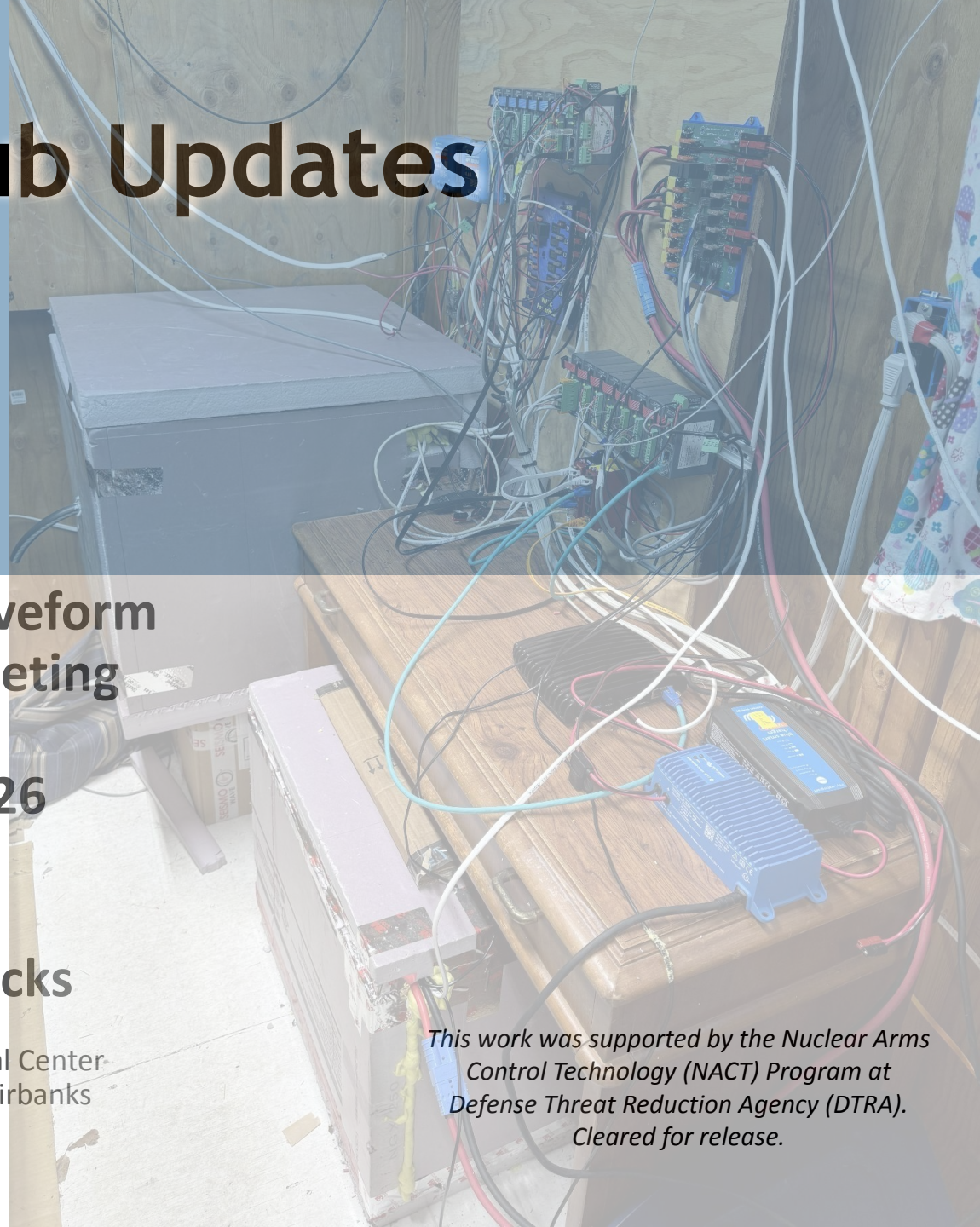
WATC Powerhub Updates



2026 NACT Waveform Engineers Meeting

Jul 7-9, 2026
UAF

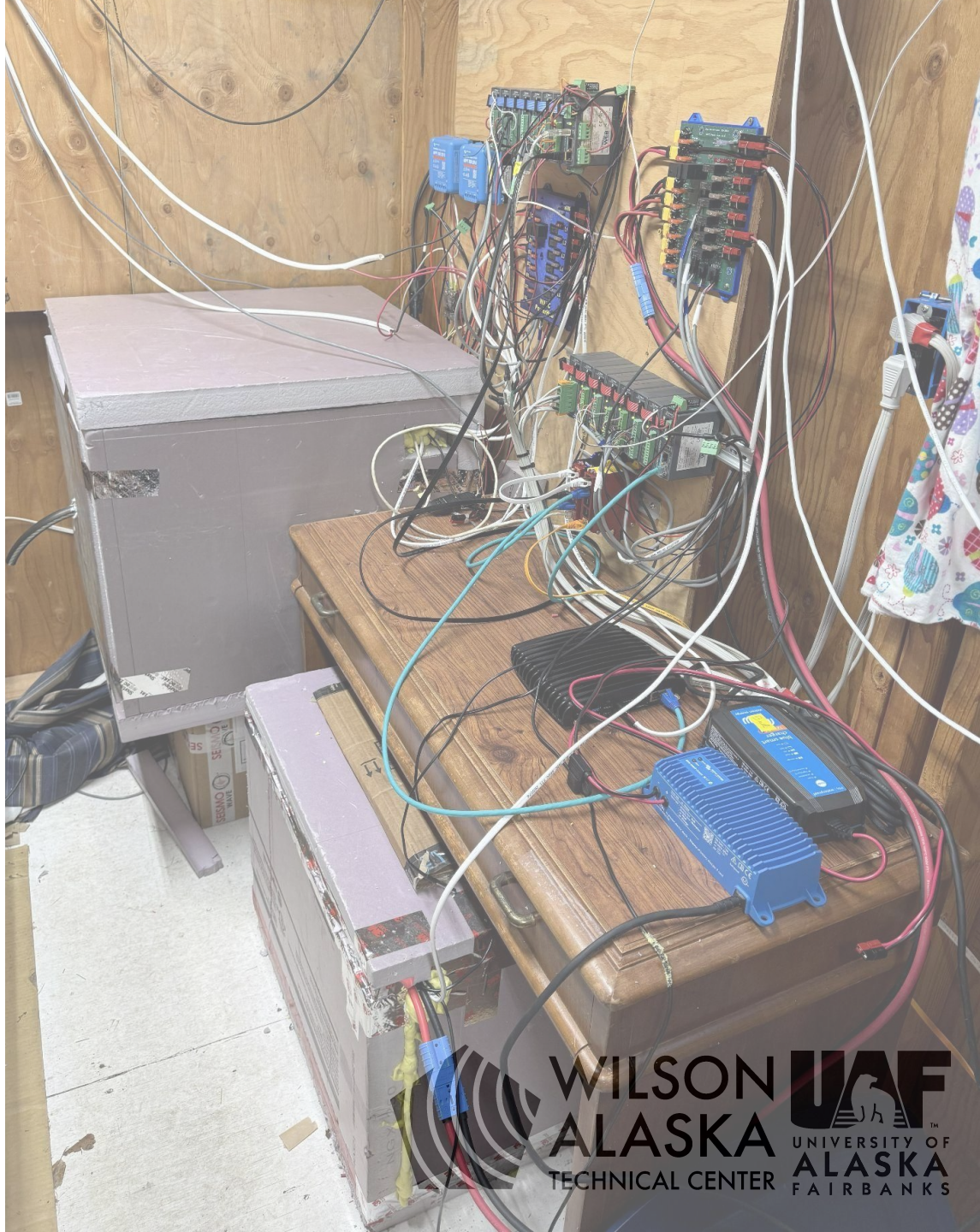
Jay Helmericks

[1]Wilson Alaska Technical Center
University of Alaska Fairbanks

This work was supported by the Nuclear Arms Control Technology (NACT) Program at Defense Threat Reduction Agency (DTRA). Cleared for release.

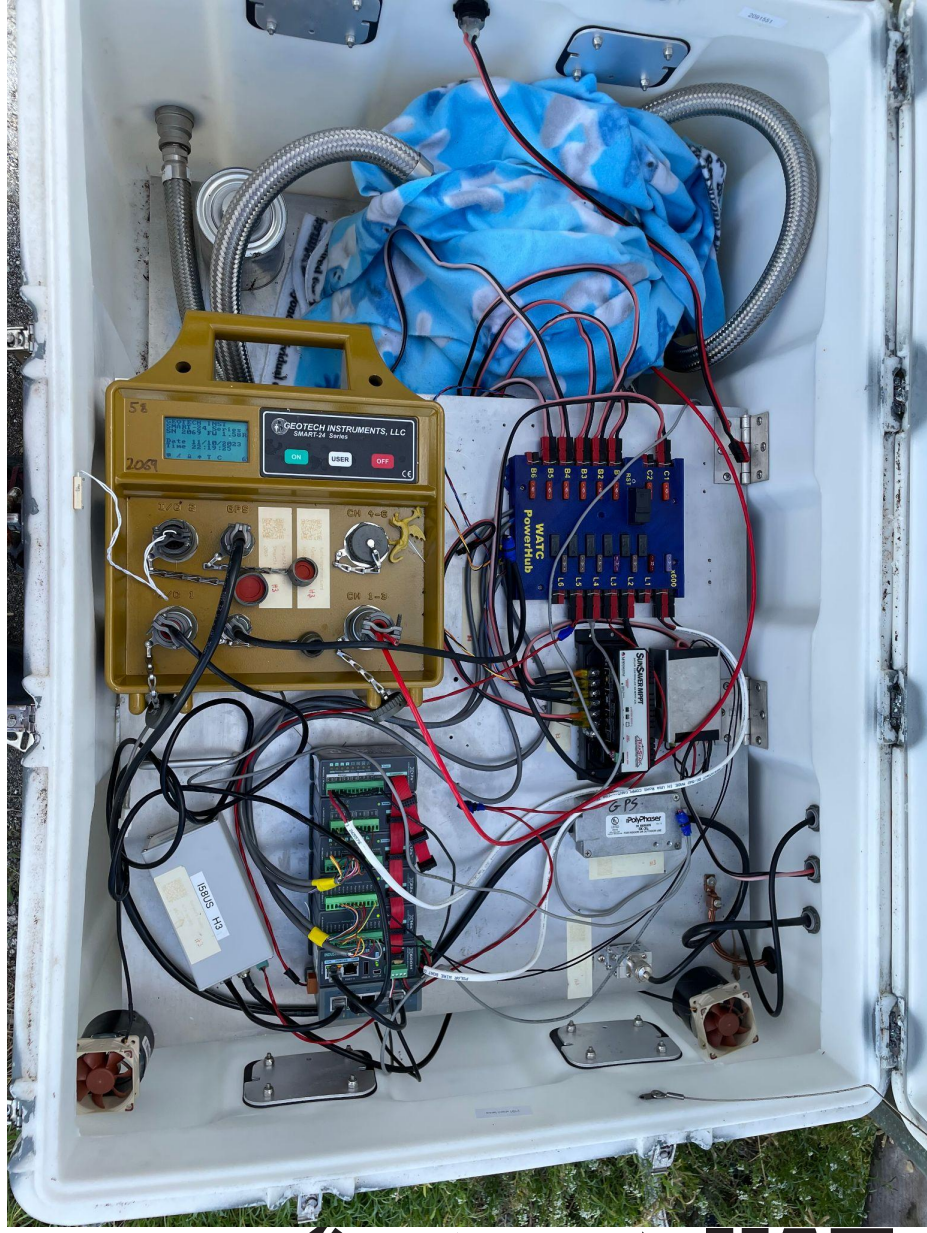
Outline

- What does a PowerHub do?
- Changing connectors
- Progress on an Arduino based controller
  - Why
  - Hardware
  - Software



Powerhub Summary

- Monitors vault power flow from every device
  - chargers
  - batteries
  - loads
- Supports charge / battery redundancy
- High resolution waveform data
- Controls load power
- Controls charge sources
- Makes some automatic decisions
  - Can shed loads
  - Provides LVD functions
  - Problem notification
  - Runs battery tests
- Emails alarms and test results

