GAS-POWERED ROBOTIC GROUND VEHICLE

Ben Bretton
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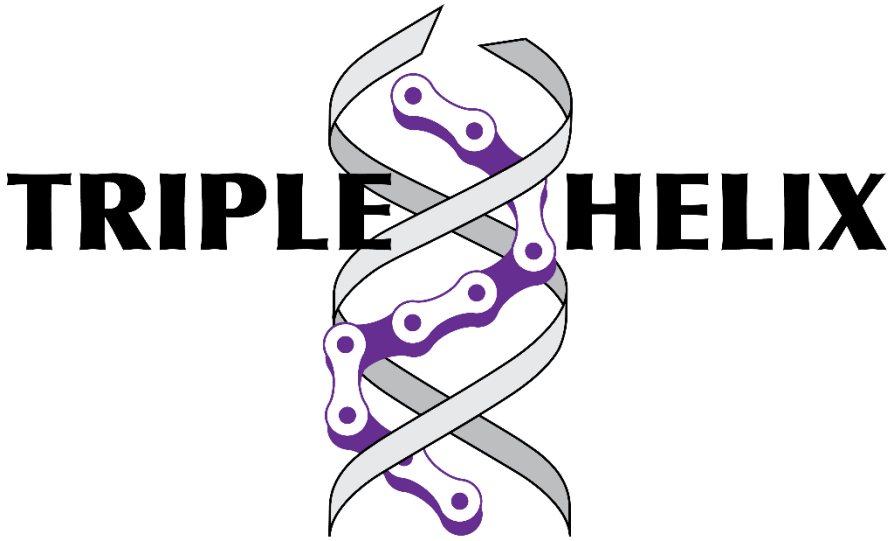


OVERVIEW

MOTIVATIONS

1st Order

- Build something cooler than an FRC robot

Higher orders

- Excite, engage, and wow
- Explore advanced FRC control techniques
- New Student Training
- Keep momentum throughout summer
- Demonstrate skills and promote team

OBJECTIVE

Produce a gas-powered robotic ground vehicle before the 2016 FRC Summit

DESIGN CONSTRAINTS

Fixed components
- Donor provided frame, engine, rear axle

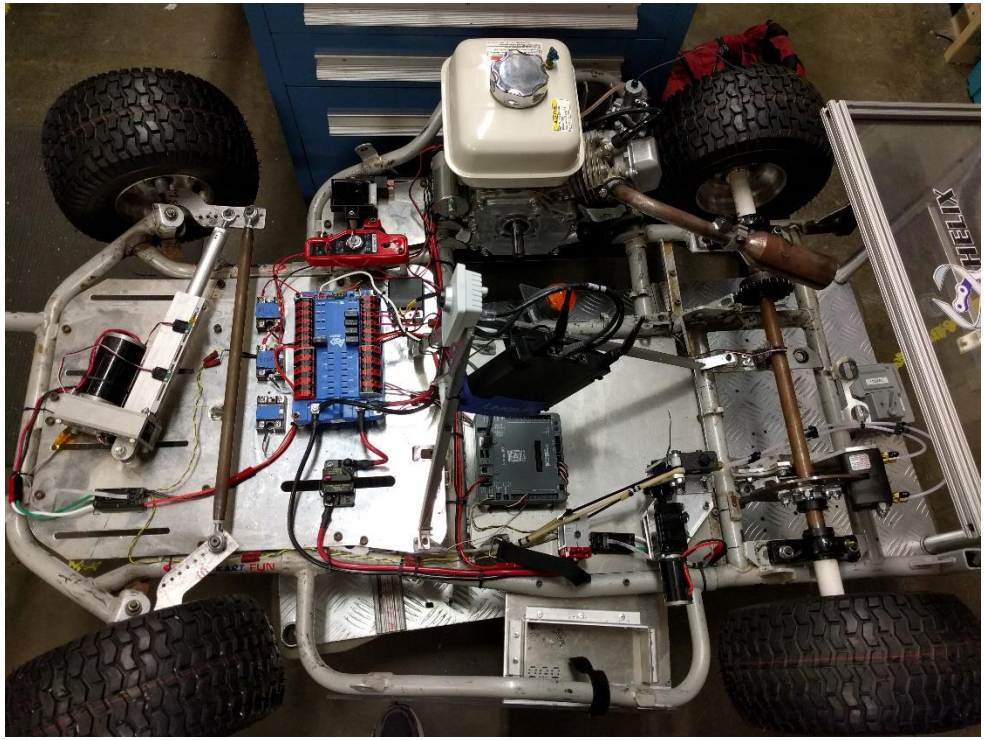
Limited resources
- Budget
- Time (summer months)

