Turtle Trials Challenge Series

2019 Game Manual

www.team3100.com

Mendota Heights, MN

Lightning Turtles

Revision	Description	Date
1.0.0	Initial Game Release	01 October 2019

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1 INTRODUCTION

1.1 ABOUT THE TEAM

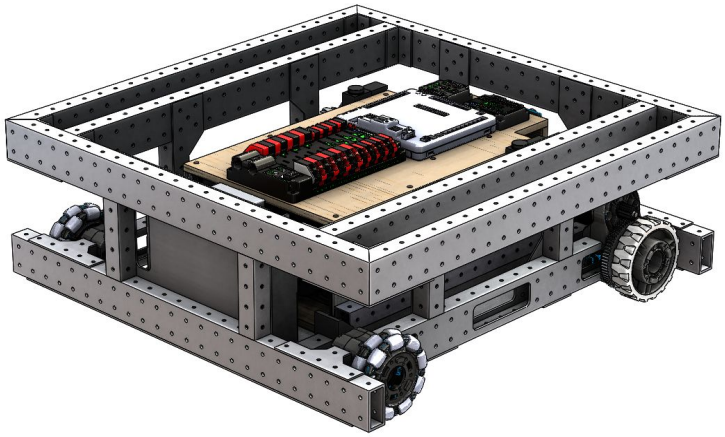
Team 3100, the Lightning Turtles is a team that competes at the *FIRST* Robotics Competition level of the *FIRST* family of programs. The team is based out of Henry Sibley High School in Mendota Heights, MN. Team 3100 has been competing since the 2009 season. However, they made a complete transformation of the team after their FRC 2017 season. Since the change, the team has been focused on improving the student experience and their competitive results.

With the continued development and improvement of the team, the team has adopted "Learn. Perform. Lead." as their mission statement. This simple statement encompasses everything each student should be able to achieve during their time on this team. Students should be able to come into this program to learn a new skill, improve upon it through performance, and teach the next generation of members through their leadership.

1.2 TRAINING & DEVELOPMENT

The *Turtle Trials Challenge Series* was created to remedy the disconnects and shortcomings of the team's teaching style from the recent years. The team leaders recognized that fall training did not translate effectively into useful skills once students needed for brainstorming, designing, fabricating, and controlling a robot during the short build season. The *Turtle Trials Challenge Series* aims to forge a direct relationship between fall training and build season by creating a platform that mimics a build season, but with an emphasis on teaching and explaining key topics every step of the way.

A base drive kit, called the LT Mk1 has been designed to partner directly with this program, as well as serve as an introductory training tool for veteran and rookie students for the team.



The veterans are responsible for the fabrication of the custom parts, inventory of the kit components, packing of the kits, as well as guiding the rookies during the assembly process. The rookies are responsible for learning basic assembly methods and wiring techniques to create a simple drivetrian that will be used throughout the duration of the *Turtle Trials Challenge Series*. To accomplish this, they are given full LEGO/IKEA-like assembly instructions to aid in the assembly process, as well as having guidance from the veteran members of the team.

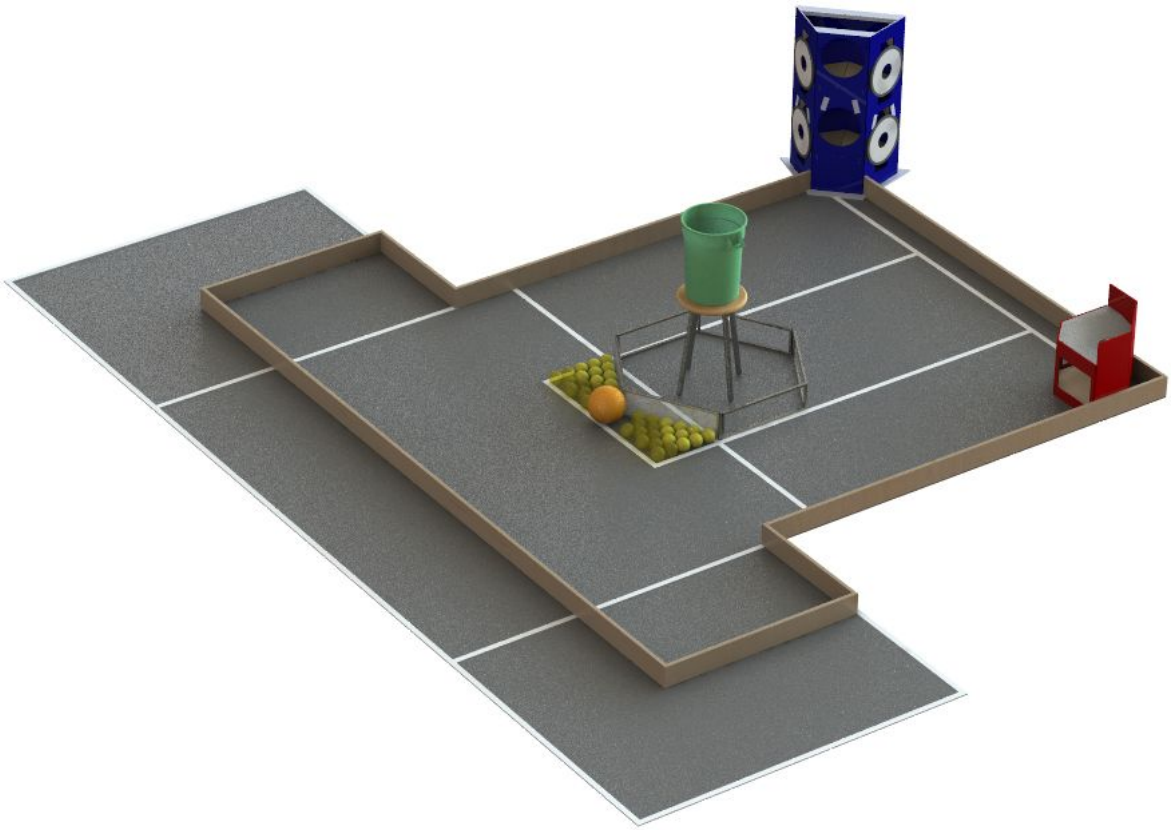
1.3 GOALS & OUTCOMES

The goal of this program is to provide direct comparisons between how we train in the fall to the skills that need to be applied during the build season. Direct deliverables and outcomes of this program will coalesce in a multi-team tournament made up of both veteran and rookie students from Team 3100 to provide an experience of competition, that will take place prior to the start of build season.

On a robot level, the goal is for each team to create a robot that challenges their skills and allows them to learn new techniques along the way. The robots that are competing at the event do not have to be FRC-level or styles of robot. As long as the robot can work mostly through operator control, it can be as complex or primitive as each team is comfortable with. For example, the game-specific mechanism can be made out of wood with a simple mechanism to play the game. The games are intentionally designed to allow for different levels of robot complexity to be effective and still have opportunities to succeed.

The hope is to grow this program in the future years and invite other teams in the Twin Cities area (and hopefully beyond) to use this to train their students their own way, but still come together to compete and network with other teams, much like what the OCCRA accomplishes in Michigan.

