



Pegasus Technical Handbook

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Team 4521

2018 Season



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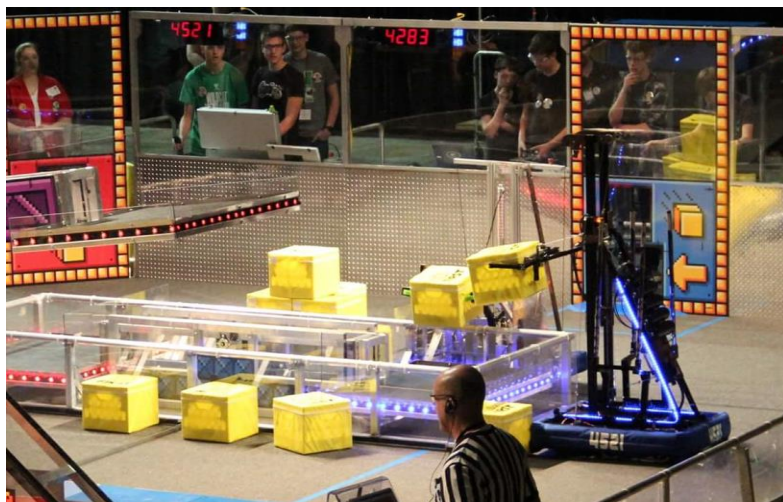
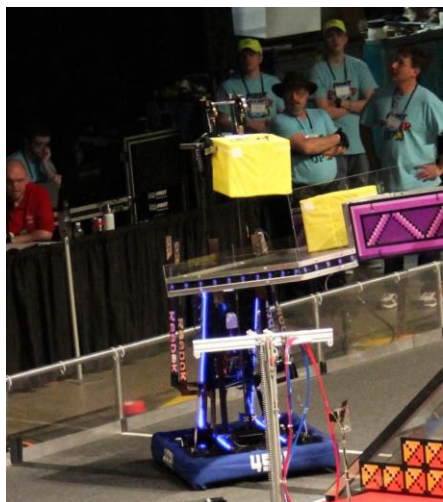
The Plan

Our teams collective thought was that this year's game would depend on speed of execution. Given this, we listed off different ways to score and ordered them based on their importance to us.

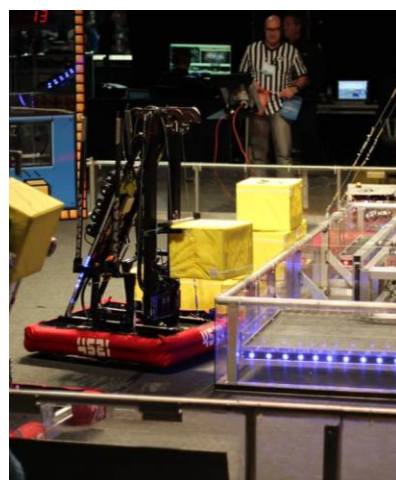
1. Drivetrain
 - a. Simple and cheap
 - b. Good maneuverability
2. Exchange/Vault
 - a. Easy to align and insert
3. Switch
 - a. Able to do 1, maybe 2 cubes during auto
 - b. Quickly lift cubes in
4. Climbing
 - a. Climb with 1, maybe 2 other robots
 - b. Somewhat quick lift time
5. Scale
 - a. Able to do full range (4-6 ft)
 - b. Somewhat quick
 - c. Same system as climb?

After deciding our priorities, we broke into teams to draw and postulate basic robot concepts. We then convened as a team and decided which concepts we utilize, and which concepts we would need to prototype before choosing.

The Robot



FIRST
POWER
UP 



Capabilities

Autonomous

- Score 1 cube in the switch from many starting positions
- Cross line

Scale

- Able to score the full range
- Can place all the way up to a third layer
- Quick acquisition with wheeled gripper

Switch

- Quick scoring of own switch
- Can easily score opponent switch with camera

Exchange

- Able to cycle exchange quickly with wheeled gripper
- Triple lift makes levitate unnecessary
- Easy to line up with camera

Mobility

- Easy to maneuver with front omni-wheels
- High traction for defense when we rock onto back traction wheels
- Able to easily go over cable protectors and ramps

Endgame

- “Iron cross” triple climb able to lift all three alliance members above the line
- Also able to climb with just one other robot because of locking hooks
- Quick climb time

Drivetrain

Wants

- Single-speed
- Maneuverable

Choices:

Custom Chassis

- Pros
 - Unique
 - Versatile
 - Robust and strong
- Cons
 - Costly
 - Design and manufacturing time