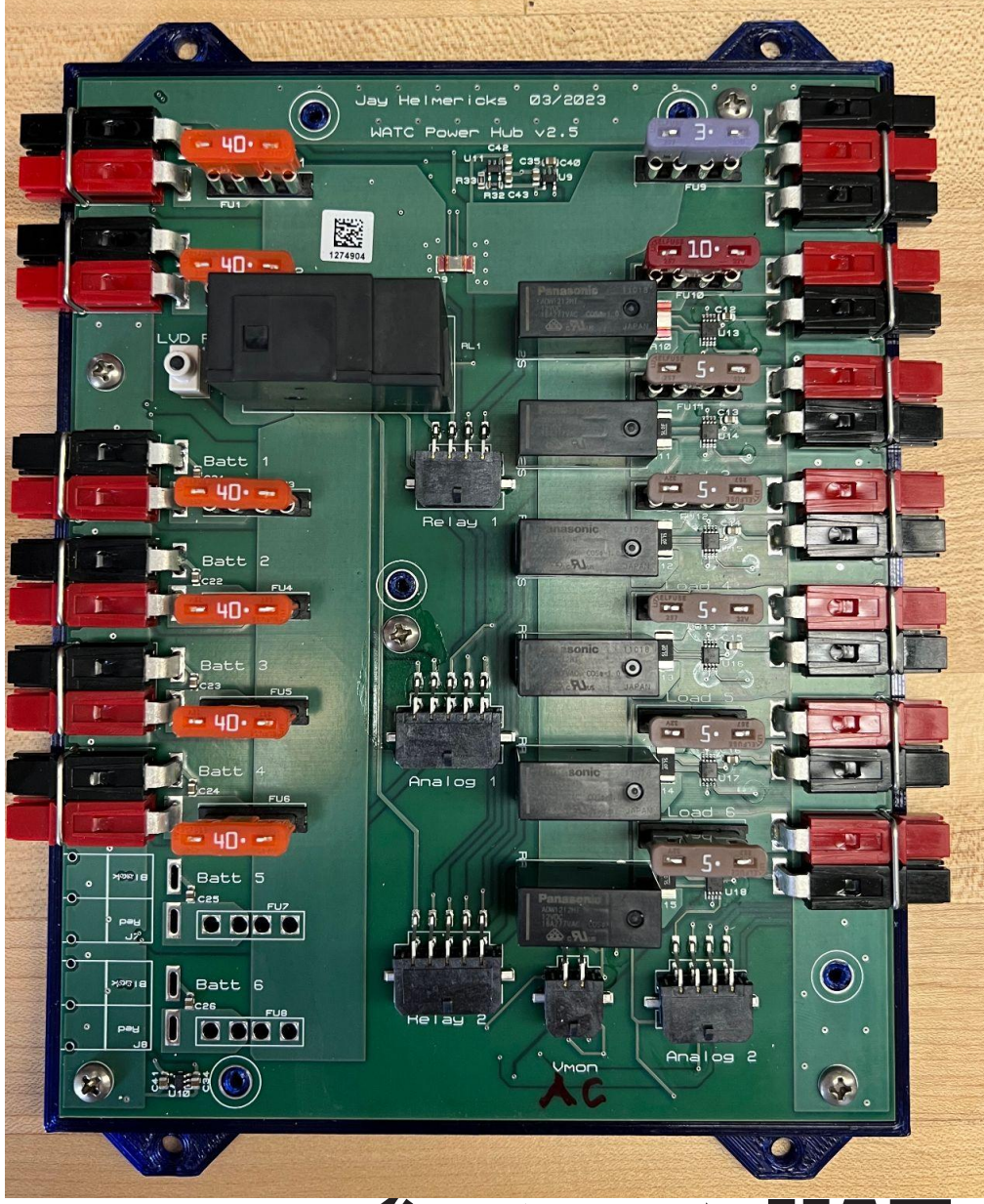


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Design Hardware

- Using a WATC designed Printed Circuit Board (PCB) as the power connectivity
  - Powerhub PCB has the current monitoring shunts, fusing, disconnect relays
  - Supports:
    - 12v battery buss (10-15v)
    - 2 charge sources
    - 6 batteries
    - 6 load outputs
    - LVD and load relays
    - Anderson power connectors, Automotive Blade fuses (ATO size)
- 3D Printed enclosure in PETG
  - Glycol modified version of Polyethylene Terephthalate (PET), a thermoplastic polyester