2 2019 GAME OVERVIEW



In QUICK QUOTA, two ROBOTS on a single ALLIANCE must work together to stop the clock as quickly as possible by scoring a combination of COMPONENTS and ACCELERATORS in key areas to score points, on a 15 ft. by 20 ft. FIELD. Once the ALLIANCE has scored 73 points, the MATCH is complete.

T = 0:00 - TEAMS, starting in their GARAGE BAYS, can traverse down the FIELD to enter zones, prep for scoring, or begin scoring GAME PIECES using pre-programmed instructions.

T = 0:15 - DRIVERS will gain control of their ROBOTS, and continue to work towards their production quota to stop the clock. After this point in time, TEAMS are able to use their GARAGE BAYS to aid in their ROBOT'S ability to perform their tasks by loading GAME PIECES or with simple human-to-ROBOT interactions.

T = 3:00 - MATCH has ended regardless of how many points are left to score. Final time will be adjusted to reflect point difference & penalties incurred.

The ALLIANCE'S final score is determined by the time on the clock once they have scored 73 points, plus any penalties added to their time.

3 ARENA

The ARENA include all elements of the game infrastructure that are required to play QUICK QUOTA: the FIELD, the GAME PIECES, and all equipment needed for the FIELD control, ROBOT control, and scorekeeping.

3.1 FIELD

The FIELD for QUICK QUOTA is a 15 ft. by 20 ft. carpeted area bound by and including the Guardrails. It is populated by the FACTORY, SILO, WAREHOUSE, and TOWER, with the FACTORY and SILO near the middle of the FIELD and the WAREHOUSE located on the far left corner of the FIELD and the TOWER located on the far right corner of the FIELD, from the orientation of the DRIVER STATION.

Two in-FIELD zones called GARAGE BAYS are located at the DRIVER STATION end of the FIELD off to the sides of the overall FIELD perimeter. These zones are an extension to the FIELD and are considered part of the playing area. There are specific rules to the GARAGE BAY (see Section 6.2 for more details).

The surface of the FIELD is low pile carpet, matching what is traditionally used in FRC games. The edge of the carpet is secured to the venue floor using tape to to prevent the carpet from coming up.

The Guardrails are made of primarily 2 in. by 8 in. lumber, with additional support to aid in the structure and stability of the walls. There are two (2) gates on the long end of each GARAGE BAY that open to allow DRIVE TEAM members and VOLUNTEERS to get on and off the FIELD safely.

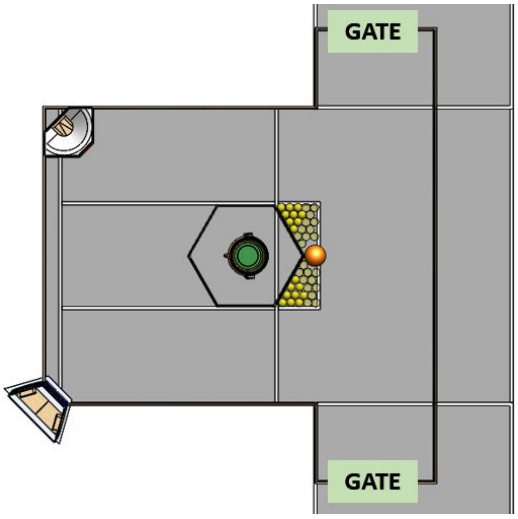


Figure 3-1 Gate Locations

3.2 ZONES & MARKINGS

FIELD zones and markings of consequence are described below. Unless otherwise specified, the tape used to mark lines and zones throughout the FIELD is 2-in. White Gaffers Tape.

The GARAGE BAY is zoned off on three (3) sides by the Guardrails and on one side by White Tape Line, which is included as part of the GARAGE BAY. The ALLIANCE STATION wraps around the end of the FIELD and ends on the far end of the GARAGE BAY from the ALLIANCE STATION.

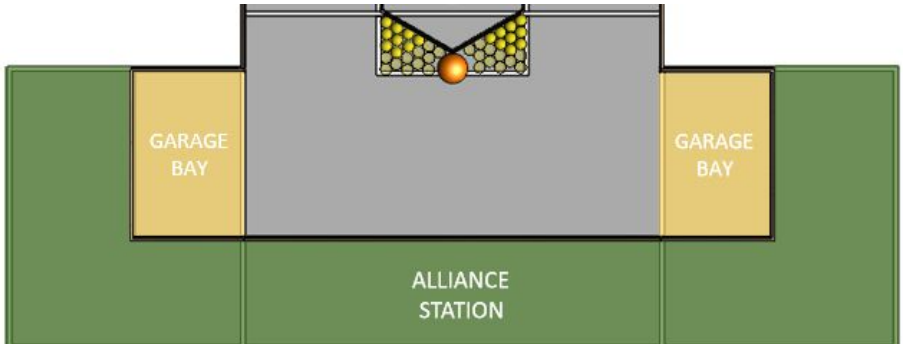


Figure 3-2 Outer Zones

The DELIVERY ZONE in the open area that contains the LOADING ZONE for pre-loading GAME PIECES into the FIELD prior to a MATCH. The Tape Line separating the DELIVERY ZONE from the INDUSTRIAL ZONES is included as part of the DELIVERY ZONE. The Tape Line between each INDUSTRIAL ZONE and the ADVANCED INDUSTRIAL ZONE are included as part of their respective INDUSTRIAL ZONES. The Tape Line showing the NULL ZONE is included as part of the NULL ZONE.

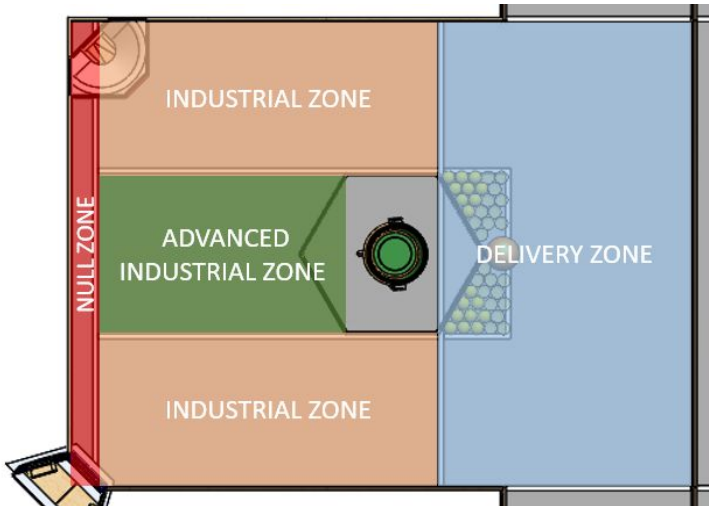


Figure 3-3 Field Zones

The LOADING ZONE is a 5 ft. and 5 ¼ in. wide by 2 ft. and 2 in. deep, taped zone which houses GAME PIECES prior to MATCH start.

