

Team 6026

Broken Arrow HS Robotics

2018 Season Team Manual

Introduction

Congratulations on the start of a new season with Team 6026. We cannot wait to see what you have to offer and how we can help you grow. This manual is a short guide to how Team 6026 works. It is not everything that you need to know, but it will teach you the essential concepts. By starting the build season with this knowledge you will be best prepared to contribute to the team. If you have any questions, just ask!

Design Philosophy

Our design philosophy is in the DNA of every robot our team builds. They are the pillars, shown in Figure 1, upon which our team is built. Every time there is a design decision to be made these principles should echo in your head.

The best robots in FIRST follow these basic, yet immensely challenging, rules. Here are examples of how each of them are applied:

SIMPLICITY: Instead of designing a shooter turret, simply rely on turning the robot using the drivetrain. Aim for the most basic, functional design.

ROBUSTNESS: Design the robot to withstand collisions and loads many times larger than what is normal. Aim for no repairs and low maintenance.

QUALITY: Design components thoroughly and build them as planned. Make the robot look and function professionally. Work with a sense of pride!

Each game challenges us to find the best solution that meets these requirements. These three main points will guide you through the remainder of the manual.

IDEAL ROBOT ATTRIBUTES

While the game changes every year, there are some attributes that are always a design priority for our team. These include:

STABLE: This means having a low center-of-gravity (CoG) so that the robot will not tip in a collision or while climbing over things. Weight should be as centred and close to the ground as possible.

STRONG AND AGILE: The robot should be able to get around the field as quickly as possible while still having the ability to push other robots or field elements. The robot should have the necessary traction and drivetrain gearing.

PRECISE: No matter what the design challenge is, the robot should function in a highly accurate and repeatable way. The robot should perform as designed, with precision.

VISUALLY ATTRACTIVE: A clean, well-finished robot will not only be easy to service but also be excellent to present to judges and function as our team's image on the field. As with our fundamental principles, these attributes aren't easy to achieve and require discipline in design.

How We Design

Each design session on Team 6026 has a similar style and follows our team culture. This culture requires intense thinking and dedication from students and mentors alike. Everyone has the responsibility to share his or her ideas and be active participants. Team members should respect all contributions and work to collectively raise our standard of excellence. The team roles in robot design fall into three general groups:

VETERAN STUDENTS: Team members with an exceptional amount of experience and activity on the team are expected bring their knowledge and leadership to the forefront. They should partner with less experienced students and encourage growth amongst the team.

ROOKIE STUDENTS: Team members who are newer to the team are expected to seek out opportunities to observe, learn, and begin to practice the skills of their senior counterparts. They should seek guidance and be unafraid to offer their ideas for consideration.

MENTORS: The mentors serve as teachers and advisors to the students. They share their engineering and operations experience in order to elevate student skills and guide the team in reaching its goals.

In design meetings, we use brainstorming, discussion, and prototyping to help the team arrive at its final robot concept. When brainstorming components, students should offer all ideas and grow them collectively. Discussion and prototyping sessions will allow the team to narrow its choices and begin to prove the design of a select set of top design candidates.

Build Season Routines

Every build season consists of six weeks from the day that the game is announced until the day that we must stop work and bag and tag the robot. The team will work 20-40 hours a week on the robot – certainly not a light commitment! The members who attend these hours and work intensely will be rewarded with personal growth and additional responsibility. The build season's weekly work breakdown generally follows the schedule in the table below.

WEEK	ACTIVITIES
1	<ul style="list-style-type: none"> - Game is released; study manual and analyze rules - Design sessions and prototyping early in the week - Deliver design choices and start building the field by end of week
2	<ul style="list-style-type: none"> - Complete mock field - Start parts fabrication and continue any additional prototyping - Initiate programming planning
3	<ul style="list-style-type: none"> - Continue parts fabrication and start planning electronics - Begin receiving and processing parts from sponsors
4	<ul style="list-style-type: none"> - Assembly and wiring of practice robot; final parts fabrication - Base code programming - First test drive of practice robot by end of week
5	<ul style="list-style-type: none"> - Fully functioning practice robot; begin competition robot assembly - Troubleshooting design and part iteration - Autonomous programming begins - Drive team practice
6	<ul style="list-style-type: none"> - Competition robot finished; matched to practice bot changes - Autonomous programming continues - Drive team practices; competition robot testing - Bag and tag robot at end of week
7+	<ul style="list-style-type: none"> - Final programming refinements for autonomous - Drive team practices and robot troubleshooting - Fabrication of spare parts; iteration of designs - Preparation of pit and scouting materials for event

Build Season Sub-Teams

During the build season, it is important that the sub-teams break down the task of creating the final robot. Members may belong to more than one team, but everyone should understand their role. All teams participate in the initial design phase. This requires good coordination and communication.

