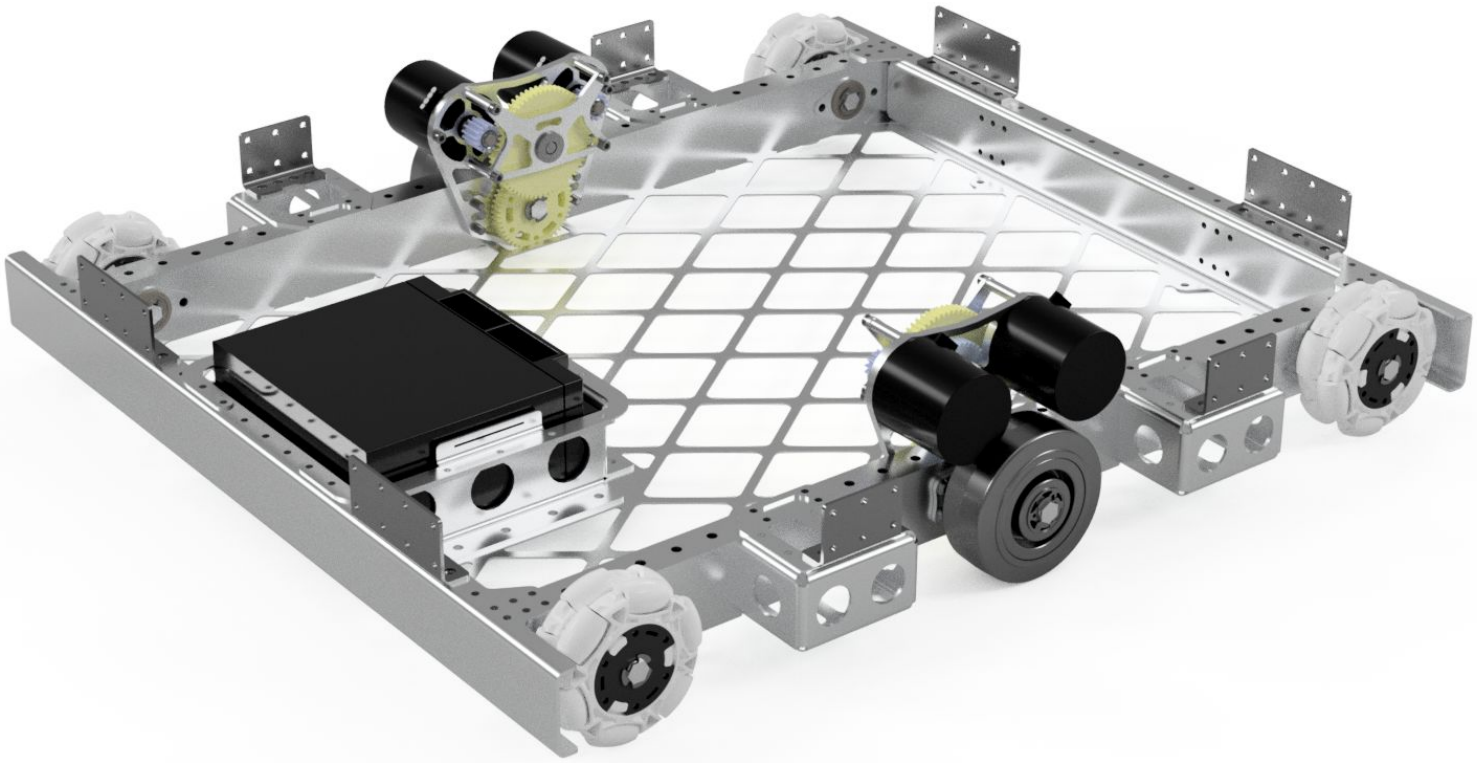
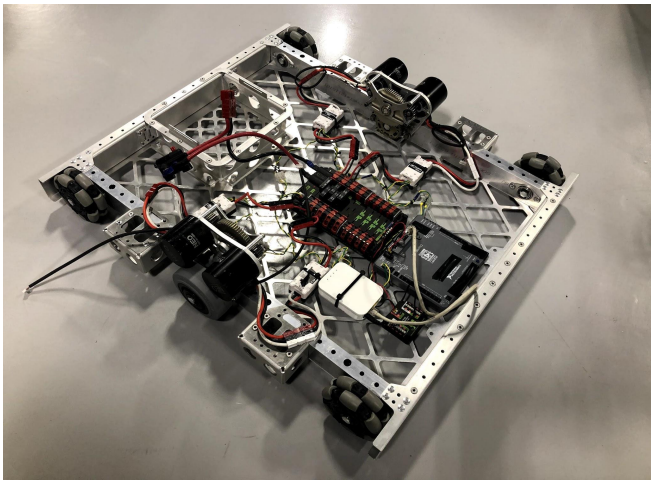