3.3 ALLIANCE STATION

3.3.1 DRIVE TEAM ZONES

The ALLIANCE STATION is sectioned off into three (3) zones, separated by 2-in. White Gaffers Tape. The Central DRIVER ZONE of the ALLIANCE STATION is where the DRIVER, CO-DRIVER, and COACH are located. During the MATCH, these members of the DRIVE TEAM are not allowed to leave this part of the zone (see rules **G13** and **G16**). The two (2) L-shaped HUMAN PLAYER ZONES at either side are where the HUMAN PLAYER(S) for each ALLIANCE are located and must remain inside during the duration of the MATCH.

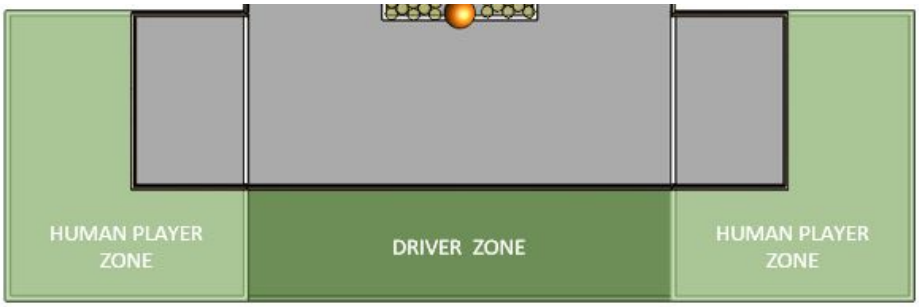


Figure 3-4 Alliance Station Zones

3.3.2 GAME PIECE HOPPERS

Two (2) clear HOPPERS will be located at either HUMAN PLAYER ZONE, each holding ACCELERATOR and COMPONENT GAME PIECES.

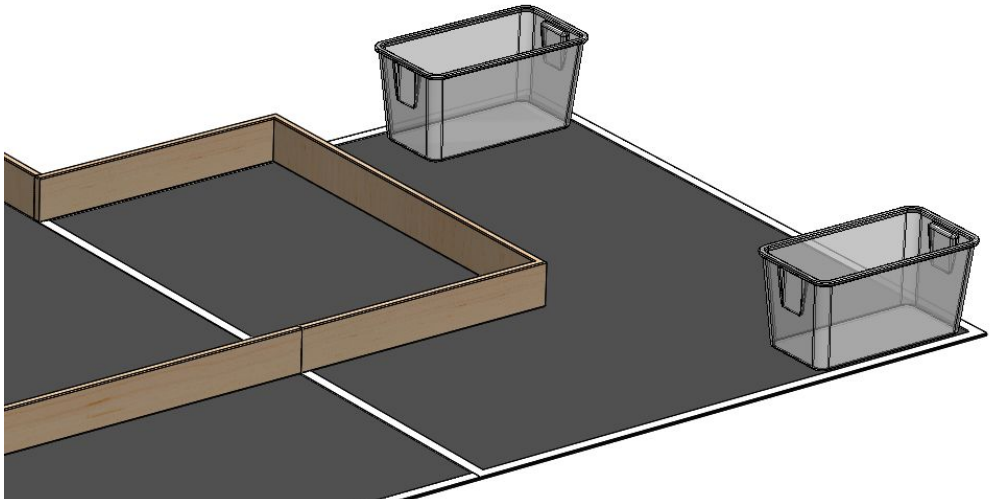


Figure 3-5 HOPPERS

3.4 FACTORY

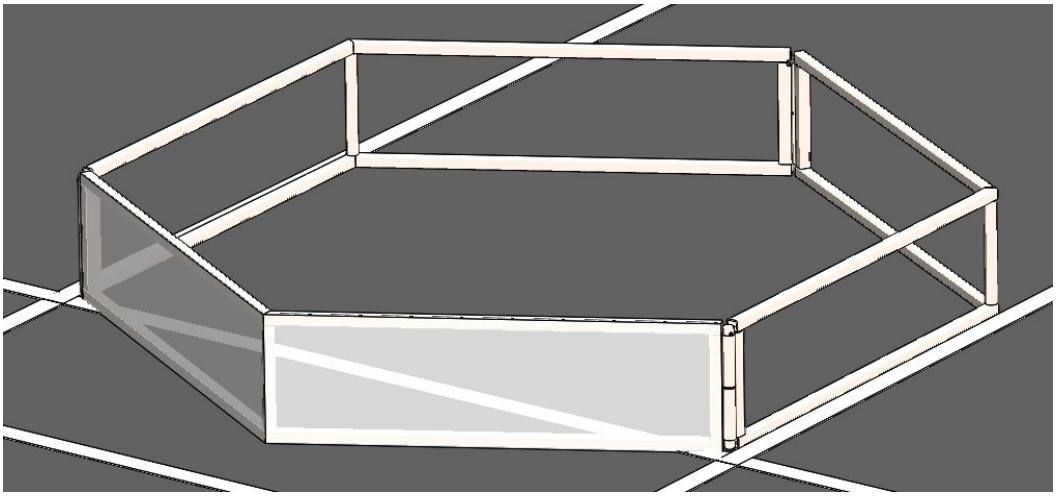


Figure 3-6 The FACTORY

The FACTORY is a hexagon-shaped structure made of 1 in. by 1 in. steel tubing, with each flat face of the structure being 3 ft. wide. It is oriented on the FIELD so that two (2) of the points of the structure face towards and away from the ALLIANCE STATION.

The top of the FACTORY wall is 10 ½ in. from the carpet, providing an opening dimension on four (4) of the sides of 8 ½ in. tall by 33 ⅓ in. wide. The two (2) faces facing towards the ALLIANCE STATION are covered by polycarbonate across the entire opening.

3.5 SILO

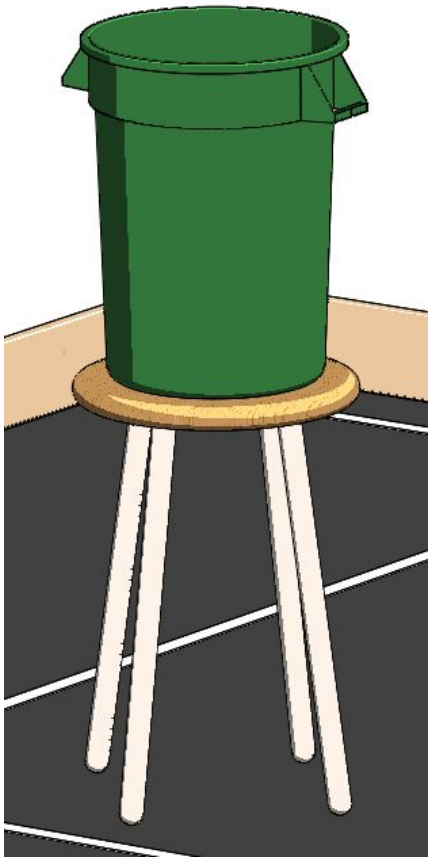


Figure 3-7 The SILO

The SILO which sits in the middle of the FACTORY is a high-tech advanced indust… wait, is that recycling bin on a stool? Yup, it is… The top of the opening of the SILO is roughly 5 ft. from the carpet.

