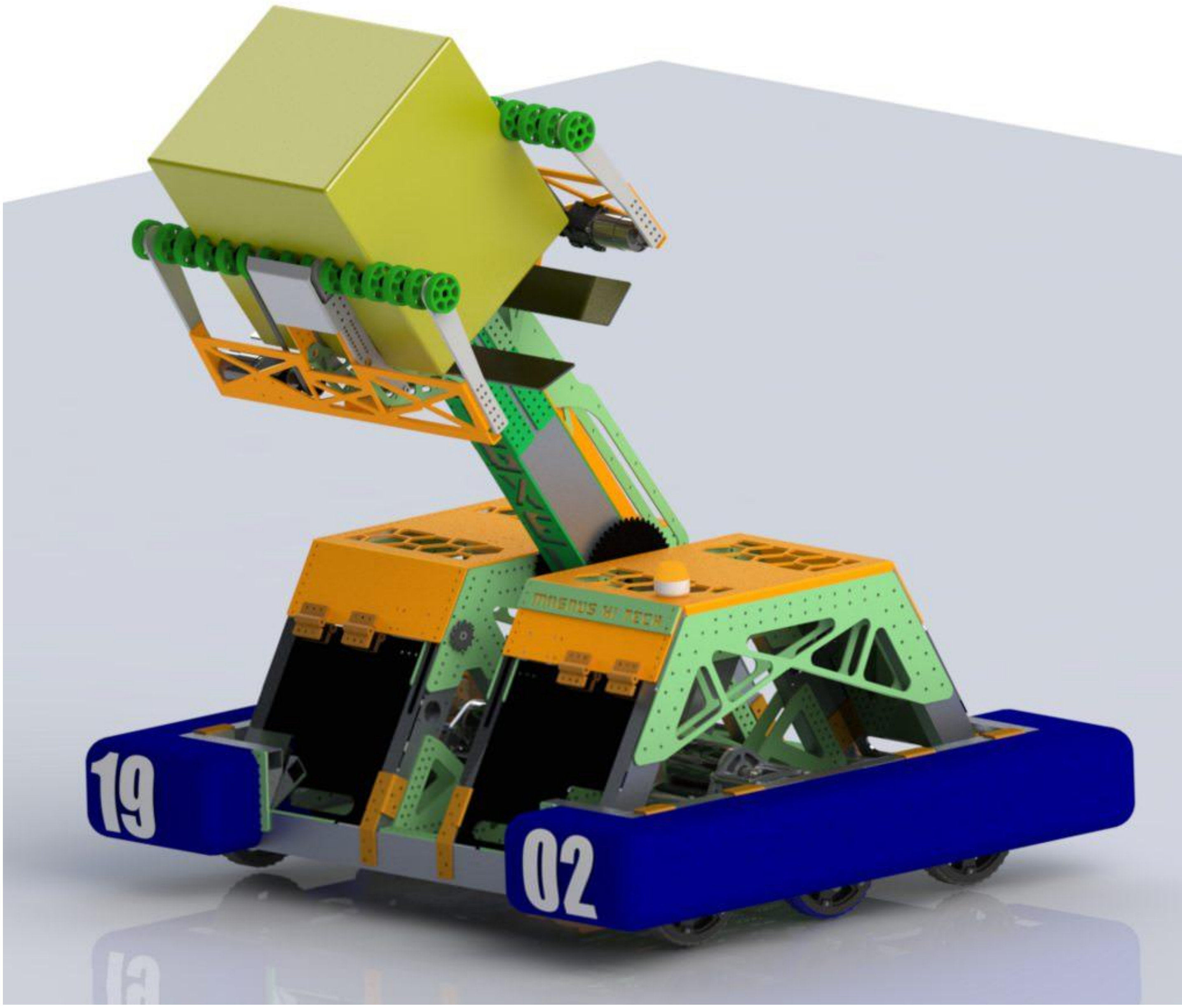
Exploding Bacon Game Manual



Pigxel Edition

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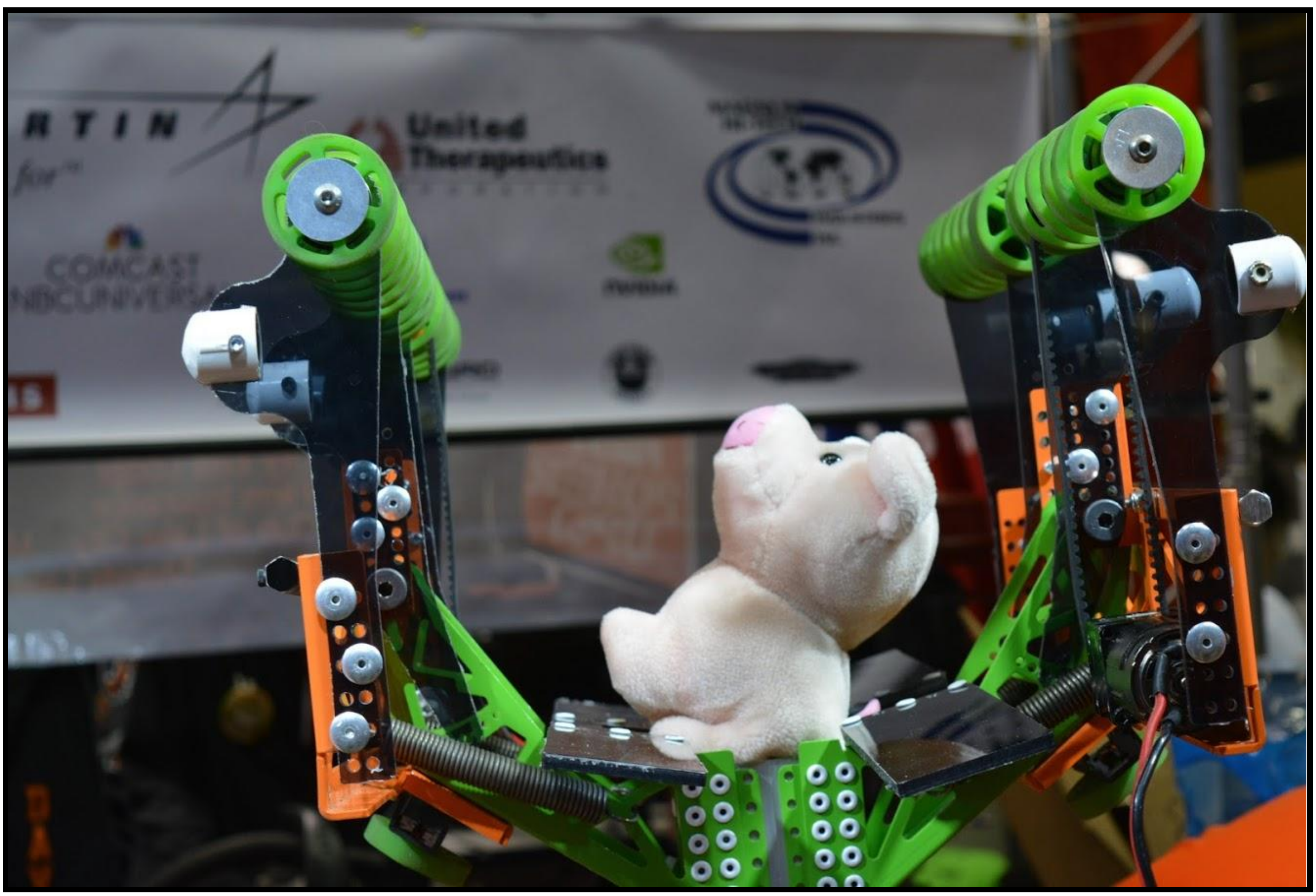



Strategic
Analysis

Analysis

This year's game presented a unique method for accruing points that was unlike any previous *FIRST* game. The main game element, power cubes, are not individually counted for points. However, the vast majority of this game is based around the manipulation of power cubes, so certain elements of our design were solidified fairly quickly.