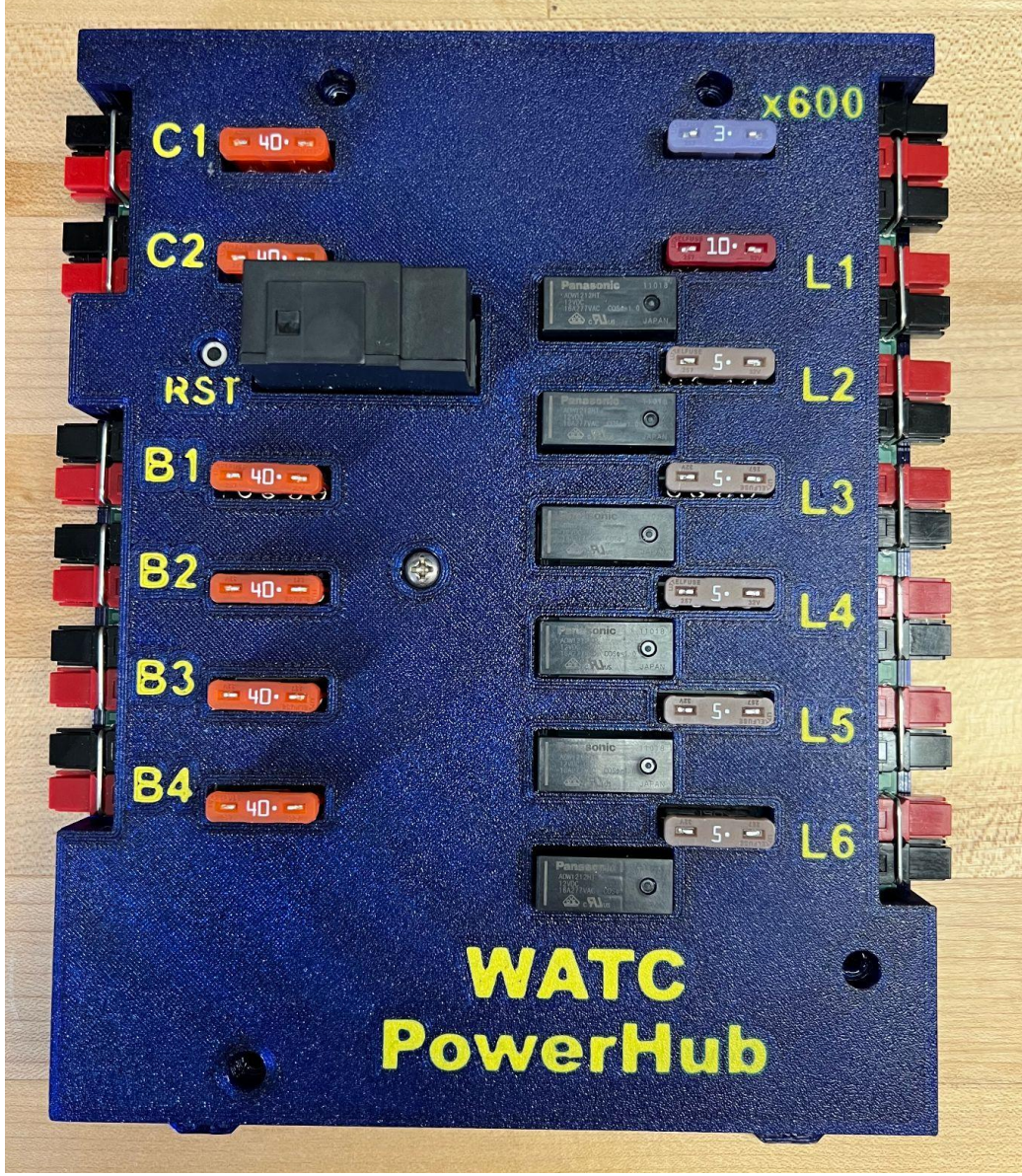


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Design Hardware

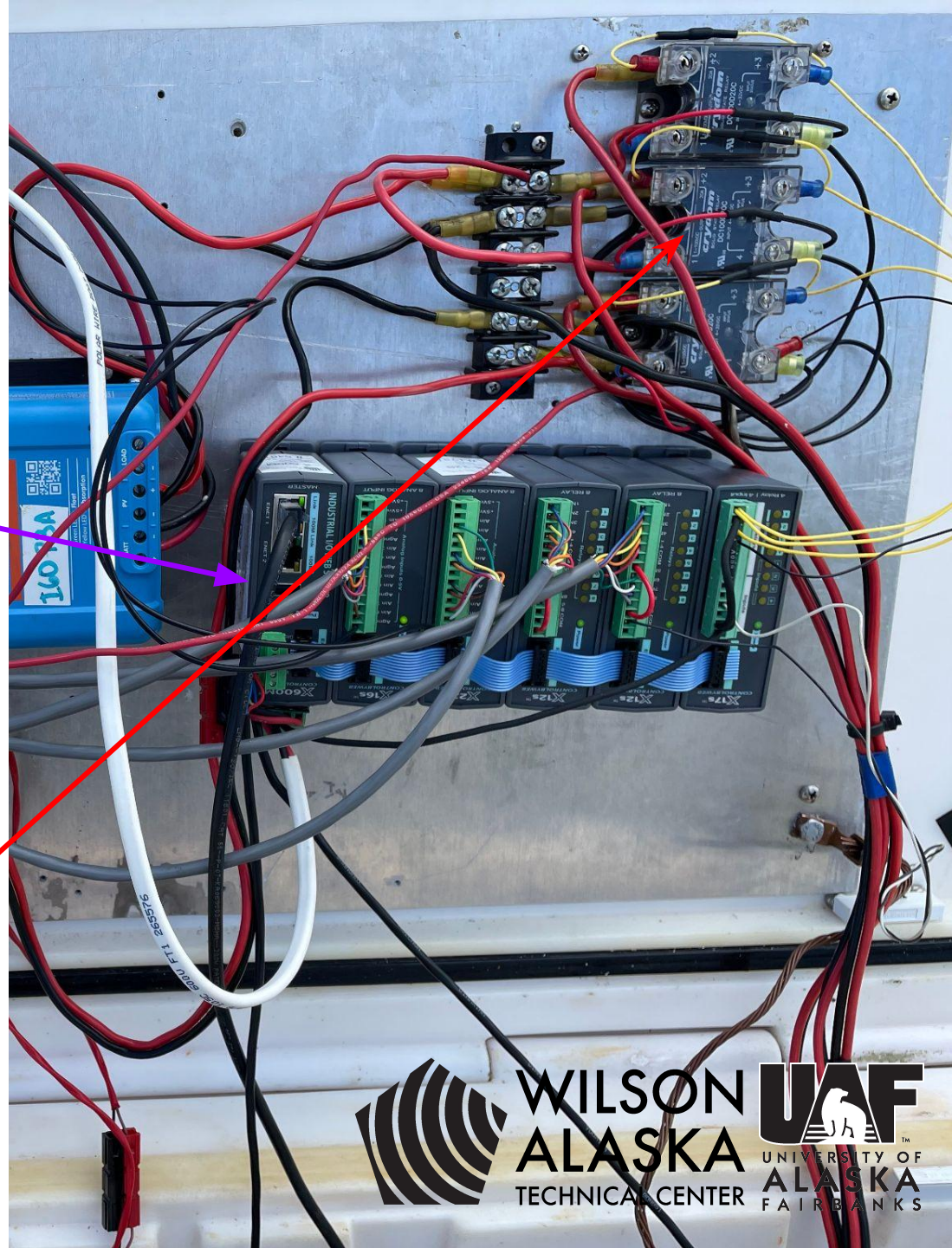
- Monitoring buss voltage, 15 current shunts
- AC and DC versions for different input monitoring
  - “AC” is an isolated digital on/off (can also be used for a DC input that needs to be isolated)
  - “DC” is an analog measurement (nominally solar panel voltage)



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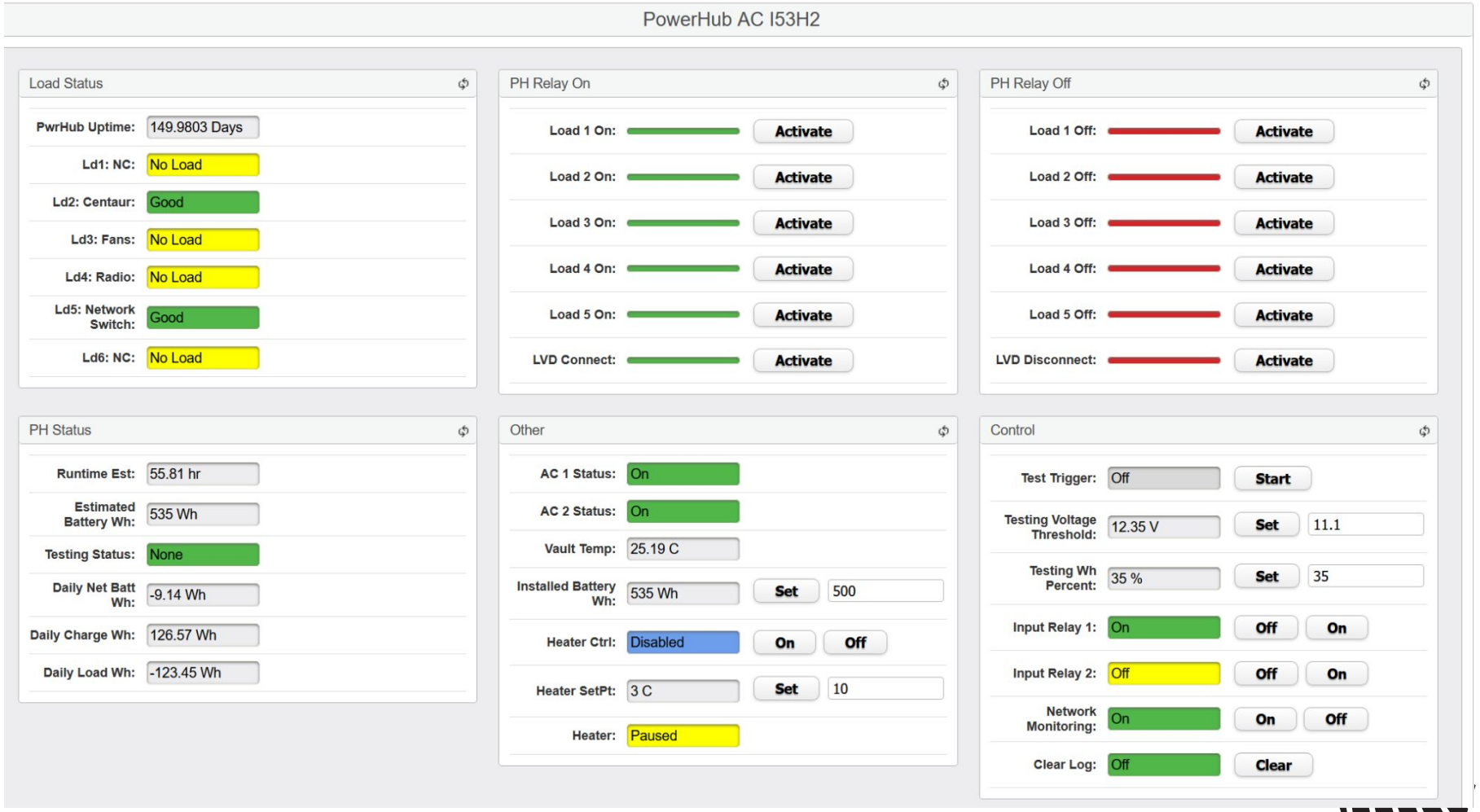
Design Hardware

