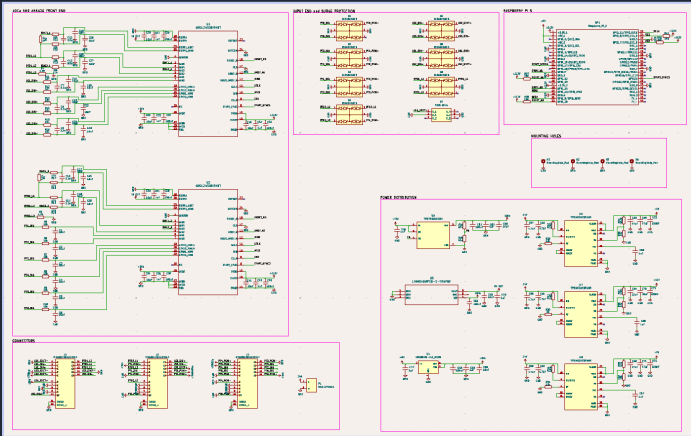# Improved Data Acquisition System Rev 2
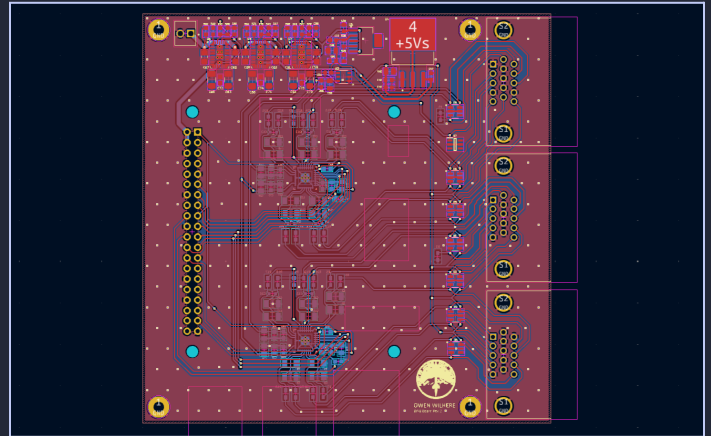
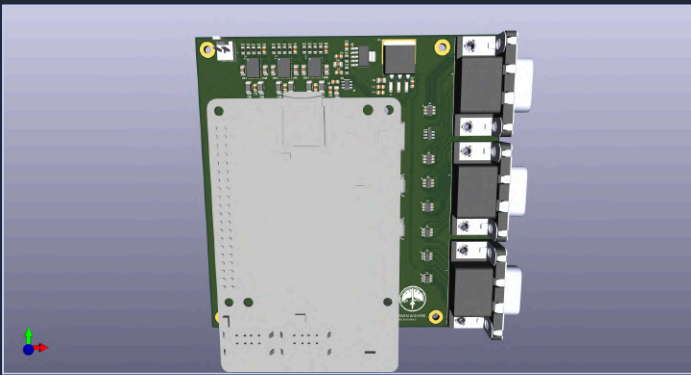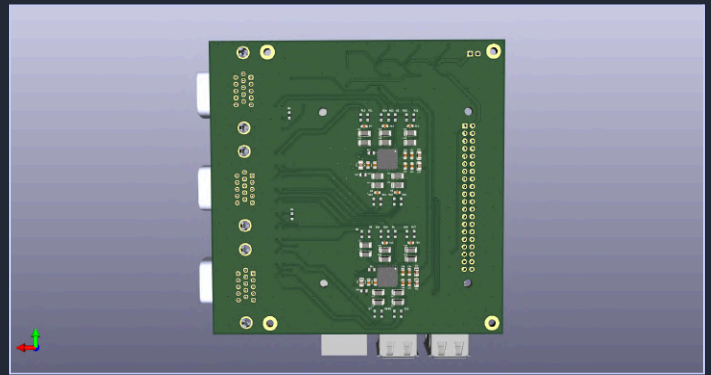*Society for Advanced Rocket Propulsion*

a.

b.

c.

d.

