# NU Racing’s 2025 MCHA Team Scopes/Projects – 1 FYP

This document contains the preferred amount of FYP Scopes and Directed Projects for NU Racing 2025’s team.

Assumptions:

* Number of FYPs: 0
* Number of Directed Reading/Extracurricular: 4

FYP Scope contain:

* Starter project
* Scope for the year

Directed Reading/Extracurricular Projects contain:

* Scope for the project

## FYP Scopes and Starter Projects

### Accumulator

* New AIL
  + TASKS:
    - Implement changes from Ivo’s report
    - Breakout board mounting style
    - LTSpice simulation to validate circuit design
  + DELIVERABLE:
    - AIL ordered (with LTspice or breadboard test)
* Fix AMS Fault
  + TASKS:
    - Replace faulty CANaMons (CANaMon 1)
    - If CANaMon replacement doesn’t work
    - Investigate BMS functionality
  + DELIVERABLE:
    - AMS fault no longer occurs
* Top plate fuse holders (maybe?)
  + TASKS:
    - Change to fuse holders that are RIGHT on the edge of a PCB, so that the wire is short enough to not need a fuse
  + DELIVERABLE:
    - New solution implemented
* New LVD
  + TASKS:
    - Interpose from LVD to CEN
    - Use of IRLB3813 MOSFET for cooling circuit (gather information from CEN engineer) or use automotive relay
    - Investigate high current draw of accum fans
  + DELIVERABLE:
    - New LVD ordered
* NU26 Accumulator
  + TASKS:
    - Design new voltage tap and temperature monitoring for pouch cell accumulator
    - Pouch cell testing and validation (maybe)
  + DELIVERABLE:
    - Voltage taps and temperature monitoring designed

### AV.One – FYP – Jayden Horvath

* Starter Project
  + Read Lena’s and Sebastian Scott’s reports
    - ‘Past\_Reports’ folder within ‘Racing-AV1’ GitHub.
  + LVD rework to enable use of charger with AV.One
  + Troubleshoot DCDC
  + Deliverable:
    - New LVD ordered and found issue with DCDC
* Implement and test 2x Raspberry HQ Cameras for stereo vision
* Investigate use of either Marine’s LiDAR or use of spare LiDAR that is somewhere on campus – refer to Malcolm for details
* Attempt to implement as many Autonomous Advancements as possible from Lena’s Report (section 8.2.)
  + Contact UQ’s autonomous race team on issues encountered and/or direction
    - [madeleine.warner@uqracing.com](mailto:madeleine.warner@uqracing.com)
    - [james.talkington@uqracing.com](mailto:james.talkington@uqracing.com)

## Directed Reading Scopes

* PEN/BSPD and potentially TSAL\_Discharge – Directed – Jayson
  + Where to start:
    - Read Bushy’s reports the BSPD and the TSAL\_Discharge breakout boards
    - Lukes’ report on why the resistor voltage divider was a time-consuming idea. With too many variables to account for during the commissioning process.
    - Read Alec Chapman’s ENGG4200 Report on the topology of the nodes
    - Read the section of PEN from Joshua Hayward’s report, to gain a brief understanding of the PEN
    - Read Josh Dawson’s report
      * Mainly:
        + 4.4 Proposed Modifications
        + 4.5 CAD/Schematic/PCB/Code
        + 4.6.3 Charger V1 PCB
        + 4.7.1 ECU Verification
  + BSPD
    - Remove voltage divider for C\_REF. Replace with potentiometer, as this is easier for someone to understand how to tune it correctly
  + TSAL\_Discharge
    - Change current naming of red to amber on Bushy’s V3 and order
    - Potentially implement green light turning off while red is flashing
  + DEN:
    - Resize to chassis (might not have to?)
    - All naming of AMS to BMS
    - Change from DT 8 pin to AT 8 pin keyed connector for CEN connection
  + PEN (later in semester, waiting for new Pedal Box to be designed)
    - Fit to pedal box
    - Add capacitors to brake sensor inputs
    - Investigate need for Zener diodes, and if possibly removing them
  + Charger
    - Add new HV connectors
    - Fix oopsie wire on PCB
  + In charge of monitoring and managing MoTeC at track days
* HIP – Directed or Extra – Mia (is ENGG3200 in SEM 2)
  + Read Jackson’s report?
  + All naming of HVD to MSD
  + New Master Switches (footprint will change)
  + HV connector interlock (part of the mech enclosure role?)
  + Change from DT connector to one that is rated for higher voltage for DCDC to HIP connector