- ControlbyWeb x600 stack provides control logic, web interface, relay control, analog-digital conversion and communication of SOH channels.
    - Solid State Relays (SSR) used to disconnect charge source
        - (3 solar panels)



Control and Visualization

- Local Dashboard



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Control and Visualization

- Grafana Display



Changing the default connector



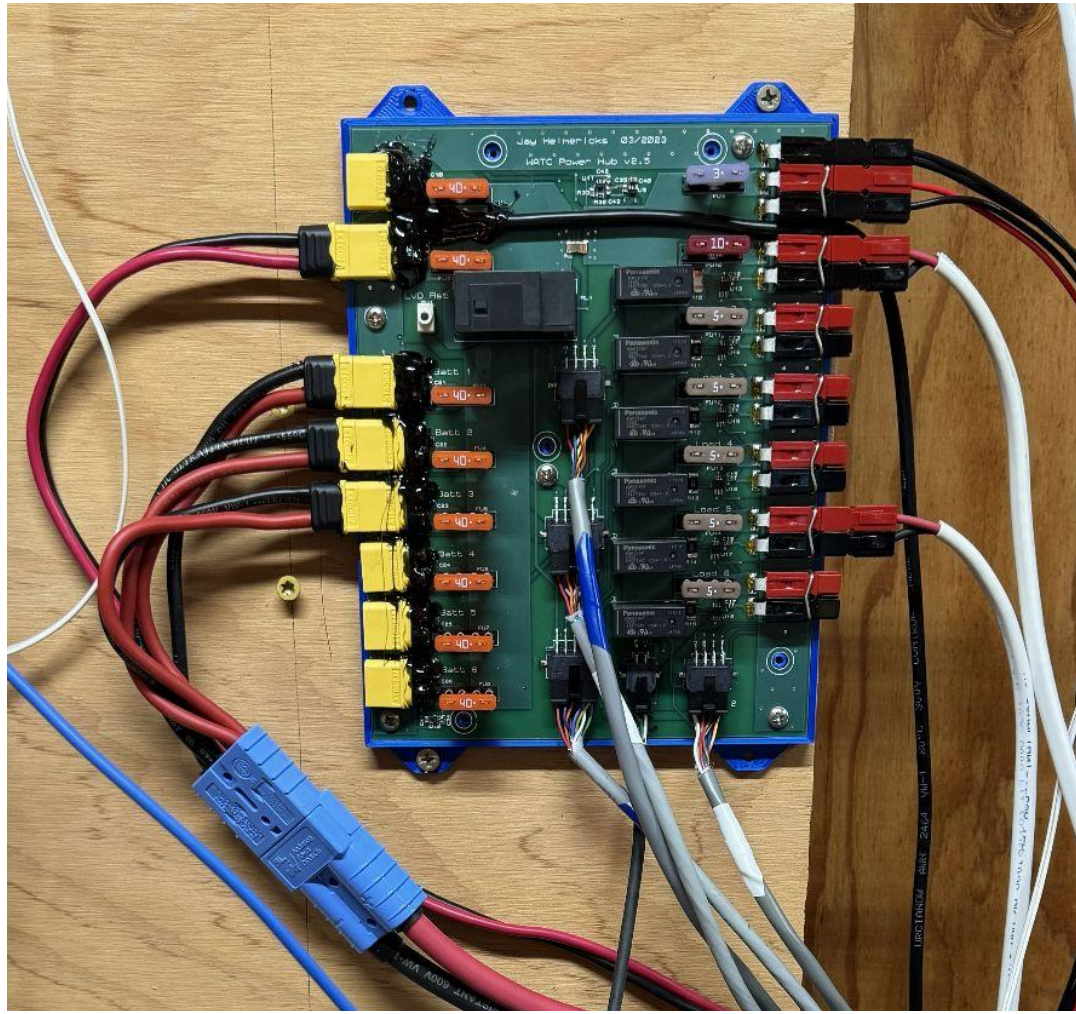
- Moving from an Anderson powerpole 45 to an Amass XT60
- Seeing issues with the Anderson in harsher environments
  - Generally on the charge or battery (higher currents)
  - Poor connection results in high heat until failure
  - connection resistance spread -> poor LFP sharing
- Also adding a connector temperature sensor to mitigate
- Advantages of the XT60
  - Gold plated contacts
  - Significantly higher mating force
  - Soldered pins
- Similarities
  - Mated size
  - 10ga max
- Disadvantages
  - Gendered connector
  - Only comes in a two pin version
  - Poor distributor availability in US



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Changing the default connector

- Are using in the Lab
- Retrofitting an existing PCB is possible
  - Wire XT60 is soldered to the Anderson Pins still in the PCB
- Have retrofitted I60US
  - were starting to see significant issues
  - so far, things look good after replacement
- Plan to retrofit FACT and I58US at their next PM
- Other sites likely wait for a replacement PCB