Custom DAQ board for reading RTDs, load cells, and pressure transducers. It powers the sensors, filters and digitizes their signals using dual 24-bit ADCs over SPI to a Raspberry Pi, logs and displays live data, and uses a custom low-noise power distribution architecture for the ADCs, sensors, and Pi.

a. Schematic shows analog sensor inputs brought in through three 15-position D-sub connectors, each line protected by a TVS diode for ESD and surge events. Signals are RC-filtered for noise reduction before reaching the ADC. The system is powered from 24 VDC, with power distributed via buck converters, LDOs, and voltage references to provide low-noise, high-accuracy rails and a high-current supply for the Raspberry Pi.

b. PCB layout fits in under 10×10 cm to reduce manufacturing cost. RC filtering networks are placed close to the ADCs for optimal performance, and analog sensor traces are carefully routed to avoid crossing noisy lines and minimize interference. An array of thermal vias is implemented to facilitate efficient heat dissipation and establish electrical connectivity between the front and back ground planes.

c. 3D front-side rendering shows the Raspberry Pi controller, the power distribution circuitry at the top, and the external connectors with TVS diode arrays along the right edge.

d. 3D back-side rendering shows the ADCs with their associated analog and power RC filtering.
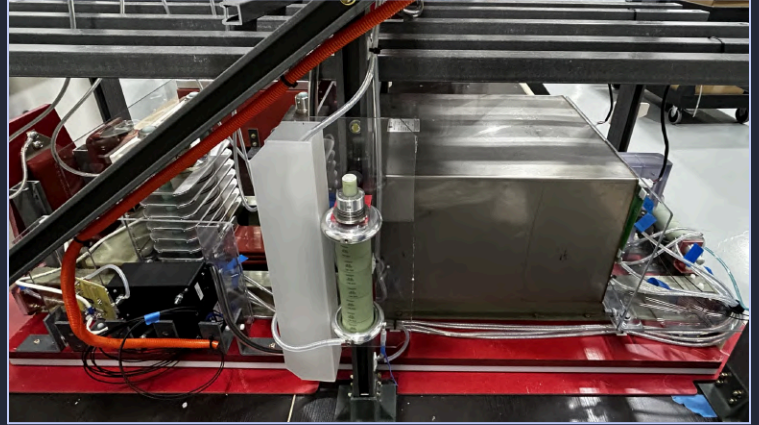
github.com/OWongit/DAQ_software

High Voltage Capacitor Test Stand Controller
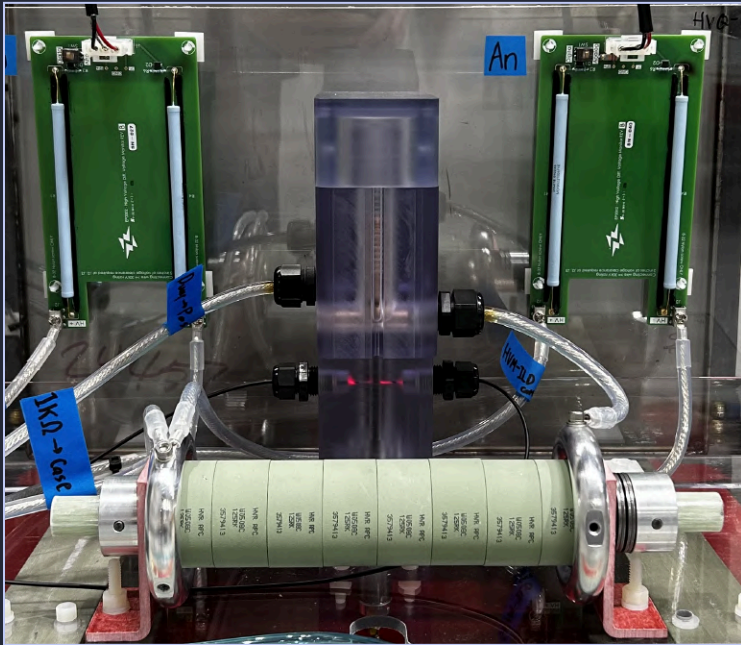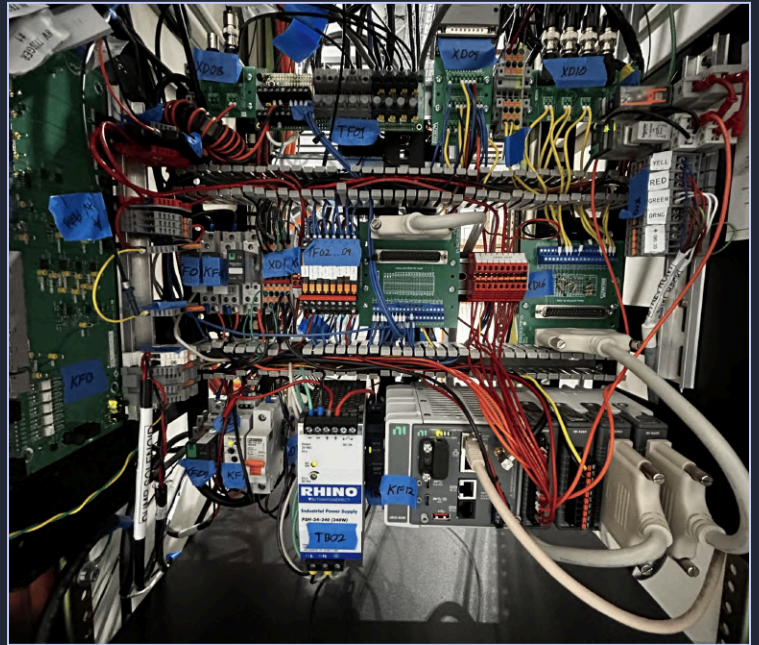
*Zap Energy, Inc.*