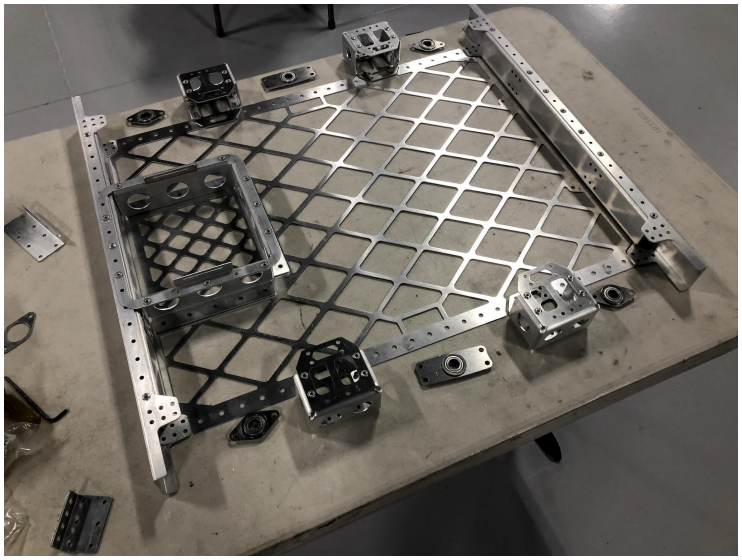