The recycling bin is the RECYCLING CONTAINER from the FRC 2015 Game, RECYCLE RUSH. The top opening of the SILO is 1 ft. and 8 in. in diameter.

3.6 WAREHOUSE

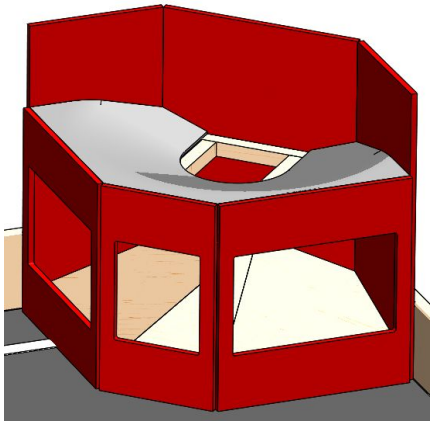


Figure 3-8 The WAREHOUSE

The WAREHOUSE is a 3 ft. and 5 in. wide irregular hexagon structure. This structure is located such that the outer walls of the WAREHOUSE mate with the Guardrails to sit in the far right corner of the FIELD. The angled surfaces within the lower structure is considered the WAREHOUSE FLOOR. The opening in the front faces provides a chance for COMPONENTS to fall out of the WAREHOUSE due to its limited inventory space. Game pieces entered in through the front openings will not be counted towards an ALLIANCE'S score.

The FEEDER opening height is 1 ft. and 8 in. from the carpet and is shaped such that GAME PIECES fall into the central opening which is roughly 7 ¾ in. wide and 9 ½ in. deep. The FEEDER is designed so that COMPONENTS are able to fit through the opening and ACCELERATORS sit on top of the opening when placed.

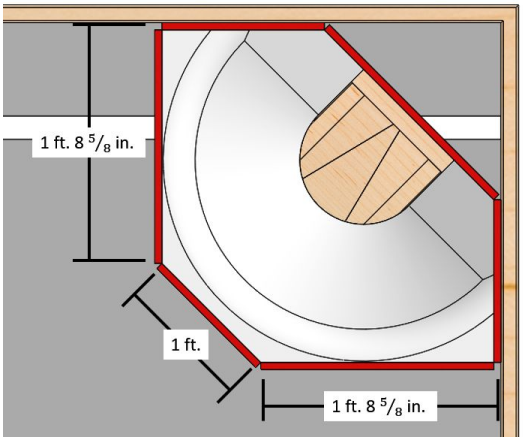


Figure 3-9 WAREHOUSE Dimensions

The FIELD facing sides of the WAREHOUSE have two (2) sides that are 1 ft. and 8 ⅝ in. wide and a center 45-degree face that is 1 ft. wide. The bottom of the openings on each of the sides is 10 ⅝ in. off the ground and the opening is 10 ⅜ in. tall.

3.7 TOWER

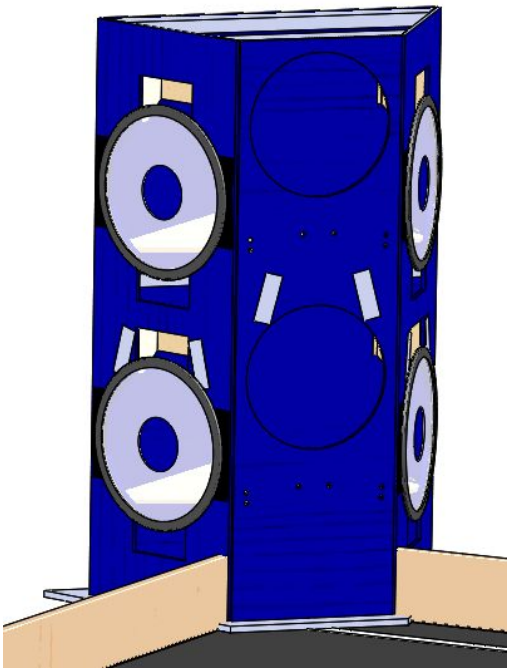


Figure 3-10 The TOWER

The TOWER is a 5 ft. and 4 in. tall assembly of the ROCKET from the FRC 2019 Game, DESTINATION: DEEP SPACE wooden practice FIELD with only the first two (2) levels built onto it. The TOWER has two (2) levels with the sides being covered from the HATCH PANEL from the FRC 2019 Game, so that only the PORT openings for the ACCELERATORS remain.

The TOWER is oriented so that the front face of the TOWER is 45 degrees from either Guardrail and only the 1 ft. and 8 in. wide front face is within the FIELD Perimeter.

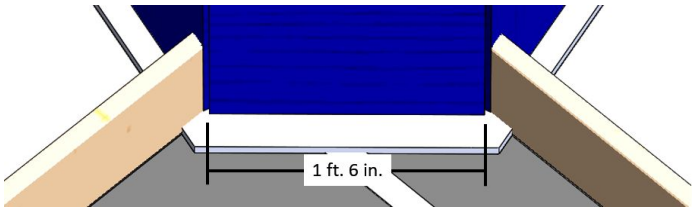


Figure 3-11 TOWER Base Dimensions

Each of the two (2) PORT openings that create Level one (1) and Level two (2) of the Tower are a 1 ft. and 4 in. diameter hole. The center of the Level one (1) PORT is 2 ft. and 3 ½ in. from the carpet, and the center of the Level two (2) PORT is 4 ft. and 7 in. from the carpet.

3.7 GAME PIECES

There are two (2) types of GAME PIECES in QUICK QUOTA: COMPONENTS and ACCELERATORS.

3.7.1 COMPONENT

Each COMPONENT is a 5 in. diameter hollow polyethylene ball with circular holes that weighs 2.6 oz. This is the same GAME PIECE that was used as the FUEL during the FRC 2017 Game, STEAMWORKS. There are a total of one hundred (100) COMPONENTS in play per MATCH.

Figure 3-12 The COMPONENT

3.7.2 ACCELERATOR

Each ACCELERATOR is an orange 13-in. +/- ½ in. diameter rubber playground ball with a *FIRST* logo as shown in Figure 3-13. The is the same GAME PIECE that was used as the CARGO during the FRC 2019 Game, DESTINATION: DEEP SPACE. There are a total of four (4) ACCELERATORS in play per MATCH.

Figure 3-13 The ACCELERATOR

4 MATCH PLAY

4.1 SETUP

During each QUICK QUOTA MATCH, two (2) TEAMS play MATCHES as a single ALLIANCE, setup and executed per the details described below.

4.1.1 GAME PIECES

The following quantities of each GAME PIECE is staged within the LOADING ZONE prior to a MATCH:

A. One (1) ACCELERATOR near the middle of the LOADING ZONE width
B. Eighteen (18) to forty (40) COMPONENTS distributed within the LOADING ZONE as determined by the TEAMS playing in the MATCH. TEAMS must distribute the COMPONENTS evenly within the LOADING ZONE.