a.
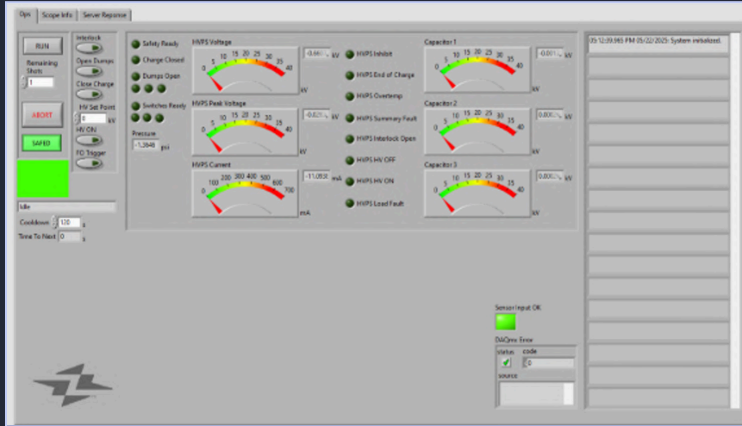
b.

c.

d.

High-voltage capacitor discharge test stand control system for applied pulsed power, integrating trigger and feedback hardware with LabVIEW.

a. LabVIEW GUI displaying power supply voltage/current and three capacitor voltages, with a control panel on the left and usage history on the right. Revised an existing system by repurposing legacy feedback and control signals to drive new relay and ignitron switches based on updated requirements.

b. Capacitor bank system with newly installed control hardware throughout, using a mix of pneumatic, electrical, and fiber-optic power and communication signals.

c. Digital and analog capacitor voltage measurement boards, modified to handle up to 48 kV in the new system, high-pot tested to verify insulation integrity and reliable operation in the test stand, and installed with clear labeling.

d. Legacy test stand safety and control circuit; Made no hardware changes, but traced, diagrammed, and documented it to support integration of the LabVIEW software updates.

Debug Terminal for Telematics Control Unit

*Zonar Systems, Inc.*

a.
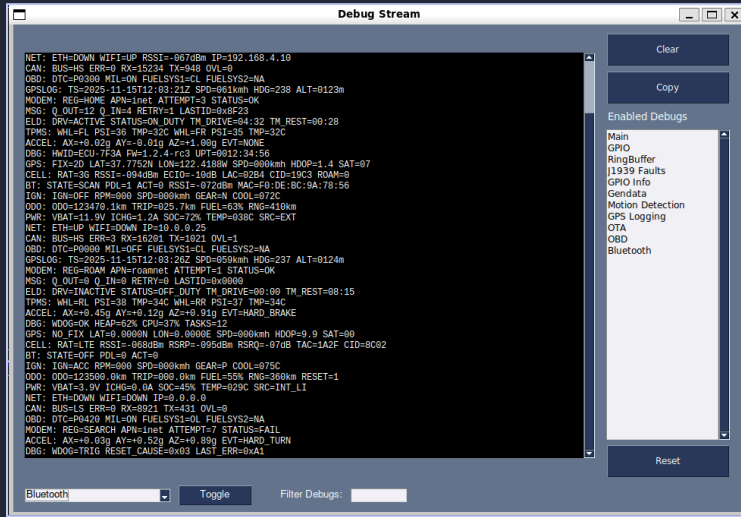
b.