Considering that our team has limited resources, especially our manpower and machining capabilities, we realized that we could not complete every possible game objective. Therefore, we listed every action a robot could take during a match, and then determined the relative difficulty of each objective. We decided on the following list, in order of priority:

1. Driving forward in auto
2. Scoring a cube in the exchange
3. Scoring a cube in a switch
4. Climbing
5. Scoring a cube on the scale

We then brainstormed different archetypes of robots that we thought would play the game effectively in some capacity. Afterwards, based on our assigned difficulties, we determined how well a robot of each archetype built by OUR team would perform on the field with a scoring matrix. We decided that we would build a robot that neglects the scale, and instead focuses on maximizing our effectiveness with the other objectives.

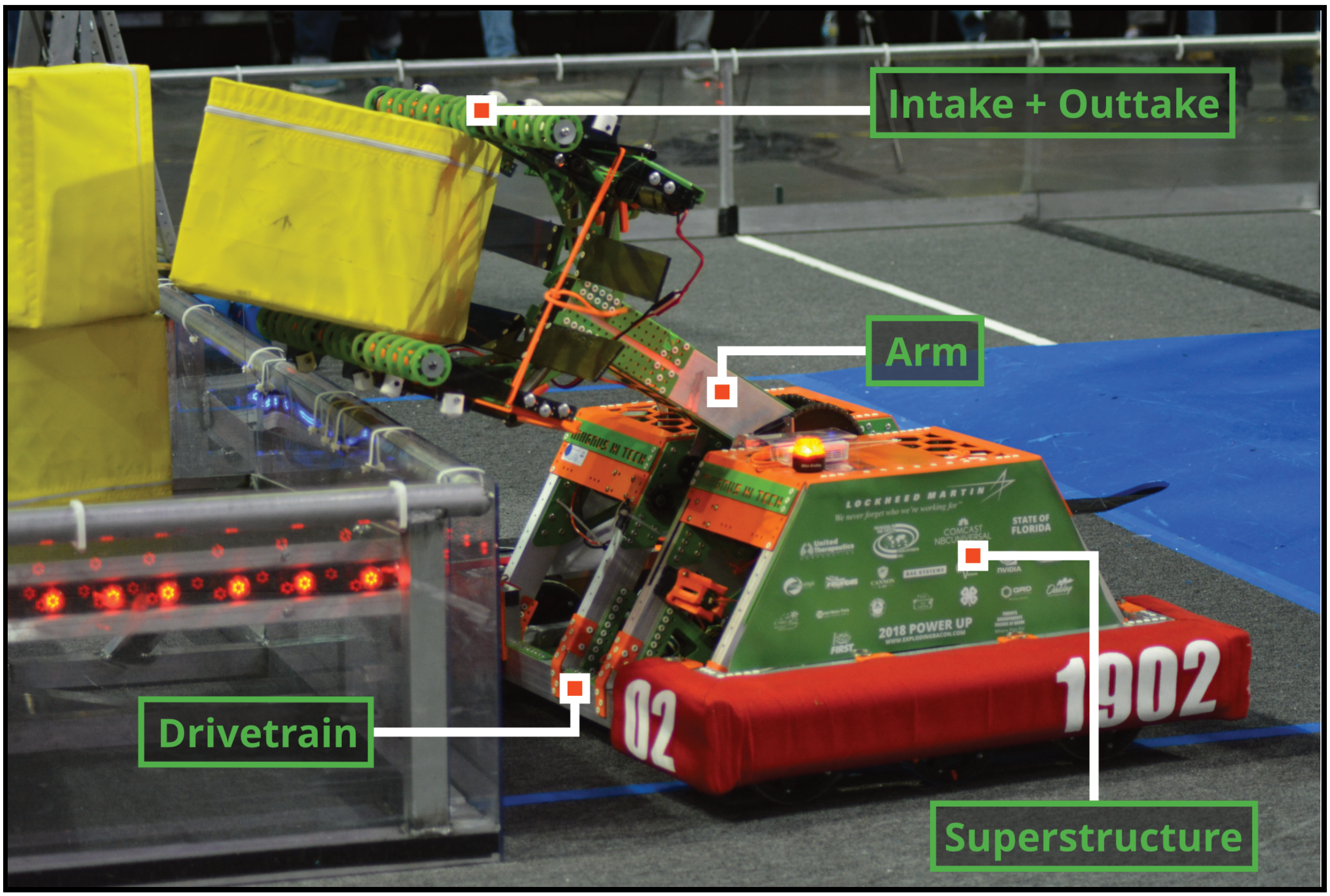
_____For our autonomous, our primary focus was obtaining ownership of our switch as quickly as possible, and then placing additional cubes to secure our possession in preparation for teleop. We decided that a three-cube autonomous was strategically valuable and attainable for our team's capabilities.