## Tasks To Be Completed During The Year

* Motor Controller
  + TASKS:
    - Hayward’s recommendations
      * Implement pack current derating at cell/pack temperatures over 50 degrees.
        + PEN code

Use either maxsegtemp or mincellvol/maxcellvolt

Derate from the 3 degrees under the max temperature rating of the VTC6

Limit current down to ~30A under high temperatures. Shut down all current above 60 degrees

* + - * Other recommendations from his report
  + DELIVERABLE:
    - Pack current derating implemented
    - Other recommendations from Hayward’s report also implemented
* Dynamometer
  + TASKS:
    - Create Load Testing Node
      * Have it be very similar to the CEN from NU23
    - Read Dawson’s report on the dyno
      * Implement as much as possible from this report
  + DELIVERABLE:
    - If all goes well, (which it won’t), we will be able to:
      * Map power curves
      * Tune the motor
* Launch Control
  + TASKS:
    - Use wheel speed sensors (implemented through another task) to implement launch control on the PEN
  + DELIVERABLE:
    - Launch control implemented
* HFR PCB Iteration
  + TASKS:
    - Implement BMS-IMD Tractive System Status Indicator fault detection circuit on this board
      * Read 2025 rules and compare them to 2024’s rules to understand the change
      * Research circuit to implement this change
      * Design circuit
        + AND gate for BMS and IMD fault detection
        + 555 timer circuit for 2-5 Hz signal generation (research correct circuit (555 timer datasheet), but ultimately use the one that is on the TSAL\_Discharge board (use DMN6140L for all MOSFETs)
        + MOSFET to switch outputted GND signal
        + Rough outline of circuit in obsidian notes
      * LTSpice/Breadboard the circuit
      * Breadboard the circuit
        + Red Flash of TSSI could be just a THT LED?
      * Correct PCB to accommodate for circuit
        + Increase input/output of header pins by 1 on each side
    - Implement green light turning off while red is flashing
      * Potentially make a second circuit to account for this possibility
        + Rough outline of circuit in obsidian notes
    - HFR PCB Ordered
  + DELIVERABLE:
    - HFR PCB manufactured and commissioned with changes detailed above
* CEN Iteration
  + TASKS:
    - Fit to opposite side of chassis
    - TSAL DT
      * Change name to UEN
      * Make it an 8-pin connector (to route new red switch ground signal)
    - Keyed AT 8 pin connectors for DCDC, DEN, REAR, MOTOR CONTROLLER
    - Route TSAL\_GREEN\_SWITCHED\_GND (rename) to HFR breakout
    - Interpose on CEN from LVD
    - IRLB3813 MOSFET on cooling circuits (or have another double switching MOSFET)
    - MOTHER Board iteration ordered
  + DELIVERABLE:
    - New MOTHER Board iteration manufactured and commissioned with changes detailed above
* Ready To Move Light Implementation
  + TASKS:
    - Order and commission a light that meets DOT FMVSS 108
    - Change loom to route an extra wire up to the Ready To Move Light
    - Design mounting for 2x amber DOT FMVSS 108 lights on the car (one facing forward and one facing backwards (aft))
  + DELIVERABLE:
    - Ready To Move Light mounted
    - Loom has changed to account for extra signal
* EXPANSION Board PCB Iteration
  + TASKS:
    - Size CAN lines correctly
    - Fix ground plane (not have big breaks)
    - Transfer SWEN functionality
      * Includes: dials for torque setting, switch for regen (implement a way so that the dial/switch are in the correct position after unplugging and plugging the board in)
    - Temperature sensors for radiator
      * Create loom to connect to them (already in radiator)
      * DBC file and MoTeC updates
    - Sensors for the board to work with:
      * brake temperature
      * shock pots
      * wheel speed
      * steering angle
    - EXNPANSION Board Ordered
  + DELIVERABLE:
    - EXPANSION Board manufactured and commissioned with changes detailed above
* EXPANSION Board Integration
  + TASKS:
    - Brake temperature sensors able to work over MoTeC
      * Loom to connect sensors to EXPANSION Board
      * Create 4 messages in NU25 DBC file for wheel speed sensors (one for each wheel), with correct scaling, offset, bit length and value range
      * Implement code for brake temperature sensors on the EXPANSION Board
      * Configure MoTeC to read and display new message
  + DELIVERABLE:
    - Brake temperature sensors able to display data over MoTeC