Self-imposed challenges
- Maximize use of FRC control components
- Convert engine to fuel injected (was carbureted)

No weight or size constraints

VEHICLE SUBSYSTEMS

- Brake
- Steering
- Engine Control
- Communications



BRAKE SUBSYSTEM

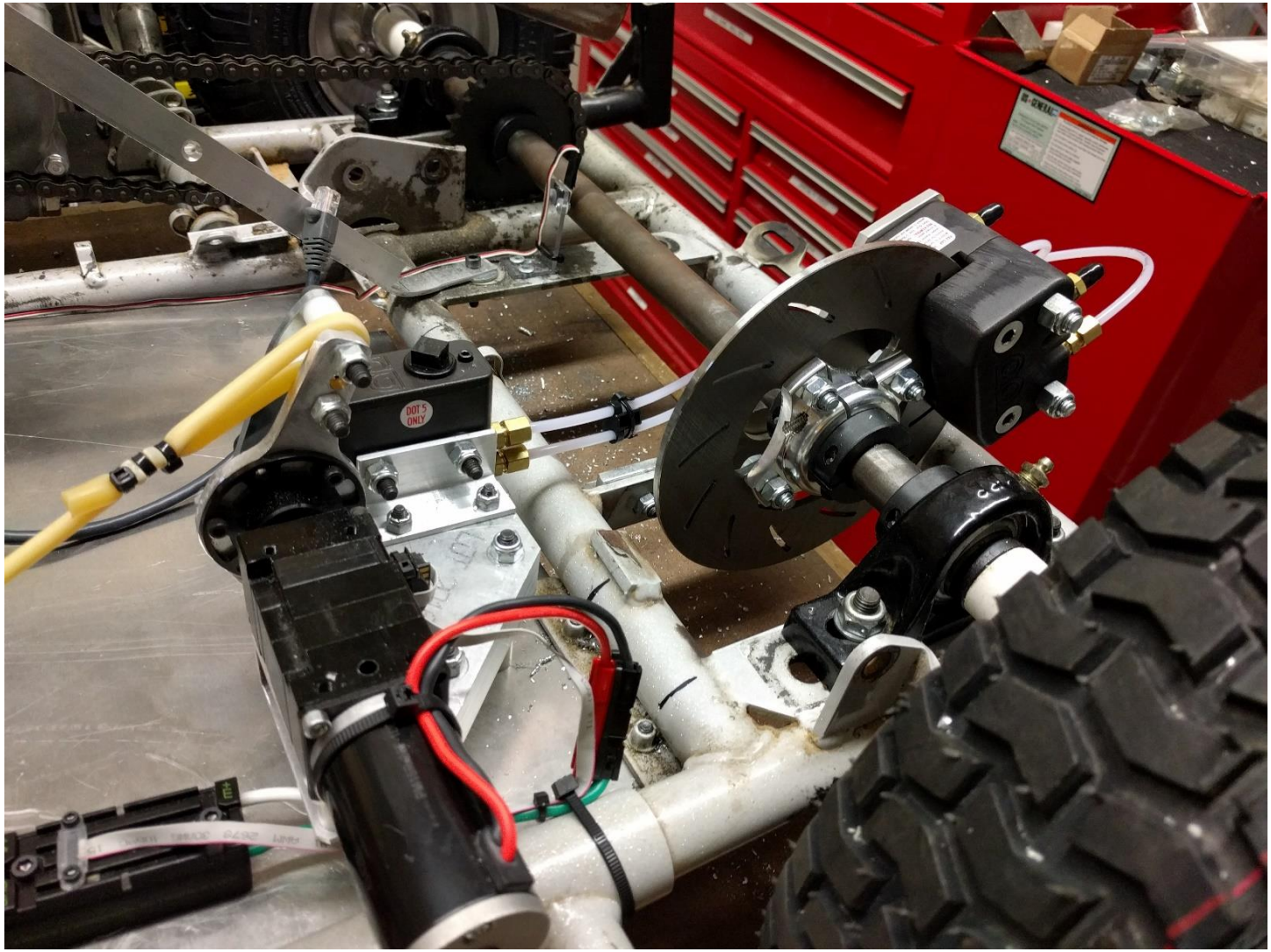
Electric actuator

- BAG motor
- 100:1 VersaPlanetary gearbox
- VEXpro integrated gearbox encoder
- Talon SRX