In teleop, our primary strategy depends on the capabilities of our alliance partners. As soon as teleop starts, we either place three cubes in the exchange or two in the opposing alliance's switch. Overall, we intend to maintain ownership of our own switch, fill our vault, and deny ownership of the opposing alliance's switch throughout the match, as well as climb.

Priority List:

1. **Drivetrain**
    a. Able to traverse the field quickly
    b. High power drivetrain for withstanding defense
    c. Easy to maintain
2. **Intake**
    a. Pick up cubes from the floor
    b. Wide acquisition zone for ease of driving
3. **Outtake**
    a. Can outtake into both the exchange and the switch
    b. Require as little time to line up as possible
4. **Climber**
    a. Able to climb consistently every match in 2 seconds

Pigxel


Intake + Outtake
Arm
Drivetrain
Superstructure
1902
02
2018 POWER UP
LOCKHEED MARTIN

Design

Drivetrain

Goals

- Maneuverable
- Capable of both defense and offense
- Can clear Platform Angle
- Is Easy to Manufacture

Prototyping

Drivetrain Type

- Swerve
    - Expensive
    - No experience
- H-Drive
    - Susceptible to Defense
    - Experience
- 6 Wheel tank (with drop-center)
    - Effective Against Defense
    - Effective as Offense
    - Lots of Experience

We chose a 6 wheel tank drive with a ⅛ in. drop center to aid in fast maneuvering and an easy to program auto. This will allow us - with 6 or 8 inch wheels - to clear the angled part of the platform with no possibility to beach.

Gearbox

- Single Speed
    - Cheap
    - Less Options
- Shifting Speed
    - Expensive
    - Gives us more options in both defensive and offensive driving

We chose a two-speed shifting speed gearbox, despite the cost, to help make our robot more efficient at the switches, while also accomplishing our speed goals. Specifically we chose the Andymark Evo shifters because a custom gearbox would take too much time to design and they come with an encoder that would allow us to create a more effective auto.

Rotational Transferring

- 35 Chain
    - Heaviest option
    - Durable
    - Highest Load Capacity
    - Cheap because we already have most of the ardware
- 25 Chain
    - Lighter Than 35 Chain
    - Weaker Than 35, But Still Strong
    - Cheap because we already have most of the hardware
- Belt
    - Light but takes up more space
    - Strong
    - More expensive because we do not already have the hardware

We chose 35 chain because it was the most robust option that wouldn't give us problems with our aggressive gearing.

Chain Tensioners

- Active Tensioner
    - Heavy
    - Durable
    - Efficient
- Solid State Pressure Tensioner
    - Light
    - Needs Occasional Replacement
    - Friction Reduces Efficiency

Considering weight, space, and design time, we decided it would be a stretch goal to add a tensioner to the drivetrain. We expected - and affirmed - that a lack of tensioners would not be a problem for our first competition and did not see any wear that would facilitate the need for tensioners in the future.