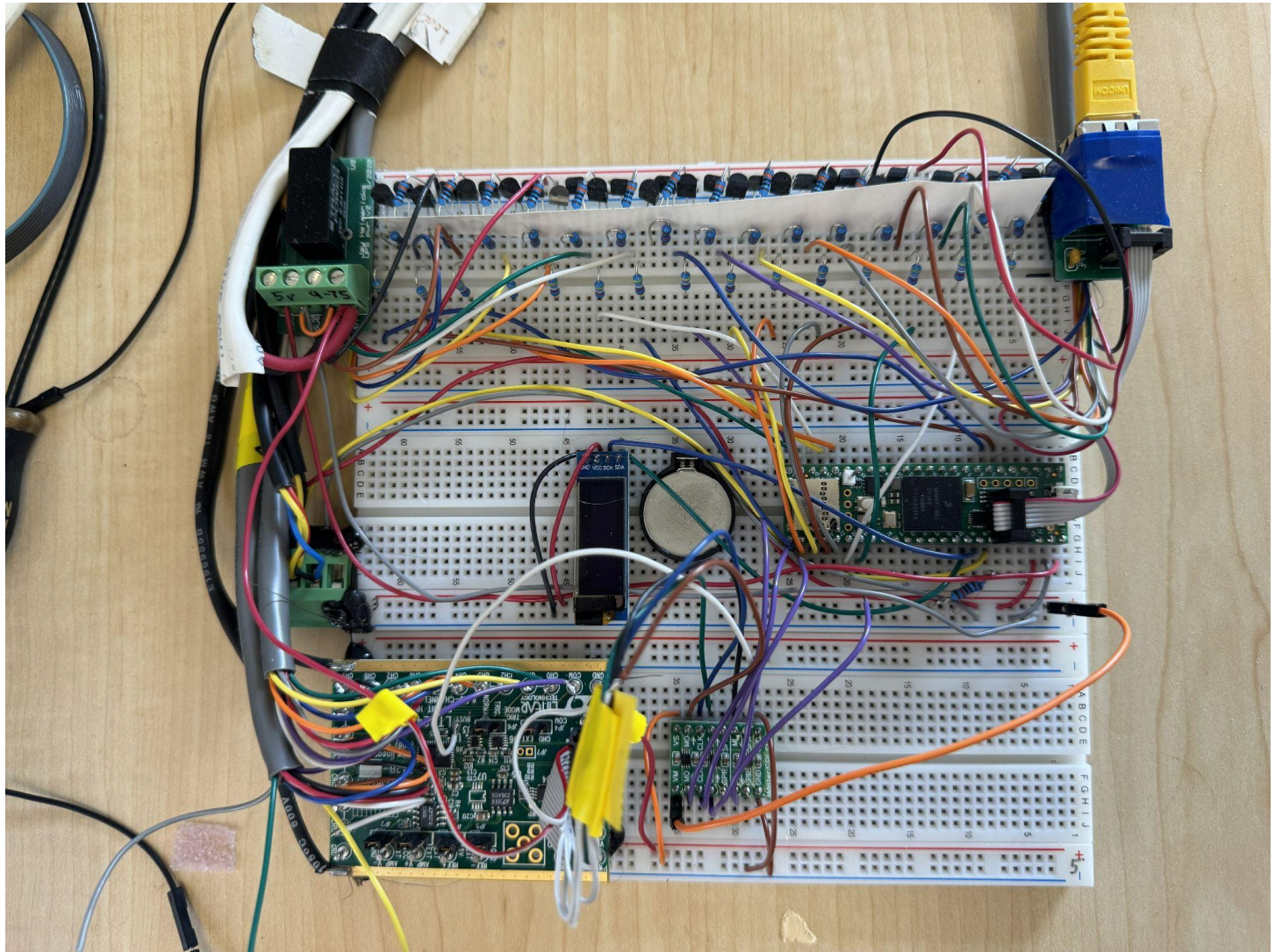


Arduino Controller

- Goals
  - Replaces the ControlbyWeb x600 stack
  - Lower controller power consumption (~6w to ~1w)
  - Lower replication cost (~$2600 to $450)
  - Improved control (no limit to custom code)
  - Improved analog information (10Hz sampling)
- Other advantages
  - Small display for local information
  - Control dial for local load control
- Other changes
  - Local web dashboard limited but will have API control
  - App running on a TWIG, laptop, or at WATC provides control and basic data

Arduino Controller

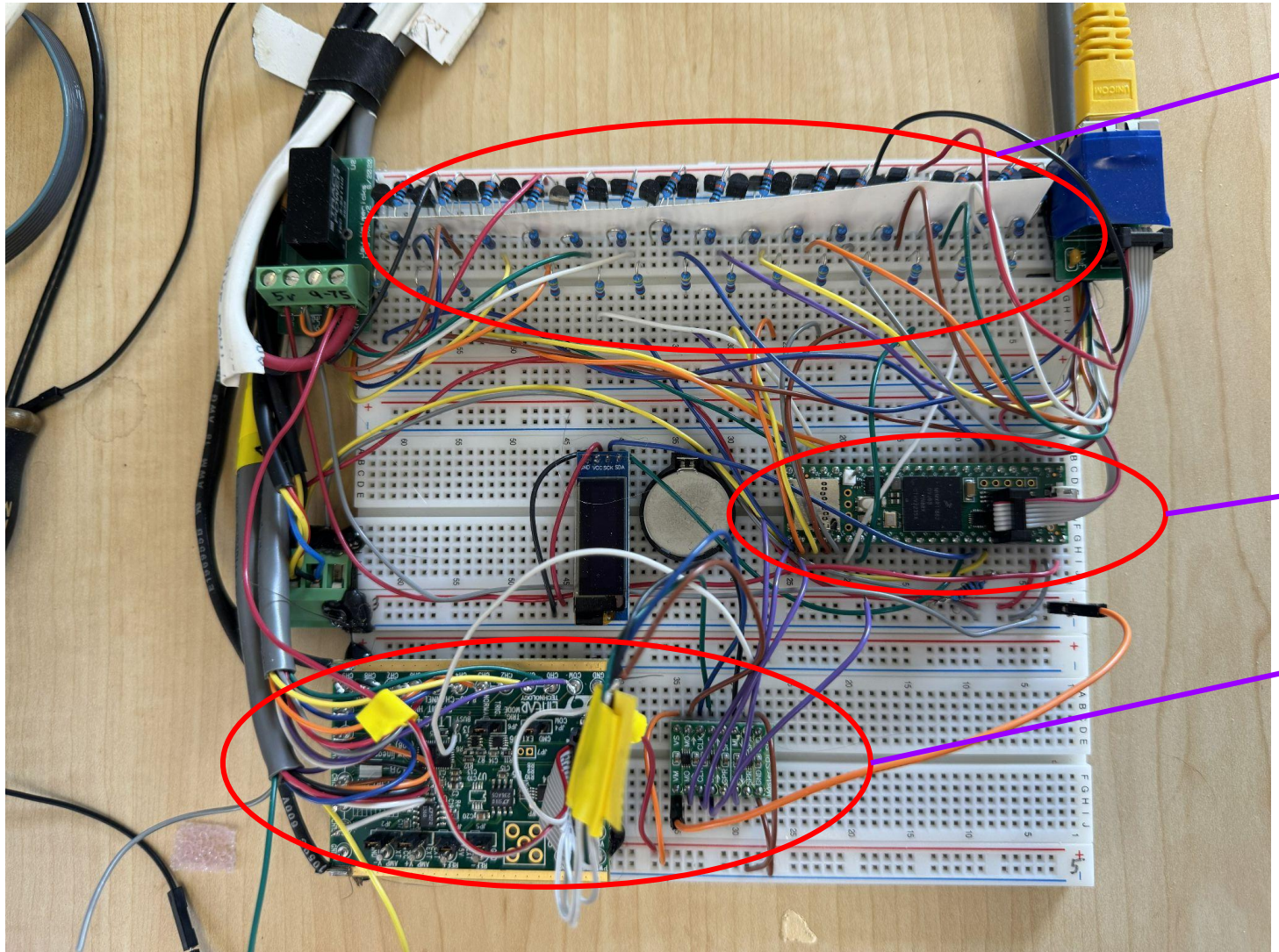
- Progress
  - Controller is proven out in bread board form