Additional GAME PIECES can be staged in the HOPPERS and distributed between the two (2) TEAMS as determined by those TEAMS playing in the MATCH.

4.1.2 ROBOTS

TEAMS stage their ROBOT fully within their GARAGE BAY, such that the ROBOT is contacting the back wall of the GARAGE BAY.

4.1.3 HUMANS

DRIVERS, CO-DRIVERS, and COACHES must stay within the DRIVER ZONE, and HUMAN PLAYERS must stay within the HUMAN PLAYER ZONE throughout the pre-MATCH and MATCH process.

4.2 AUTONOMOUS PERIOD

The AUTONOMOUS PERIOD is a fifteen (15) second period at the start of each MATCH (T= 0s to T=15s), during which ROBOTS operate only on pre-programmed instructions. During this period, ROBOTS work to reach specific zones and may begin scoring GAME PIECES to reach their quota.

4.3 TELE-OPERATED PERIOD

The TELE-OPERATED PERIOD is an up to two (2) minute and forty-five (45) second period where DRIVERS have control of their ROBOT and continue to score GAME PIECES to reach their quota. This period, and thus the MATCH, ends once the quota has been reached.

4.4 SCORING

An ALLIANCE is rewarded for accomplishing various actions throughout the course of a MATCH, including ROBOT movements during AUTONOMOUS; placing COMPONENTS to be converted into Production Units and placing ACCELERATORS to boost production in the FACTORY, WAREHOUSE, and SILO; as well as placing ACCELERATORS to be converted into Production Units using the TOWER.

For the purposes of a ROBOT scoring during the AUTONOMOUS PERIOD, a ROBOT must be completely within a specific zone. If any part of a ROBOT is contacting a previous zone, then points are awarded for the lesser-point zone. If any part of a ROBOT is within the NULL ZONE, then the ROBOT is considered within the NULL ZONE.

Table 4-1 Autonomous Scoring Opportunities

Field Zone	Value
DELIVERY ZONE	1
INDUSTRIAL ZONE	3
ADVANCED INDUSTRIAL ZONE	9
NULL ZONE	0

Table 4-2 Industrial Site Scoring Opportunities

Industrial Site	GAME PIECE	Max	Val/EA
WAREHOUSE	COMPONENT	∞	1
	ACCELERATOR	1	2x Mult
TOWER - Level 1	ACCELERATOR	2	10
TOWER - Level 2	ACCELERATOR	2	30
FACTORY	COMPONENT	∞	1*
	ACCELERATOR	1	Initiates COMPONENT count
SILO	COMPONENT	∞	3
	ACCELERATOR	1	2x Mult

For the WAREHOUSE, COMPONENTS only count as a Production Unit if they are supported directly or transitively by the WAREHOUSE FLOOR, and cannot be supported by the FEEDER.

For the FACTORY, COMPONENTS only count as a Production Unit if an ACCELERATOR is scored within that zone.

4.5 RULE VIOLATIONS

Upon a rule violation, one or more of the penalties listed in Table 4-3 will be assessed.

Table 4-3 Rule Violations

Penalty	Penalty Types
+5 Sec	COMPONENT possession based penalties; Overproduction penalties; Removing GAME PIECES after scored; GAME PIECE mis-use; FIELD boundary violations; ROBOT configuration penalties
+10 Sec	COACHES violate "hands off"
+15 Sec	ACCELERATOR possession based penalties; Double possession
+20 Sec	Safety violation penalties
YELLOW CARD	Issued for egregious ROBOT or TEAM member behavior or rule violations. A subsequent YELLOW CARD within the same Tournament phase will lead to a RED CARD.
RED CARD	Issued for egregious ROBOT or TEAM member behavior or rule violations which results in a TEAM being DISQUALIFIED for the MATCH.

4.6 DRIVE TEAM

A DRIVE TEAM is a set of up to five (5) members from the same TEAM responsible for TEAM performance for a specific MATCH. There are four (4) specific roles on a DRIVE TEAM which ALLIANCES can use to assist ROBOTS with QUICK QUOTA.

Table 4-4 DRIVE TEAM Member Roles

Role	Description	Max
Driver	Controls the drivetrain of the ROBOT	1
Co-Driver	Controls the SUBSYSTEM mechanisms of the ROBOT	1
Coach	A guide or advisor	1
Human Player	Aids in setup of the ROBOT prior to a MATCH; Can introduce GAME PIECES into their ROBOT or onto the FIELD; Manual manipulation of a ROBOT while in the GARAGE BAY	2

4.7 MATCH LOGISTICS

If an ALLIANCE is unable to reach the score of 73 Production Units by the end of the three (3) minute MATCH time, the clock will stop and that ALLIANCE will be awarded their time based on the three (3) minute time, one second added per point left to score (i.e. the difference between 73 points and the amount of points the ALLIANCE has scored), and penalties assessed during the MATCH.

GAME PIECES that leave the FIELD will be placed back into a HOPPER closest to where the GAME PIECE left the FIELD. The return of GAME PIECES into play may only be performed by FIELD STAFF.

An ARENA FAULT will not be called for MATCHES that accidentally begin with an incorrect number of, incorrectly positioned, or damaged GAME PIECES. Damaged GAME PIECES will not be replaced until the next FIELD reset period. DRIVE TEAMS should alert the FIELD STAFF to any missing or damaged GAME PIECES prior to the start of the MATCH.

Once the MATCH is over and the FIELD STAFF determines that the FIELD is safe for FIELD STAFF and DRIVE TEAMS, they will announce that the FIELD is safe and DRIVE TEAMS may retrieve their ROBOT.

In addition to the up to three (3) minutes of play, each MATCH also has pre- and post-MATCH time for setup and reset of the ARENA. During ARENA reset, the ARENA is cleared of ROBOTS and OPERATOR CONSOLES from the MATCH that just ended. The ROBOTS and OPERATOR CONSOLES for the subsequent MATCH are loaded into the ARENA by DRIVE TEAMS at this time. FIELD STAFF also use this time to reset ARENA elements and GAME PIECES.

5 SAFETY RULES

Safety is paramount at all times, and each rule below is intended to establish norms that will mitigate injury risk to all participants.

S1. Dangerous ROBOTS: not allowed. ROBOTS whose operation or design is dangerous or unsafe are not permitted.

*Violation: If before the MATCH, the offending ROBOT will not be allowed to participate in the MATCH, if during the MATCH, the offending ROBOT will be **DISABLED**.*

S2. Wait for the ALL CLEAR before entering the FIELD. TEAM members may only enter the FIELD if the Key FIELD STAFF has given the ALL CLEAR signal or has verbally allowed TEAMS to enter onto the FIELD.

*Violation: **Verbal warning**. If repeated at any point during the event, **YELLOW CARD**. If egregious, **RED CARD**.*

S3. Never step/jump over the Guardrail. TEAM members & FIELD STAFF may only enter or exit the FIELD through open gates.

*Violation: **Verbal warning**. If repeated at any point during the event, **YELLOW CARD**. IF egregious, **RED CARD**.*

S4. Humans, stay off the FIELD during the MATCH. DRIVE TEAMS may not extend body parts into the FIELD during the MATCH unless they are with accordance to **G18**.

