CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)

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Project Number

S0306

Project Title

Can a Modified Lockwood-Hiller Valveless Pulsejet Engine Be Built that Maintains Self-sustained Periodic Combustion?

Abstract

Objectives/Goals

In the late 1950#s Ray Lockwood of Hiller Aircraft began his organized study of valveless pulsejet engines and developed the unique U-bend configuration. This study seeks to build a modified Lockwood-Hiller valveless pulsejet engine that maintains a self-sustained periodic combustion process, and test its performance against Tharratt#s 1965 theoretical thrust calculation. The modified Lockwood-Hiller valveless pulsejet engine#s experimental performance data, measured in pounds of thrust, will be less than the prototype#s theoretical thrust calculation, using C. E. Tharratt#s mid-1960#s mathematical analysis. The hypothesis is based on the literature that indicates with many valveless pulsejet engines the margin of error is small, and altering the dimensions incrementally can result in a significant increase or decrease in thrust.

Methods/Materials

A valveless pulsejet engine is a long hollow tube, open at its ends, with no moving parts. A mix of flat stainless steel and preformed mild steel conical and cylindrical shapes were TIG welded to make the body. Lockwood#s U-bend section is in the middle of the design. Frequent volume recalculations were made to rescale the pulsejet sections. An ignition system was assembled to start the engine and a propane fuel system started and maintained the pulse. Wheels were attached to the body and a simple performance measurement system using a fish-scale device was used to quantify the thrust generated.

Results

Tharratt#s mathematical model predicted 19.5 pounds of thrust (86.7 N) while 36 pounds of thrust (160.1 N) were measured.

Conclusions/Discussion

The data did not support the hypothesis and the modified Lockwood-Hiller valveless pulsejet engine#s experimental performance data, measured in pounds of thrust, was greater than the prototype#s theoretical thrust calculation, using C. E. Tharratt#s mathematical analysis. The results show a modified Lockwood-Hiller valveless pulsejet engine that maintains self-sustained periodic combustion can be built, and exceed the maximum pounds of thrust predicted by Tharratt#s theoretical calculation.

Summary Statement

This study seeks to build a modified Lockwood-Hiller valveless pulsejet engine that maintains a self-sustained periodic combustion process, and test its performance against Tharratt#s 1965 theoretical thrust calculation.

Help Received

Mr. Dino Fry at Dino Fry Racing Enterprises in Redwood City, CA for answered questions during the project, provided access to a machine shop, welding instruction, and fabrication assistance.