Which drives a hydraulic actuator

- Hydraulic brake master cylinder
- Calipers clamp around brake disk

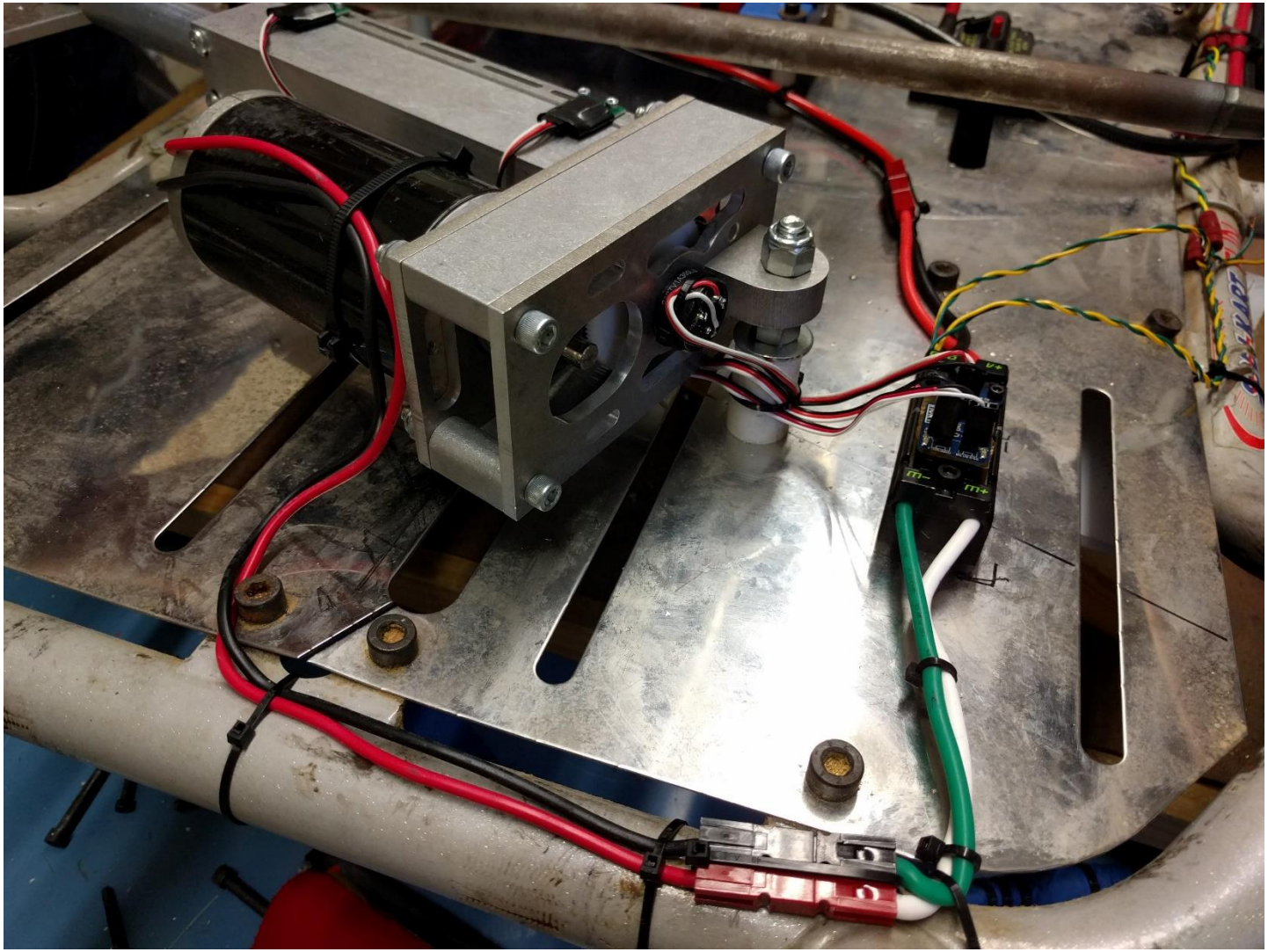
BRAKE SUBSYSTEM



STEERING SUBSYSTEM

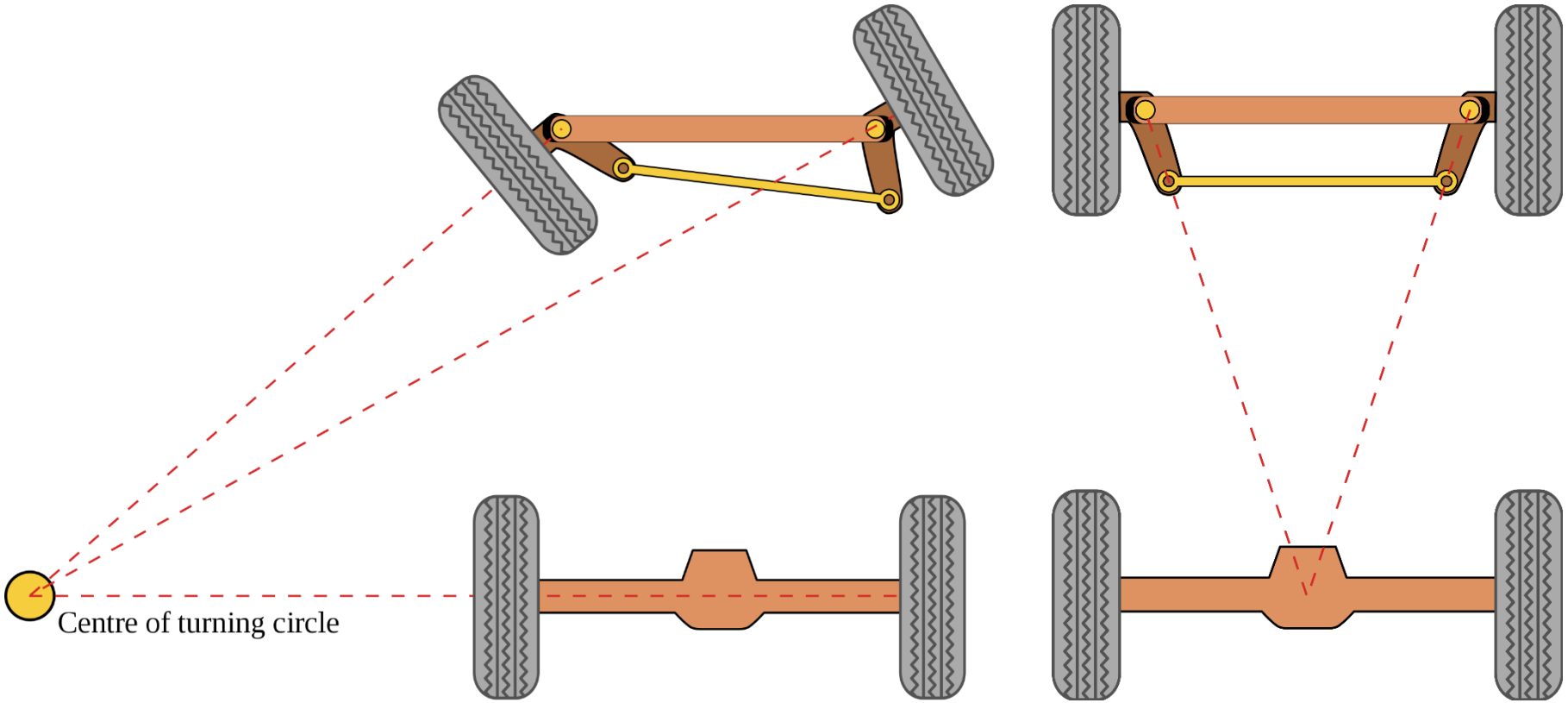
- Ackerman steering
- Linear actuator
  - CIM Motor
  - Dart Linear Actuator
- On-board closed loop control
  - Talon SRX with a analog breakout board
  - 2x magnetic Hall effect limits
  - 10-turn potentiometer
- Terminate CAN system
  - 120 Ohm resistor attached to Talon

