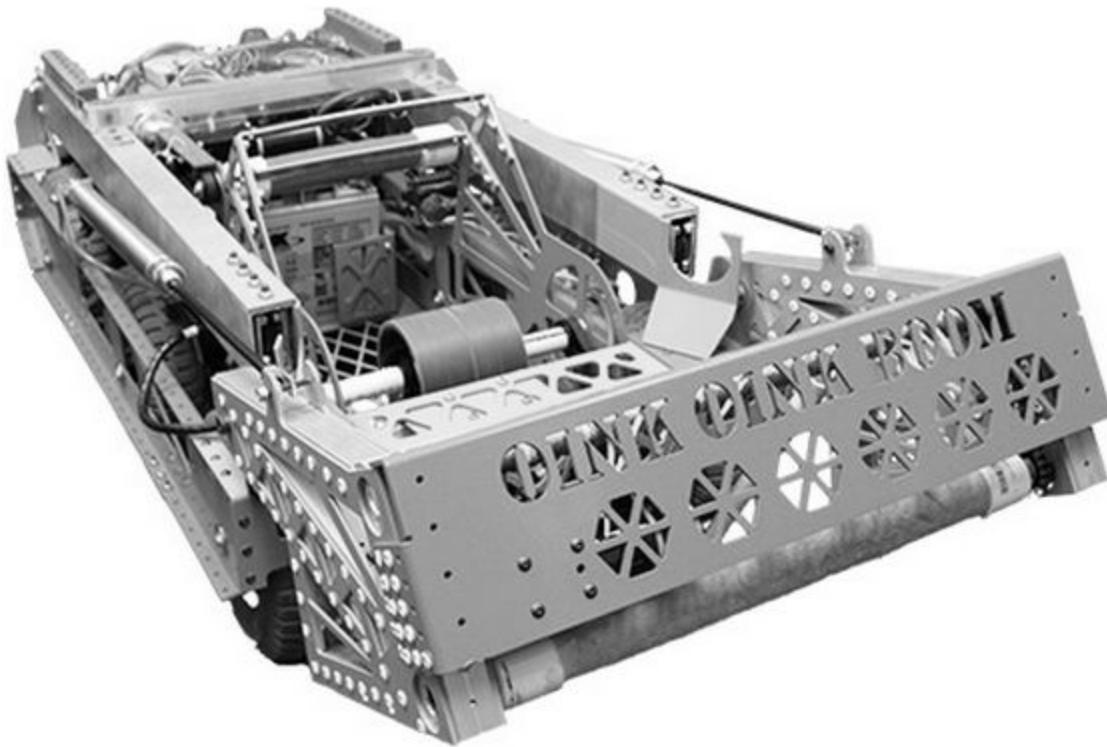


# Owner's Manual Revision 3.14...



CAUTION: Read and follow all Safety Rules and operating Instructions before FIRST using this product.

2016 FIRST Robotics Competition  
FIRST STRONGHOLD  
“Battering Ham”

Model No.  
200620161902  
Serial No.  
00001 of 00001

Assembled at: 7040 Stapoint Ct, Winter Park, FL

Parts fabricated at: Magnus Hi-Tech Industries, 1605 Lake St., Melbourne, FL

For more information visit our web page: [www.explodingbacon.com/robot](http://www.explodingbacon.com/robot)

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## WARRANTY

### FULL ONE YEAR WARRANTY ON BATTERING HAM

The robot covered by this manual is guaranteed to inspire kids to pursue careers in STEM fields for a period of 1 (one) year following the 2016 bag and tag date. In the event that this robot fails to give complete satisfaction,

**RETURN TO EXPLODING BACON 6021 S. Conway Rd, Orlando, FL 32812 IN THE U.S., free of charge.**

NOTE: This warranty does not apply to any failure (mechanical, electrical, software, workmanship, or materials), as these types of failures create unique challenges and only contribute more to the FIRST experience.

## INTRODUCTION

Congratulations! You and your team are now the proud owners of Battering Ham, a custom-built, one-of-a-kind FRC robot, specifically designed to play the 2016 Stronghold game. This robot was carefully designed and built by 4-H Exploding Bacon Robotics Club, a dedicated group of high school and middle school students, and their mentors. The robot was conceived, designed, produced, and tested in exactly 45 days. It is designed to pick up Boulders and shoot them into the opposing teams tower. The robot can be programmed to operate autonomously to complete tasks. It can also be controlled remotely from a driver's station (included). It has everything a team needs to play the game, and play it well. It is an excellent tool for learning the importance of teamwork, dedication, perseverance, and gracious professionalism. The team that competes with this robot will be inspired and inspire others to accomplish their goals, whatever they may be.