Blue Cheese Robotics

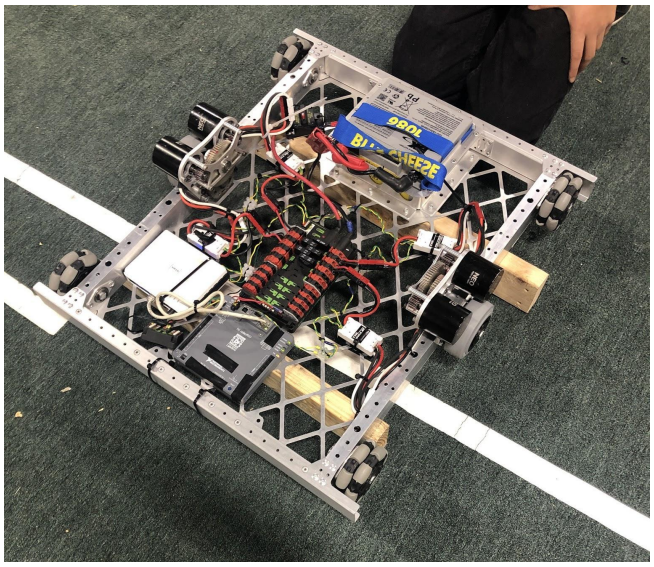
1086

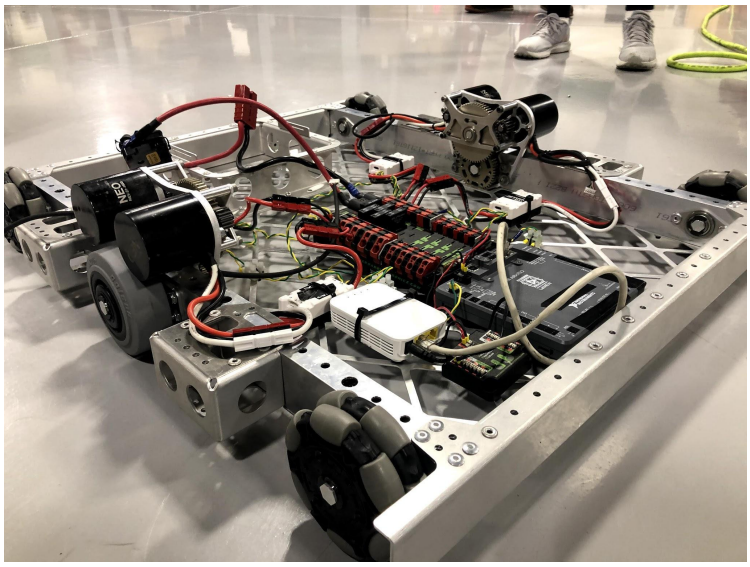
2019 Offseason Drivetrain





Overview



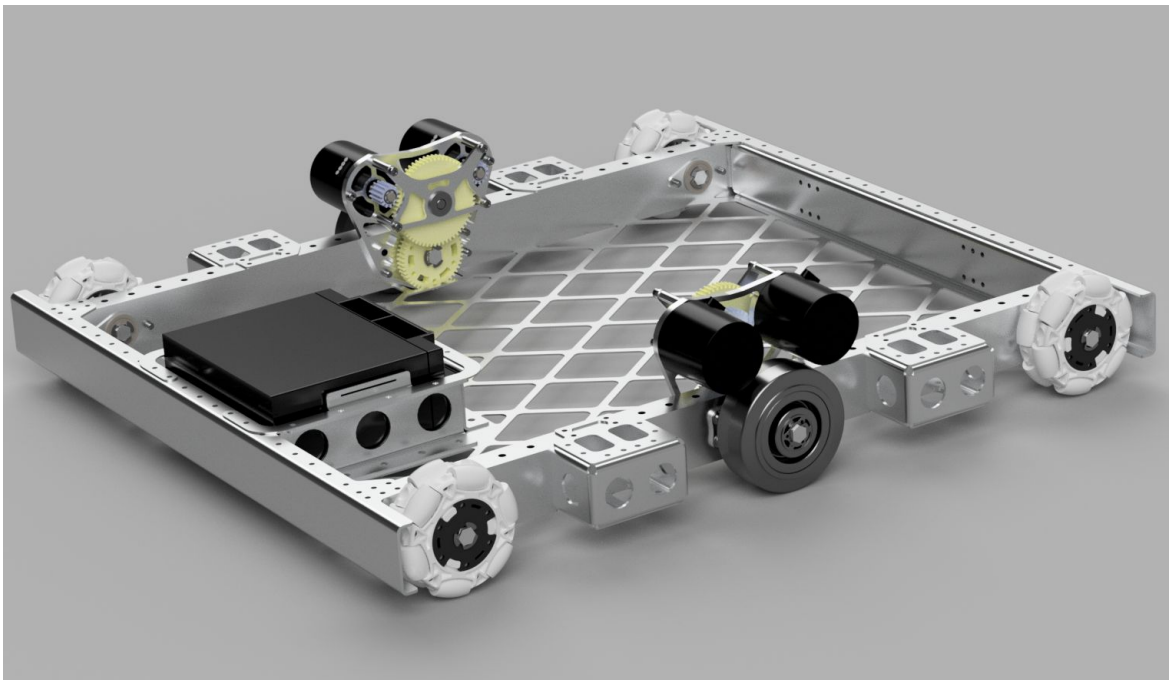


During the 2019 season, we experienced significant issues regarding the reliability and performance of our drivetrain. In response, we designed an offseason drivetrain that would simulate the most likely design for our 2020 robot (game permitting). This process allowed us to test certain designs which were relatively unfamiliar to Team 1086.

Goals of the drivetrain

- Test new custom gearbox design.
- Endure additional wear due to the removal of bag.
- Minimizes unnecessary weight.
- Take advantage of our sheet metal sponsors while utilizing in-house machining capabilities.
- Test new structures and designs.