STEERING SUBSYSTEM



STEERING SUBSYSTEM

STEERING CONCEPT



ENGINE CONTROL

Start switch state diagram

		Conductor		
		Batt	Ign	St
State	Off			
	On	■	■	
	Start	■	■	■

Logic

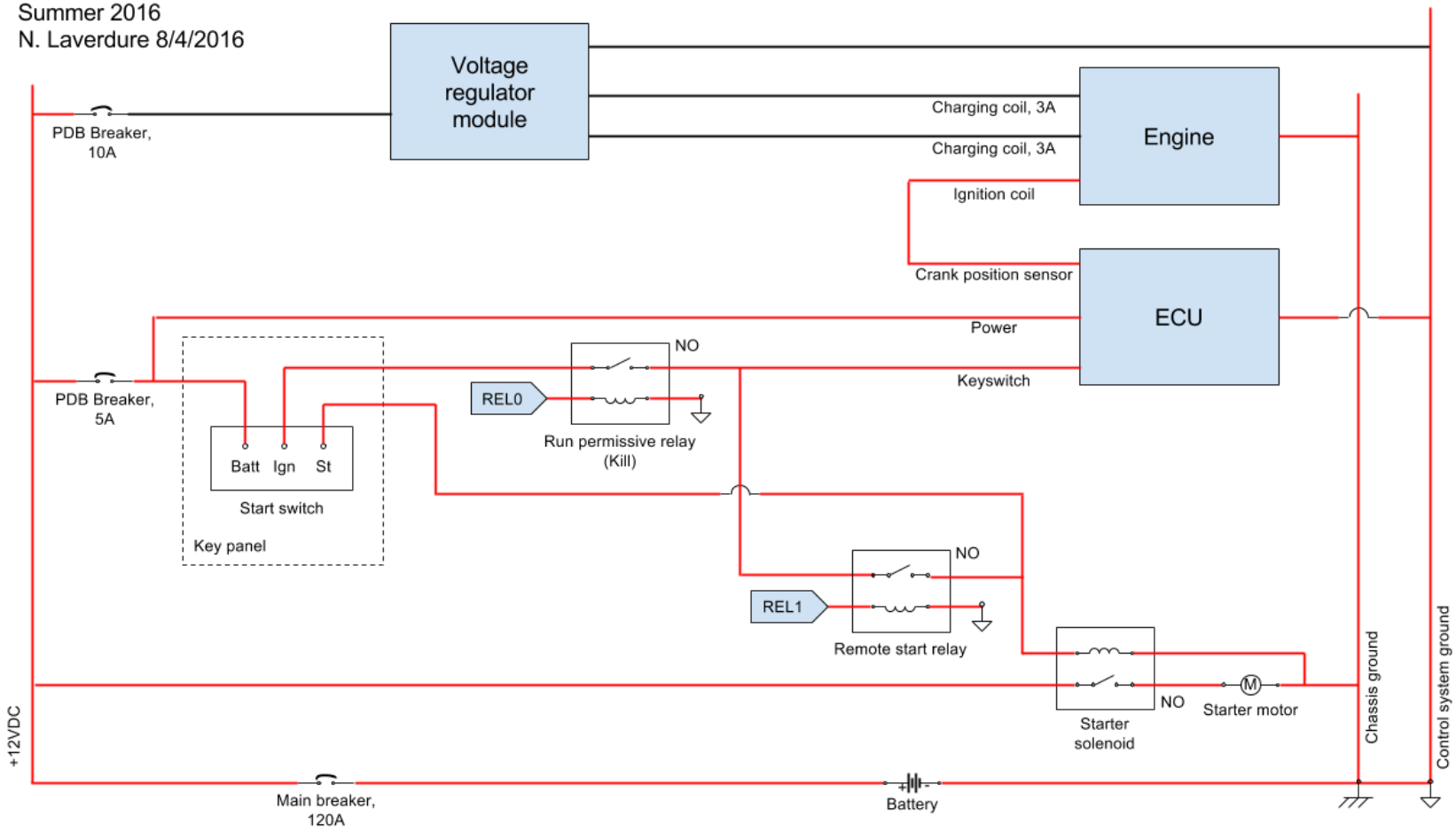
- Engine controllable (on AND off)
- By BOTH roboRio and manually and using the key switch