# SPECIFICATIONS

## Overall Robot:

Number of motors/speed controllers: 12  
Number of pneumatic storage tanks: 1  
Number of pneumatic cylinders: 5  
Dimensions: 20in by 37in by 15in  
Weight: 115lb  
Power Supply: 1 12 VDC 18Ah Sealed Lead-Acid Battery  
Pneumatic Pressure: 120psi stored, 60psi working

## Base:

Type: Drop-center chain driven  
Wheels: 6 non-marring rubber tire (red)  
  
Transmission: 2 3-CIM Ballshifters  
Speed: 17 FPS or 6.5 FPS  
Chain: 12ft of #35 chain  
Motors: 6 CIM motors  
Controllers: 6 Victor speed controllers

## Shooter

Type: Single axle  
Motors: 2 775 pros  
Wheels: 4 Andymark stealth wheels (blue)  
Speed: 13050RPM  
Controllers: 2 Talon SRX

## Intake:

Motors: 1 BAG motor  
Belt: 1  
Roller: PVC with co-flex wrap  
Controller: 2 Talon SRX

## Hanger

Type: Hook with Winch mechanism  
Motors: 2 BAG motors  
Belt: 1  
Controller: 1 Talon SRX

## SAFETY

Robots, like any other tool, can be dangerous if not operated properly. Always be aware of your surroundings and make sure others are aware of the robot.



**ALWAYS WEAR YOUR  
SAFETY GLASSES!**

Safety glasses and close-toed shoes are not just a safety precaution - they're a part of the FRC culture! Always wear them when working on or near your robot. Keep long hair tied back and tuck in loose clothing.



**AIRBORNE BOULDERS  
CAN BE DANGEROUS!**

Stronghold robots launch boulders at high altitude. Never stand in front of a robot that's about to fire a boulder. Do not load the boulders until the robot is ready to be operated safely.

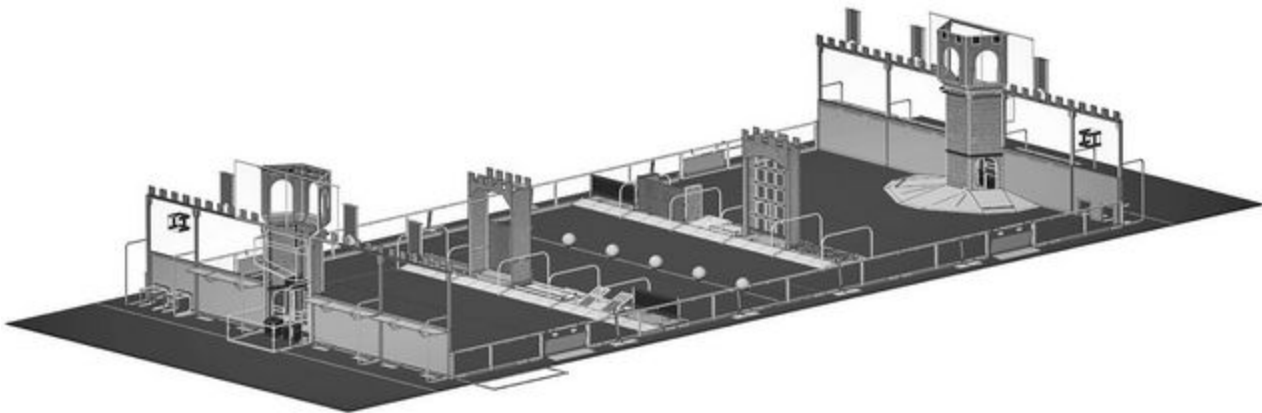


**DON'T BURN  
YOUR BACON**

It takes a lot of energy to make a robot run, shoot, and hang. Don't release all of that energy at the same time by sticking a tool in the wrong place! Always unplug the battery before servicing the robot.

## THE GAME

Stronghold is played on 54 by 27ft field. The matches consist of three parts, autonomous (15sec), Tele-operated (90sec), and the end game (15sec). The entire round is 2 minutes and 30 seconds. There are two alliances that consist of three teams which compete to see which alliance can get the most points. The game piece is a 1ft diameter ball. You may shoot this ball into the opposing enemy's tower to score points, and capture the Tower during the end game period.



## STRATEGY

Exploding Bacon designed BATTERING HAM specifically to play STRONGHOLD. Before picking up a single wrench or writing a line of code, the entire team met and discussed what they thought would be required in this year's game. Here's what they came up with:

- Small enough robot to travel through the Lowbar with ease
- Skinny robot to travel through the ramparts on one ramp
- Strategic tank drive with pneumatic wheels to get over multiple defenses
- Shooting from the Outerworks makes it difficult for defensive robots to defend
- Staying away from the opposing alliances Secret Passage is extremely important
- Hanging at the end of the match is important to qualify or getting point for finals

Based on this analysis, the team chose to design a robot that can start with a boulder and shoot them in autonomous mode. However, in tele-operated mode, it depends on moving quickly between the Neutral Zone and Courtyard to shoot boulders.