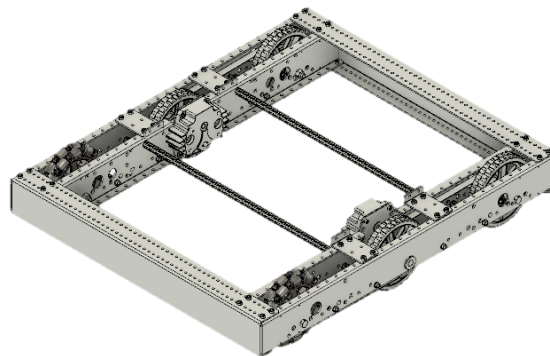
AndyMark Chassis

- Pros
 - Cost-effective
 - Simple
 - Proven
 - Robust and strong
- Cons
 - Not very unique

Decision:

AndyMark Chassis

- 6WD with front omni wheels
- 4-CIMs
- 10.71:1 Toughbox Minis
- Front ABS belly-pan for electronics



Elevator

Wants

- Fast for scale cubes
- Strong for climbing
- Robust

Decision:

Cascade Elevator

- 47" tall and 12" wide
- 80/20 T-slotted extrusion for linear bearings
- Actuated with a ½" 8-start fast travel acme steel lead screw and bronze nut
- Driven by 2-CIMs on a 10.71:1 Toughbox Mini
- 2 cables with pulleys to raise second stage
- Box extrusion diagonal and horizontal supports
- Cable diagonals with turnbuckles to adjust tension



Arm

Wants

- Quick
- Strong
- Light
- Maximum reach

Choices:

Front-Facing Motor Actuated Arm

- Pros
 - Light
 - Quick
 - Multiple positions
- Cons
 - Not as strong

Back-Facing Pneumatic Actuated Arm

- Pros
 - Strong
 - Simple
- Cons
 - Heavy
 - 2-position

Decision:

Front-Facing Motor Actuated Arm

- 2 Bosch KoP Bosch seat motors
- Broached carbon-fiber hockey stick with aluminum insert
- Held by T-slotted frame with linear bearings

Cube Manipulator

Wants

- Quick
- Simple
- Light
- Strong hold

Choices:

Wheeled Intake

- Pros
 - Easy to grab cubes
 - Strong hold
- Cons
 - Heavier
 - More moving parts

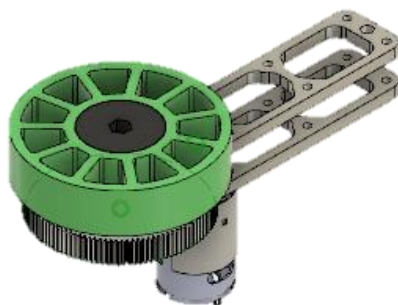
Pneumatic Grabber

- Pros
 - Very simple
 - Strong hold
 - Light
- Cons
 - Harder to get inside stacks
 - Very difficult to line up and get cubes

Decision:

Wheeled Grabber

- Lightweight carbon-fiber back frame
- Custom milled gearbox “fingers”
- 10:1 reduction from AM-9015 motors to 3D printed gears with 4” AM compliant wheels



Climbing Hooks

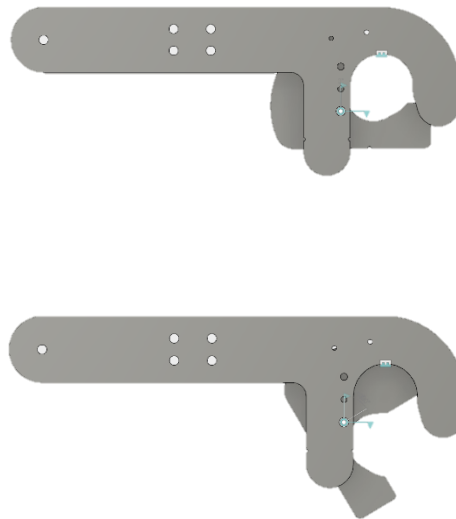
Wants

- Extremely strong
- Prevents rocking in case of an uneven load
- Double as pulley mount for elevator

Decision:

“Lego Hand” Hook with Locking Bottom

- Milled $\frac{1}{2}$ ” aluminum plate for hook
- Milled $\frac{1}{4}$ ” aluminum plate for bottom
- Spring-loaded bolt to lock bottoms
- Shoulder bolts with pulleys in the back



Platforms

Wants

- Extremely strong
- Little deflection
- Light

Decision:

Aluminum and Carbon Fiber Side Platforms

- Moved on standard residential hinges
- Released by a pneumatic cylinder
- Aluminum bumper wrap around structure
- Forks made from carbon fiber hockey sticks