Implementation

- Solid state relays (Run Permissive, Start, Performance)
- Run Permissive (or ‘KILL’) is normally open
- Run Permissive must be closed to allow for remote start or the Engine Control Unit (ECU) to run
- Run Permissive is open when robot is disabled, preventing the motor from starting and preventing the ECU from running

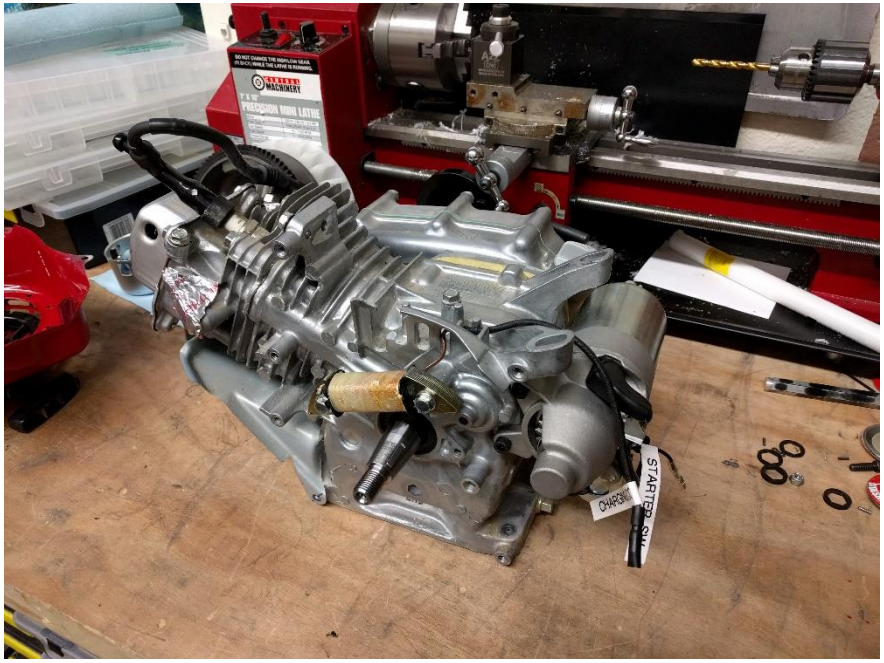
ENGINE CONTROL

Triple Helix
Ground vehicle engine control logic
Summer 2016
N. Laverdure 8/4/2016