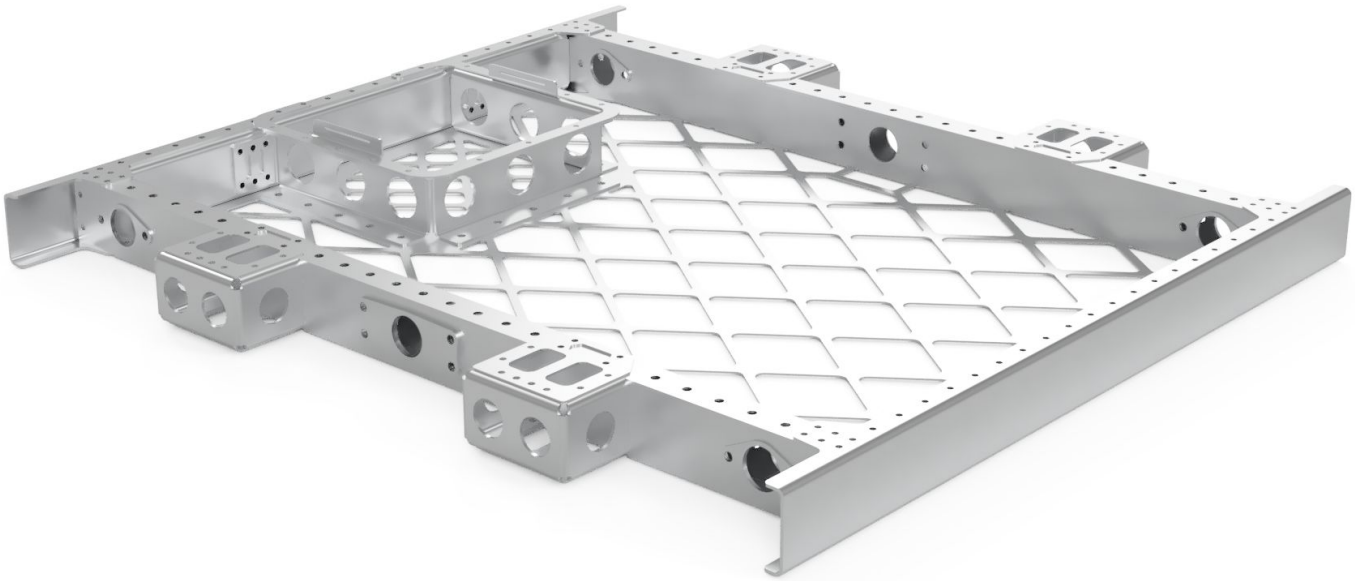
Design Overview



General Info

- 6 wheel, “West Coast” Style drivetrain.
- Custom flipped gearbox.
- Chain in tube.
- Set sprocket C-C distance (Additional 0.018" added).
- No center drop.
- 4” Colson wheels in the center and 4” Omni wheels on the outside.
- Omni wheels have a plastic Versa hub on the outside and aluminum Versa hub on the inside.
- Uses the WCP 18 tooth, #25 chain, double hub sprockets.
- Weight: 23.82 lb.

Frame



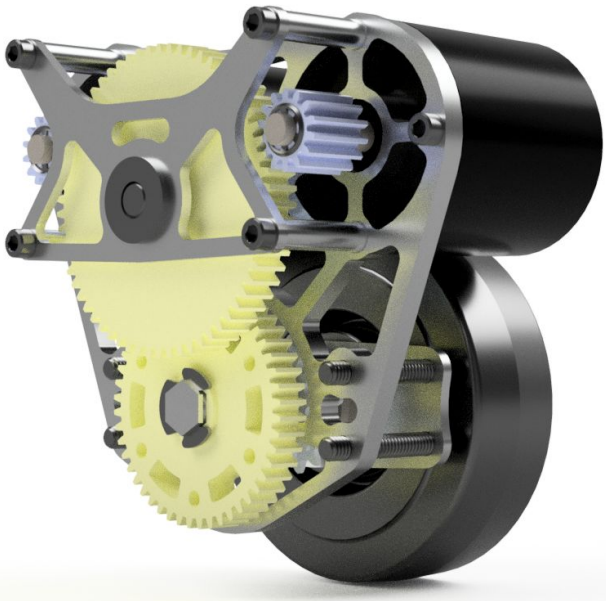
General Info

- 2" x 1" x 0.0625" aluminum tube rails.
- 0.0625” bearing blocks on the outside bearing holes, 0.125” bearing block on the center bearing holes.
- 0.09” sheet metal “U” front and back rail, with supporting 0.09” sheet metal “U” inside piece inside forming a rectangle tube structure.
- 0.0625” Belly pan, 0.1875” webbing thickness, thicker webbing profile used under the battery.
- 25.5” x 28.5”

Machining

- Square tube machined in-house on a CNC mill.
- Sheet metal laser cut and bent by a sponsor.