*Violation: **YELLOW CARD**.*

S5. ROBOTS, stay on the FIELD during the MATCH. ROBOTS and anything they control, e.g. a GAME PIECE, may not contact anything outside the FIELD.

*Violation: Offending ROBOT will be **DISABLED**.*

6 GAME RULES

6.1 ROBOTS

6.1.1 BEFORE/AFTER THE MATCH

G1. Know your ROBOT setup. When placed on the FIELD for a MATCH, each ROBOT must be:

A. In compliance with all ROBOT rules, i.e. has passed Inspection,
B. The only item left on the FIELD by the DRIVE TEAM,
C. Confined to its STARTING CONFIGURATION,
D. Set within their GARAGE BAY, and
E. Possessing no more than one (1) ACCELERATOR or up to five (5) COMPONENTS

*Violation: If fix is a quick remedy, the MATCH won't start until all requirements are met. If it is not a quick remedy, the offending ROBOT will be **DISABLED**.*

G2. ROBOTS must be removed from the FIELD by hand (i.e. no enabling, power, etc.). ROBOTS will not be re-enabled after the conclusion of the MATCH, nor will TEAMS be permitted to tether the ROBOT unless with express permission from Key FIELD STAFF.

*Violation: **YELLOW CARD**.*

6.1.2 GAME PIECE INTERACTION

G3. Don't hold both types of GAME PIECES at the same time. ROBOTS may not fully possess (i.e. a GAME PIECE being primarily supported by the ROBOT) more than the following:

A. One (1) ACCELERATOR at a time, or
B. Up to five (5) COMPONENTS at a time.

*Violation: Possession of both GAME PIECES at the same time will result in a **+15 Second** penalty.*

G4. Don't hold more than five (5) COMPONENTS at a time. ROBOTS may not fully possess (i.e. a GAME PIECE being primarily supported by the ROBOT) more than five (5) COMPONENTS at a time.

*Violation: **+5 Seconds** for each COMPONENT being possessed past five (5) COMPONENTS.*

G5. Don't hold more than one (1) ACCELERATOR at a time. ROBOTS may not fully possess (i.e. a GAME PIECE being primarily supported by the ROBOT) more than one (1) ACCELERATOR at a time.

*Violation: **+15 Seconds** for each ACCELERATOR being possessed past one (1) ACCELERATOR.*

G6. Don't remove GAME PIECES once they've been scored. GAME PIECES may not be removed from their scored locations.

*Violation: **+5 Seconds** for for each intentional offense.*

G7. Use GAME PIECES as directed. ROBOTS may not deliberately use GAME PIECES in an attempt to ease or amplify the challenge associated with FIELD elements.

*Violation: **+5 Seconds** for each GAME PIECE. Repeated at any point during the event or egregious violations of this rule are likely to escalate rapidly to **YELLOW CARD** or **RED CARD**.*

G8. Keep GAME PIECES in bounds. ROBOTS may not intentionally eject GAME PIECES from the FIELD.

*Violaton: **+5 Seconds** for each GAME PIECE.*

6.1.3 FIELD INTERACTION

G9. Don't hurt the FIELD. ROBOTS may not intentionally or repeatedly cause damage to the FIELD. Damaging the FIELD can include:

A. deformation of FIELD elements,
B. significant movement of FIELD elements,
C. or significant damage of FIELD elements.

*Violation: **Verbal warning** after first offense; escalation to **YELLOW CARD** or **RED CARD** with repeated or intentional attempts to damage the FIELD.*

6.1.4 ROBOT RESTRICTIONS

G10. Keep it together. ROBOTS may not intentionally detach or leave parts on the FIELD.

*Violation: **RED CARD**.*

G11. Don't overextend yourself. ROBOTS may not extend more than 6 in. beyond their STARTING CONFIGURATION.

*Violation: **+5 Seconds** every 5 seconds past extension after a seven (7) second countdown. **DISABLED** after 3 consecutive offenses.*

6.2 HUMANS

6.2.1 BEFORE THE MATCH

G12. Rotate your DRIVE TEAM for Qualification MATCHES. The point of the *Turtle Trials Challenge Series* is to provide valuable DRIVE TEAM experience to as many students as possible on the TEAM. No TEAM Member is allowed to be DRIVER or CO-DRIVER for a second time until everyone else on their TEAM has had an opportunity to be one of those roles in a Qualification MATCH.

Violation: MATCH will not start until the situation has been corrected.

G13. Know your DRIVE TEAM positions. Prior to the start of the MATCH, DRIVE TEAMS must be positioned as follows:

A. DRIVER, CO-DRIVER, and COACH must be within the DRIVER ZONE of the ALLIANCE STATION.
B. HUMAN PLAYER(S) must be within the HUMAN PLAYER ZONE of the ALLIANCE STATION

Violation: MATCH will not start until situation remedied. If discovered or used inappropriately during a MATCH, ***YELLOW CARD****.*

G14. Self-serve GAME PIECE locating. Prior to the start of the MATCH, DRIVE TEAMS are responsible for placing and distributing GAME PIECES onto the FIELD and into their respective HOPPERS.

Violation: MATCH will not start until the situation is corrected.

6.2.2 DURING THE MATCH

G15. Controllers for DRIVERS only. A ROBOT shall be operated solely by DRIVERS and CO-DRIVERS of that TEAM.

Violation: ***DISABLED****.*

G16. No Wandering. During the MATCH, all members of the DRIVE TEAM must stay within their respective zones, as laid out in **G13**.

Violation: ***YELLOW CARD****.*

G17. COACHES, hands off. During a MATCH, COACHES may not touch GAME PIECES or DRIVER controls unless for safety purposes.

Violation: ***+10 Seconds*** *per instance.*

G18. Enter GAME PIECES into the FIELD only when it is safe to do so. HUMAN PLAYERS may roll GAME PIECES into the FIELD one at a time only when no ROBOTS are present in the DELIVERY ZONE or their GARAGE BAY.

Violation: ***+20 Seconds*** *for each GAME PIECE introduced into the FIELD in unsafe conditions.*

G19. Lateral entry of GAME PIECES only. GAME PIECES may only be introduced into the FIELD into the DELIVERY ZONE.

Violation: COMPONENTS intentionally rolled past the DELIVERY ZONE is penalized as a ***G4 violation****.*
ACCELERATORS intentionally rolled past the DELIVERY ZONE is penalized as a ***G5 violation****.*

G20. HUMAN PLAYER(S) can interact with ROBOT only when safe to do so. HUMAN PLAYERS may only interact with the ROBOT, i.e. place GAME PIECES into or reset their SUBSYSTEM, when a SAFETY ADVISOR has declared it safe to do so by raising a Green Flag and holding it up in the air. A HUMAN PLAYER may continue to interact with the ROBOT until the Flag is lowered. Approved HUMAN PLAYER interaction with the ROBOT includes the following:

A. Reset of a Mechanism that has been deemed permissible to reset during the MATCH,
B. Refill of Air Reservoirs,
C. or addition of GAME PIECES into a ROBOT'S mechanism.