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Arduino Controller

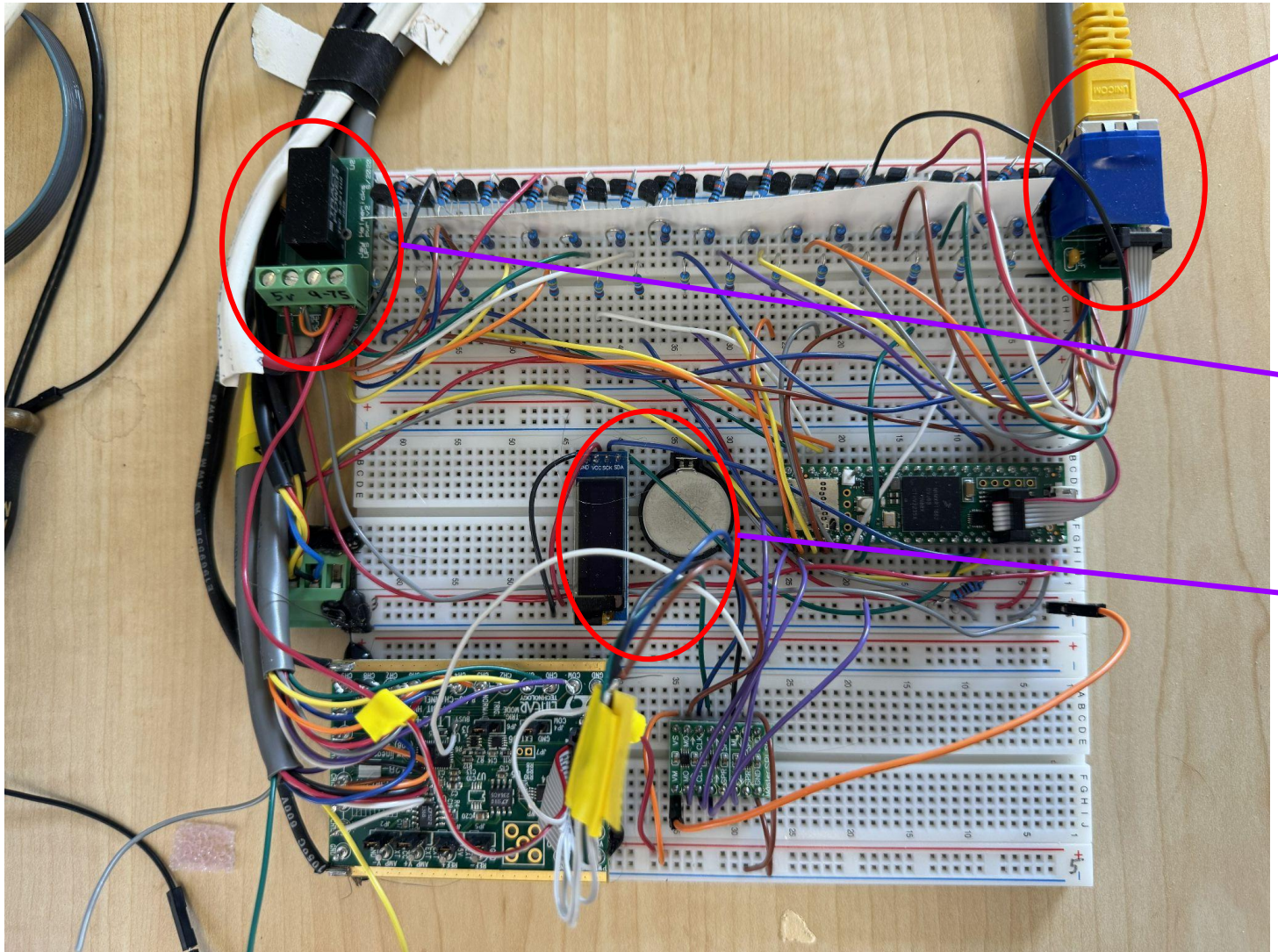
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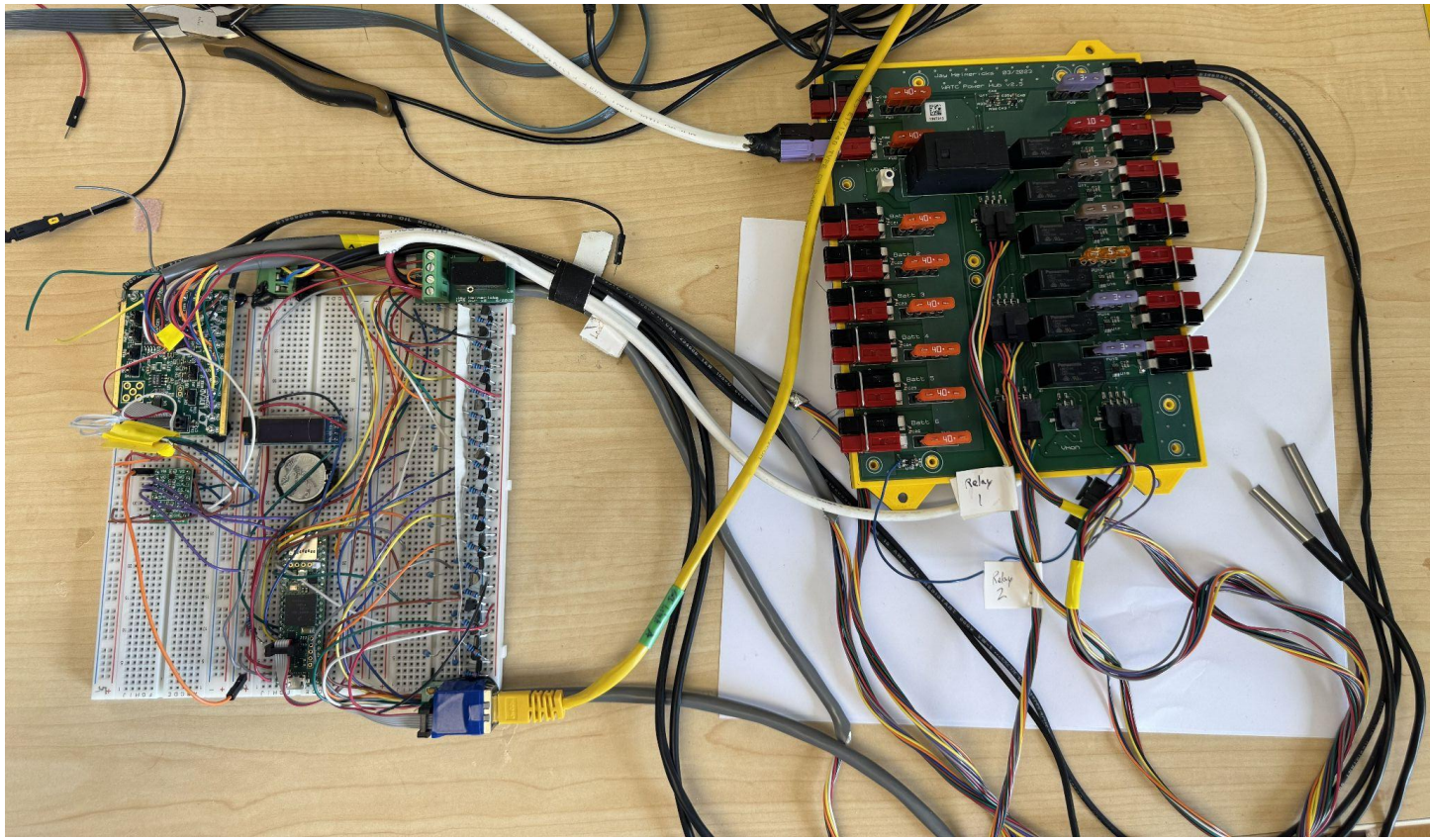
- Progress
  - Controller is proven out in bread board form