Drive Gearbox



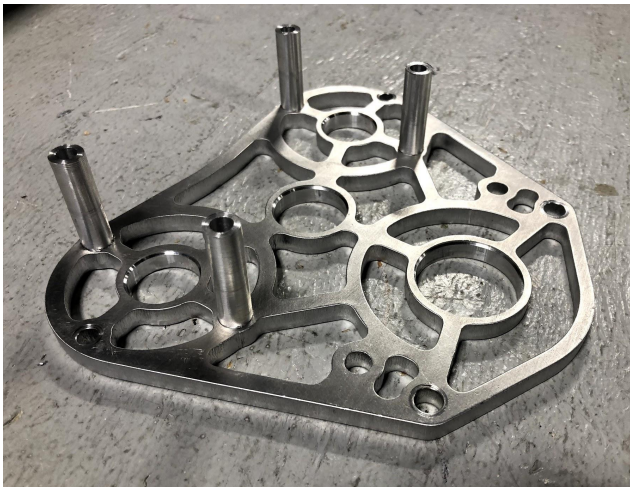
General Info

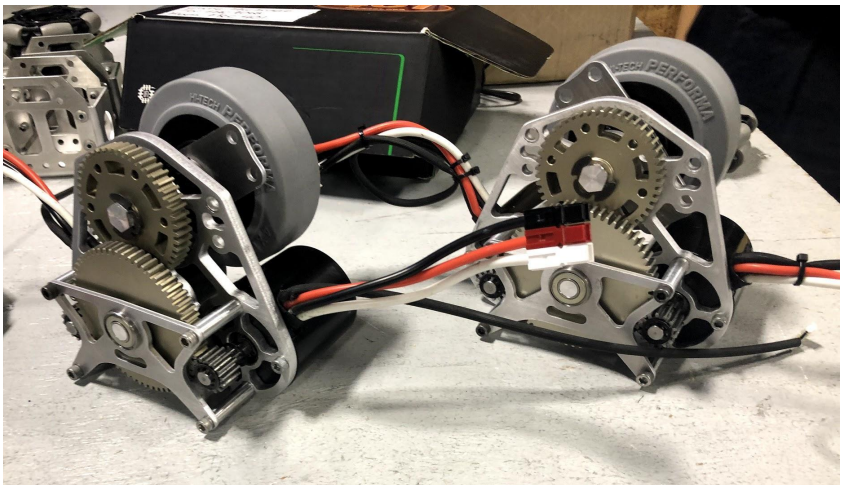
- Each gearbox weighs 3.17 lb (Colson wheel [0.53lb] not included).
- 5.90:1 Reduction.
- Free speed: 16.78 ft/s.
- Adjusted speed: 13.59 ft/s.

4 NEO Brushless Motors

- Smaller NEO motors package better than Mini-CIMs motors, allowing for a low profile flipped gearbox and maximizes usable space.
- 4 NEOs provide comparable power to 6 Mini-CIMs.
- Each NEO motor provides a drastic weight reduction over previously-used Mini-CIM motors.

Drive Gearbox - Cont.





Machining

- Gearbox plate profile laser-cut by sponsor.
- Bearing holes (machined to snap fit) and standoff counterbores machined in-house on a CNC Mill to insure proper tolerances.
- Standoffs and axles machined on a lathe.

Design

- 0.003” added to the gear pitch diameter.
- Counterbored standoffs to provide additional rigidity to insure gears maintain proper meshing.
- 2 stage reduction to allow for the NEO motors to ride over the wheel.

Reflection

Firstly, the most notable difference about this drivetrain compared to some of our previous ones is its maneuverability. The combination of the 4 outside Omni wheels and no drop-center allows for the drivetrain to be incredibly dynamic. On the flip side, the wheel setup allows for the robot to be more easily pushed off course from a rear or front, side hit. Secondly, during the assembly of this drivetrain we had learned the importance of rivet clearances. They will not always form in the direction you wish them to, so when doing chain in tube, this is something we need to be aware of in the future. Lastly, after our testing, we found no damage to our side rails, so the possibility of competing next year with 0.0625” wall tubing versus 0.125” is high.

Changes for the future:

- The front sheet metal rail assembly can be lightened. Possible choices are changing the interior piece from 0.09” to 0.0625” and pocketing it aggressively, or changing both the interior and exterior piece from 0.09” to 0.0625”and lightly pocketing the interior piece.
- The material around the bearing holes on the 0.25” gearbox plate should be increased from 0.125”.
- The battery holder can be more aggressively-pocketed.
- Additional clearance for rivets needs to be accounted for.
- Possible small drop center.
- Test front Omni wheels with center and back traction wheels.

Huge thanks to Team 401, Copperhead Robotics, for loaning us NEO motors and SPARKMAX motor controllers for this offseason allowing this project to be possible.