ENGINE HARDWARE

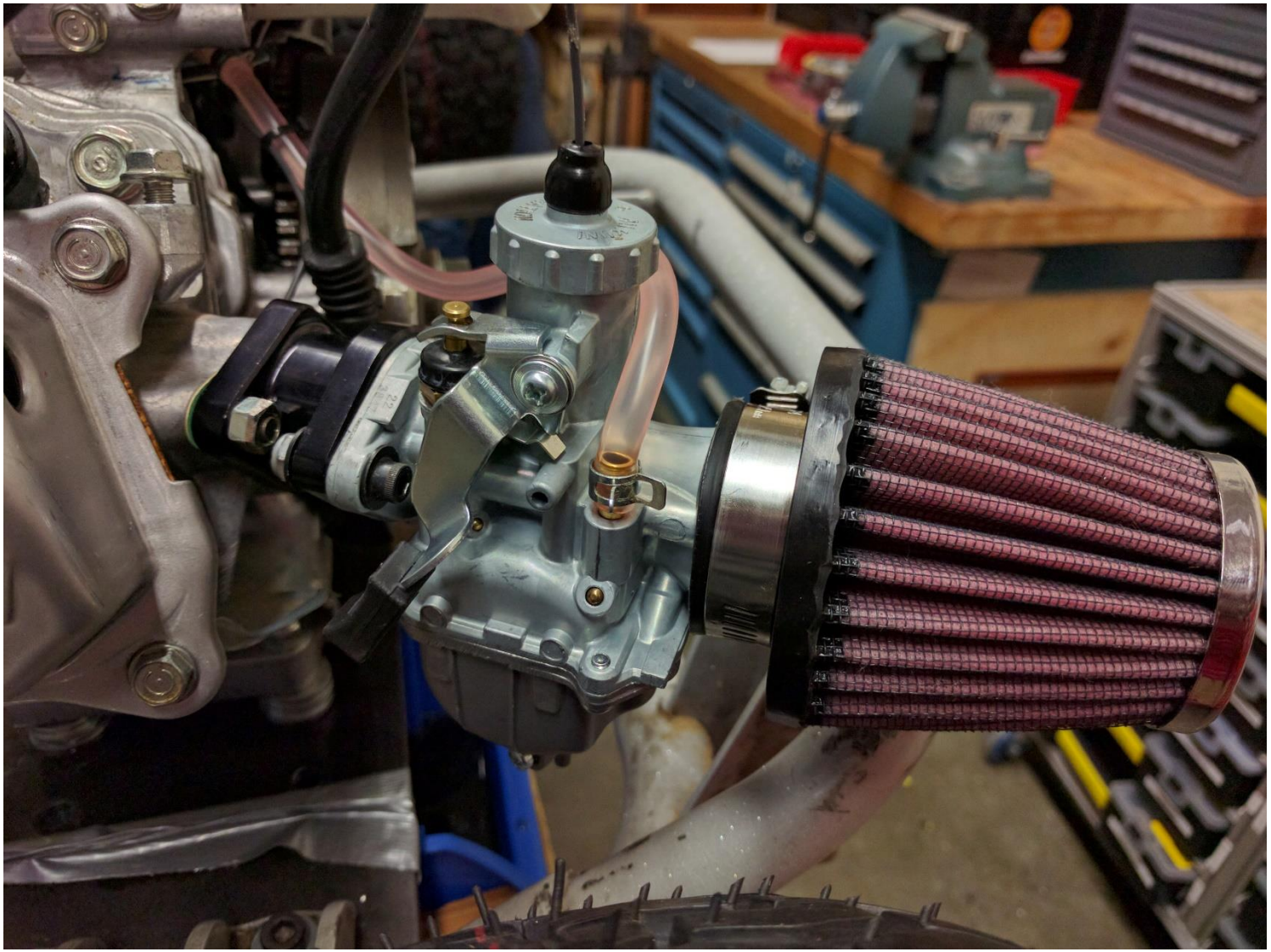
- Honda GX160 5.5hp
  - Aftermarket Mikuni carburetor
  - Electric start
  - Charging coils
- Reduction case
  - Centrifugal clutch
  - 2:1 gear reduction