*Violation: **+20 Seconds** per instance. Repeated violations will escalate to a **YELLOW CARD** or **RED CARD**.*

G21. DRIVERS may only take back control of the ROBOT when safe to do so. DRIVERS may not touch the controllers until the SAFETY ADVISOR has lowered the Green Flag, marking it safe for the DRIVERS to take back control of their ROBOT.

*Violation: **+20 Seconds** per instance. Repeated violations will escalate to a **YELLOW CARD** or **RED CARD**.*

6.2.3 IN THE ARENA

G22. By invitation only. Only DRIVE TEAMS for the current MATCH are allowed in their respective ALLIANCE STATIONS.

Violation: MATCH will not start until the situation is corrected.

G23. Identify yourself. DRIVE TEAMS must wear proper identification while in the ARENA. Proper identification consists of members of the DRIVE TEAM wearing the appropriate member button.

Violation: MATCH will not start until the situation is corrected. Those not displaying identification must leave the ARENA.

G24. Don't abuse ARENA access. TEAM members outside of DRIVE TEAM may not COACH or use signaling devices during the MATCH.

*Violaton: **YELLOW CARD**.*

G25. Don't mess with GAME PIECES. TEAMS may not intentionally modify or damage GAME PIECES in any way.

*Violation: **RED CARD**.*

6.3 SCORING

G26. Don't overproduce. Do not score over 73 points during the MATCH.

*Violation: **+5 Second** penalty; Live score **reset to 55**.*

7 ROBOT CONSTRUCTION RULES

This section of the 2019 *Turtle Trials Challenge Series* Game Manual presents legislation relevant to the construction of a 2019 *Turtle Trials Challenge Series* ROBOT. ROBOTS must pass Inspection at the event to confirm compliance before being allowed to compete.

7.1 OVERVIEW

The ROBOT construction rules closely mirror those of a traditional FRC game. Many times in this section, you will be directed to view the FRC 2019 Game Manual for further details. The following sections will further explain the unique differences that are specific to the *Turtle Trials Challenge Series*.

7.2 GENERAL ROBOT DESIGN

R1. The ROBOT must be contained within a STARTING CONFIGURATION of 30 in. by 28 in. by 40 in. tall, with it's STARTING PERIMETER determined by the outermost features of the ROBOT.

> Unlike a traditional FRC ROBOT, TEAMS may have ROBOTS with a STARTING CONFIGURATION outside the FRAME PERIMETER. I.e. as long as the ROBOT is within the STARTING CONFIGURATION dimensions, the outermost part of the ROBOT may be a mechanism feature.

R2. ROBOTS may not extend more than 6 in. beyond any direction of their STARTING CONFIGURATION.

R3. The ROBOT SUBSYSTEM weight must not exceed 40 lbs. When determining weight, the basic ROBOT SUBSYSTEM excludes any component included in LT Mk1 Drivetrain, as well as the standard FRC battery assembly

R4. ROBOT SUBSYSTEMS must be designed so it can be quickly and easily removed from the LT Mk1 Drivetrain.

> *This is done so that more TEAMS can compete without having to develop their own regulation LT Mk1 Drivetrain. The expectation for the 2019 Season is that four (4) TEAMS will be sharing two (2) LT Mk1 Drivetrains throughout the Tournament.*

7.3 ROBOT SAFETY & DAMAGE PREVENTION

R5. Traction devices must not have surface features such as metal, sandpaper, hard plastic studs, cleats, hook-loop fasteners, or similar attachments that could damage the ARENA. Traction devices include all parts of the ROBOT that are designed to transmit any propulsive and/or braking forces between the ROBOT and FIELD carpet.

R6. Protrusions from the ROBOT and exposed surfaces on the ROBOT shall not pose hazards to the ARENA elements (including the GAME PIECES) or people.

R7. ROBOT parts shall not be made from hazardous materials, be unsafe, cause an unsafe condition, or interfere with the operation of other ROBOTS.

For more details on this rule, see the blue box section of FRC 2019 Game Manual's R9.

R8. ROBOTS must allow removal of GAME PIECES from the ROBOT and the ROBOT from the FIELD elements when DISABLED and powered off.

R9. Lubricants may be used only to reduce friction within the ROBOT. Lubricants must not contaminate the FIELD or other ROBOTS.

7.4 FABRICATION CONSTRAINTS

R10. TEAMS must attempt to fabricate their ROBOT SUBSYSTEM using components readily available in TEAM 3100's inventory along with a small Kit of Parts (KoP). TEAMS may request a special purchase but must be approved by a MENTOR in order to purchase those items. The provided KoP is two (2) 4" Compliant Wheels (Blue) and two (2) each of 8 in. and 18 in. elastic tie downs.

Standard construction materials are encouraged to be used as per below. For this competition wood is highly encouraged for its ease of manufacturing, low cost, and wide availability. When metal must be used the alternatives below should be used sparingly.

Table 7-1 Standard Materials

Standard Materials	
Wood	**Metal Alternative**
1/2" Plywood	0.09" and 0.125" Aluminum Plate
2"x4" Lumber	2"x1" Aluminum Box Tubing
1/2" Round Dowel	3/8" Churro Shaft
3/4" Round Dowel	1/2" Churro and Hex Shaft

R11. TEAMS only have two (2) free speed controllers, two (2) solenoids, and two (2) 574 mL air reservoirs. No onboard compressors are allowed on their ROBOT, but are allowed to refill their tanks during the match while in their GARAGE BAY (See **G20** for further detail).

7.5 MOTORS & ACTUATORS

R12. A maximum of two (2) motors may be used as part of a TEAM'S ROBOT SUBSYSTEM. The only motors and actuators permitted on 2019 ROBOTS includes the following:

Table 7-2 Motor Allowances

Motor Name	Max Qty
CIM	2
775pro/Redline	2
miniCIM	2
AndyMark 9015	2
VEXpro BAG	2
AndyMark PG-line	2
Snowblower Motor	2

For gearboxes each TEAM is provided two (2) 5:1 and two (2) 7:1 VersaPlanetary Gearboxes along with two (2) universal output shaft base kits for 775pros. See VEXpro's site for details. All other gearboxes must found in TEAM 3100's inventory.

R13. TEAMS will be provided with two (2) 2" throw ¾" diameter pneumatic cylinders (Bimba P/N 042-DP). TEAMS can also select up to two (2) other pneumatic cylinders from TEAM 3100's inventory. These pneumatics are on a first come, first served basis.

R14. The integral mechanical and electrical system of any motor must not be modified.

For more details on this rule, see FRC 2019 Game Manual's R35.

R15. For the 2019 *Turtle Trials Challenge Series* GAME, TEAMS are required to use the Spark Motor Controllers available and populated in the LT Mk1 Drivetrain. No additional motor controllers may be added to the LT Mk1 Drivetrain or a ROBOT SUBSYSTEM.

R16. Every motor that is part of a ROBOT SUBSYSTEM must be powered through the provided motor controller in the LT Mk1 Drivetrain.

