Electrical Control and Power for Shock Dyno

Milestones:

- M1: Demonstrate successful wiring, programming, configuring of digital pot with MCU (doesn't have to use MATLAB commands, just want to know that it works and we know how to make it function properly). Consider looking at other applications online.
- M2: Replace analog pot that is already on the ESC with the digital pot. Demonstrate that the replacement is successful and that the MCU can now be used to control motor speed. (use the motor wiring setup we already have). Determine a final wiring circuit to prototype
- M3: Create prototype electrical power system to prove that:
    - Power supplies in parallel work well
    - That the ESC can be controlled from the digital pot/MCU from 0-100% with motor load
    - Your circuit for the power system works and can be turned into the final thing
- M4: Create final design for speed control system (digital pot, connections to MCU, connections to ESC..) that can be integrated into a single PCB/protoboard. The end goal is to have a single electrical cluster with all the circuits/components except the power supplies and ESC on. Work with others to make sure this can integrate well.
- M5: Design system for attaching/containing all power electronics. Consider a board or box that the power supplies/ESC can be safely attached to.
- M6: Build the electrical power system you designed, along with component mounts and attach to shock dyno. Run first tests of dyno.
- M6: Create documentation/instructions for repair/maintenance/how things work
    - Completion deadline: **October 24 2019**

Deliverables/Explanation:

- Overall challenge is this: the physical analog potentiometer is what currently controls the ESC (which controls motor speed). We want to instead control the ESC from a MATLAB GUI. Your job is to determine how the digital pot can replace the analog pot by making it be controllable from a microcontroller (arduino Nano or Teensy 3.2).
- Additionally, it must be verified that the proposed way of powering the motor works. It is also your job to verify that the electrical power system (the power supplies and ESC) do their job properly and safely. This means putting them together in a circuit and verifying it all work.
- You will need to do some microcontroller programming because the digital pot uses SPI (type of serial connection) to talk to the MCU. When programming, make sure the system has no bugs and make certain that you come up with something that can use commands coming from a PC (via MATLAB) to control the pot. Will require collaboration
- It is as yet unknown how we will attach all the electrical hardware to the dyno. It is your job to design a system for this. This should be simple, easy to manufacture and robust.

Make sure loose wires are managed, things can cool down and where possible, everything is earthed.

- We already have all of the electrical hardware needed to get this system working. This project should just be about learning to apply, design and refine things. Google is your friend.
- Must be well documented for future (uninformed) users (hardware and software)

Tips, details and pertinent information:

- MCU to be used: Either the Arduino Nano: https://store.arduino.cc/usa/arduino-nano
  Or the Teensy 3.2: https://www.pjrc.com/store/teensy32.html
- Digital pot we have: https://www.sparkfun.com/products/10613
- **Start here, very good example!!!:**
  http://www.learningaboutelectronics.com/Articles/MCP4131-digital-potentiometer-circuit.php
- DAQ GitHub: https://github.com/GTOR-BajaSAE/DAQ
- Purchasing spreadsheet:
  https://docs.google.com/spreadsheets/d/1ILN35p0WuqsaUOu9AnwBnsDROKAHuUL8cqE_y23wues/edit#gid=1937511476
    - Use line item number “21” and “DAQ shock dyno” for purpose. Ask Billy before adding anything to the list. Visit the invention studio/Hive to see if they have hardware before buying anything.