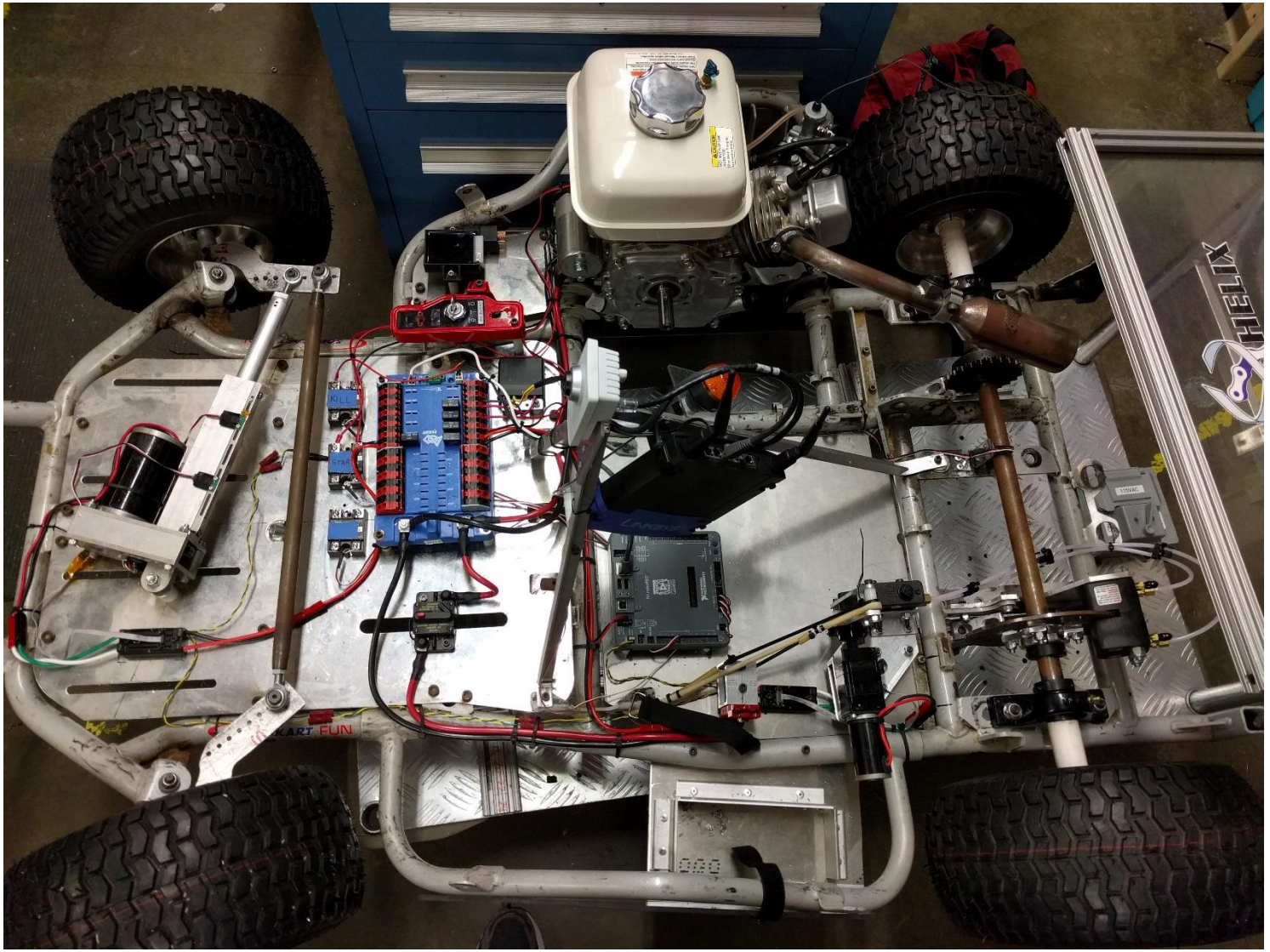
ISSUES ENCOUNTERED

- Engine cannot start
  - Troubleshooting is ongoing
  - Ignition timing problem?
  - Fuel/air mixture/delivery problem?
- Changes made during troubleshooting
  - Reverted engine back to carbureted
  - Adapted throttle system to carburetor
  - Bypassed relays

NEW CARBURETOR



CURRENT STATE



COST SUMMARY

Subsystem	Subtotal
Power transmission	451.13
Frame	1,000.00
Engine	683.59
Engine controls	794.65
Other vehicle controls	1,276.10
Steering	409.77
Brakes	338.86
Free Labor	0.00
Total	**$4,954.10**

RESULTS

Build something cooler than an FRC robot

Excite, engage, and wow

Explore advanced FRC control techniques

New student training

Keep momentum throughout summer

Demonstrate skills and promote team

NEXT STEPS

Carburetor troubleshooting and tuning

Test and improve brake system design

Communication system testing

Possible change back to ECU

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