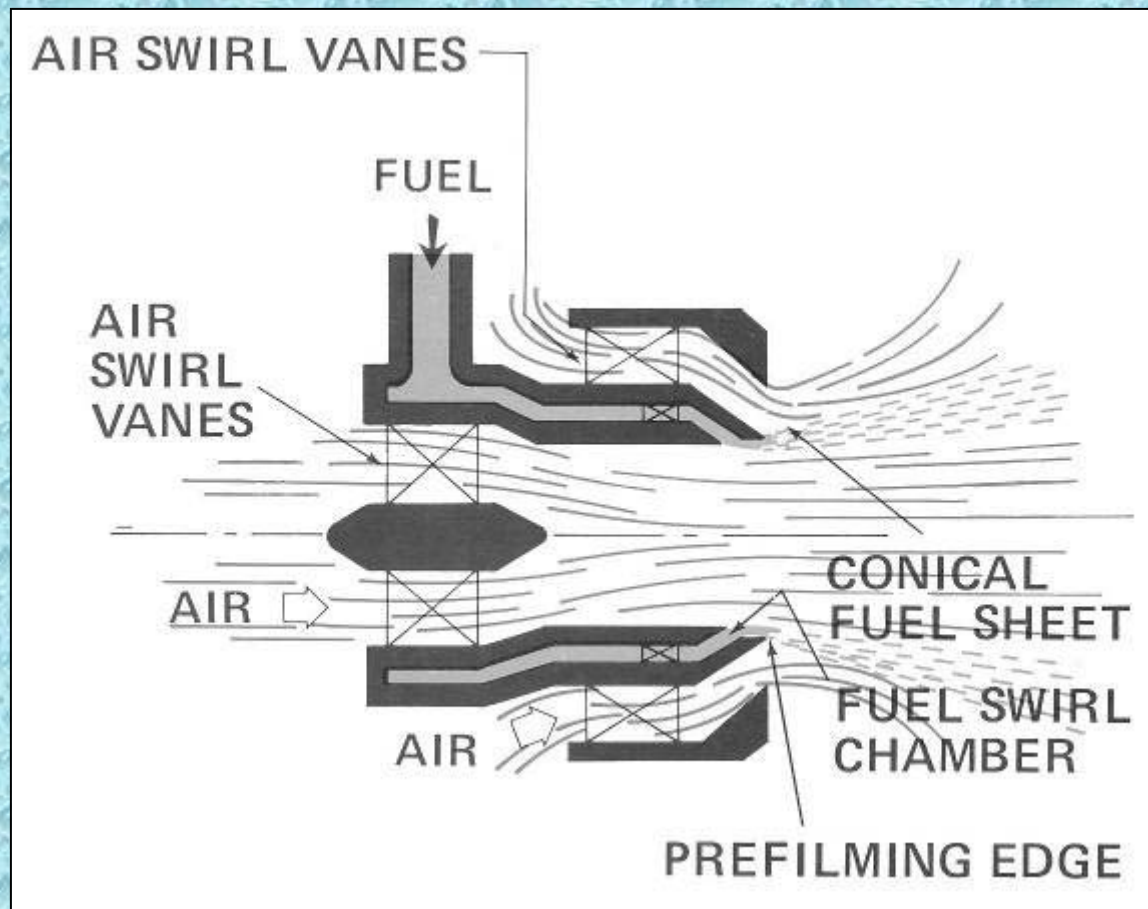
- To learn more about the prefilming process observed in fuel injectors.



Background

- Prefilming is defined as the formation of a thin sheet of fluid (also known as film) upon exiting the tip of a nozzle.
- Prefilming plays an important role in fluid atomization in air-blast nozzles.
- NO_x emissions may be reduced by more uniform sprays, which can only be achieved with more uniform prefilming.

Air-blast Fuel Injector





Air-blast Fuel Injector, cont'd

- The fluid flow of an air-blast fuel injector is typically controlled by a fuel swirler and a prefilmer.
- The fuel swirler imparts a tangential component to the velocity to the moving fluid.
- The prefilmer encloses the fuel swirler and facilitates the film formation.



Design of Experiments

- Four fuel swirler iterations and eight prefilmer iterations were made, yielding a total of 32 different assembly combinations.
- The goal of the experiments is to determine which assembly performed best.



Experiment Implementation

- Mil-PRF-7024E Type II calibration fluid was used for the experiments.
- Assemblies were connected to a fluid line and then suspended in a spray chamber.
- Fluid was flowed at 5, 10, 15, 20, 25, 30, 40, 50, 75, and 100 psig
- Pictures of the spray were taken at every pressure drop.



Sample Sprays



50 psig



100 psig



Results

- Many combinations were eliminated from consideration for future experiments.
- The assemblies which performed best will be further tested in upcoming experiments.
- Combustion tests will be performed to measure the effectiveness of the designs in reducing emissions.