MECHANICAL TEAM: The mechanical team focuses on the fabrication, assembly, and iteration of the robot's mechanical systems. This includes shop work, troubleshooting functional design, and maintenance of parts. They must coordinate with the electrical team and programming teams to communicate any changes needed or completed. Responsible for insuring the mechanical design of the robot (including weight and size) meets the restrictions dictated in the rules book for this season.

ELECTRICAL TEAM: The electrical team implements the electronics, controls, and pneumatics systems for the robot. This includes wiring, troubleshooting communications and power, and maintenance of the robot. They must work closely with the programming team to coordinate system configuration and with the mechanical team to match changes. Responsible for insuring the electrical design and construction of the robot meets the rules.

PROGRAMMING TEAM: This team designs the software and controls for the robot's teleoperated and autonomous modes. This includes coding, driver interfacing, and troubleshooting – especially for autonomous programs. This team also develops software used in the machine vision system which allows the robot to autonomously recognize targets within the game. They must work closely with the electrical team for system configuration, seek feedback from the mechanical team on performance, and design the controls with the drive team.

Competition Sub-teams

DRIVE TEAM: The drive team is responsible for delivering the robot to the field, and operating the robot during the matches. The drive team is selected during the build season thru a process of tryouts and testing where the candidates demonstrate their driving abilities and understanding of the game rules. Students with previous radio control experience and/or video game experience are ideal candidates. Drive team candidates are expected to have exemplary participation records.

ROBOT SUPPORT TEAM: The robot support team is responsible for keeping the robot running during the competition. This includes robot checkouts before and after matches as well as emergency repairs between matches. Robot support is also responsible for maintaining the resources required in the pit area including battery charging and tools. Typically the robot support team will have representatives from the electronics, mechanical, and programming teams. Robot support responsibility generally starts and stops while the robot is in the pit.

SCOUTING TEAM: The scouting team is responsible for following all the matches (not just the ones we are in), and identifying the strengths and weakness of the best teams. The goal is to identify teams which would be good partners for our alliance. Part of scouting involves visiting potential alliance partners in their pit areas and developing “friendship”. As we come to the end of the qualifying matches, the scouting team should have a list of their top 25 teams. They should also have a short list of teams which they think are the best alliance partners. One thing the scouts should do is try to identify teams which may not be ranked high, but are still good teams that are just having a run of bad luck. These teams can be hidden gems.

Operational Support Activities

Because of the smaller size of our team, we will all share the operational support activities in addition to our primary team duties. If there are responsibilities described here which you would particularly like to take on, please speak up!

OPERATIONS TEAM: Operations team members play key roles on the team by taking on tasks such as finance, outreach, website design, awards, and team management. They must communicate with the other teams in a wide variety of ways and prepare the team to be successful on and off the field. Includes website maintenance, social media updates, t-shirt and poster designs, and team photography/videography. This group spearheads the team’s outreach activities where we try to inspire an interest in STEM. This group is responsible for interacting with all of our sponsors and making sure they get the recognition they deserve.

Important Dates

Kickoff Event : Saturday, January 6th, 2018

This is where the game is revealed to everyone. Marks the start of the 6 week build season. We usually go to the Kickoff event at the University of Tulsa with the other area FRC teams. The kickoff takes place in the morning and is over around noon.

Saturday Build Sessions: January 13, 20, 27 and February 3, 10, 17

These Saturday sessions are where we get the most done. We usually start around 12:30pm and work until 3:30 or 4:00pm.

Stop Build Day: Tuesday, February 20th

This is the last day we can work on the robot. The robot must be bagged by midnight local time. No changes can be made to the robot until the regional competition event starts.

OKC Regional Competition: March 29th (Thursday) to March 31st (Saturday).

This is our regional competition. Thursday is setup, inspection and practice. Friday is qualifying matches. Saturday morning is alliance selection and elimination matches followed by the finals. We will be back in Broken Arrow Saturday evening.

FIRST Western Championships: April 18th to the 21st

Winners from the regional competitions are invited to attend the Championship event in Houston, TX.