

Engineering Physics Propulsion Lab Thruster Test Stand

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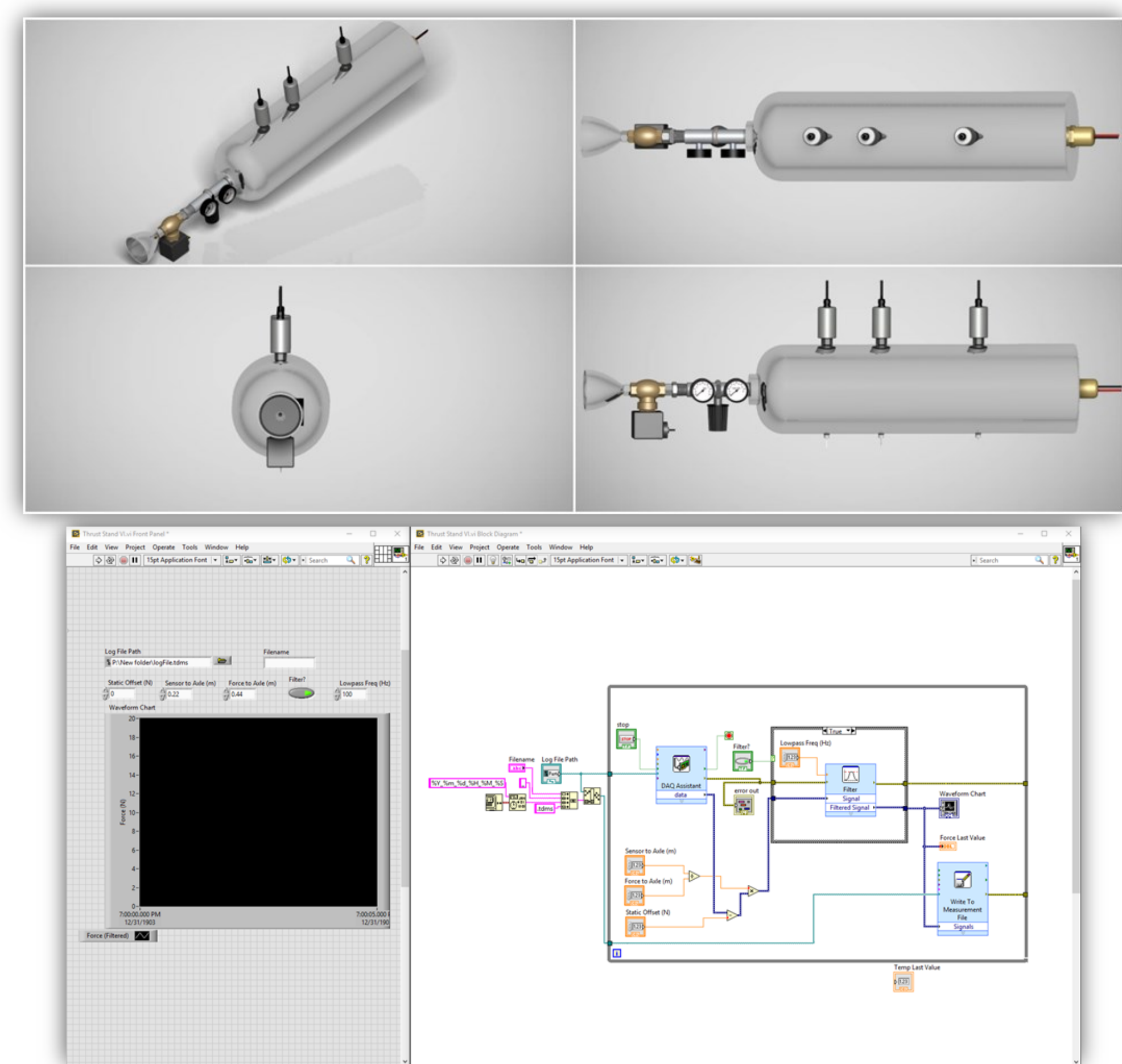
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Abstract

The Engineering Physics Propulsion Laboratory (EPPL) student team advised by Dr. Sergey Drakunov and Dr. Patrick Currier, has been working on the design, development, and construction of a Thruster Test Stand (TTS) in the College of Arts and Science. The TTS is a tool developed for a NASA, UCF, and Honeybee Robotics STTR Phase II project that will allow the team to measure the thrust, temperature, pressure, exhausted velocity, frequencies, and electrical loads on any kind of propulsion unit. The Thruster Test Stand thus provides a valuable tool to develop and optimize propulsion units.

Introduction

The Thruster Test Stand is currently testing cold gas thrusters with plans to develop and test a steam propulsion and chemical propulsion system. Current and future research to be conducted in optimizing the design parameters and conduct practical tests of the thrusters are being pursued at the University from several different departments, including the COAS, the COA, & the COE. The TTS is designed to be modular towards many different propulsion systems. The modularity on the design will allow all students involved in research related to propulsion and control thrusters to utilize the test stand and gather data on their projects. The TTS frame components are design to increase the stability and rigidity to minimize noise and unwanted natural frequencies on the readings.



Materials and Methods

- The TTS received two new key measurement devices, a thermocouple and a pressure transducer. Both tools are integrated into the LabView program.
- The thermocouple manufactured by Omega is able to work up to 260°C or 315°C depending on the method of adhering onto a material. This model also holds the fastest response time found for a thermocouple at 0.15 seconds so far and maintains an accuracy of 0.4%.
- These thermocouples will be connected to a new DAQ module that is capable of processing the data collected.
- Similarly, the pressure transducer is also manufactured by Omega and is capable of measuring pressures up to 3000 psig. The response time for this device is under a millisecond with an accuracy of 0.25%.
- These instruments are attached to a data acquisition module to collect the pressure data.



Results

Currently, the TTS is capable of producing data within a 1% accuracy and has a resolution of $\pm .1$ N for thrust measurements. Additionally, the current configuration can accommodate a thruster nozzle for steam, compressed gas, and chemical propulsion. The data acquisition is capable of measuring the temperature and the pressure of the system at different stages of the thrust profile of varying nozzles.

Conclusion & Future Work

The TTS framework is reliable and versatile for taking thrust data of any propulsive device with minimal modification. The improvements that are being completed are adding the capability to measure pressure and temperature that will be directly used for steam-based experiments.

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