7.6 POWER DISTRIBUTION

R17. For this section of the ROBOT Rules, see FRC 2019 Game Manual's Section 10.7 (R39-R63).

7.7 CONTROL, COMMAND & SIGNAL REQUIREMENTS

R18. For this section of the ROBOT Rules, see FRC 2019 Game Manual's Section 10.8 (R64-R90).

7.8 PNEUMATIC SYSTEM

R19. For this section of the ROBOT Rules, see FRC 2019 Game Manual's Section 10.9 (R91-R94).

7.9 OPERATOR CONSOLE

R20. TEAMS will be provided with a laptop to use as that TEAM'S programming laptop as well as their DRIVER STATION.

8 TOURNAMENT

The 2019 *Turtle Trials Challenge Series* event is played in a Tournament format. The Tournament consists of three (3) sets of MATCHES called Practice MATCHES, Qualification MATCHES, and Playoff MATCHES. The 2019 *Turtle Trials Challenge Series* Tournament will consist of four (4) TEAMS, each made up of students from Team 3100.

Practice MATCHES provide each TEAM with an opportunity to operate its ROBOT on the FIELD prior to the start of the Qualification MATCHES.

Qualification MATCHES allow each TEAM to earn a seeding position that may qualify them for participation in the Playoff MATCHES.

Playoff MATCHES determine the event Champions.

8.1 MATCH SCHEDULES

A MATCH schedule is used to coordinate MATCHES at the Event. Figure 8-1 details information shown on each schedule.

	Match #	Station 1	Station 2	Time
Match Cycle 1	1	A	B	12:30:00 PM
	2	A	C	12:39:30 PM
	3	D	C	12:49:00 PM
	Break	-	-	*12:58:30 PM*
	4	D	B	01:08:00 PM
	5	C	B	01:17:30 PM
	6	A	D	01:27:00 PM

Figure 8-1 Sample MATCH Schedule

8.2 PRACTICE MATCHES

Practice MATCHES are played before Qualification MATCHES. Practice MATCHES will be split between Assigned Practice and Open Practice.

Each TEAM at the event will be given two (2) Assigned Practice MATCHES. Open Practice MATCHES will continue for the remainder of the Practice Day. During Open Practice MATCHES, TEAMS can play on a first-come, first-served basis to continue playing Practice MATCHES.

8.3 QUALIFICATION MATCHES

Qualification MATCHES will be played in the Triple Round Robin format. This will guarantee that each TEAM will play every other TEAM an equal amount of times as well as provide each TEAM with nine (9) Qualification MATCHES.

In accordance with rule **G12**, every TEAM member must rotate into the DRIVER or CO-DRIVER positions at least once before allowing a TEAM member to become DRIVER or CO-DRIVER a second time.

8.3.1 QUALIFICATION RANKING

A TEAM'S Ranking Score (RS) will be determined by their average Qualification MATCH time after penalties and other time additions have been included, based on their ALLIANCE'S performances. With this style of Tournament, the TEAM with the lowest average Ranking Score will rank the highest, with following seeds determined by the next lowest times.

8.4 PLAYOFF MATCHES

Playoff MATCHES will be played in a Double Round Robin format. During the Playoff portion of the Tournament, TEAMS may choose a single DRIVE TEAM configuration to compete with during these MATCHES. TEAMS are still allowed to rotate positions if they like, but are no longer required to.

8.4.1 PLAYOFF SCHEDULE

Table 8-1 below provides the order of the Playoff MATCHES. Notice that breaks are built into this schedule as FIELD Timeouts to provide TEAMS with some time to use as they need. These breaks add an extra "Cycle Time" worth of time before the next MATCH begins.

Table 8-1 Playoff Schedule

MATCH	STATION 1	STATION 2		MATCH	STATION 1	STATION 2
1	#1 Seed	#2 Seed		7	#3 Seed	#4 Seed
2	#1 Seed	#3 Seed		8	#3 Seed	#1 Seed
3	#4 Seed	#3 Seed		*Break*	-	-
4	#4 Seed	#2 Seed		9	#2 Seed	#1 Seed
Break	-	-		10	#2 Seed	#4 Seed
5	#3 Seed	#2 Seed		11	#4 Seed	#1 Seed
6	#1 Seed	#4 Seed		12	#2 Seed	#3 Seed

8.4.2 PLAYOFF PERFORMANCE

The Double Round Robin format will allow each TEAM to play six (6) MATCHES. At the end of the Double Round Robin Playoff, the Champion of the Tournament will be determined by the TEAM that has the lowest average Playoff MATCH time.

8.4.3 TIMEOUTS

During the Playoff MATCHES of the Tournament, each TEAM will be given a total of one (1) Timeout for the duration of the Playoff MATCHES. Each Timeout adds an additional six (6) minutes of time from the original Cycle Time between MATCHES.

Timeouts must be requested within forty-five (45) seconds after the previous MATCH has ended to be awarded the timeout. TEAMS may not request a timeout between MATCHES that already have a built-in FIELD Timeout (after Playoff MATCHES 4 and 8).

8.5 TIEBREAKERS

In the event of an exact Ranking Score tie at the end of the Qualification and Playoff MATCHES, the tie breaking order is as follows:

1. Least amount of penalty points awarded
2. Highest total autonomous score
3. Sum total of points scored in all MATCHES of that portion of the Tournament
4. Best of three (3) Rock-Paper-Scissors MATCH between tied ALLIANCES

9 GLOSSARY

9.1 DEFINITIONS

See Glossary Section of the FRC 2019 Game Manual for additional definitions.

ROBOT SUBSYSTEM: This term represents the components that TEAMS build that are meant to play QUICK QUOTA, which are unique from the LT Mk1 Drivetrain.

SAFETY ADVISOR: A FIELD STAFF member that determines the time in which DRIVE TEAMS are able to perform certain tasks while in their GARAGE BAY. There will be one (1) SAFETY ADVISOR per GARAGE BAY in each MATCH.

PRODUCTION UNIT: Another term used to describe a point scored during a Quick Quota MATCH.

9.2 FAQ

Q1. Why such a small FIELD size?

A1. The size of the FIELD was designed to fit into our team's assembly room, as well as keep some space for audience and other teams. We hope to grow this in the future if we can find a bigger space to play in.

Q2. Why 2 vs. 0 instead of 1 vs. 1?

A2. We want to focus on the students learning strategy and communication with one another, so a single-alliance based game seemed to be the most appropriate way to do so.

Q3. Why can't I design my own drivetrain for this challenge?

A3. We want the students to focus on the game-specific tasks and allow them to focus on that from day 1. This method also allows them to think immediately about integrated design from the start as well.

Q4. Will this run on FMS or FMSlite?

A4. No, this will just be run locally with a couple laptops communicating directly to the robots in play.

Q5. How will live scoring be handled in a game that is very exact-score dependent?

A5. We will be live-counting by hand using a Google Spreadsheet or Form and making sure our scoring volunteers are well trained and know what to look out for. This will

not be a perfect system, but this is the best we can do with our limited resources at the time.