Custom debug-terminal application that interfaces with a Telematics Control Unit (TCU) over RS-232 to issue commands, capture logs, and streamline QA and root-cause analysis.

a. Debug printouts can be enabled/disabled via a dropdown and "Toggle" button in the lower left, with a "Filter Debug" field for searching by type. Double-clicking "Clear" wipes the terminal to prevent accidental clears, and the right panel lists all enabled debugs, with reset disabling them all. The app is written in Python using serial communication and the FreeSimpleGUI library.

b. Zonar V4 TCU under test, an embedded telematics device for large-scale asset tracking and fleet management that connects to the vehicle's CAN bus to collect speed, fuel, engine, and diagnostic data, processes it on-board, and prepares it for transmission to backend systems.
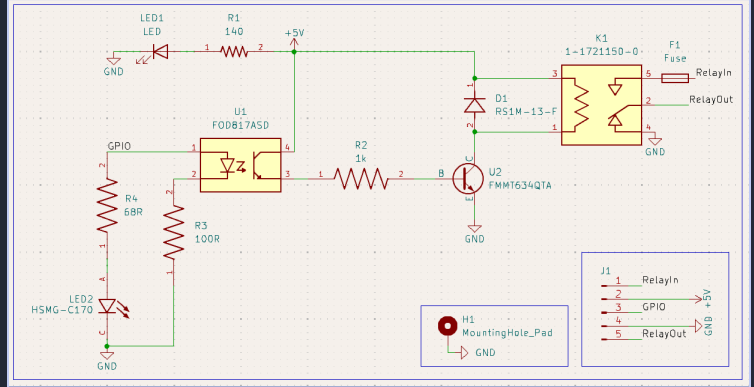
Valve Actuation Switch for Launch Controller

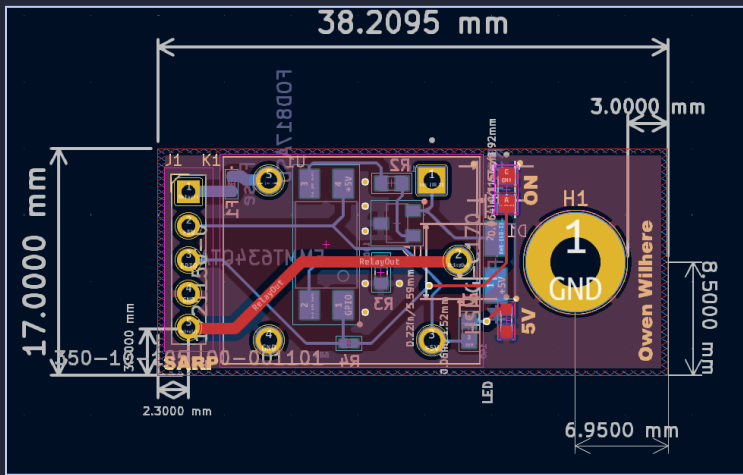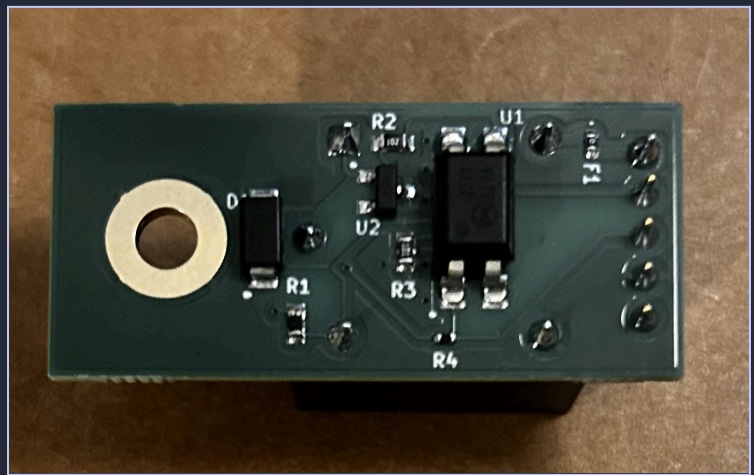*Society for Advanced Rocket Propulsion*

a.
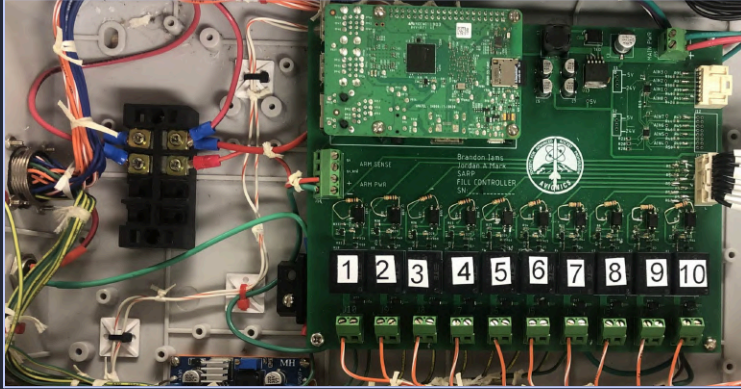
b.

c.

d.