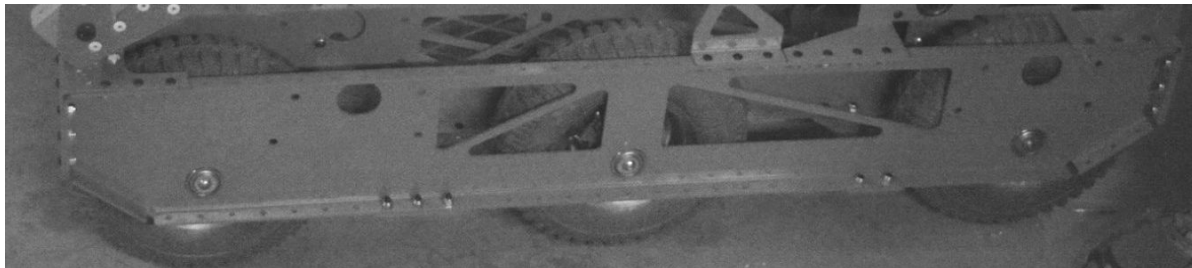
## Design

The Exploding Bacon design process focuses on ensuring that the final design is a result of a team effort. Every student, mentor, and parent that comes to the meetings has an opportunity to have their ideas heard. Emphasis is placed on keeping the robot simple and practical while encouraging innovation and eloquence in design. The team relies heavily on the experience of the mentors when deciding what designs we should spend precious time prototyping. The team prototypes everything - sometimes two or three times over!

Normally, the final working prototype would be found on the final robot. However, several of our mentors and students have been developing their CAD skills. Magnus Hi-Tech, a machine shop in Melbourne, donated machine time to fabricate our final parts! This extra step really improves the quality and reliability of the robot, and makes it look awesome!

### Drive Base

Our Drive base was specifically designed to ram through most of the the defenses with it's slim structure. The Drive-train consists of six wheels and is a drop center drive base. We use pneumatic non-marring rubber tire (red). The Drive-train is powered by two single shifting Three CIM gearboxes.

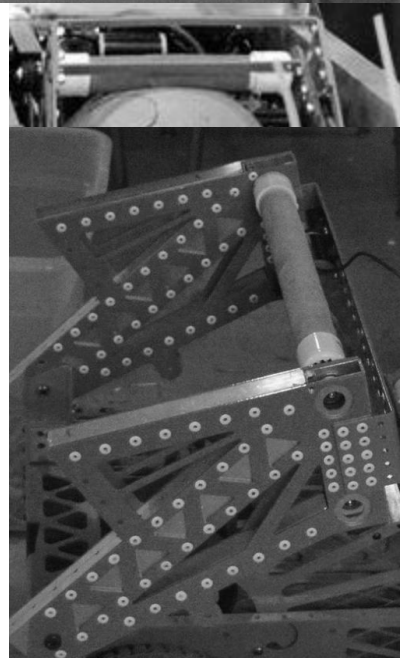


### Shooter

Driven by two 775 pros attached to a hex shaft that spins the main wheels the RPM of which is approximately 13050 our shooter could make almost any shot in the the Courtyard. The shooter also works as part of the intake. The shooter also runs backwards for the use of lodging the ball inside the robot. Located at almost the back of the arc for the shooter there is a BAG motor attached to a belt that runs a roller which help keep the Boulder in place once it gets inside the robot.

### Intake

Pneumatically actuated to mechanically move itself almost a full 180 degrees. It starts within the frame perimeter. It is rotated by a BAG motor attached to a belt that powers the main, and lower hex shaft that also works as a roller.



# OUR TEAM

## Student Officers

- Nathaniel - Co. President
- Jordan G. - Co. President
- Cole - Treasurer
- Dominic - Student BOD Rep
- Sarah H. - Corresponding Secretary
- Alex H. - Recording Secretary
- Phillip - Sergeant in Arms
- Ashley - 4-H Representative

## Seniors

- Alex M. Homeschooled
- Cole - Lake Highland Prep
- Sebastian - Crooms Academy
- Ashley - Timber Creel HS
- Robert - Winter Park HS

## Juniors

- Phillip - Hagerty HS
- Nathan B. - Winter Park HS
- Jordan G. - Winter Park HS
- Bryce - Winter Park HS
- Dominic - Lake Highland Prep
- Jason - Champion Prep Academy
- Alex H. - Homeschooled
- Charles - Winter Park HS
- Kevin - Winter Park HS

## Sophomores

- Graham - Dr. Phillips HS
- Nathaniel W. - Homeschooled
- Noah - Homeschooled
- Sarah H. - Homeschooled
- Sean - Paragon
- Ryan - Homeschooled
- Jenifer - Winter Park HS
- Allison - Winter Park HS

## Freshmen

- Ruhi - Seminole HS
- Saloanee - Homeschooled
- Shruti - Seminole HS
- Rumsha - Lake Highland Prep





**LOCKHEED MARTIN**

*We never forget who we're working for™*



Law Office of  
Kevin Cannon PA



**PARENTS  
GRANDPARENTS  
FRIENDS OF BACON**

Where Pigs Fly!



**2016 STRONGHOLD**

**WWW.EXPLODINGBACON.COM**