Wheels

- 6 in. wheels
    - High Traction
    - Slightly lower surface contact area than 8 in. wheels
    - Cheap
    - Simple Geometry
- 8 in. wheels
    - High Traction
    - Cheap
    - Geometry Gets Difficult When Used (for 6 collinear wheels)

We chose 6 inch wheels because they gave us enough clearance to drive onto the platform while also not shortening the wheelbase significantly. We used Andymark blue nitrile tread on Vex hubs to ensure traction on center wheels, reducing cost.

Intake & Outtake

Goals

- Intake and outtake in ½ a second
- Bi-directional so that you can intake from both sides of the robot
- Intaking against walls to easily intake cubes from different parts of the field

Prototyping

Horizontal intake

- Can easily make larger to intake cubes from a larger side
- Requires something that can pop it off the ground
- Cannot intake cubes that are not flat
- Can hold the cube when flipping easily

Side intake

- Can intake any cube orientation on the field
- Can lose grip at higher speeds of motion

Each of these prototypes were easier or harder to implement based on the way we manipulated the cubes once they were in the robot. This meant that we wanted to go for an easier solution for moving cubes inside the robot. We ended up going with a horizontal intake because it helped us achieve our design priorities more effectively.

Intake & Outtake Manipulator

Goals

- Fast and stable enough that we can flip it from one side to the other for fast exchange and opponent switch/portal cycles
- Maintains constant contact with the cube
- Sustain impact from other robots for potential defense situations
- Sensors to allow accurate movement of mechanism
- Stretch goal - Integrated Climber
    - Support 2 to 6 times the weight of the robot

Prototyping

Arm

- Easy to build and prototype a robust mechanism
- Can integrate the climber easily
- Team history experience
- Can scale with a shooting mechanism
- Easy sensor integration

Elevator

- Complicated to integrate climber without sacrificing elevator speed
- Heavy
- Not a lot of team history experience
- Allows us to scale easily

Conveyor

- Does not give the option to add a climber
- Hard to prototype without quick access to precise sheet material cutting
- Cannot scale without a complicated shooting mechanism
- Hard to figure out where the cube is in the mechanism

We decided on the arm because it focuses on our priorities. Because it is a simple mechanism, it allowed us to focus more time on other mechanisms that were higher priorities. Since we chose the arm, the climber would be easy to integrate.

Climber

Goals

- Climb in 2 seconds
- Support over 2 times the weight of the robot
- Stretch goal - be able to support 6 times the weight of the robot - making double or triple climbing a potential option

Prototyping

Telescoping Latch

- Something we can prototype inhouse
- It doesn't take time away from other parts
- Could use a rope & hub that would be integrated onto the - arm shaft for coaxial rotation of the arm and climber.

Folding Climber

- Heavier than the telescoping latch
- Could use a rope & hub, but it would have to be part of a separate mechanism from the arm
- Not attached to the arm, so the arm can move faster (lower inertia)

Despite having success with the telescoping latch and the folding climber prototype, we will not be implementing it at a competition because it will take too much time away from our first 3 priorities. Weight reduction to the point of implementation might take needed strength away from other more important mechanisms like the intake and arm.

Superstructure

Goals

- Can easily support the robot for climbing
- Can support the arm
- Protect electronics from Cubes

Prototyping

Tubing

- Strong
- Heavy
- Easy to Machine

Sheet metal

- Light
- Stiff - But Not as Strong as Tubing
- Difficult to Machine

Lexan

- Bendy
- Not as Stiff as Metal
- Difficult to Machine

We decided to use a combination of tubing and sheet metal to optimize usage of materials and costs. This allowed us to create a solid superstructure that would achieve our goals.

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