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Arduino Controller

- Progress
  - Framework of the code in place
    - Processes analog data
    - Controls relays
    - hosts json page for telegraf
    - API for configuration
    - synchronizes time via NTP
    - displays messages on the mini screen
    - Calendar timer for tests
    - Pings for network tests



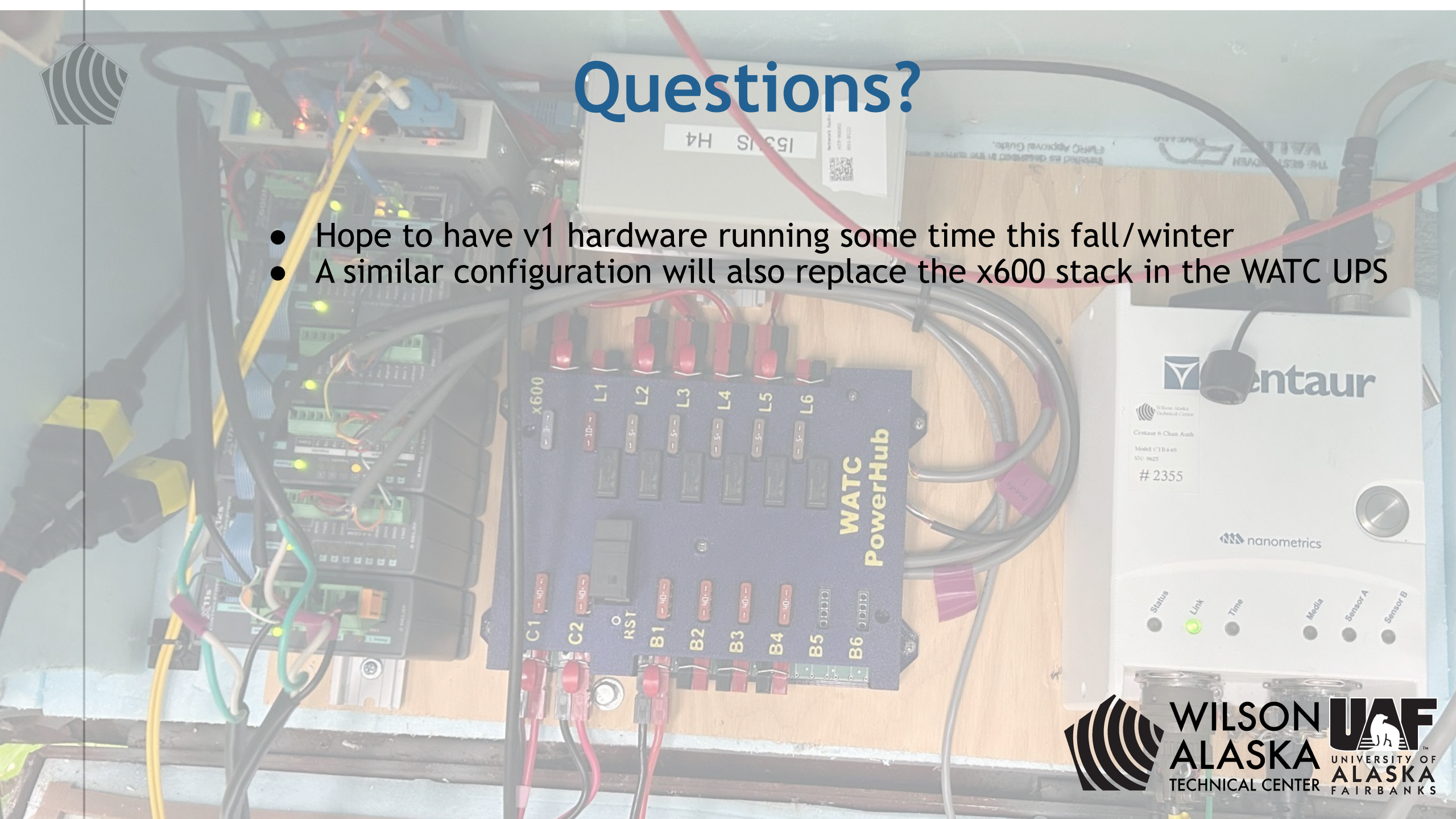
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Arduino Controller

- Next steps:
  - PCB layout started
    - Version one will be retrofit version
    - A2D will be a daughter board
  - Kyle has an alpha version of the control app
    - API may allow control to be imbedded into the grafana dashboard
    - Custom functionality for qualification and deployment testing
  - Independent but parallel project to make an integrated charge power control box

Questions?

- Hope to have v1 hardware running some time this fall/winter
- A similar configuration will also replace the x600 stack in the WATC UPS



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