Redesigned relay switch circuit to interface with a larger launch controller, enabling reliable high-voltage signal handling for precise valve actuation.

a. Existing launch controller system. The relay switch components, labeled 1 through 10, frequently experience failures or malfunctions. To address this issue, the redesign incorporates detachable relay modules, allowing for easier maintenance and replacement.

b. Relay switch daughterboard schematic adds two LEDs, one indicating reception of the 5V control signal and another confirming the microcontroller input, for improved diagnostics and monitoring. The valve power line now includes an in-line fuse to protect the circuit against faults and overvoltage events.

c. Two-layer daughterboard PCB layout keeps cost and size low, interfaces to the main board via a 5-pin connector, and mounts externally with a grounded through-hole for mechanical stability and grounding.

d. Back side of fully assembled board, with clean solder joints and no visible cold joints.
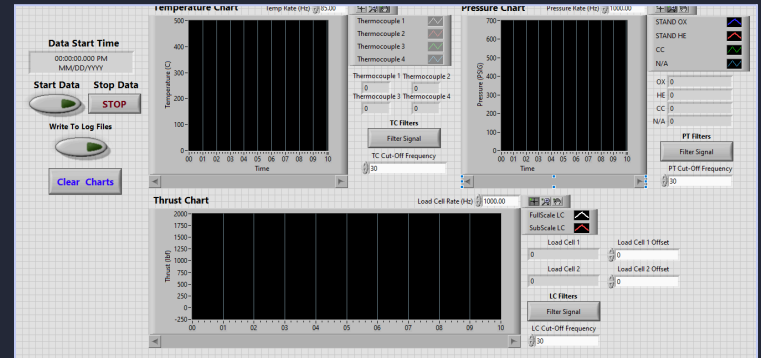
Real-Time Monitoring of Rocket Engine
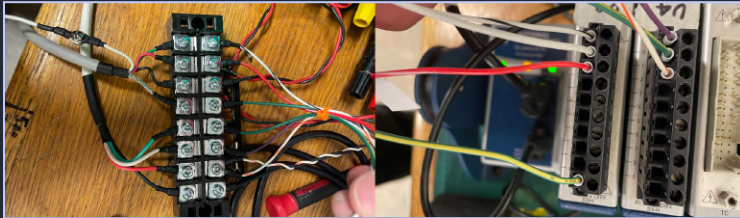
Society for Advanced Rocket Propulsion

a.

Figure 1. The block diagram for the DAQ setup.
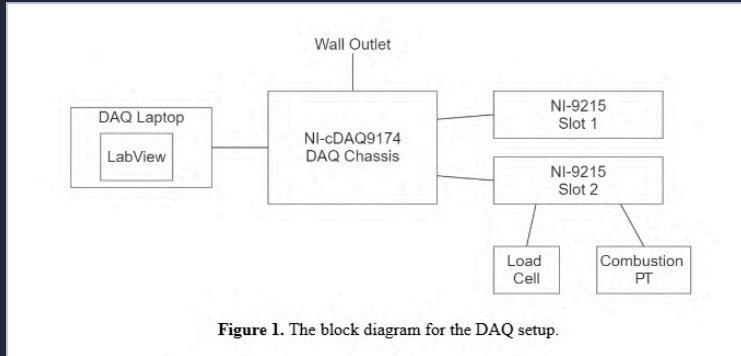
b.

c.

d.

Captured and visually presented real-time data from a load cell and pressure transducer in a rocket engine through graphical representation.

a. *Architecture of the Data Acquisition (DAQ) system illustrates the signal flow within the National Instruments DAQ setup. The system captures high-resolution analog signals from an external load cell and pressure transducer, converting them into digital data for processing and analysis.*

b. *Real-time display implemented using NI LabVIEW, showcasing pressure, thrust, and temperature measurements. The system allows for toggling of signal filtering and provides an option to enable or disable data recording to an MS Excel spreadsheet.*

c. *Wire harnessing for system organization: The DAQ hardware receives sensor inputs and a DC power supply for sensor excitation, ensuring proper signal routing and electrical connectivity.*

d. *Image capturing the combustion process of the rocket engine during testing. Insanely Cool!*